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Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean

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Abstract:

The Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean was held in Grand Baie, Mauritius, between 14 and 16 April 2005. The Meeting was attended by nearly 192 participants from 24 countries in the Indian Ocean region, 9 other IOC Member States, 12 organizations, and 27 observers. The Meeting took note of reports on national progress with the development of national tsunami warning systems and adopted the Mauritius declaration. Several donors pledged support towards the development of the Tsunami Warning and Mitigation System for the Indian Ocean.

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1 OPENING

In a message to the Mauritius participants read on his behalf by Dr. Patricio Bernal, Director-General Koïchiro Matsuura urged the countries of the Indian Ocean basin and donor nations to "*really commit themselves*" to the establishment and implementation of a tsunami warning system for the region.

"*Nature has alerted us once again that there is no place for complacency*," Mr. Matsuura said, referring to the earthquake that struck a string of islands off Sumatra in Indonesia on 28 March 2005. Although information on the earthquake was quickly transmitted by the Pacific Tsunami Warning Centre in Hawaii and the Japanese Meteorological Agency, "*we still did not have any way of detecting the presence of a tsunami in the eastern part of the Indian Ocean*," continued the Director-General.

"*The risk of tsunami is real and we cannot afford to be unprepared in case a major disaster occurs. […] I therefore urge all governments participating in this initiative, especially those that were not affected and where the urgency to act might seem like an exaggerated over-reaction, to really commit themselves*." They can do this, the Director-General said, by immediately identifying country contacts for receiving tsunami information.

Mr. Matsuura also reiterated his conviction that a robust, effective and durable tsunami warning system should be "*fully embedded in the global operational ocean observing system that is regularly used for other related hazards, such as storm surges and cyclones*."

The goal of achieving such a system for the Indian Ocean by June 2006 is "*realistic*" said the Director-General, "*under the condition of using the existing networks of instrumentation and communication links, working on their immediate upgrading and establishing national warning centres as a first priority*."

The Prime Minister of Mauritius, Mr. Paul Raymond Bérenger, echoed Mr. Matsuura's concerns. "*Procrastination*," he said "*could result in more loss of life, material damage and irreversible negative impacts*." Mr. Bérenger also stressed the importance of international cooperation, sharing Mr. Matsuura's view that the system should be built on a "*foundation of international cooperation in accordance with the principle of open, free and unrestricted exchange of data and information*."

Mr. Matsuura, Prime Minister Bérenger and the Director of the Inter-Agency Secretariat for the International Strategy for Disaster Reduction (UN/ISDR), Dr. Salvano Briceno, all called on donors to maintain the spirit of commitment and support the work underway. Mr. Briceno gave particular thanks to the governments of Japan, Norway, Sweden, Finland and Germany, as well as to the European Commission for their "*tremendous efforts*" and encouraged all donors to "*go that extra mile and cover the requirements that have been identified*" to put a fully functional system in place.

2 ADMINISTRATIVE ARRANGEMENTS

2.1 INTRODUCTION OF THE MEETING

The IOC's Executive Secretary introduced the meeting. He indicated that countries of the Indian Ocean region are already in the process of building a Tsunami Warning System to protect people living in coastal zones bordering the Indian Ocean. He highlighted the need to renew the engagement agreed at the International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean within a Global Framework, UNESCO Headquarters, France, 3-8 March 2005. He especially requested all countries that have not yet done so to designate national focal points to receive advisory tsunami information. He mentioned that a tide gauge had been updated in Rodriguez Island, Mauritius, enabling detection of tsunami activity in the sea and its real-time reporting to recipient centres. However, much more than that is needed to speed up the process of building the actual system. The purpose of the meeting is twofold: first, review the status of the interim system and the implementation of tsunami warning national entities and second,

finalize the planning of the technical requirements in terms of detection networks, including coordination of donors contributing to the system. Additionally, the meeting may address the contents of the draft resolution on the establishment of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS) that the IOC Assembly will discuss 21-30 June 2005. He informed the plenary that the UN Special Envoy for Tsunami Recovery, former USA President Bill Clinton, and the UN Secretary General Mr. Kofi Annan are considering the possibility of attending the IOC Assembly in June 2005 when this Resolution will most likely be approved.

2.2 ADOPTION OF THE AGENDA

The IOC Executive Secretary asked the plenary for comments on the Provisional Agenda. Indonesia proposed a new item to the Agenda immediately after Agenda Item 6 in order to open the possibility of further defining and formulating the results that the meeting will achieve. To this end, Indonesia proposed a new item 7 with the title "The Way Forward," composed of two sub items: 7.1 General Discussions and 7.2. Adoption of the Mauritius Declaration. In order to prepare for discussion of this item, Indonesia suggested forming a Working Group to draft a document for the new item 7.2. Australia seconded the proposal of Indonesia and the plenary decided to amend the Agenda accordingly. The meeting agreed to establish an intrasessionnal group to prepare a declaration.

The Mauritius Delegate proposed to slightly amend the former Item 7.2 to reflect that not only donors will intervene in the process of building the system but the community of all Member States. The plenary agreed to rename former Item 7.2. as Item 8.2 "Call for the International Community."

With this amendment, the plenary approved the Agenda as included in Annex I.

2.3 DOCUMENTATION AND PRACTICAL ARRANGEMENTS

The Head of IOC Ocean Services Section, Mr. Peter Pissierssens, introduced the documentation for the Meeting including the Provisional Annotated Agenda and the Provisional Timetable. The Agenda of the meeting is available under Annex I and the List of Participants is available in Annex II.

3 ELECTION OF THE CHAIR OF THE MEETING

The IOC Executive Secretary informed the Mssembly that he had been approached by Member States that desired to nominate Mr. S.C. Seeballuck, Secretary for Home Affairs of Mauritius, to Chair the Meeting. The Meeting approved this nomination by acclamation. The elected Chairman addressed the plenary indicating that Mauritius is very pleased to host this technical meeting. The importance that the Government of Mauritius assigned to the establishment of a Tsunami Warning and Mitigation System for the Indian Ocean is being reflected in its offer to host the Meeting, is a significant step forward in this process.

He called volunteers to participate in the Working Group preparing the Mauritius Declaration, including Mauritius. Australia, France, Germany, India, Indonesia, Italy, Japan, Kenya, Malaysia, Norway, Sri Lanka, the Republic of Tanzania, Thailand and the United Stated of America expressed their interest to participate in the Working Group. In view of the interest expressed by the participants, he declared the Working Group as open to the participation of all participants of the Meeting.

4 REPORT ON THE STATUS OF THE INTERIM ADVISORY INFORMATION SYSTEM AND HOW IT SATISFIES THE NEEDS OF THE PARTICIPATING COUNTRIES

Dr. Jan Sopaheluwakan of Indonesia chaired the Session. He pointed out that the recent earthquakes in Sumatra stressed the urgency of establishing an Indian Ocean Tsunami Warning System.

4.1 STATUS OF THE ESTABLISHMENT OF NATIONAL CONTACT POINTS (PRIME AND ALTERNATE) FOR ADVISORY INFORMATION

Dr. François Schindele, Chairman of the International Coordination Group of the Tsunami Warning System in the Pacific, presented the status of the establishment of National Contact Points. He referred to the first meeting held in Paris in March 2005 that adopted a Communiqué that included the statement:

"Welcome that, in addition to the steps taken, or to be taken, by countries of the Indian Ocean, the UNESCO/IOC and ISDR for interim tsunami warning, the Pacific Tsunami Warning Centre and the Japan Meteorological Agency have agreed to provide, if requested, reliable interim tsunami advisory information to authorized contacts in the Indian Ocean States.

Member States are requested to provide to UNESCO/IOC their official 24x7 contact information (prime and alternate) for receiving this information by 1 April 2005;"

He reported that six different methods are available to receive the messages:

i) Global Telecommunication Systems (GTS)
ii) Fax
iii) Email
iv) Aeronautical Fixed Telecommunications Network (AFTN)
v) Telex
vi) Emergency Managers Weather Information Network (EMWIN)

Up till 1 April 2005, only 9 Member States had provided their National Contact Points. The following week, IOC received 5 additional National Contact Points coordinates.

19 National Contact Points are currently in the http://ioc.unesco.org/indotsunami web page. This information was provided to PTWC and JMA to initiate the tests. The Indian Ocean has 27 Member States.

In the Indian Ocean, the institutions in charge of the Interim Tsunami Advisory Information system are essentially meteorological agencies or services. Some are national disaster organizations, oceanographic institutions and ministries of research.

The primary method of reception chosen by participants is Fax (10), GTS(6) and Email (1). The alternate method of reception chosen is Email (14), Fax (3), GTS(1) and AFTN (1).

Comments:

Several delegations stated their preference for the type of communication preferred in their countries. Work should continue in identifying contact points and the appropriate communication means (fax, GTS, email, etc.). The use of alarm mechanisms was also mentioned as an important tool to ensure delivery of warnings. To improve the warning itself, real-time data is required, such as from sea-level stations and ocean-bottom sensors. This will lead to increased reliability and a decrease of false warnings.

The IOC Executive Secretary reminded the meeting that an Indian Ocean Tsunami Warning System does not exist today in the Indian Ocean. The urgency to develop one is very high and this will require the emplacement of sea-level gauges and other ocean measuring instruments, such as DART buoys.

In response to these comments, Dr. Schindele mentioned that automatic warnings are available by installation of the proper software.

4.2 SPECIFIC ARRANGEMENTS MADE BY THE PACIFIC TSUNAMI WARNING CENTRE (PTWC) AND THE JAPAN METEOROLOGICAL AGENCY (JMA) TO PROVIDE THE INTERIM TSUNAMI ADVISORY INFORMATION SERVICE TO INDIAN OCEAN MEMBER STATES

Mr. Masahiro Yamamoto (Director, Earthquake and Tsunami Observations Division, JMA) reported on the status of the interim tsunami advisory information service operated by JMA and PTWS. He provided the recent progress and the current situation of the earthquake and tsunami monitoring system for the Indian Ocean. In the case of the earthquake on 28 March 2005, JMA issued tsunami information indicating potential for tsunami generation and estimated tsunami travel times, etc. This information was distributed by fax to all available focal points.

On 10 April 2005, JMA issued the first Tsunami Watch Information (TWI) for the earthquake of magnitude 6.8. The detailed content of the TWI procedures are introduced in the IOTWS-II/10.

He stressed the need for more real-time data. JMA would like to get information directly from countries through diplomatic channels, in addition to sending it directly to IOC. This is because of occasional problems in transmission.

Comments:

Several delegations reported on their experience with receipt of warnings including:

- Tanzania: received information in time from JMA by fax and email, GTS did not work.
- Pakistan: requested information in the future by SMS with repeated messages.
- France: messages from JMA are received and retransmitted to Reunion, etc. through GTS, and Geoscope in Paris should be added to JMA system.
- WMO: GTS procedures for TWS were developed at the Jakarta meeting and are still being implemented; tests in early March were successful and took only minutes to reach National Meteorological Centres; parts of GTS are weak in some developing countries and GTS does not have Internet-type problems as overloading.

4.3 COMMUNICATION PLAN FOR THE INTERIM TSUNAMI ADVISORY INFORMATION SERVICE

Dr. Charles S. McCreery, Director, Richard H. Hagemeyer Pacific Tsunami Warning Center (PTWC) first provided an overview of PTWC procedures for issuing interim tsunami advisory information for the Indian Ocean region. He reiterated that due to the continuing inadequacy of sea-level data from the region, it is not possible to quickly confirm the existence of a tsunami nor evaluate its strength. He explained that PTWC issue four types of bulletins: a Tsunami Information Bulletin, a Local Tsunami Watch, a Regional Tsunami Watch, and an Ocean-Wide Tsunami Watch. Criteria used to issue these bulletins were shown and they have been closely coordinated with the Japan Meteorological Agency for consistency of bulletins from both PTWC and JMA. An expected frequency of issuance of each type of bulletin was presented and a Watch of any sort may be expected only once every few years on average.

Dr. McCreery described procedures used for locating and determining the magnitude of earthquakes in the Indian Ocean region. Based on the distribution of seismic stations in the region with data being sent to PTWC, mostly a part of the Global Seismic Network, sufficient data for the preliminary location and magnitude will take about 10 minutes. This situation may improve when data from stations of the CTBTO and Geoscope, as well as from regional seismic networks, are accessed by PTWC. The expected time of issuance of initial bulletins is currently 15 to 20 minutes. The 26 December 2004 bulletin was issued in 15 minutes and the 28 March 2005 bulletin was issued in 19 minutes.

Dr. McCreery showed the location of 11 IOC/GLOSS sea-level stations in the Indian Ocean currently reporting their data to PTWC. While these stations are important for the warning system,

none are located near the source region. He noted that sea-level stations, both coastal and deep ocean, are urgently needed near the tsunamigenic seismic zones in order to detect and measure tsunami waves in a timely way for accurate forecasting, as well as for cancelling alerts quickly, when there is no significant tsunami.

Sample PTWC bulletins were shown and described. Included in the bulletins are special forecast points that are used to determine if an area is in a Watch, and for which estimated tsunami arrival times are given in bulletins. Dr. McCreery asked Member States to review the preliminary list of forecast points and request modifications if needed.

Regarding the "Communications Plan for the Interim Tsunami Advisory Information Service," Dr McCreery explained its purpose based on the equivalent document for the Pacific system. The Plan should serve as a general reference manual for the early warning system and should include a description of warning centre procedures, of the bulletins and their meanings, and of the communications methods used for bulletin dissemination. It should also include information on the designated contact points of each Member State that can be used operationally by the warning centres, as well by Member States to contact each other during events. He referred to an initial draft of the Plan that has been distributed (IOC/IOTWS-II/8), and noted that this version needs to be improved by including the information on JMA procedures and bulletins.

The Global Telecommunications System of the U.N. World Meteorological Organization was recommended by Dr. McCreery as the backbone system for bulletin dissemination to contact points, to be complemented as needed by telefax, email, and other methods. He raised the question of whether some kind of confirmation of bulletin receipt should be implemented. He also mentioned that although direct person-to-person communication by telephone is an option for dissemination of bulletin information, it should not be required since it can be too time consuming for warning centre staff.

The PTWC Director described new WMO product identifiers that have been approved for PTWC's Indian Ocean products. Information bulletins will be issued under the "WEIO23 PHEB" identifier and all Tsunami Watch bulletins will be issued under the "WEIO21 PHEB" identifier. These products have information and language crafted for the designated government contact point agencies. In addition, identifiers "WEIO33 PHEB" and "WEIO31 PHEB" are approved for corresponding products that could be crafted for the public and the media. One other identifier, "SEIO61 PHEB," is intended for the exchange of the preliminary earthquake parameters.

Dr. McCreery raised the issue of partnering with the media to take advantage of their ability to quickly deliver tsunami information to the public at risk. He pointed out that the media already has access to WMO products and will report on tsunami bulletins even without such partnering. But he suggested there is an opportunity to shape the information they report so it is accurate and results in saved lives, while at the same time does not interfere with national control of the situation. This might be accomplished in part by utilizing the aforementioned public and media products with carefully crafted language, as well as by implementing procedures to ensure the media are quickly alerted to significant events.

Lastly, Dr. McCreery reported about the conducting of regular communications tests to ensure tsunami bulletin dissemination systems are working properly, as well as to sustain a certain level of awareness about the tsunami hazard during the long periods between tsunami events. He provided a summary of the first such test conducted 7 April 2005. Although most Member States received the test bulletin within a few minutes by at least one means, there were also a number of failed methods or long delays. GTS dissemination seemed to be the most reliable. PTWC is investigating the problems and will work to resolve and test them in future communications tests.

A number of comments were made by delegations and are herein recorded to ensure appropriate follow-up:

- South Africa: indicated interest in selecting its own impact points.
- Pakistan: media should be involved in distribution of communications.
- Russia: local tsunamis require seismic data for warnings.
- India: warning exercise was good and should be repeated.
- Finland: authorities will want to be ahead of the media. Tourists are disconnected to usual info channels and means such as SMS can help resolve that.

The IOC Executive Secretary reminded the meeting that we know the potential sources of tsunamis and our system must include detection networks, assessment of the risk, and awareness building and emergency preparedness. Tsunami warnings are based on oceanographic information and not earthquakes.

Dr. McCreery noted that forecast points have never been used. Input is needed from countries on forecast points they would prefer. He also reminded the meeting that the 26 December bulletins were not intended for the Indian Ocean and that magnitude-8 earthquakes have not presented a problem in the Pacific.

The participants were thankful for the interim advisory system and believed that the Indian Ocean system should grow from the Pacific system. Finally, participants were encouraged to provide focal points.

5 REPORTING ON PROGRESS WITH THE DEVELOPMENT OF NATIONAL TSUNAMI WARNING AND MITIGATION INITIATIVES

5.1 NATIONAL REPORTS

Chair's introductory remarks

Every nation in the Indian Ocean region should be able to receive a message, make decisions on appropriate actions to take, and disseminate information. Some nations will also need to be able to take relevant observations.

National Reports

Australia is serious about developing an effective warning system, but is not yet in a position to share information about its plans. It expects to be in a position to provide more detailed information in a few weeks.

Bangladesh looks forward to participating in the development of an Indian Ocean Tsunami Warning system. Bangladesh has identified its contact persons to the IOC and has on-going educational activities. The government has agreed to establish a national tsunami warning centre. Bangladesh envisions integrating tsunami warnings within its existing cyclone warning system.

Comoros regretted that all of the documents for this meeting are in English. Once such documents are available in French, Comoros will be more readily able to fully participate in the tsunami warning system. Comoros has a national, operational protection centre. There are three warning centres. A national plan for an emergency response has been drawn up. Comoros is ready to collaborate with partners, particularly those in the region with adequate warning centres.

France (Reunion) has successfully established an operational centre on Reunion for distant tsunami warnings.

India pointed out that there are two seismic tsunami generation zones in the Indian Ocean. Eight work packages for activities ranging from detection of tsunamis through dissemination of information were presented. The project began in February 2005 and has a dedicated budget of 30 million dollars. The system will be operational by September 2007. India will work in collaboration

with all concerned and will share its advisory information with all interested nations and tsunami warning centres. Countries on the Indian Ocean rim need to develop their own inundation maps and information dissemination plans. India supports integrating tsunami and storm surge warning systems and working with the IOC and GOOS.

Indonesia presented an overview of seismic generation zones and stressed that some of these are expected to be active in the near future. Indonesia has identified its contact points to the IOC and designated the bureau to host its national operational warning system. Both the national centre and five regional nodes within Indonesia will be fully operational by the end of 2005. Public awareness activities have begun, most immediately in cities considered at the highest immediate risk.

Iran maintains both a real-time seismic network and 12 tide gauges and makes these data available to partners on the Internet. Iran lacks information from the surrounding areas and the open ocean, and would like to cooperate with partners.

Kenya is working towards the establishment of a national warning system for tsunamis and related hazards. The Kenya Meteorological Department will serve as the operational centre and the Director of this department will be the contact point for IOC. Dissemination of warnings will be under the direction of the Hazard Department in the Office of the President. Kenya lacks capacity in many aspects of Tsunami detection and communications and is looking for partners to help in developing it. Kenya strongly supports the proposal from Mozambique to develop a West Indian Ocean Warning system under the auspices of GOOS Africa.

Madagascar has a cyclone warning system and intends to reinforce this system for tsunami warning. Madagascar supports the proposal for a West Indian Ocean Warning system for Africa.

Malaysia has allocated 5 million dollars to set up its national tsunami warning system that will cover monitoring, analysis and dissemination. In addition to protecting its own people, Malaysia would like to contribute to the Indian Ocean Warning system for the benefit of neighbouring countries. The monitoring array is in the final stages of development and will soon be installed. Malaysia supports fast exchange of relevant seismic and tidal gauge data. Malaysia looks forward to working with other nations in the region.

The **Maldives**' primary effort is in establishing a seismic network. Enhancing communication links is also a priority. Upgrading of tide gauges is on-going. Training and education is required. The Maldives looks forward to cooperating with interested colleagues in this endeavour.

Mauritius has successfully established a tsunami warning centre under a multi-hazard framework. A work plan has been developed so as to be able to easily implement an operational system in the future. A new tide gauge has been installed and one upgraded with the partnership of the IOC and other countries.

Mozambique has identified its national contact point to the IOC. It has set up its national warning centre in the National Department of Meteorology. Mozambique has assessed its national requirements and prepared a national proposal to compliment the Western Indian Ocean regional proposal for Africa.

Myanmar maintains 4 seismological stations and has existing public warning dissemination mechanisms. Myanmar has identified its national contact point to the IOC. Public education efforts should begin now to provide a 'disaster awareness culture'.

Oman is keen to cooperate with countries in the region and international organizations. Oman seeks consultancies and guidance from the IOC and the WMO.

Pakistan has established a technical committee. Pakistan would like to establish a national early warning system and cooperate with regional partners and international organizations. Pakistan

would like to establish a national centre and two back-up centres. Pakistan would like to upgrade its seismic network at an estimated cost of Rs. 180-200 million. The Government is considering a 6-10 million dollar proposal.

Seychelles has designated its national contact point at the Meteorological Service. The National action plan includes four parts (1) a multi-hazard oceanographic observation program (2) dissemination of warnings (3) outreach and education (4) capacity building. Seychelles has pledged to put this system in place with support from international agencies.

Singapore maintains seismographic stations and tide gauges. These are being upgraded to allow real-time reporting and will be shared with regional partners.

Somalia's transitional federal government is in place. Somalia has the longest coastline in Africa and suffered the worst damage in Africa associated with the 26 December 2004 tsunami. Somalia appeals to the IOC and interested nations to help them to develop a disaster warning system.

South Africa has established its contact point. An initial workshop has been held and a plan for initial actions was agreed. Priority will be given to upgrading the seismic network.

Sri Lanka has registered its contact point and warning procedures are already in place. An operational warning centre has been established. A plan has been developed including observations, capacity-building and public awareness. A proposal has been submitted to the IOC for evaluation and funding.

Tanzania has established its contact point and is receiving advisories. Tanzania requests that the WMO improve the GTS system in Eastern Africa. An operational warning centre is being established. Tanzania's primary requirement is to upgrade communications, especially between the contact point and users. There is also a need for tide gauges and buoys since, like Somalia, Tanzania and Mozambique, Tanzania also has no observational system.

Thailand is implementing a project of an end-to-end national multi-hazard warning system and sub-regional early warning centre. 10 million dollars from the Government of Thailand has been provided as seed money. Final confirmation of the overall budget is not yet available. Once operational, the centre is willing to share operational data with interested partners. (Several countries) have agreed to form a sub-regional multi hazard warning centre for South East Asia in Bangkok.

United Kingdom – no statement.

Chair's concluding remarks

We have had 22 presentations providing an overview of the range of activities underway in the region. Some, but not all, of the nations in the region have established their contact points and others are encouraged to do so as soon as possible. The IOC should send technical missions to countries requesting assistance.

5.2 REPORT ON PROGRESS WITH THE UPGRADING AND EXPANSION OF THE SEA LEVEL OBSERVING NETWORK IN THE INDIAN OCEAN

Mr. Bernie Kilonsky provided an overview of the IOC's Global Sea Level Observing Program (GLOSS) and the contribution of the GLOSS network of tide gauges is making to the Indian Ocean tsunami monitoring and warning efforts. He highlighted progress since the First International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean within a Global Framework (3-8 March 2005, Paris).

- Many GLOSS sites report real-time high frequency sea-level information on an hourly transmission cycle to the Pacific Tsunami Warning Centre. 3 GLOSS stations are transmitting data every 15 minutes and 11 GLOSS stations are transmitting data every hour to the PTWC

via WMO's Global Telecommunication System (GTS). (Two gauges were upgraded at Rodrigues and Port Louis to deliver data every 15 minutes).

- GLOSS will upgrade/install 16 gauges over the next 12 months in 11 countries. This is enabled through funds from the IOC pledged through the flash appeal and through a donation from the Government of Finland.

- GLOSS has recently secured access to data transmission channels on Meteosat-5 (and Meteosat-7) for real-time transmission of sea-level observations. This satellite is centred over the Indian Ocean.

Mr. Kilonsky noted the present lack of tide gauges in the Eastern Indian Ocean and he expressed the hope that two Indian stations (Nicobar and Andaman Islands) could be brought on-line in the very near future.

The IOC Executive Secretary mentioned that the IOC and ISDR (through the first OCHA flash appeal) are funding the upgrade/installation of an initially small number of interim tide gauges. Additional funds will be available for installation/upgrade of tide gauges and he expressed the need for the cooperation of Member States in getting those upgrades/installations under way in a timely manner.

The meeting took note of the report of Mr. Kilonsky and how GLOSS tide gauges can be used for multiple applications beside tsunami monitoring and warning, and the training and other opportunities what the GLOSS program can offer. The meeting also took note of the offer from the IOC in provision of tide gauges and encouraged countries of the Indian Ocean to take advantage of that offer.

Tsunami Warning Systems for the Indian Ocean: Efficient use of Tide Gauge Stations

Prof. A.B. Rabinovich (Institute of Ocean Sciences, Canada and P.P. Shirshov Institute of Oceanology, Russia) presented this matter as an information item only.

For an arbitrary tsunami source location, it is possible to estimate a safe warning time for any specified coastal site and known warning station – as the time delay between the arrival time at the coastal site and the station. Prof. Rabinovich presented such calculations for Vishakhapatnam (India), Phuket (Thailand), Sri Lanka and East Africa for a tsunami source located in the S.E. Indian Ocean (similar to the 26 December 2004 earthquake). He summarized his findings in the following conclusions: (i) A global network of tide gauges should form the backbone of the warning system; (ii) Existing and newly-deployed open ocean island tide gauges will be effective for early tsunami warning for most countries in the Indian Ocean (including India, Sri Lanka, East Africa, and Madagascar); (iii) Additional buoys or bottom pressure gauges at open ocean stations are important for early tsunami warning for countries close to tsunami source zones (Thailand, Indonesia, Myanmar, Malaysia); (iv) Seismically-based early warning is important for regions located in the source regions (Sumatra, Nicobar and Andaman Islands).

5.3 REPORT OF THE EXPERT MEETING ON THE EXCHANGE OF EARLY WARNING AND RELATED INFORMATION INCLUDING TSUNAMI WARNINGS IN THE INDIAN OCEAN (JAKARTA, 16-18 MARCH 2005)

Dr. Maryam Golnaraghi, WMO, reported on this item.

The World Meteorological Organization (WMO), as a specialized agency of the United Nations, works through National Meteorological and Hydrological Services (NMHSs) to ensure that, among other things, issues dealing with early warning for hydro-meteorological disasters are addressed effectively across political boundaries. The WMO briefly presented on the capabilities for monitoring, observing, detecting, forecasting and early warning systems, operated through the NMHSs

for a wide rage of hazards related to weather, climate and water, such as severe storms, cold spells, heat waves, tropical cyclones (hurricanes and typhoons), storm surges, floods, droughts, forest fires, locust swarms. The WMO Global Operational Network includes 10 international scientific and technical programmes, and a global network of three World Meteorological Centres (WMCs) and 40 Regional Specialized Meteorological Centres (RMSCs) — operated by NMHSs of its 187 Members, its Global Observing System (GOS), Global Telecommunication System (GTS) and Global Data-Processing and Forecasting System (GDPFS) — provides around the clock operational capabilities, along with international and regional collaborations and coordination to support the early warning activities of the NMHSs at the national level.

The WMO has developed partnership and collaborations with UNESCO/IOC, ISDR and other partners to accelerate the development of an "end-to-end Tsunami Early Warning System" for the Indian Ocean (IO). To this end, the WMO's contributions fall into four areas:

1. The WMO Global Telecommunications System (GTS) for the exchange of TWS-related information

The WMO Global Telecommunications System (GTS) is a dedicated network of telecommunication facilities and centres via leased lines, satellite-based systems and data networks, that is implemented and operated by the WMO Member countries. It interconnects NMHSs of all countries for the rapid, reliable collection and exchange of all meteorological and related data, and the distribution of weather, water and climate analyses, forecasts and warnings produced by the World, Regional/Specialized and National Meteorological Centres. It also supports the exchange of some other data, including seismic parametric data. The GTS ensures that each Member country has access to the information it needs to provide effective weather, water and climate services and warnings to its economy and population. The GTS is regularly upgraded to take early benefit from the evolving telecommunication technology, as well as to meet increasing requirements.

The WMO GTS is used by the Tsunami Warning System in the Pacific (TWSP) for collection and exchange of tide gauge data and distribution of tsunami warnings in that region. The meeting confirmed the WMO GTS as the backbone for the distribution of Tsunami Warning System bulletins to countries on the Indian Ocean rim region, including for the Interim Tsunami Advisory Information Service.

The meeting noted with appreciation the steps taken by the WMO and NMHSs for ensuring the most effective use of the GTS for the immediate support of the Interim Tsunami Advisory Information Service, as well as for the longer-term support of the IO-Tsunami Warning System. As a first step, WMO organized the Multidisciplinary Workshop followed by an Expert Meeting held in Jakarta on 14-18 March 2005 in coordination with US/ISDR and UNESCO/IOC. The Workshop and the Expert Meeting endorsed the WMO Action Plan for making GTS fully operational in all Indonesian-rim countries to support the Tsunami Warning System. The WMO Expert Meeting agreed upon the following technical plan and actions:

a. Operational procedures and arrangements for distribution of Tsunami Warning System messages on the GTS to all NMHSs concerned, including interim Tsunami Watch messages generated by the PTWC (Hawaii) and JMA (Japan); TWS bulletins are transmitted as highest priority messages (Warnings), with specific headers to enable proper identification and action by receiving centres; Operational tests and monitoring is organized and acknowledgment messages procedures being consolidated. The scheme for the international distribution of TWS messages as regards the IO is provided in Figure 1;

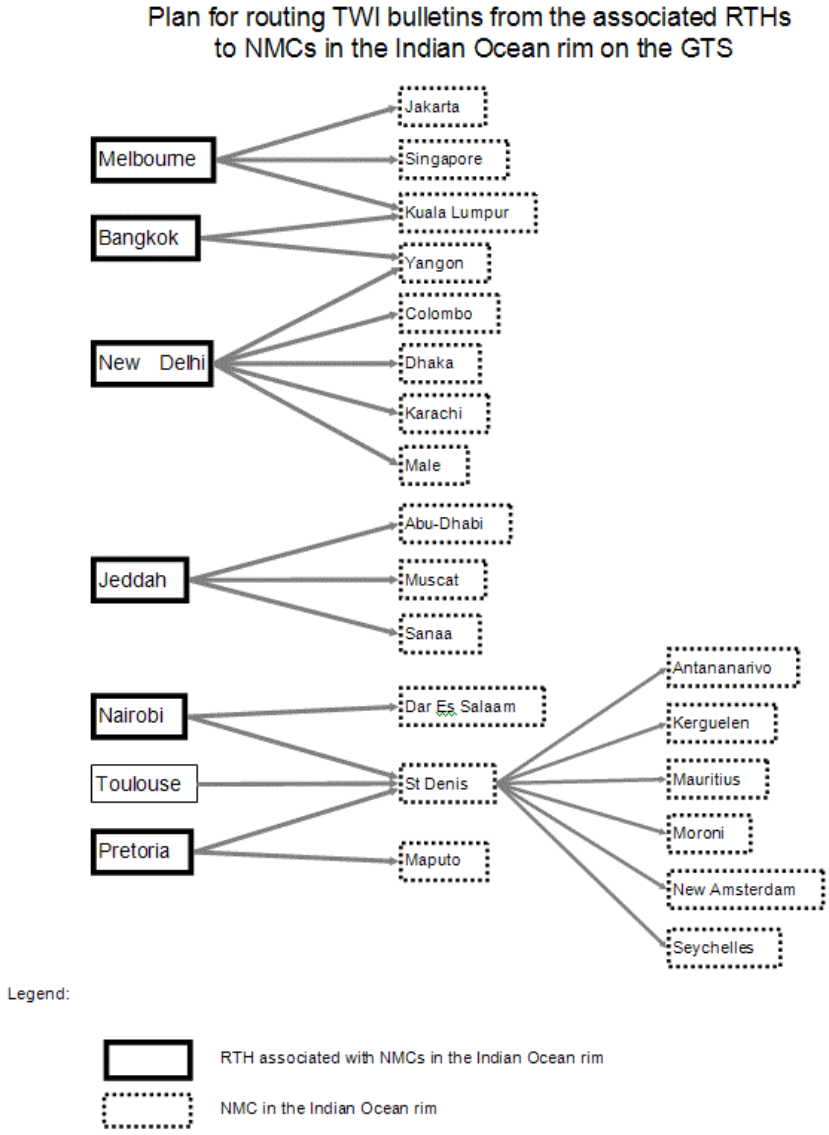

Figure 1

b. Use of the WMO/GTS satellite-based data-distribution systems, including RETIM-Africa (France), EUMETCast and METEOSAT MDD (EUMETSAT) for West IO, CMA PCVSAT (China) for N-E IO, ISCS and EMWIN (USA) for East IO and SADIS (pending ICAO agreement);

c. The potential contribution of the Global Maritime Distress and Safety System (GMDSS) NAVTEX & SafetyNET for distributing warnings to ships and the IMO initiative was noted;

d. GTS procedures for the collection and exchange of data collected via Data Collection Service missions of Meteorological Satellites are fully operational and currently used; three Meteorological Satellites providing Data Collection Service on the Indian Ocean were identified as ready to expand support for sea-level data collection and its exchange via GTS: CMA/FY-2 (China), JMA/GMS & MTSAT (Japan) and METEOSAT 5 (eventually METEOSAT 7) (EUMETSAT);

e. The GTS can provide for the international exchange of parametric seismic data, and current GTS procedures are operational. The exchange of full resolution seismic data on the GTS would require upgraded capacity. It was noted that CTBTO/PTS seismic and hydro-acoustic data will be made available by CTBTO on a test basis to international Tsunami Warning Organizations recognized by UNESCO/IOC;

f. Developing and less-developed Indian-rim countries that require upgrading/strengthening of NMHS centre equipment and GTS links to meet TWS requirements were identified: Bangladesh, Maldives, Myanmar, Sri Lanka and Yemen; Comoros, Djibouti, Kenya, Madagascar, Seychelles, Somalia and Tanzania;

The WMO is planning roving expert missions to the above-mentioned countries upon their agreement, by teams of experts for fact-finding and developing national projects for upgrading/strengthening their national GTS components. Special attention will be given to the impact on recurrent costs of national projects for facilitating sustainability (e.g., use of satellite-based telecommunication systems). The WMO has submitted a request for funding the activities of the WMO action plan for the GTS support to TWS, including the procurement and installation of upgrading national equipment and facilities at the NMHSs centres concerned, for an amount of US$ 1,400.000. The meeting noted that part of the requirements formulated by several countries would be addressed by the WMO action plan. Furthermore, the equipment costs of (US$ 1 million) in the WMO proposal needed to be raised to implement the GTS equipment upgrades in Bangladesh, Maldives, Myanmar, Sri Lanka and Yemen; Comoros, Djibouti, Kenya, Madagascar, Seychelles, Somalia and Tanzania. The WMO indicated that through its roving expert visits to the countries, it will develop a detailed itemized equipment need report of each country.

The meeting noted that operational tests of IO Tsunami Watch messages over the GTS were carried out on 7 April (from PTWC, Hawaii) and 8 April (from JMA, Tokyo). Test messages have been relayed by main RTHs (Washington, Tokyo, Melbourne, New Delhi, Exeter, Toulouse), other RTHs and distributing centres (Bangkok, St. Denis-La Reunion) to most NMCs in the IO within less than 1 to 7 minutes. As expected, the delay on low speed circuits of the GTS that needed to be upgraded, reached 20 minutes or more. The test messages have also been transmitted over the WMO/GTS satellite-based data distribution systems RETIM-Africa and ISCS. The implementation of the GTS support to TWS was being completed to include Eastern Africa (especially RTH Nairobi). Further detailed operational tests over the GTS will be carried out.

2. Enhancement of multi-hazard national warning alert mechanisms provided through NMHSs to support around-the-clock dissemination of tsunami warnings and to raise public awareness to enhance community preparedness through development of educational and community outreach programmes of NMHSs.

Dr. Golnaraghi informed the meeting of another proposal, in partnership with UNESCO/IOC with the goal to enable countries at risk to fully realize the benefits of hazard warning systems by ensuring that user-oriented warning information is properly understood and communicated to governments and public in an easily accessible way to enhance response; and to raise public awareness and enhance community preparedness through educational and community outreach programmes delivered through National Meteorological and Hydrological Services (NMHSs).

The WMO indicated that NMHSs are operational 24/7 national organizations, responsible for issuance of around-the-clock warnings for a wide range of hydro-meteorological hazards. Currently, nearly 50 NMHSs in the world have their governments' mandate to provide seismic and/or tsunami early warnings. In the Indian Ocean, 11 NMHS, including 4 along the eastern coast of Africa and 7 in Asia have some seismic and tsunami-related mandate. However, the capabilities and resources of the NMHSs significantly vary from country to country. The WMO indicated that through capacity building, educational and training programmes, sharing of guidelines and best practices, the WMO works with NMHSs to ensure that countries can (i) utilize, integrate and extend warning services for national needs; (ii) provide warnings that are easily accessible and understandable; and (iii) enable effective decision-making by decision makers and the public.

The WMO has developed a detailed action plan to enhance NMHSs capabilities for issuance of warnings, strengthen their linkages with the national authorities and the media and develop educational and outreach modules targeted at their stake holders (authorities, risk managers, media, and the Public). The WMO has extensive experience in NMHSs relations with Media. The WMO

briefed the meeting on the details of the action plan, the cost of the proposal (US$ 850,000). The project will be carried out in 4 Steps:

1) Step 1: Expert assessments of current capabilities and requirements of NMHSs and emergency management agencies for delivery and use of information – Q3 and Q4 2005
2) Step 2: Development of education and training modules for NMHSs and emergency managers (Tsunami, storm surges, cyclones, etc.) – Q1 2006
3) Step 3: Education and training modules for the general public delivered through NMHSs and partners - Q1 2006
4) Step 4: Review the project outcome and develop plan for next steps based on specific country needs – Q2 2006.

The WMO has initiated assessments of the needs of NMHSs, by conducting preliminary surveys in April 2005. The results of the survey will be used to coordinate its efforts with national needs and plans and to develop detailed Terms of Reference for the assessment visit to the countries requesting support.

3. The WMO through the coordination activities of its Space Programme and in partnership with the space agencies, UNESCO/IOC and other key partners will ensure optimal utilization of space technologies for enhancing multi-hazard early warnings, including tsunamis, in the Indian Ocean rim.

The WMO has, since 1961, successfully facilitated international cooperation among Space Operators contributing to WMO GOS and GTS. This involves operational satellites of US - NOAA/NESDIS, Europe – EUMETSAT, Russian Federation – ROSHYDROMET, India - IMD, China – CMA, Japan – JMA, and research and development satellites of, US – NASA, Japan – JAXA, Europe – ESA, Russian Federation – FSA, France – CNES, India – IMD and Republic of Korea – COMSAT-1.

During the Fifth WMO Consultative Meeting with heads of space agencies, the session indicated the need for a consolidated plan of action related to emerging needs and requirements for use of space technology for multi-hazard early warning systems (including seismic and tsunami), and that the WMO Space Programme and Affiliated Space Agencies would be well positioned to respond to these requirements.

To this end, the WMO has developed a proposal with the following steps:
1) Step 1: To increase awareness of space system capabilities (Two regional workshops East and West IO) - Q3 and Q4 2005.
2) Step 2: To develop an overall consolidated plan that space agencies participating in the space-based GOS can respond to (Two regional workshops, East and West IO) - Q1 and Q2 2006.
3) Step 3: Coordination meeting to prepare Consolidated Plan - Q3 2006.
4) Step 4: Operational test - Q2 2007.
5) Step 5: Evaluation of satellite system performance and impacts - Q3 2007.

The estimated cost of the project is US$ 350,000 and it will start upon availability of funding. The WMO also indicated that it would ensure that these requirements are integrated within the Global Earth Observing System of Systems (GEOSS) 10-year plan.

4. The WMO will continue to promote the benefits of a multi-hazard approach to the tsunami early warning system and significantly contribute to its implementation through its infrastructure, coordination and leadership in early warning systems for all hazards related to weather, water, and climate.

6 WAYS AND MEANS TOWARDS THE NETWORKING OF NATIONAL TSUNAMI WARNING CENTRES IN A REGIONAL OPERATIONAL FRAMEWORK

In his introduction of this Agenda item, Dr. David Pugh, the IOC Chairperson, explained that he participated in this Meeting in his capacity as the IOC Chairman to identify the decisions that would be required from the Twenty-third Session of the IOC Assembly that will be held between 21 and 30 June 2005, and to which the 130 Member States of the IOC will be invited to attend. He informed the Meeting that the first day of the Assembly would be dedicated to the IOTWS. President Clinton, in his capacity of Special Envoy of the Secretary-General of the United Nations for [the follow up of the 28 December tsunami], as well as the Secretary-General of the United Nations, Mr. Kofi Annan, will be invited to this special day.

Dr. Pugh strongly welcomed the close collaboration between the IOC, ISDR and the WMO in the IOTWS development. He further noted the considerable number of actions taken by Member States in the Indian Ocean following the Paris meeting, referring to the national reports, submitted under Agenda Item 5.1. He pointed out however, that a series of national plans does not constitute an integrated programme and he stressed the need for strong regional collaboration. He noted that the IOC provides the mechanism for such coordination.

Dr. Pugh then introduced the speakers for this Agenda Item.

6.1 COORDINATION MECHANISMS PROPOSED BY THE FIRST INTERNATIONAL COORDINATION MEETING FOR THE DEVELOPMENT OF A TSUNAMI WARNING AND MITIGATION SYSTEM FOR THE INDIAN OCEAN WITHIN A GLOBAL FRAMEWORK

In his presentation, Mr. Peter Pissierssens, Head Ocean Services, IOC, recalled the recommendations formulated in the Communiqué of the First International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean within a Global Framework (Paris, 3-8 March 2005) including the recommendation to establish the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS*)* of which he described in detail the proposed terms of reference. He further recalled that the Paris meeting had stressed that the IOTWS should consist of a coordinated network of national systems and capacities, building upon existing organizations and institutions, and complementing existing warning frameworks. All associated assets should be owned and operated by the Member States. He noted that the Paris communiqué had stated that every endeavour should be made to share seismic, sea-level and other data, as well as national assessments and warnings relevant to tsunamigenic events at or near real-time. He further recalled that Member States in the Indian Ocean region had been requested to provide their official 24x7 contact information by 1 April and noted that, as reported under Agenda Item 4.1, only about fifteen had done so by 15 April 2005. He therefore called on Member States to urgently provide the requested information to the IOC Secretariat.

Mr. Pissierssens, referring to Document IOTWS-II/5 (IOC/INF-1213), introduced the proposal for Member States to establish National Tsunami Warning and Mitigation Coordination Committees to facilitate the integration of the various sectors and actors required at the national level. He provided details on the proposed membership and objectives of such Committees and stated that the planned assessment missions would work closely together with these Committees.

6.2 COORDINATING THE DISSEMINATION OF TSUNAMI RELATED INFORMATION AND TRAINING: THE CASE FOR AN INTERNATIONAL TSUNAMI INFORMATION CENTRE FOR THE INDIAN OCEAN

In her presentation, Dr. Laura Kong, ITIC Director, referred to Document IOTWS-II/6 (A Regional Tsunami Information Centre: Roles and functions for the implementation of an effective tsunami warning and mitigation system). She stated that the implementation of an end-to-end tsunami warning system can be facilitated greatly by the establishment of a Regional Tsunami Information

Centre (RTIC), which can efficiently serve as an information resource from which nations can draw upon to build their national systems.

Ms. Kong identified the purposes and functions of such a Centre as follows: (i) monitor the international tsunami warning activities in the Region and recommend improvements with regard to communications, data networks, data acquisition, data processing, tsunami forecasting methods, and information dissemination; (ii) bring to Member and non-Member States of the Region knowledge on tsunami warning systems, on the affairs of the IOC and RTIC, and on how to become active participants in the activities of the Regional Tsunami Warning System; (iii) assist Member States of the Region in the establishment of national warning and mitigation systems, and the improvement of tsunami preparedness for all nations in the Region through the implementation of comprehensive mitigation programmes in risk assessment, warning guidance and emergency response, and education and awareness; (iv) act as a technical resource providing for the transfer of technology, and the fostering of research and its application to prevent loss of life and minimize damage to property; (v) act as an information resource providing for the development, publication, and distribution of educational and preparedness materials on tsunamis and tsunami hazards; and (vi) act as an information resource on tsunami events, cooperating with the World Data Centre for Solid Earth Geophysics and the ITIC in collecting and making available through appropriate channels all records pertaining to tsunami events, and assisting national authorities in making investigations of all aspects of major tsunamis, including the development of standard survey procedures for such investigations.

The RTIC will support and carry out the work plan of the ICG/IOTWS and should work closely with the Member States, the ITIC (in Honolulu, Hawaii) and the IOC Secretariat to implement the most effective warning and mitigation system for the Region. She stated that the Regional Tsunami Information Centre (RTIC) should be hosted by a Member State of the Region.

6.3 DISCUSSIONS

The Chair of the Meeting, Mr. Seeballuck, then invited comments and discussions.

During the discussions, several countries called on the IOC to undertake assessment missions to assist with advice on the establishment of cost-effective solutions. Reference was also made for the need of cooperation on the access to, and exchange of (real-time) data, using the most effective technological solutions.

With regard to the “last-mile solution,” the Representative of the International Telecommunications Union (ITU) offered the ITU expertise to bring messages to the population (especially rural communities) through e.g., telecentres. He also offered the considerable expertise and experience of the ITU in e-learning.

The Meeting welcomed the principle of the Regional Tsunami Information Centre (RTIC) but called on the ICG/IOTWS to further define the technical requirements and objectives.

The Meeting noted that National Tsunami Warning Centres could be sub-divided into 3 categories: (i) Centres that will receive warnings (from other Centres in the region) that will then feed into national mitigation systems for appropriate action; (ii) Centres that will receive warnings but also operate local observation platforms (e.g., sea-level stations); and (iii) Centres that will develop analysis capabilities so they can issue warnings. It is expected that in a few years, the 27 countries in the region will become sub-divided into the aforementioned categories. It was recalled that it is similar to what evolved in the Pacific region where there are now 5 analysis centres.

7 THE WAY FORWARD

7.1 GENERAL DISCUSSIONS

This Agenda Item was introduced by Dr. Jan Sopaheluwakan (Indonesia). He explained that it was important to have concise formulations on the important issues that we achieved during this Second meeting. The Mauritius Declaration will be one of the important results of the meeting. We have seen that the ICG/IOTWS has been given the mandate to govern the system and its terms of reference have been prepared. The next step will be to identify the date and place of the First Session and its Agenda.

Dr. Patricio Bernal (IOC Executive Secretary) recalled the timeline that had been set by the First Coordination Meeting in Paris. It was agreed in Paris that:

(i) by the end of September, the interim system should be established and operational. This would include the upgrading of 15 tide gauges. He noted that Mauritius has upgraded 2 tide gauges to become the national component of the TWS. He further reported that the IOC is now establishing a tsunami unit within the Secretariat to accomplish these goals;

(ii) the fully-fledged IOTWS should be in operation preferably by July 2006 and not later than the end of 2006;

(iii) by 1 April, all countries should have provided national contact points. He recalled that only about 15 had now been identified.

During the discussions, several delegations called for a detailed timeline and work plan. At this point the Chair referred to Document 5 (IOC/INF-1213) entitled “Progress and further requirements for the development of a Tsunami Warning and Mitigation System for the Indian Ocean”, and specifically to Section 4 (Immediate additional needs of Core system implementation: Project TSU-REG-05/CSS10-region) and Annex 2 (Status of on-going Projects: Proposals Submitted to OCHA by ISDR). It was pointed out that these document sections provide detailed work plans, timeline and budgets for the period March 2005 - March 2006.

Reference was made to the absence of DART buoys in the technical solution planning. In this regard it was noted that such instruments were included in existing national implementation plans (e.g., India). In addition, it was noted that sea-level gauge technology was more accessible and cheaper to maintain.

It was pointed out that the next and urgent step forward will be the organization of the assessment missions (as planned and illustrated in Document 5, Annex 3). These will then enable Member States to define clear and comprehensive national work plans and to formulate, as appropriate, proposals for submission to donors. Preferably the missions should be completed prior to the Twenty Third Session of the IOC Assembly, so an assessment report can be distributed at that time. This report will then also enable the definition of a comprehensive capacity building plan, of which the implementation can be coordinated by the IOC.

It was also stressed that there has to be political will of the countries in the region to establish the TWS.

7.2 ADOPTION OF THE MAURITIUS DECLARATION

The Meeting adopted the following Declaration:

We, the participants of the Second International Coordination Meeting for the Development of an Indian Ocean Tsunami Warning and Mitigation System held in Grand Baie on 14-16 April 2005:

1. Recall the many directions and guidance provided by the Special ASEAN Leaders’ meeting in Jakarta on 6 January 2005, the UN Conference on Small Island Developing

States held in Port Louis on 14 January 2005, the UNGA Resolution 59/279 in New York on 19 January 2005, the Common Statement of the Special Session on Indian Ocean Disaster and the Hyogo Framework for Action 2005-2015, both adopted at the World Conference on Disaster Reduction in Kobe on 22 January 2005, the Ministerial Declaration in Phuket on 29 January 2005, the GEO Communiqué in Brussels on 16 February 2005, and the technical meetings held in India, China and Indonesia;

2. Endorse the communiqué adopted by the International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean within a global framework held in Paris at UNESCO Headquarters on 3-8 March 2005;

3. Reaffirm that the Indian Ocean Tsunami Warning System (IOTWS) will be a coordinated network of national systems and capacities;

4. Reaffirm also the need for the establishment of an Intergovernmental Coordination Group (ICG) by the Intergovernmental Oceanographic Commission (IOC) Assembly to govern the IOTWS;

5. Recognize the unique tectonic plate structure of the Indian Ocean, and that there are primarily two tsunamigenic sources that could affect the coastlines of the Indian Ocean, namely the Indonesian seismic zone and its extensions, about 4000 km in length, and the Makran source;

6. Welcome the plans and intentions of Australia, India, Indonesia, Malaysia and Thailand to develop their national capability to detect, analyse and provide timely warning of tsunami generated along the Indonesian seismic zone and its extensions, as well as the plans of India, Iran and Pakistan to cover the Makran source;

7. Encourage these countries to continue to cooperate closely in developing their national systems to ensure effective coverage of the above-mentioned tsunamigenic zones;

8. Reaffirm that each Member State should have the responsibility to issue warnings within their respective territories;

9. Urge the ICG, as the governing body of the IOTWS, to develop and coordinate appropriate arrangements for the effective and timely dissemination of tsunami advisory information and warnings;

10. Reaffirm that all regional efforts should serve the purpose of strengthening international cooperation aimed at the creation of a global multi-hazards warning system;

11. Welcome the plans and intentions of all countries of the Indian Ocean to enhance their abilities to receive tsunami advisory information and warnings and issue appropriate warnings within their respective territories on a 24x7 basis;

12. Welcome the efforts by countries of the Indian Ocean to, jointly or individually, enhance their capacity to build knowledge, public awareness, preparedness, including through the use of traditional knowledge, and exchange good practices globally;

13. Recognize the many generous offers of financial, technical and other kinds of assistance made by countries across the globe to help establish the IOTWS, including the further generous pledges of assistance made at the Mauritius meeting;

14. Invite the countries of the Indian Ocean to complete by July 2005, where necessary with the support of UNESCO/IOC, an assessment of their requirements and capacity needs for

an effective and durable national tsunami warning and mitigation system, to be followed by the development of appropriate national strategic plans;

15. Welcome the readiness of Member States and other donors to provide further financial, technical and other kinds of assistance to promote national capacity, and in this context request UNESCO/IOC to develop a mechanism to coordinate donor assistance in relation to assessed needs;

16. Note with appreciation that the Pacific Tsunami Warning Centre (PTWC) and Japan Meteorological Agency (JMA) have started to provide interim tsunami advisory information to authorized contacts in the Indian Ocean States, that many Member States have already provided information on their designated contact points and that the remaining Member States will provide this information as soon as possible;

17. Express our determination to enhance regional and national capacities for tsunami detection, including through further upgrading of existing observation facilities;

18. Reaffirm our commitment to an open, free and unrestricted sharing of tsunami-relevant real-time observational data in accordance with the UNESCO/IOC Oceanographic Data Exchange Policy and without prejudice of the sovereignty of Member States;

19. Call for the formal creation of the IOTWS and the Intergovernmental Coordination Group for the IOTWS by a resolution at the Assembly of the Intergovernmental Oceanographic Commission (IOC) to be held in Paris on 21-30 June 2005;

20. Request Indian Ocean Member States to report to the forthcoming IOC Assembly on national progress made in establishing IOTWS;

21. Recommend that the first meeting of the Intergovernmental Coordination Group of the IOTWS be held in the second half of 2005 and, among other matters, develop a strategic plan to implement the IOTWS;

22. Request the UNESCO/IOC Secretariat to finalize the technical plans for the detection systems of the IOTWS through the convening of the technical working groups identified at the Paris meeting, for consideration by the first meeting of ICG/IOTWS;

23. Appreciate the financial contribution made by Japan to make the Second International Coordination Meeting for the Development of an Indian Ocean Tsunami Warning and Mitigation System possible;

24. Express appreciation to UNESCO's Intergovernmental Oceanographic Commission for its strong coordination role, the UN International Strategy for Disaster Reduction Secretariat for its guidance and support, and the World Meteorological Organization for its infrastructure and technical support;

25. Also express appreciation to the Government of Mauritius for hosting the Second International Coordination Meeting for the Development of an Indian Ocean Tsunami Warning and Mitigation System.

Grand-Baie, Mauritius, 16 April 2005.

8 CALL TO DONORS: PROJECT PROPOSALS FOR THE ESTABLISHMENT OF NATIONAL AND REGIONAL TSUNAMI EARLY WARNING SYSTEMS, WITH FOCUS ON THE INDIAN OCEAN

8.1 PRESENTATION ON THE DOCUMENT "PROGRESS AND FURTHER REQUIREMENTS FOR THE DEVELOPMENT OF A TSUNAMI WARNING AND MITIGATION SYSTEM FOR THE INDIAN OCEAN"

The Executive Secretary presented the bluebook for development of an Indian Ocean Tsunami Warning System (Document 5).

Indonesia pointed out that the Indian Ocean GOOS is an important organization for the implementation of an IOTWS and invited participants to the next IOGOOS meeting, 9-11 August, in Jakarta or Bali.

South Africa noted that their proposal was submitted, but too late to be included in the extant version of the bluebook and inquired how proposals not yet included are to be dealt with.

The Executive Secretary clarified that the current bluebook is only a first step in an iterative procedure that will require close cooperation between donors and proponents of individual proposals.

Tanzania noted that arrangements for bilateral funding appear to have been emphasized in the development of the IOTWS so far, but that this should not be the only option. There should be a minimum common denominator available through multilateral funding and assistance mechanisms for all countries in the region. Bilateral arrangements can be made for activities above and beyond this minimum. It is important that the least advanced countries are not left out of the process.

The Executive Secretary clarified that this is precisely the role that UNESCO/IOC wishes to play and the need the bluebook is intended to serve.

Sri Lanka requested clarity as to the responsibilities of individual governments vs. those of UNESCO/IOC. Is it up to individual governments in the region to make bilateral agreements with donor nations or will they be facilitated by UNESCO/IOC? There is a lack of clarity on how the bilateral vs. multilateral processes will operate. There is a need for precise definitions on who is responsible for what and how to obtain funding.

The Executive Secretary clarified that there are two types of projects. National projects are the responsibility of national governments – the Blue book lists them for purposes of coordination and transparency. The second type of project is regional in nature and being promoted by various regional or international organizations. Implementation of these later projects will require that donor countries employ multilateral funding mechanisms and the IOC is ready to support this as called upon to do so.

Thailand announced that it has decided to set up an end-to-end operational tsunami warning system with a budget of about 60 million dollars provided by the Thai government. The system will be operational by 2007. Assistance from donor countries to enhance this effort will be appreciated. A 10 million dollar multi-donor trust fund is available within this effort as a mechanism for donor countries to provide support to countries in the region.

The IOGOOS Chair pointed out that IOGOOS has made significant progress in developing operational oceanographic observations in the Indian Ocean over the past two years and has a relevant proposal in the bluebook. The Director-General of UNESCO has repeatedly presented IOGOOS as an excellent framework for tsunami warning activities in the region. The IOGOOS Chair supported the intervention of Indonesia in this regard.

Bangladesh drew attention to the fact that its proposal in the Blue book on page 23 has a budget request which should, but does not, appear in the summary table on page 18. Bangladesh has

not yet done anything to establish a tsunami warning system but is very keen to do so. The first required step is for an IOC technical mission to be sent to Bangladesh to assess their needs.

8.2 DONOR COUNTRY INTERVENTIONS

Full statements are available in Annex IV.

Finland announced a new contribution of 1.4 million Euros for upgrading tide gauges in the region under the auspices of GLOSS to be provided via the IOC Trust Fund. Finland is a strong supporter of the IOC and UN. Finland has expressed its intention to participate in the IOTWS, both globally and bilaterally. Finland will further consider support to facilitate full participation of the coastal countries of Africa in the system. Finland stressed the importance of a multi-hazard, multi-purpose system and improving communications systems. Finland feels that SMS technology should be included as a fast and effective mechanism to provide alerts to the general public.

Belgium announced a new contribution, above and beyond its regular and on-going contributions, of 500,000 Euros per year to be used for tsunami-related training and education activities carried out at the IOC-IODE Office in Ostend, to be provided via the Flanders UNESCO Science Trust Fund.

France announced that it is enhancing seismological stations and upgrading tide gauges on a number of islands in the Indian Ocean region. France plans to send expert teams to a number of countries in Africa to assist with identifying their needs and improving their telecommunications systems. France is in discussion with the two most effected countries from the 2004 event, Indonesia and Sri Lanka, to assist with the development of crisis management centres.

Norway announced a new contribution of 12 million Norwegian Kroner (~2 million US dollars) above and beyond its previous commitments to the ISDR via the OCHA call. The money is to be made available via the IOC Trust Fund for 3 primary purposes. 1) Enhance the technical support available to IOC for its tsunami warning coordination activities 2) Sea-level measurements 3) Support for those countries in the region with special needs. Norway may additionally be engaged in bilateral activities with individual countries in the region. Norway confirmed a strong commitment to developing a strong and sustainable multi-hazard warning system in the Indian Ocean region. Norway stressed the linkage between natural disaster and development programs, as capacity building is often a prerequisite for the operation of a technically advanced system. This meeting in Mauritius is a part of a process and that the UN, through its IOC, has been given a mandate to take the lead in coordinating and developing the IOTWS. Norway is happy to see that this is increasingly recognized. Bilateral agreements are welcome but cannot replace the regional needs. Not a single country should be left out and a coordination mechanism among all efforts is required. UNESCO/IOC is the focus of this effort.

Australia reaffirmed its strong support to the development of an effective and durable tsunami warning system built upon national efforts. Australia encourages the IOC to invite the government of East Timor to join the countries involved in these efforts. Australia will make every endeavour to make its own tsunami warning information available to countries in the region. Regional assistance and training and direct support to the IOC are also under consideration. Australia welcomes the efforts of the IOC to coordinate national efforts.

Japan is committed to providing its technical expertise and bilateral financial support to countries in the region. Japan has already provided 4 million dollars to ISDR via the OCHA call. Japan is willing to consider additional support once a clear picture of the basic design of the IOTWS and timetable for its installation with strong ownership on the part of the countries in the region is available. The material in the Bluebook provides a start in this direction.

The European Union has provided substantial funding to the ISDR via OCHA through its ECHO program. After adoption of the EU tsunami statement by the commission later this month, the EU will be in a position to announce the possible support for the IOTWS at the next IOC Assembly in June in Paris. ISDR is the most appropriate vehicle for coordination of EU-funded efforts. A number

of EU grants have already been provided to help in the development of tsunami warning efforts world-wide, including the Indian Ocean region.

Germany announced a new contribution of a secondment of an oceanographer to the IOC Secretariat to support their tsunami warning coordination efforts. Germany is committed to a global multi-hazard warning system, including an Indian Ocean Tsunami Warning System. Furthermore, the German Government will sponsor a conference on warning to promote international cooperation in this field.

China announced that it will provide technical expertise through bilateral agreements with countries in the region. China will hold a workshop in June, including training in tsunami warning models for countries in the South China Sea. China will continue to support the IOC in its leading role in promoting and coordinating the IOTWS.

The United States legislature is currently debating a Presidential request for 900 million dollars in support of tsunami efforts. Some of this will be bilateral aid. Some is being set aside for contribution to a multi-hazard global hazard monitoring, assessment and warning system. Integrated end-to-end disaster approaches. Risk reduction for all coastal hazards. Enhanced mechanisms for real-time data sharing. The US supports the lead coordinating role of the IOC in developing a global warning system. The United States will hold an all hazard best practices workshop from June 6-10, in Honolulu.

Italy announced a new contribution of 1 million dollars above and beyond the funding that Italy has already contributed to tsunami relief efforts. Italy acknowledges that coordination efforts are required for developing an IOTWS. National efforts, while welcome, should be part of a coordinated effort lead by UNESCO. Italy is willing to make available further funding and looks forward to working closely with the IOC Secretariat before the IOC Assembly in June in order to finalize the range of Italian support for this exercise.

India has established a 30 million US dollar end-to-end program for tsunami warning. 700 million dollars of associated satellite and ship activities are on-going. India pledges technical training via the IOC to countries in the region as a contribution to capacity building in the region.

IMO confirmed its support and contribution to the IOTWS, stressing marine distress systems.

ITU confirmed its support and contribution to the IOTWS, stressing communications technologies.

WMO confirmed its support and contribution to the IOTWS, stressing operational agencies.

ISDR confirmed its support and contribution to the IOTWS, stressing community education.

9 CLOSURE OF THE MEETING

In his closing words, the Hon. Minister Seeballuck noted that, with the adoption of the Mauritius Declaration, the Meeting had made good progress towards the development of a Tsunami Warning and Mitigation System for the Indian Ocean region. The Mauritius meeting has enabled the region to make an inventory of the facilities that exist at the national level, the level of preparedness in Member States and the requirements to develop a national tsunami warning system.

The Meeting also took note of the readiness of donor countries and agencies to provide funding for the development of the System. The Hon. Minister thanked the donors and agencies on behalf of the Indian Ocean Member States. The Hon. Minister further expressed his appreciation to the UN agencies that, shortly after the 26 December events, had taken the lead to establish a Tsunami Warning and Mitigation System for the Indian Ocean.

He expressed the hope that this matter would remain high on the agenda. He also thanked the IOC Executive Secretary and his team for their efforts in making the Mauritius meeting a success, and thanked the Delegates and Representatives for their active participation in the Meeting.

Dr. Patricio Bernal, Executive Secretary IOC, thanked the participants for their support and participation, the Chair for his excellent guidance, and the Government of Mauritius for the excellent organization and beautiful venue. He also expressed his appreciation to the donors for their strong interest in the IOTWS.

Dr. Bernal noted that 16 requests for national assessment missions had been received by the IOC Secretariat and he announced that, in coordination with ISDR, these missions would be organized within the next few months.

The Meeting was closed on 16 April 2005 at 14h05.

ANNEX I

AGENDA

1. OPENING

2. ADMINISTRATIVE ARRANGEMENTS
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   - 2.2. ADOPTION OF THE AGENDA
   - 2.3. DOCUMENTATION AND PRACTICAL ARRANGEMENTS

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4. REPORT ON THE STATUS OF THE INTERIM ADVISORY INFORMATION SYSTEM AND HOW IT SATISFIES THE NEEDS OF THE PARTICIPATING COUNTRIES
   - 4.1. STATUS OF THE ESTABLISHMENT OF NATIONAL CONTACT POINTS (PRIME AND ALTERNATE) FOR ADVISORY INFORMATION
   - 4.2. SPECIFIC ARRANGEMENTS MADE BY THE PACIFIC TSUNAMI WARNING CENTER (PTWC) AND THE JAPAN METEORLOGICAL AGENCY (JMA) TO PROVIDE THE INTERIM TSUNAMI ADVISORY INFORMATION SERVICE TO INDIAN OCEAN MEMBER STATES
   - 4.3. COMMUNICATION PLAN FOR THE INTERIM TSUNAMI ADVISORY INFORMATION SERVICE

5. REPORTING ON PROGRESS WITH THE DEVELOPMENT OF NATIONAL TSUNAMI WARNING AND MITIGATION INITIATIVES
   - 5.1. NATIONAL REPORTS
   - 5.2. REPORT ON PROGRESS WITH THE UPGRADING AND EXPANSION OF THE SEA LEVEL OBSERVING NETWORK IN THE INDIAN OCEAN
     - 5.2.1. Tsunami Warning Systems for the Indian Ocean: Efficient use of Tide Gauge Stations
   - 5.3. REPORT OF THE EXPERT MEETING ON THE EXCHANGE OF EARLY WARNING AND RELATED INFORMATION INCLUDING TSUNAMI WARNINGS IN THE INDIAN OCEAN (JAKARTA, 16-18 MARCH 2005)

6. WAYS AND MEANS TOWARDS THE NETWORKING OF NATIONAL TSUNAMI WARNING CENTRES IN A REGIONAL OPERATIONAL FRAMEWORK 15
   - 6.1. COORDINATION MECHANISMS PROPOSED BY THE FIRST INTERNATIONAL COORDINATION MEETING FOR THE DEVELOPMENT OF A TSUNAMI WARNING AND MITIGATION SYSTEM FOR THE INDIAN OCEAN WITHIN A GLOBAL FRAMEWORK
   - 6.2. COORDINATING THE DISSEMINATION OF TSUNAMI RELATED INFORMATION AND TRAINING: THE CASE FOR AN INTERNATIONAL TSUNAMI INFORMATION CENTRE FOR THE INDIAN OCEAN
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7. THE WAY FORWARD
   - 7.1. GENERAL DISCUSSIONS
   - 7.2. ADOPTION OF THE MAURITIUS DECLARATION

8. CALL TO DONORS: PROJECT PROPOSALS FOR THE ESTABLISHMENT OF NATIONAL AND REGIONAL TSUNAMI EARLY WARNING SYSTEMS, WITH FOCUS ON THE INDIAN OCEAN

8.1. PRESENTATION ON THE DOCUMENT “PROGRESS AND FURTHER REQUIREMENTS FOR THE DEVELOPMENT OF A TSUNAMI WARNING AND MITIGATION SYSTEM FOR THE INDIAN OCEAN”
8.2. DONOR COUNTRY INTERVENTIONS

9. CLOSURE OF THE MEETING

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ANNEX III

SPEECHES

**Address of the Honourable Paul Raymond Bérenger,
Prime Minister of the Republic of Mauritius at the Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean**

Colleague Ministers,

Mr. Patricio Bernal, Assistant Director-General of UNESCO and Executive Secretary of the Intergovernmental Oceanographic Commission, the IOC,

Distinguished Delegates from Overseas,
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Ladies and Gentlemen,

The Government and people of the Republic of Mauritius are honoured indeed to host this high-level UNESCO/IOC Second International Coordination Meeting for the Development of a Tsunami and Mitigation System for the Indian Ocean and it is with great pleasure that I extend a warm welcome to you all.

Ladies and Gentlemen,

The world was badly shaken by the tsunami of 26 December last, one of the strongest ever known, which brought indescribable loss and desolation to countries in and around the Indian Ocean region. The horrendous pictures of the aftermath of this catastrophe are indelibly imprinted on our minds. The earthquake which struck Sumatra on 28 March this year was a grim reminder that another tsunami may strike at any time and that the setting up, at the earliest, of an early warning and mitigation system for the Indian Ocean is therefore of paramount importance. For although we are incapable of withstanding the forces of nature once unleashed, we can put ourselves in an optimal state of preparedness.

The United Nations International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States held in Mauritius just two weeks after the deadly December 26 tsunami and the more tsunami-focused meetings which followed, particularly the UNESCO/IOC First International Coordinating Meeting held in Paris in March, have all contributed to create maximum awareness and have boosted networking efforts to help mitigate the impact of future such catastrophes.

Ladies and Gentlemen,

I note from the IOC Report which came out of the Paris Meeting last month that the meeting has recognized, I quote "**the need to develop a tsunami warning and mitigation system in the Indian Ocean with the purpose of enhancing all aspects of tsunami disaster mitigation, including hazard assessment, detection and warnings, preparedness, and research through international cooperation and coordination of activities**". End of quote. The recommendations in that report have benefited from the contributions of previous International Meetings held in Kobe and Phuket respectively. I wish to express my appreciation of the intention and plans of friendly countries within and outside the Indian Ocean region to establish systems and capacities to detect potential tsunamigenic events, detect and measure tsunamis, forecast their impacts and issue appropriate warnings and provide relevant information to other interested and concerned Member States.

Ladies and Gentlemen,

This UNESCO/IOC Second International Coordination Meeting is another key event that will pave the way towards better preparedness and the formulation and implementation of mitigation

strategies. This meeting provides the right platform for donors to pledge funds for the different initiatives to be undertaken at national and regional levels, under the responsibility of the different partners identified at the Paris meeting. It is expected that longer-term commitments to tsunami and other natural disaster-related risk management will follow.

Ladies and Gentlemen,

Mauritius, like many other Small Island Developing States, is prone to natural disasters such as cyclones and we are particularly vulnerable given our size. Over the years, we have been able to develop the right mechanisms for early warning and public awareness and preparedness as well as for post-disaster recovery and rehabilitation. In Mauritius, a National Cyclone and other Disasters Committee closely monitors the situation. However, given the increase which we have noted recently in the frequency and intensity of natural disasters, it is imperative for us to have a well-planned and highly effective early warning system and to adopt new disaster management technologies. Moreover, a good and reliable early warning system will give comfort and a feeling of security to the population in the region.

Ladies and Gentlemen,

It is high time that we take firm decisions for the rapid and successful implementation of the early warning system project. Procrastination could result in more loss of life, material damage and irreversible negative impacts. Our discussions should therefore be action and result-oriented, specially on the following key issues:

- The type of early warning system best suited for the region;
- The funding required and the contributions which will effectively be made;
- The immediate identification of training and capacity needs; and
- The choice of the site for an eventual Regional Centre.

I do share the view of the Director-General of UNESCO that the system should be built on, I quote, "**a foundation of international cooperation in accordance with the principle of open, free and unrestricted exchange of data and information**". End of quote.

Ladies and Gentlemen,

I would like to avail myself of this opportunity to congratulate UNESCO/IOC, that is, the Intergovernmental Oceanographic Commission of UNESCO, for its leadership and praiseworthy initiative in mounting a series of meetings with the objective of developing, within a global framework, an early warning system for and in the Indian Ocean. We are grateful indeed for this proactive approach as natural disasters respect neither geographical nor political boundaries.

I welcome the proposal to set up an Intergovernmental Coordination Group to coordinate the activities of the eventual Indian Ocean Tsunami Warning and Mitigation System and to organize and facilitate exchange of information and also promote research on tsunamis. Needless to say that Mauritius stands ready to participate in and contribute to the work of this Group.

I wish all participants in this meeting very fruitful discussions. I have no doubt that your recommendations with regard to the type of system to be put in place and the choice of the site for an eventual Regional Centre will be guided by technical considerations and the best interests of the hundreds of millions of people living in this region and who have pinned their hopes to you.

May I take this opportunity to convey our appreciation and grateful thanks to the donors present at this meeting for their interest in this project. We are all bent on finding ways and means to avert any recurrence of the unprecedented scale of death and destruction which the December 26 tsunami brought in its wake. We rely on the contributions of donors to make of this project a reality.

Finally, let me also wish all our friends from overseas a very pleasant stay in Mauritius. I hope that you will find some time to visit our rainbow island and meet our people.

I now have the pleasure to declare officially open this Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean within a Global Framework.

Thank you.

Address by Mr. Koïchiro Matsuura, Director-General of the United Nations Educational, Scientific and Cultural Organization (UNESCO) on the occasion of the Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean, Grand Baie, Republic of Mauritius, 14 April 2005

Excellencies,
Distinguished Participants,
Ladies and Gentlemen,

I would like first to acknowledge and sincerely thank the Government of the Republic of Mauritius for hosting this second coordination meeting for the development of a tsunami warning system for the Indian Ocean, here in this beautiful town of Grand Baie. The strong participation in this important meeting is particularly heartening as we begin to take the first steps to actually build the tsunami early warning system.

Nature has alerted us once again that there is no place for complacency. On March 28, two days before the deadline established in Paris to designate the national focal points to receive tsunami advisory information from the Pacific Tsunami Warning Centre in Hawaii and from the Japanese Meteorological Agency Centre in Tokyo, the eastern Indian Ocean basin was exposed again to the menace of a tsunami in the aftermath of a severe earthquake – recorded at 8.7 on the Richter Scale – that hit a string of islands off Sumatra. At least 647 people were killed and many thousands of people were reminded of their acute vulnerability.

First of all, we must acknowledge the swift and appropriate response of the authorities that, having received authoritative seismological information, decided to act by warning or evacuating their coastal populations.

Fortunately, no destructive tsunami was generated, though a perturbation did occur and was detected. However, the downside of this emergency is that, at the time of the earthquake, we still did not have any way of detecting the presence of a tsunami in the eastern part of the Indian Ocean. It was the provision of travelling-time information that enabled the lifting of the warning – that is, when the time that elapsed from the occurrence of the earthquake exceeded the expected arrival time for different locations.

I cannot hide my concern when I learned that, at that moment, only two countries had identified their national focal points to receive tsunami advisory information, although this week I am informed that thirteen national focal points have now been designated. Meanwhile, last Sunday, around 5:30 in the afternoon, the region was again shaken by another earthquake of magnitude 6.8 on the Richter Scale, off the city of Padang in Sumatra. It seems that Nature is trying to tell us something.

The risk of tsunami is real and we cannot afford to be unprepared in case a major disaster occurs. It would be unthinkable that all this outpouring of goodwill and leadership that we have witnessed since 26 December would be totally ineffective in the case of a renewed tragedy. We would lose all credibility. I therefore urge all governments participating in this initiative, especially those that were not affected and where the urgency to act might seem like an exaggerated over-reaction, to really commit themselves. They can do this by immediately identifying and empowering their national focal points for receiving tsunami information.

I also call on the countries hosting the GLOSS sites that have been identified to be upgraded to act now by facilitating the deployment of the new instruments and by cutting through the red-tape. Let me repeat: there is no room for complacency. ITSU has started the application of the regular protocols to check on the effectiveness of these links, and we are ready to provide information on the success rate at the request of the different countries. We all need to be mutually accountable, and these communication drillings serve that additional purpose too.

Ladies and Gentlemen,

The recent events in the Indian Ocean call for an urgent improvement of ocean observing systems and for enhancing the capacity of all nations to make optimum use of the information and services that these systems generate. The international community has shown an unprecedented and generous level of response to the emergency generated by the tragedy of last December and a strong will to accompany the community of affected countries in the rehabilitation and reconstruction phase.

Allow me now to provide some background and orientation on where we are right now in this process. I will raise four main points.

First, the nations of the Indian Ocean have decided to build a single Indian Ocean Tsunami Warning System under the coordination provided by the Intergovernmental Oceanographic Commission (IOC) of UNESCO. They have further agreed to establish an Intergovernmental Coordination Group to provide for its governance. This Coordination Group will be established through the adoption of a resolution by the 23rd IOC Assembly that will take place in Paris in the third week of June 2005.

The system will apply the robust, comprehensive mitigation approach based on three mutually dependent components: the assessment of tsunami hazards; the detection/warning system; and the adoption and promotion of preparedness measures at country level.

My second main point is that we have put in place a mechanism to provide tsunami advisory information to the Indian Ocean rim and have started to implement immediately an interim solution while we finalize plans for the full system. The upgrading of existing sea-level stations to equip them for tsunami warning has proceeded as funds from the emergency UN Flash Appeal are becoming available. I would like to express here our appreciation to those nations that have provided donations for the implementation of the Tsunami Warning System.

Third, we are in the process of enlarging that support beyond what the initial Flash Appeal covers. In principle, the emergency help applies to the directly affected countries during the initial period after a disaster. However, building the warning system requires that actions are taken at the national level in all countries of the Indian Ocean rim. For that purpose, we have presented, under the coordination of the IOC of UNESCO, a new regional project in the Mid-Term Review of the UN Flash Appeal. Furthermore, together with the International Strategy for Disaster Reduction (ISDR), the World Meteorological Organization (WMO) and other international agencies and partners engaged in the process, we have prepared an integrated document that defines the needs in the different areas of implementation of the system and for all participating nations.

Fourth, taking into account that the full system depends on the joint operation of the detection/warning system and on each national system of emergency preparedness, we need to act simultaneously at these two levels. While support to build-up the institutions that will act as national focal points can be provided immediately to participating nations, we need to complete the basic design of the observation networks beyond sea-level stations. Moreover, we need to plan for the assessment of the tsunami hazard in the region, coordinate the post-tsunami research, and plan all the medium- to long-term actions that will build a safe, effective and people-oriented system.

Ladies and Gentlemen,

I would like to remind everyone that UNESCO's IOC has proposed a strategy to make this regional effort the first step in building a Global Tsunami Warning System. Tsunami risk exists in all

ocean basins to different degrees. This proposal is consistent with the long-term goal of IOC to establish a Global Ocean Observing System, that can underpin a variety of ocean services world-wide. As we said in Paris, the sensible way to proceed is to develop a tsunami warning system fully embedded in the global operational ocean observing system that is regularly used for other related hazards, such as storm surges and cyclones. Storm surges associated with tropical cyclones can hit coastal areas well ahead of the landfall of the actual storm, with nearly the same rapidity as tsunamis, but they occur much more frequently. Together with our partners in building GOOS, especially with WMO, we are working on the technical elements that would help to integrate the Tsunami Warning System of the Indian Ocean into a multi-hazard system.

The GLOSS tide gauge network, which we are upgrading to provide immediate tsunami protection, can provide vital information for model validation and data assimilation in high-resolution models employed for storm surge prediction. The same high-resolution coastal bottom topography data needed for tsunami run-up and inundation maps is also required for storm surge impact modelling.

In response to the Indian Ocean tsunami, at their last Earth Observation Summit in Brussels the Group on Earth Observations (GEO) adopted a declaration supporting the coordination efforts that UNESCO and IOC are leading on behalf of the UN system. We welcome this development. Because of this mutual recognition, at this time when they are moving ahead with plans for 2006, I call on the leaders of GEO to seize this unique opportunity to prove the validity of the concepts underpinning the design of Global Earth Observation System of Systems (GEOSS).

Far from promoting a huge, single, centralized system, the goal is to integrate the existing efforts in an architecture that allows for the many specialized environmental, meteorological and oceanographic services to be run by the corresponding responsible agencies on a 24 hours a day, 7 days a week regime, but benefiting from a strong synergy and a continuous upgrading of their components. The Indian Ocean tsunami warning system must be an early example of a coordinated and sustained effort in the family of systems foreseen in GEOSS.

I sincerely hope that we can move into the implementation phase as soon as possible. The deployment of the tsunami warning system by June 2006 is realistic under the condition of using the existing networks of instrumentation and communication links, working on their immediate upgrading and establishing the national warning centres as a first priority. Together with the WMO and ISDR, we express our commitment to directly contribute to this goal.

The implementation of preparedness plans based on up-to-date tsunami hazard assessments will take more time and the incremental improvement of the system should be planned in close association with the development of a global system, which should be in place by June 2007.

Excellencies,
Ladies and Gentlemen,

We are honoured to have served the international community in the first steps of establishing of a tsunami early warning system in the Indian Ocean. However, the most important part of the work still lies ahead of us, and requires significant engagements from everybody. We need to complete the list of national focal points of the interim system. In addition, we need to move towards the adoption of the Resolution in the next IOC Assembly whereby the System will become fully established. On that basis, we can move further in defining the different contributions that each of us will have to commit in order to complete the System, hopefully by June 2006 or by December 2006 at the very latest.

We therefore look forward to the outcomes of this meeting in Mauritius, in particular the commitments that the donor community will be ready to identify in support of our joint efforts. I wish that you have a most successful meeting.

Thank you.

**Opening Statement by Mr. Salvano Briceno, Director,
Inter-Agency Secretariat for the International
Strategy for Disaster Reduction (UN/ISDR)**

Prime Minister, friends and colleagues,

I would like to start by thanking our hosts here today for their warm and friendly welcome. It has been a busy few months for all of us. The dimension of the December tsunami has been a completely new nature and has brought us to look beyond our traditional ways of responding to disasters.

As you know, the disaster risk community has been engaged in an in-depth review of its *modus operandi* and in January adopted in Kobe the Hyogo Framework for Action 2005-2015, a set of guiding principles and priorities for the coming ten years on disaster risk reduction.

The Government of Mauritius, deserves a lot of praise for its hard and dedicated work in organizing this meeting nearly back-to-back, with the January, Small Island Developing States (SIDS) Conference that reviewed the implementation of the Barbados Plan of Action. At that conference, the need for a tsunami early warning system was referred to by many delegates and amplified by strong calls for strengthened strategies for disaster risk reduction in the region, as an essential element of broader efforts to increase resilience to future hazards.

I can also note that Mauritius takes disaster reduction seriously, in particular through its National Disaster Committee under the Prime Minister's Department – a model of a national platform that other countries might emulate.

The UN Secretary General, Kofi Annan, called for a global early warning system covering all hazard and all countries, an objective which is now included in his recent major report on the reform of the organization, "In larger freedom …" (A/59/2005).

As you know, the earthquake that struck Indonesia on 28 March caused further damage in the region. It is a timely reminder of what we might expect in the future. In fact, large earthquakes could happen again at any moment. Some geologists are suggesting that these earthquakes along the Sumatra fault line could be part of a domino effect triggering further large earthquakes and tsunami.

Last month, the first coordination meeting held in Paris was an important step towards a consolidated plan for a tsunami warning system for the Indian Ocean. At the Paris meeting, we called for the future tsunami early warning system to be integrated, cohesive, and cover not only tsunamis but also other hazards such as cyclones and floods.

Now more than before we need to ensure that we involve relevant sectors and build partnerships in order that a regional tsunami early warning system comes with effective support at national and local level to support capacity-building development. Yesterday's presentations reflected clearly the need to involve a wide-range of entities, beyond tsunami concerns and early warning. We need to concentrate our efforts on multi-hazard risk assessment, disaster preparedness, communication of early warning information from national and local authorities to the communities at risk. This means efforts need to be geared towards ensuring that such disasters never happen again, thus reducing risk and vulnerability to natural hazards.

A group of partners from the UN and regional disaster organizations associated with the existing ISDR Asia Partnership, are currently advancing on a matrix of roles and functions to address the numerous tasks ahead of us. I invite all of you to contribute to this exercise to facilitate orderly and timely implementation of activities and ensure that gaps and problems are promptly identified. A draft version is available and will be discussed on the side of this meeting.

The urgency of the task ahead of us and the high level of the expectations resting on this endeavour, mean that we are going to have to be flexible and find new and innovative ways to quickly overcome any obstacles.

The IOC of UNESCO has very ably led the formulation of plans for implementing the essential core elements of an Indian Ocean tsunami early warning system that we hope will attract the support of the meeting.

Let me finish by inviting the donor community to maintain the strong spirit of commitment and support to these multi-lateral efforts and in particular to thank the Governments of Finland, Germany, Japan, Norway, Sweden and the European Commission. Their response so far has been tremendous and we would encourage all donors to go that extra mile and cover the requirements that have been identified to have a fully functional system in place by the end of 2006, including a disaster risk reduction strategy in the region in response to the Hyogo Framework for Action (HFA).

Thank you and I wish for a very productive meeting.

ANNEX IV

STATEMENTS BY DONORS

Statement by the Australian Delegation

Australia welcomes this opportunity to reaffirm our strong support and commitment to the establishment of an effective and durable Indian Ocean tsunami warning system.

As this system will consist of a coordinated network of national tsunami warning systems and capacities, it demands much from each one of us in the region.

In this context we warmly welcome the commitment by all our regional neighbours to establishing effective and durable national tsunami warning systems.

In developing national systems in the region no countries should be left behind with regard to donor consideration of support.

In addition, we would like to encourage the IOC to invite the Government of East Timor to join the IOC.

A large portion of the Sunda trench lies close to or within Australian waters. Australian islands such as Christmas, Cocos and Ashmore will play a vital part in the IOTWS given their close proximity to the Sunda trench.

In this regard Australia is already working closely with our nearest neighbours on how to best cover the tsunami threat from the Sunda trench.

As we develop our national capabilities Australia will make every endeavour to make available our tsunami-relevant data in real time, noting this includes both seismic and oceanographic data.

Australia shall also make every endeavour to make available our tsunami advisory information and our own tsunami warnings to other Indian Ocean States in a timely manner, and other interested countries to the extent possible.

Australia's endeavour will provide a major contribution to the IOTWS.

Australia is also considering other ways in which we can make a strong contribution towards the IOTWS including the provision of regional technical assistance and training and direct support to the IOC.

We warmly welcome the decision here requesting the IOC to develop a mechanism to coordinate donor assistance to ensure the needs of all regional countries are addressed as required.

We look forward to the formal creation of the IOTWS in June and the first meeting of its Intergovernmental Coordination Group shortly thereafter.

Finally I would like to express the warm appreciation of the Australian Delegation to the Government of Mauritius for hosting this meeting and the excellent work of the IOC in coordinating our efforts. Thank you.

Statement of the Belgian Delegation

Belgium announced an additional annual contribution by the Government of Flanders of € 500,000 to be allocated to training and capacity building in the context of the IODE Project Office of the IOC. This contribution is in addition to the € 1.4 million annual contribution already being made.

This supplementary contribution will serve to train experts who will be part of the establishment of the Data and Information Network for the Indian Ocean Member States and will be closely coordinated with the IOC Secretariat.

Statement by the Chinese Delegation

Thanks Mr. Minister. Good morning ladies and gentlemen, distinguished delegates.

This is my first remark, I would like to take this opportunity to express our sincere thanks to the Government of Mauritius for the hospitality to host this Conference in this beautiful place.

The previous two days' reports reflected that many Indian Ocean countries have made progress on establishment of the Tsunami Early Warning System in the Indian Ocean basin and other Oceans and Seas within the UN framework.

On 6 January this year, the Chinese Premier Wen Jiabao indicated during his speech at the Special ASEAN leader's meeting on aftermath of Earthquake and tsunami, the Chinese Government is ready to help the neighboring countries, the afflicted countries in particular, to establish an earthquake monitoring and tsunami early-warning network with a view to exchanging and evaluating information in good time and preventing earthquakes, tsunamis and other natural disasters. After the tsunami in 26 December 2004, the Chinese government has committed to provide relevant seismographs as well as training and expertise through bilateral cooperation with Indonesian Government.

In addition, China will host a regional workshop on tsunami, storm serge and typhoon disaster mitigation in South China Sea, scheduled in the first week of this June, including a training on a new tsunami early warning model . The countries boarding the South China Sea will be kindly invited to participate in the Workshop. From long run, for the purpose of promotion of cooperation in the South China Sea region, we will consider the possibility to provide the tidal gauges for the countries boarding the South China Sea who requested. Further discussion will be carried out during the workshop on the requirements of interested countries.

As the member state of IOC, China will continuously support IOC as the leading role to promote the development of Tsunami Warning and Mitigation System under the UN framework as usual .

We hope IOTWS will be established as early as possible, and that it is not only multi-hazard but also operational.

Thank you Mr. Chairman.

Statement by the Finnish Delegation

Mr. Minister,

I would like to thank the Government of the Republic of Mauritius for inviting us to this beautiful country and facilitate this meeting. My gratitude goes also to the IOC and its partners for the organization and the leadership of this international meeting.

Finland has been a strong supporter of the IOC, and has expressed its support to the UN and IOC in the Phuket and Paris meetings.

In Kobe, Phuket and Paris, Finland expressed its willingness to participate in and facilitate the development of the early warning system at its various levels both globally as well as regionally and bilaterally. Now, that we are moving from words to actions, I have a great pleasure to announce the Finnish financial contribution.

Finland has decided to donate 1.4 M€ to the upgrade and extension of the Indian Ocean tidal gauge network, operated by GLOSS. This extension is expected to upgrade seven existing stations in Maldives and Sri Lanka with new instruments and real-time data transmission. This donation facilitates also the installation of another seven new stations in the Eastern part of the Indian Ocean. These funds will be at the disposal of the IOC, the project being implemented in a close cooperation with the host countries of the stations.

In addition, Finland is currently considering with relevant partners how to best support the involvement of the Coastal Countries of Eastern Africa, namely Kenya, Mozambique, Somalia, and Tanzania into the network of the early warning system.

Finland has also embarked on discussions with the Kingdom of Thailand on further cooperation in this field.

Mr. Chairman,

I believe that the role of GLOSS will be crucial in linking the national networks with the regional networks in order to establish a new comprehensive real-time, interoperable and compatible hierarchical multi-hazard and multi-purpose sea level observation network in the Indian Ocean.

In this connection I would strongly like to point out the need for a transparent and fast transfer of the data and advisories. The communication system should be upgraded to enable, not only the relevant institutions to be alarmed, but also the citizens of all countries involved. Priority should of course be given to the countries and the people in the region. During the last tsunami and related incidents, our experience was, that the SMS technology proved to be the fastest and most accurate technology to inform the general public about the incidents. We are convinced that the SMS technology could and should be applied more extensively in further development of the warning system.

Mr. Chairman,

I would like to thank the IOC and its partners and you Mr. Chairman with our colleagues for all the hard work so far and I trust that with your leadership together with the international community we will be able to improve the tsunami warning system in the Indian Ocean region in an effective and sustained manner.

Thank you.

Statement by the French Delegation

France’s contribution to the strengthening of the alert chain at different levels in the short and medium terms.

Having established a French national tsunami warning center in La Réunion island, set up telecommunication facilities to route the warnings issued by JMA and PTWC via the GTS to La Réunion as well as to South Western Indian ocean countries equipped with RETIM satellite dissemination facilities, and defined the local arrangements in order to properly handle the warnings, France has started to assess the various areas where actions could be taken in order to contribute to the IOTWS, especially in the field of observation and telecommunication networks.
A) The short term actions are made of three main components that should be carried on in the 2005-2006 bienium :

1. upgrade to real time transmission capabilities for the GEOSCOPE **seismometer** network. The GEOSCOPE network is a very high quality network that would bring a remarkable benefit to the existing international seismic detection networks. 8 seismometer would be upgraded: Djibouti, Canberra (Australia), Hyderabad (India), La Réunion, Amsterdam, Kerguelen and Crozet (Southern Indian ocean islands), Dumont d'Urville (Antartica).

2. upgrade of the **tide gauge** network, with real time transmission and tsunami ability. Kerguelen (GLOSS 023), Amsterdam Saint-Paul (GLOSS 024), Crozet (GLOSS 021), La Réunion Pointe des Galets (GLOSS 017) and Dzaouzi Mayotte (GLOSS 096) would be either equipped with new systems or upgraded.

3. following the Jakarta expert meeting and in accordance with the WMO leaded project aiming at enhancing the **GTS network** in the Indian ocean region, France would fund expert missions in order to evaluate the needs of some interested countries – namely Yemen, Djibouti, Somalia, Kenya and Tanzania – for enhancement and upgrade of their GTS telecommunication infrastructures and decision tools. These audits could lead to a range of scenarios :
   a. upgrade of telecommunication infrastructures (message routing, GTS link) ;
   b. installation of GTS satellite based transmission facilities like RETIM 2000 and expertise workstations like Synergie ;
   c. installation of a comprehensive and end-to-end solution emcomprising decision making tools in a multi-hazard framework – like what has been achieved in 2003-2004 for the Commission de l'Océan Indien island countries namely for cylone purposes with EU funding.

B) In parallel, France has initiated projects on a bilateral basis with two of the most affected countries, Indonesia and Sri Lanka, in order to strengthen their capacity for civil crisis management.

This includes the definition and establishement of a national crisis management headquarters, the set up of a centralized telecommunication center, training of personnels, as well as the set up of regional structures for crisis management and "last mile" delivery of warnings. Besides, information, awareness and preparedeness campaigns toward the population will be organized in co-ordination between French and local Red Cross.

The budget allocated for the project in Indonesia is 4.5 M€.

Statement of the German Delegation

Mr. Chairman,

First of all, the German Delegation would like to thank you for hosting this conference and providing a splendid venue for our deliberations.

Germany is strongly supporting an international tsunami warning system in the framework of a global comprehensive multi-hazard warning system.

It is my honor and my pleasure to inform you that the German Government is prepared to complement its contribution to an international tsunami early warning system in the Indian Ocean that was announced and presented by the Federal Minister for Education and Research, Mrs Bulmahn, in Kobe earlier this year.

The German Delegation is pleased to announce today that the German Government will second a German oceanographer to the Tsunami Unit of the IOC Secretariat this year.

Mr. Chairman,

Further I'd like to inform you that Germany will invite to the Third International Early Warning Conference in the framework of the International Strategy for Disaster Reduction under the auspices of the United Nations.

The EWC-III will focus on the implementation of concrete measures and projects in the field of early warning, including tsunami early warning, in order to promote the implementation of the results of the Kobe Conference and to foster international cooperation in this field.

Thank you, Mr. Chairman.

Statement from the Indian Delegation

India is developing an Early Warning System for tsunami (and storm surges) on top priority, covering the two tsunamigenic zones that, could affect the Indian Ocean rim countries. India is ready to share such warnings and advisory information to the countries in the region. Further, India could contribute to the efforts of UNESCO/IOC by providing training on several aspects of the Early Warning and Mitigation System to earthquake detection, tsunami and storm surge modeling, underwater modeling, using space systems etc. India has already installed its tide gauges along its coasts. India would be willing to extend this support to the countries in the region.

Statement by the Italian Delegation

Mr. Minister, distinguished delegates,

The conference of Mauritius is approaching an end, after very intense and fruitful negotiations.

The Italian Delegation wishes to express its gratitude to the Government of Mauritius, to you Mr. Minister, to the distinguished Chairmen of the drafting committee, Ambassador K. Koonjul, Permanent Representative of Mauritius Mission to the UN, New York, and the representatives of UNESCO and other relevant international bodies for making possible the successful outcome of this meeting.

The extent of the impact of the tsunami of the 26 December, followed by a slightly less intense earthquake on the 28th of March, has reminded us of the destructive power of nature. However, it is reassuring to notice that the affected countries and concerned populations have been able to confront the implications of this huge tragedy with the strong response and the support of the international community. Italy, among others, was quickly to react to the disaster in South East Asia and to assist the population in the aftermath of the tsunami. The response has been immediate and generous at the level of governments, local and regional authorities, civil society and the general public.

An estimated amount of € 158,3 million have been earmarked and are being channeled to the affected countries through various programmes and initiatives. Ten millions Euros have been already devoted to the immediate relief of the tsunami victims. 72,5 millions Euros have been destined to rehabilitation, reconstruction and capacity building projects in the hit areas. These funds have been managed by the Italian development cooperation, the Ministry of the Environment and the Ministry of Economy and Finances.

The Italian Delegation is very satisfied for the message of confidence and hope that is emerging from this meeting. It is reassuring to reaffirm the capability of mankind to master and mitigate the forces of nature by sophisticated technological means.

We feel that notwithstanding the encouraging progresses that have been made, some additional efforts for coordination are still necessary in order to better establish and consolidate the architecture of an effective early warning system in the region, capable of delivering a speedy and holistic response to the hazards of tsunamigenic catastrophes.

While the Italian delegation welcomes the plan of some countries of this area to develop their national capabilities to detect and provide timely warning of tsunamis, we strongly feel that all the regional efforts should be also part of a global strategy of intervention led by the pertinent institution of UNESCO.

The Italian Delegation encourages also an open and holistic approach to international scientific and technological cooperation in this field, in order to fully exploit all the possibilities and innovations offered by all the concerned countries.

Italy is willing to make available not only additional financial resources (one million Euros have been already earmarked and are currently available for this purpose), but also the expertise and technological capabilities some of which have been presented at this conference by the experts of the Italian Ministry for the Environment, of the National Research Council, of the University of Bologna and of the Istituto Nazionale di Geofisica e Vulcanologia in Rome. In this respect we look forward to work very closely with the Secretariat before the meeting in Paris in order to better define and tune the range of the Italian cooperation in this activity.

Statement by the Japanese Delegation

In response to the unprecedented level of damages caused by the tsunami in the Indian Ocean countries, the international community has worked for the establishment of a tsunami early warning system in the region, especially since the Kobe Conference on Disaster Reduction.

Japan is committed to providing its know-how and technologies that we have for tsunami early warning to countries in the region, through international agencies and by bilateral assistance. In responding to the UN flash appeal on January 6, Japan made a financial contribution of four million USD to ISDR for building an early warning system in the region. And, ISDR is now conducting projects for capacity building in close partnership with UNESCO/IOC.

Japan is planning to further conduct its technical cooperation with Indian Ocean countries through JICA, JMA and other government agencies, based on the needs assessment and request from those countries, including dispatching of experts and lecturers.

With regard to funding support for construction of an early warning system in this region, Japan is of the view that, first, we need to have a clear picture of basic design of the system, time-table for the establishment, clear division of functions and notes between international agencies and countries in the region; second, we must have a sustainable and durable system in the region with strong ownership on the part of countries in the region. I think the information contained in the Blue Book would be a basis for that, and we would like to see the assessment in the Book further elaborated.

Having said that, Japan would like to continue its cooperation to the extent possible, including financial support for establishment of the early warning system in the region.

Finally, my delegation would thank the government of Mauritius for hosting this important meeting.

Statement by the Norwegian Delegation

Mr. Chairman,

I want to confirm a strong Norwegian commitment to the task of building a functional and sustainable early warning system in the Indian Ocean, as one very important step towards a global multi hazard system.

All through the process, starting in Geneva last October, Norway has emphasized the interlinkages between preparedness against national disasters on the one side and development programmes on the other. Along with this we have reiterated that information, training and awareness building in local societies often will be prerequisites for technologically advanced systems to function. Similarly we have underscored that viable policies regarding environment, planning and management of natural resources, adequate legislation, law and order, house planning and ability to have a frank dialogue between government, local communities and the private sector - all these policies do have an important impact on our possibilities to cope with natural disasters.

Mr. Chairman,

It should be stressed that this meeting in Mauritius is a part of a process, the meeting is not acting in a vacuum. Likewise, the setting is not only natural calamities, it is also what we have achieved in previous meetings - in Geneva, Kobe, Phuket and in Paris. And let us remind each of us that UNESCO/IOC has been given a mandate to fulfill a better strategy for dealing with tsunamis and other hazards. From a Norwegian perspective this means that all of us do have an obligation to make this meeting a constructive move ahead - compared to what was achieved in Paris some weeks back.

It should also mean that the UN, represented by UNESCO/IOC, should take the lead as a coordinating body, on the cost of the national flagging. I`m happy to see that the drafting committee during their hard work at this meeting seems to have recognized this point. And, in order to avoid misunderstanding; this should not be seen as some- thing contrary to the task of constructing national systems, neither to the need for bilateral cooperation between donor countries and the various partners in the region.

The challenge in front of us is comprehensive, and our endeavours should be imple- mented in a mutual and joint manner. Not a single country in the region of the Indian Ocean should be left alone, and because we all know that the countries do not have equal financial and administrative opportunities to fulfill their commitment and meet their requirements, there is a need for a strong coordinating mechanism among the donors. I`m glad to see that UNESCO/IOC will organize this, and special focus should be offered to those countries which are, and will be, in need of support from outside.

Mr. Chairman,

After having presented these brief comments, I`m pleased to announce that Norway will offer NOK 12 millions, close to USD 2 millions, to the project we are planning for. This amount will be additional to previous contributions to the ISDR in regard to the Kobe-process, and our preferences regarding the spending of the funds will be on three components;

- Financial and/or technical support to UNESCO/IOC in order to enhance their capasity and capability to promote relevant coordinating efforts.

- Support for strengthening and enlarging systems for see level observation. As you may know Norway has experience in this regard, and hopefully this can be a basis for further achievements in this field.

- Some funds may be earmarked for those countries in the region which may have specific needs - financially and/or administratively.

I will not at this stage elaborate more in detail, Mr. Chairman, but I look forward to a constructive dialogue with UNESCO/IOC in order to clarify the modalities regarding our pledges.

Allow me, however, to mention that over a long period of time there has been involvement by some very able and well experienced Norwegian companies in hazard-related activities in some of the countries in the region. Hopefully, this involvement will be proceeded as a part of bilateral cooperation or through the mechanism and systems which will be established.

Finally, Mr. Chairman, on behalf of my delegation, I want to commend you and Dr. Bernal and the ISDR for your frank and very able leadership during this meeting. And not at least, I want to express gratitude to the Government of Mauritius for the very kind hospitality extended to all of us.

Thank you.

Statement from the United States Delegation

Mr. Minister,

The United States would like to extend its sincere gratitude to the Government of Mauritius for the excellent venue it has provided for this conference. We would be remiss if we did not also give special thanks to the warm and wonderful people of Mauritius who have made our stay so enjoyable.

As has been widely reported, the President of the United States has requested a special supplemental appropriation in response to the horrible tsunami of December 26th of approximately $900 million. Much of this money is planned to be used bilaterally to support USAID efforts in India, Indonesia, Sri Lanka and Thailand. However, a substantial portion is slated to support a regional early warning system for the Indian Ocean. While I am unable to make specific commitments on behalf of the U.S. until our Congress appropriates funds to support this effort, the United States is pleased to support the development of a tsunami warning and mitigation system for the Indian Ocean within the construct and compatibility of a global framework of warning systems. These systems should be viewed as “all hazards” warning systems and include improved hazard assessment, real-time monitoring, forecasting and warning, rapid and efficient responses/remediation, cost-effective mitigation measures, and outreach and education for all relevant countries.

We will coordinate our assistance with the IOC and other donors in strengthening the capacity of governments, national warning centers, and communities in the region to undertake an integrated end-to-end disaster management approach that will achieve:

- risk and vulnerability reduction;
- public awareness, education, and preparedness;
- warning dissemination;
- emergency response;
- regional and global system interoperability.

We encourage nations and organizations to work together to develop such a capability, in accordance with the following principles and approaches:

- risk reduction for ALL coastal hazards;
- full and open exchange of publicly-funded, unclassified data, and enhanced mechanisms for real-time data sharing, both of which are key principles of the Global Earth Observation System of Systems;
- community-based development of disaster management systems appropriate for the accepted level of risk;
- adaptive management techniques to respond to different requirements of national and international institutions; and

- regional and global cooperation and cross-learning

The United States is pleased to have this opportunity to coordinate its assistance with other donors, and the U.S. Delegation has been very impressed with the cooperation and commitment that the other donors have brought to this critically important effort. We support the lead coordinating role of the IOC in the development of a global tsunami warning and mitigation framework and look forward to working with and within the IOC.

The U.S. would also like to take this opportunity to announce a joint APEC/U.S. Asia Pacific All Hazards Workshop, 6-10 June 2005 in Honolulu, Hawaii. The workshop will address all-hazards technology and best practices used in the U.S. The agenda and fact sheet will be distributed to all participants today.

Statement by the representative of the International Maritime Organization (IMO)

Following the catastrophic events after the tsunami in the Indian Ocean, on 26 December 2004, IMO has taken a number of initiatives towards disaster risk reduction and supports the establishment of a tsunami early warning system for the Indian Ocean and other regions as required.

Following the catastrophe, IMO established a Tsunami Maritime Relief Fund in order to coordinate the maritime communities wider response to the UN's immediate efforts.

On the 9th of April 2005, Secretary-General of IMO, Mr. Efthimios Mitropoulos, presented to the UN Secretary-General Pounds Stg. 86,580 from the Maritime Relief Fund for Tsunami.

Mr. Mitropoulos requested that the donation be passed to the office of President Clinton who has been appointed as Special Envoy of the United Nations Secretary-General for Tsunami affected countries to mobilize continued support for the reconstruction phase. In particular he requested that the money from the Tsunami Maritime Relief Fund be used specifically for the restoration of the maritime infrastructure and also to support the reconstruction of the fishing industry in the region affected.

The fund will remain open to assist for the long-term task of capacity building in the affected maritime communities.

IMO is assisting in the establishment of two Maritime Search and Rescue Coordination Centres (MRCCs) one in Mombasa, Kenya to cover Kenya, Seychelles and Tanzania. The second one in Cape Town, South Africa to cover Comoros, Madagascar, Mozambique and South Africa. These will be supported by sub centres in each of the countries and will be equipped with GMDSS. The centres will therefore be a good support for communication on tsunami warning in the covered areas.

Statement by the representative of the International Telecommunication Union (ITU)

Mr. Chairman,
Excellencies,
Ladies and Gentlemen,

As I speak on behalf of my organization I take the floor first, to thank and congratulate our colleagues from UNESCO/IOC who have successfully organized the two successive meetings to look at ways of coordinating the development of a Tsunami Warning and Mitigation system for the Indian Ocean region. This no doubt, goes a long way towards limiting the duplication that is so often difficult to avoid when working on an initiative of this magnitude and importance.

Second, let me reinforce my intervention of yesterday. For us in the International Telecommunication Union, the issue of universal access to information and communication technologies, the need for efficient telecommunication networks, the importance of new, low-cost and

affordable technologies are very critical for a sustained social and economic development. But, there cannot be sustainable development without security – security guaranteed against both man-made and natural disasters. As the very tired old adage says 'Prevention is better than cure.' Indeed, what we are doing here contributes immensely to this thought. A good, reliable, and well-crafted early warning system goes a long way towards limiting the havoc that disasters can wreak in terms of human loss and economic disruption.

Mr. Chairman,

The ITU stands ready to contribute to the ongoing process. We believe and certainly know that any meaningful early warning system must be backed by timely dissemination of critical information. Any delay can result in untold suffering and loss of great magnitude. For that reason, we stand ready to contribute with our expertise and resources in providing this important element. We want to work with all those who have the expertise to detect impending disasters and help put in place the right systems that can ensure that the information on these dangers are transmitted in real-time. Once this information has reached the authorities concerned, we can help with our expertise to find solutions to most efficiently disseminate this information to the public through a bouquet of channels of communication (sms, mms, cell broadcasting, radio, television, tetra, and the traditional fixed line). This is all the more facilitated by the current technological convergence between telecommunication, information technology, and broadcasting. We have the expertise to assist countries with appropriate policies and regulations that are pro-disaster management. We can help them build their institutional capacities.

Ladies and Gentlemen,
Distinguished Friends,

The recently coming into effect of the Tampere Convention that we have so vigorously campaigned for together with our colleagues in OCHA is a pleasant development as it breaks barriers to cross-border transportation of telecommunications equipment for disaster mitigation. This is critical especially for the world's 49 least developed countries and the many small island developing countries that remain the most vulnerable due to their inherent structural and systemic weaknesses.

Mr. Chairman,

Following the tsunami disaster of December 2004, we immediately intervened by deploying satellite terminals in the Tsunami hit countries, we are about to kick-off the implementation of a project for all the tsunami hit countries in the Indian Ocean seeking to reconstruct their damaged telecommunications networks, and we have set aside slightly over 700'000 US dollars for this purpose. We continue to develop standards for telecommunications networks building on what we have done in the past such as the famous recommendations on the prioritization of calls for emergency communications seeking to avoid network congestion and other work aimed at ensuring smooth inter-operability of telecommunication networks, and spectrum management as well as its efficient use for disaster management. As we do this, we will certainly provide advice on how to make these networks more resilient. We are ready to forge partnerships with any other entities including with development partners to put in place information and communication systems that can be used for multi-hazard disaster mitigation covering all the various stages ranging from disaster early warning, preparedness, response, and reconstruction.

I have no doubt in my heart that together we can achieve great things. Never again can we let the 'December 2004 dark history' repeat itself in terms of the losses that confronted us.

Finally, my sincere thanks go to the Mauritius government and the very warm hearted people that have received us here and made our stay quite memorable.

I thank you.

Statement made the representative of the World Meteorological Organization (WMO)

Your Excellencies, Ladies and Gentlemen,

On behalf of the World Meteorological Organization (WMO) and my own, I wish to express our appreciation for the opportunity to address the Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean. I am also grateful to the Government and people of Mauritius for hosting this Conference, as well as for their hospitality and unflinching commitment to disaster reduction.

We are deeply grieved by the desolation and suffering of the millions of people devastated by the tsunami that hit Indian Ocean countries on 26 December 2004. The impacts of this disaster have reached staggering proportions in terms of the scale of human loss, associated damage, number of countries affected as well as related response and recovery efforts. This disaster in tragic proportions has demonstrated the need for development of tsunami early warning system, not only in the Indian Ocean region, but also in all other regions at-risk.

We have established strong partnership with UNESCO and its IOC, ISDR and other concerned organizations to ensure that our relevant capabilities are utilized and built upon to accelerate efforts in strengthening pre-disaster strategies, including the development of the tsunami early warning system.

As we progress with the development of the Tsunami Early Warning System in the Indian Ocean Region, I would like to raise your attention to a few issues:

A fundamental precondition for national disaster preparedness is a well-functioning "end-to-end early warning system" that delivers accurate information dependably and in a timely manner to the population at risk. It must rely on:

(1) Commitment, collaboration, coordination, information sharing and reliable telecommunication systems at the international and regional levels to support national early warning capabilities.

(2) National capacities for:

(a) implementing technology for observing, monitoring and developing hazard warnings;
(b) rapid, dependable, and authoritative warning distribution (alert) systems to reach all threatened people;
(c) ability to respond to warnings effectively at the national to community levels;
(d) education of the public and decision makers to enhance their under-standing of the information and to enable their taking effective action.

The development of the tsunami early warning systems should address all these critical components. While we must raise funds to develop the technical infrastructure and institutional mechanisms for development of Tsunami warnings, our most challenging task is to ensure that the warnings cascade to the people at the local level and that government authorities, risk managers and the public at risk can understand and utilize the information. Particularly where the warning period is short, public education and outreach programmes, the involvement of media and strong institutional linkages and collaboration, continuous interaction between the relevant national organizations and authorities in the countries at-risk pose the most challenging task ahead of us. Tsunami Early Warning Systems should be developed with a global perspective to address the needs and gaps in other regions at-risk (Atlantic, Caribbean, South Pacific, Mediterranean).

The development of an end-to-end tsunami early warning system from observations to response at the community level should be carried out within a multi-hazard approach. The main synergistic advantage of this approach is the multipurpose use of observational and telecommunication systems, which exploit the routine operational facilities and services to provide accurate and timely

emergency information to decision makers and the general public down to the village and household levels. National hydrological and meteorological experience and capabilities with successful early warning systems, such as those for tropical cyclones and storm surges, and its integrated flood management capabilities can be leveraged to accelerate the development of an integrated, multi-hazard early warning approach. Regular activation of multi-hazard warning systems ensures sustainability and effectiveness for rare events (e.g. tsunami). WMO can contribute significantly through its Global Observing System and Global Telecommunication System, which links all National Meteorological and Hydrological Services (NMHSs) to support national capabilities for early warnings of hydro-meteorological hazards.

At the national level, as countries develop and enhance their national hazard alert and response mechanisms, adoption of early warning systems through a multi-hazard approach would save more lives and be more cost effective. Its more frequent use would help the public by repeatedly exercising their exposure to, and understanding of, contents of warnings and specific actions they should take on each type of hazard.

WMO, as a specialized agency of the United Nations, has worked through NMHSs to ensure that, among other things, issues dealing with early warning for hydro-meteorological disasters are addressed effectively across political boundaries. Today, WMO has 187 Members. The infrastructures of NMHSs undoubtedly constitute a considerable asset to the international community, in their efforts to deal with emergency situations. This is because they are organizations operating 24 hours a day, 365 days a year that are responsible for the issuance of around-the-clock early warnings for a wide range of hazards related to weather and water, such as tornadoes, tropical cyclones, storm surges, floods, droughts, heat waves and severe storms. Significant capabilities for early warning systems for these hazards have been developed within the NMHSs of the countries. These capabilities span the range of observing, monitoring, detection, research, forecasting, early warning development and alert mechanisms including tele-communication networks. Currently, nearly 50 NMHSs in the world have their governments' mandate to provide seismic and/or tsunami early warnings. In the Indian Ocean, 11 NMHSs, including four along the eastern coast of Africa and seven in Asia have some seismic and tsunami related mandate. However, the capabilities and resources of the NMHSs significantly vary from country to country. By enhancing these capabilities, and establishing a stronger link between NMHSs and the risk management authorities we can be more effective and save more lives.

WMO has taken proactive action and is contributing to the development of the end-to-end tsunami early warning system in the Indian Ocean Rim countries in four areas:

1. The WMO Global Telecommunication System is being upgraded, where needed (target end of 2005) to address requirements for tsunami-related information exchange for the interim period and longer term, in the Indian Ocean rim. We have identified countries in need of equipment upgrades and through our fund raising and technical assistance aim to meet these needs by the end of 2005.

2. WMO is working towards enhancement of multi-hazard national warning alert mechanisms provided through NMHSs to support around-the-clock dissemination of tsunami warnings and to raise public awareness to enhance community preparedness through development of educational and community outreach programmes of NMHSs. We have initiated assessments of the needs of NMHSs in this regard and have developed a detailed plan of action to address these needs.

3. WMO through the coordination activities of its Space programme and in partnership with the space agencies, UNESCO-IOC and other key partners will ensure optimal utilization of space technologies for enhancing multi-hazard early warnings including tsunamis, in the Indian Ocean rim.

4. WMO will continue to promote the benefits of a multi-hazard approach to the tsunami early warning system and significantly contribute to its implementation.

The Honourable Paul Raymond Bérenger G.C.S.K., Prime Minister of the Republic of Mauritius, your Excellencies, Ladies and Gentlemen, before closing, I wish to thank you again for your attention. Your presence here is a true testimony to your deep commitment to the development of the tsunami early warning system. Let us work together towards a safer world and prevent the occurrence of such tragic disasters in the future.

ANNEX V

LIST OF ACRONYMS

ADPC	Asian Disaster Preparedness Center
AFTN	Aeronautical Fixed Telecommunications Network
ASEAN	Association of Southeast Asian Nations
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
DART	Deep Ocean Assessment & Reporting of Tsunamis
DIPECHO	Directorate General (European Commission) for Humanitarian Aid
EMWIN	Emergency Managers Weather Information Network
EU	European Union
GDPFS	Global Data-Processing Meteorological Centre
GEOSS	Global Earth Observation System of Systems
GLOSS	Global sea Level Observing System
GMDSS	Global Maritime Distress & Safety System
GOOS	Global Ocean Observing System
GOS	Global Observing System
GTS	Global Telecommunication System
ICG/IOTWS	Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning & Mitigation System
IFRC	International Federation of Red Cross & Red Crescent Societies
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOGOOS	Indian Ocean GOOS
IOTEWS	Indian Ocean Tsunami Early Warning System
IOTWS	Indian Ocean Tsunami Warning System
ISDR	International Strategy for Disaster Reduction
ITIC	International Tsunami Information Center (USA)
ITU	International Telecommunications Union
JMA	Japan Meteorological Agency
NMC	National Meteorological Centre
NMHSs	National Meteorological & Hydrological Services
OCHA	Office for the Coordination of Humanitarian Affairs
PTWC	Pacific Tsunami Warning System
RMSCs	Regional Specialized Meteorological Centre
RTCI	Regional Tsunami Information Centre
RTH	Regional Telecommunication Hub
TWI	Tsunami Watch Information

UN	United Nations
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic & Social Commission for Asia & the Pacific
UNESCO	United Nations Educational, Scientific & Cultural Organization
UNGA	United Nations General Assembly
WAPMERR	World Agency of Planetary Monitoring & Earthquake Risk Reduction
WMC	Word Meteorological Centre
WMO	World Meteorological Organization

IOC Workshop Reports

The Scientific Workshops of the Intergovernmental Oceanographic Commission are sometimes jointly sponsored with other intergovernmental or non-governmental bodies. In most cases, IOC assures responsibility for printing, and copies may be requested from:

Intergovernmental Oceanographic Commission – UNESCO
1, rue Miollis, 75732 Paris Cedex 15, France

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 UNDP (CCOP),	E (out of stock)
2	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)
3	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean; Monte Carlo, 9-14 September 1974.	E,F E (out of stock)
4	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)
5	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
6	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
7	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
8	Joint IOC/FAO (IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters; Penang, 7-13 April 1976	E (out of stock)
9	IOC/CMG/SCOR Second International Workshop on Marine Geoscience; Mauritius 9-13 August 1976.	E, F, S, R
10	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring; Monaco, 14-18 June 1976	E, F E (out of stock) R
11	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, S (out of stock)
11 Suppl.	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
12	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
13	Report of the IOCARIBE Workshop on Environmental Geology of the Caribbean Coastal Area; Port of Spain, Trinidad, 16-18 January 1978.	E, S
14	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas; Abidjan, Côte d'Ivoire, 2-9 May 1978	E, F
15	CPPS/FAO/IOC/UNEP International Workshop on Marine Pollution in the South-East Pacific; Santiago de Chile, 6-10 November 1978.	E (out of stock)
16	Workshop on the Western Pacific, Tokyo, 19-20 February 1979.	E, F, R
17	Joint IOC/WMO Workshop on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS); Moscow, 9-11 April 1979.	E
17 suppl.	Papers submitted to the Joint IOC/WMO Seminar on Oceano-graphic Products and the IGOSS Data Processing and Services System; Moscow, 2-6 April 1979.	E
18	IOC/UNESCO Workshop on Syllabus for Training Marine Technicians; Miami, U.S.A., 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 tock), R
19	IOC Workshop on Marine Science Syllabus for Secondary Schools; Llantwit 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), S, R, Ar
20	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources; Bandung, Indonesia, 17-21 October 1978	E
21	Second IDOE Symposium on Turbulence in the Ocean; Liège, Belgium, 7-18 May 1979.	E, F, S, R
22	Third IOC/WMO Workshop on Marine Pollution Monitoring; New Delhi, 11-15 February 1980.	E, F, S, R
23	WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific; Tokyo, 27-31 March 1980.	E, R
24	WESTPAC Workshop on Coastal Transport of Pollutants; Tokyo, Japan, 27-31 March 1980.	E (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 (Superseded by IOC Technical Series No.22)
26	IOC Workshop on Coastal Area Management in the Caribbean Region; Mexico City, 24 September- 5 October 1979.	E, S
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
28	FAO/IOC Workshop on the effects of environmental variation on the survival of larval pelagic fishes. Lima, 20 April-5 May 1980.	E
29	WESTPAC Workshop on Marine Biological Methodology; Tokyo, 9-14 February 1981.	E
30	International Workshop on Marine Pollution in the South-West Atlantic; Montevideo, 10-14 November 1980.	E (out of stock) S
31	Third International Workshop on Marine Geoscience; Heidelberg, 19-24 July 1982.	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, France, 27 September-1 October 1982.	E, F, S
32 Suppl.	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, France, 27 September-1 October 1982.	E
33	Workshop on the IREP Component of the IOC Programme on Ocean Science in Relation to Living Resources (OSLR); Halifax, 26-30 September 1963.	E
34	IOC Workshop on Regional Co-operation in Marine Science in the Central Eastern Atlantic (Western Africa); Tenerife, 12-17 December 1963.	E, F, S
35	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
36	IOC/FAO Workshop on the Improved Uses of Research Vessels; Lisbon, Portugal, 28 May-2 June 1984.	E
36 Suppl.	Papers submitted to the IOC/FAO Workshop on the Improved Uses of Research Vessels; Lisbon, 28 May-2 June 1984	E
37	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
38	IOC/ROPME/UNEP Symposium on Fate and Fluxes of Oil Pollutants in the Kuwait Action Plan Region; Basrah, Iraq, 8-12 January 1984.	E
39	CCOP (SOPAC)-IOC-IFREMER-ORSTOM Workshop on the Uses of Submersibles and Remotely Operated Vehicles in the South Pacific; Suva, Fiji, 24-29 September 1985.	E
40	IOC Workshop on the Technical Aspects of Tsunami Analysis, Prediction and Communications; Sidney, B.C., Canada, 29-31 July 1985.	E
40 Suppl.	First International Tsunami Workshop on Tsunami Analysis, Prediction and Communications, Submitted Papers; Sidney, B.C., Canada, 29 July-1 August 1985.	E
41	First 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 (WACAF/2); Dakar, Senegal, 28 October- 1 November 1985.	E
43	IOC Workshop on the Results of MEDALPEX and Future Oceano-graphic Programmes in the Western Mediterranean; Venice, Italy, 23-25 October 1985.	E
44	IOC-FAO Workshop on Recruitment in Tropical Coastal Demersal Communities; Ciudad del Carmen, Campeche, Mexico, 21-25 April 1986.	E (out of stock) S
44 Suppl.	IOC-FAO Workshop on Recruitment in Tropical Coastal Demersal Communities, Submitted Papers; Ciudad del Carmen, Campeche, Mexico, 21-25 April 1986.	E
45	IOCARIBE Workshop on Physical Oceanography and Climate; Cartagena, Colombia, 19-22 August 1986.	E
46	Reunión de Trabajo para Desarrollo del Programa "Ciencia Oceánica en Relación a los Recursos No Vivos en la Región del Atlántico Sud-occidental"; Porto Alegre, Brasil, 7-11 de abril de 1986.	S
47	IOC Symposium on Marine Science in the Western Pacific: The Indo-Pacific Convergence; Townsville, 1-6 December 1966	E
48	IOCARIBE Mini-Symposium for the Regional Development of the IOC-UN (OETB) Programme on 'Ocean Science in Relation to Non-Living Resources (OSNLR)'; Havana, Cuba, 4-7 December 1986.	E, S
49	AGU-IOC-WMO-CPPS Chapman Conference: An International Symposium on 'El Niño'; Guayaquil, Ecuador, 27-31 October 1986.	E
50	CCALR-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
51	CCOP/SOPAC-IOC Workshop on Coastal Processes in the South Pacific Island Nations; Lae, Papua-New Guinea, 1-8 October 1987.	E
52	SCOR-IOC-UNESCO Symposium on Vertical Motion in the Equatorial Upper Ocean and its Effects upon Living Resources and the Atmosphere; Paris, France, 6-10 May 1985.	E
53	IOC Workshop on the Biological Effects of Pollutants; Oslo, 11-29 August 1986.	E
54	Workshop on Sea-Level Measurements in Hostile Conditions; Bidston, UK, 28-31 March 1988.	E
55	IBCCA Workshop on Data Sources and Compilation, Boulder, Colorado, 18-19 July 1988.	E
56	IOC-FAO Workshop on Recruitment of Penaeid Prawns in the Indo-West Pacific Region (PREP); Cleveland, Australia, 24-30 July 1988.	E
57	IOC Workshop on International Co-operation in the Study of Red Tides and Ocean Blooms; Takamatsu, Japan, 16-17 November 1987.	E
58	International Workshop on the Technical Aspects of the Tsunami Warning System; Novosibirsk, USSR, 4-5 August 1989.	E
58 Suppl.	Second International Workshop on the Technical Aspects of Tsunami Warning Systems, Tsunami Analysis, Preparedness,	E

No.	Title	Languages
	Observation and Instrumentation. Submitted Papers; Novosibirsk, USSR, 4-5 August 1989.	
59	IOC-UNEP Regional Workshop to Review Priorities for Marine Pollution Monitoring Research, Control and Abatement in the Wider Caribbean; San José, Costa Rica, 24-30 August 1989.	E, F, S
60	IOC Workshop to Define IOCARIBE-TRODERP proposals; Caracas, Venezuela, 12-16 September 1989.	E
61	Second IOC Workshop on the Biological Effects of Pollutants; Bermuda, 10 September-2 October 1988.	E
62	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
63	IOC/WESTPAC Workshop on Co-operative Study of the Continental Shelf Circulation in the Western Pacific; Bangkok, Thailand, 31 October-3 November 1989.	E
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 ad hoc Expert Consultation on Sardine/ Anchovy Recruitment Programme; La Jolla, California, U.S.A., 1989	E
67	Interdisciplinary Seminar on Research Problems in the IOCARIBE Region; Caracas, Venezuela, 28 November-1 December 1989.	E (out of stock)
68	International Workshop on Marine Acoustics; Beijing, China, 26-30 March 1990.	E
69	IOC-SCAR Workshop on Sea-Level Measurements in the Antarctica; Leningrad, USSR, 28-31 May 1990.	E
69 Suppl.	IOC-SCAR Workshop on Sea-Level Measurements in the Antarctica; Submitted Papers; 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 1989.	E
75	IOC-SCOR Workshop on Global Ocean Ecosystem Dynamics; Solomons, Maryland, U.S.A., 29 April-2 May 1991.	E
76	IOC/WESTPAC Scientific Symposium on Marine Science and Management of Marine Areas of the Western Pacific; Penang, Malaysia, 2-6 December 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, U.S.A., 18-21 February 1992.	E
79	IOC/WESTPAC Workshop on River Inputs of Nutrients to the Marine Environment in the WESTPAC Region; Penang, Malaysia, 26-29 November 1991.	E
80	IOC-SCOR Workshop on Programme Development for Harmful Algae Blooms; Newport, U.S.A. 2-3 November 1991.	E
81	Joint IAPSO-IOC Workshop on Sea Level Measurements and Quality Control; Paris, France, 12-13 October 1992.	E
82	BORDOMER 92: International Convention on Rational Use of Coastal Zones. A Preparatory	E
83	IOC Workshop on Donor Collaboration in the Development of Marine Scientific Research Capabilities in the Western Indian Ocean Region; Brussels, Belgium, 12-13 October 1992.	E
84	Workshop on Atlantic Ocean Climate Variability; Moscow, Russian Federation, 13-17 July 1992	E
85	IOC Workshop on Coastal Oceanography in Relation to Integrated Coastal Zone Management; Kona, Hawaii, 1-5 June 1992.	E
86	International Workshop on the Black Sea; Varna, Bulgaria, 30 September – 4 October 1991	E
87	Taller de trabajo sobre efectos biológicos del fenómeno «El Niño» en ecosistemas costeros del Pacífico Sudeste; Santa Cruz, Galápagos, Ecuador, 5-14 de octubre de 1989.	S only (summary in E, F, S)
88	IOC-CEC-ICSU-ICES Regional Workshop for Member States of Eastern and Northern Europe (GODAR Project); Obninsk, Russia, 17-20 May 1993.	E
89	IOC-ICSEM Workshop on Ocean Sciences in Non-Living Resources; Perpignan, France, 15-20 October 1990.	E
90	IOC Seminar on Integrated Coastal Management; New Orleans, U.S.A., 17-18 July 1993.	E
91	Hydroblack'91 CTD Intercalibration Workshop; Woods Hole, U.S.A., 1-10 December 1991.	E
92	Réunion de travail IOCEA-OSNLR sur le Projet « Budgets sédimentaires le long de la côte occidentale d'Afrique » Abidjan, côte d'Ivoire, 26-28 juin 1991.	E
93	IOC-UNEP Workshop on Impacts of Sea-Level Rise due to Global Warming. Dhaka, Bangladesh, 16-19 November 1992.	E
94	BMTC-IOC-POLARMAR International Workshop on Training Requirements in the Field of Eutrophication in Semi-enclosed Seas and Harmful Algal Blooms, Bremerhaven, Germany, 29 September-3 October 1992.	E
95	SAREC-IOC Workshop on Donor Collaboration in the Development of Marine Scientific Research Capabilities in the Western Indian Ocean Region; Brussels, Belgium, 23-25 November 1993.	E
96	IOC-UNEP-WMO-SAREC Planning Workshop on an Integrated Approach to Coastal Erosion, Sea Level Changes and their Impacts; Zanzibar, United Republic of Tanzania, 17-21 January 1994.	E
96 Suppl.	IOC-UNEP-WMO-SAREC Planning Workshop on an Integrated Approach to Coastal Erosion, Sea Level Changes and their Impacts; Submitted Papers 1. Coastal Erosion; Zanzibar, United Republic of Tanzania 17-21 January 1994.	E
96 Suppl	IOC-UNEP-WMO-SAREC Planning Workshop on an Integrated Approach to Coastal Erosion, Sea Level Changes and their Impacts; Submitted Papers 2. Sea Level; Zanzibar, United Republic of Tanzania 17-21 January 1994.	E
97	IOC Workshop on Small Island Oceanography in Relation to Sustainable Economic Development and Coastal Area Management of Small Island Development States; Fort-de-France, Martinique, 8-10 November, 1993.	E
98	CoMSBlack '92A Physical and Chemical Intercalibration Workshop; Erdemli, Turkey, 15-29 January 1993.	E
99	IOC-SAREC Field Study Exercise on Nutrients in Tropical Marine Waters; Mombasa, Kenya, 5-15 April 1994.	E
100	IOC-SOA-NOAA Regional Workshop for Member States of the Western Pacific - GODAR-II (Global Oceanographic Data Archeology and Rescue Project); Tianjin, China, 8-11 March 1994.	E
101	IOC Regional Science Planning Workshop on Harmful Algal Blooms; Montevideo, Uruguay, 15-17 June 1994.	E
102	First IOC Workshop on Coastal Ocean Advanced Science and Technology Study (COASTS); Liège, Belgium, 5-9 May 1994.	E
103	IOC Workshop on GIS Applications in the Coastal Zone Management of Small Island Developing States; Barbados, 20-22 April 1994.	E
104	Workshop on Integrated Coastal Management; Dartmouth, Canada, 19-20 September 1994.	E
105	BORDOMER 95: Conference on Coastal Change; Bordeaux, France, 6-10 February 1995.	E
105 Suppl.	Conference on Coastal Change: Proceedings; Bordeaux, France, 6-10 February 1995	E
106	IOC/WESTPAC Workshop on the Paleographic Map; Bali, Indonesia, 20-21 October 1994.	E
107	IOC-ICSU-NIO-NOAA Regional Workshop for Member States of the Indian Ocean - GODAR-III; Dona Paula, Goa, India, 6-9 December 1994.	E
108	UNESCO-IHP-IOC-IAEA Workshop on Sea-Level Rise and the Multidisciplinary Studies of Environmental Processes in the Caspian Sea Region; Paris, France, 9-12 May 1995.	E
108 Suppl.	UNESCO-IHP-IOC-IAEA Workshop on Sea-Level Rise and the Multidisciplinary Studies of Environmental Processes in the Caspian Sea Region; Submitted Papers; Paris, France, 9-12 May 1995.	E
109	First IOC-UNEP CEPPOL Symposium; San José, Costa Rica, 14-15 April 1993.	E
110	IOC-ICSU-CEC regional Workshop for Member States of the Mediterranean - GODAR-IV (Global Oceanographic Data Archeology and Rescue Project) Foundation for International Studies, University of Malta, Valletta, Malta, 25-28 April 1995.	E
111	Chapman Conference on the Circulation of the Intra-Americas Sea; La Parguera, Puerto Rico, 22-26 January 1995.	E
112	IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials (GESREM) Workshop; Miami, U.S.A., 7-8 December 1993.	E
113	IOC Regional Workshop on Marine Debris and Waste Management in the Gulf of Guinea; Lagos, Nigeria, 14-16 December 1994.	E
114	International Workshop on Integrated Coastal Zone Management (ICZM) Karachi, Pakistan; 10-14 October 1994.	E
115	IOC/GLOSS-IAPSO Workshop on Sea Level Variability and Southern Ocean Dynamics; Bordeaux, France, 31 January 1995	E
116	IOC/WESTPAC International Scientific Symposium on Sustainability of Marine Environment: Review of the WESTPAC Programme, with Particular Reference to ICAM, Bali, Indonesia, 22-26 November 1994.	E
117	Joint IOC-CIDA-Sida (SAREC) Workshop on the Benefits of Improved Relationships between International Development Agencies, the IOC and other Multilateral Inter-governmental Organizations in the Delivery of Ocean, Marine Affairs and Fisheries Programmes; Sidney B.C., Canada, 26-28 September 1995.	E
118	IOC-UNEP-NOAA-Sea Grant Fourth Caribbean Marine Debris Workshop; La Romana, Santo Domingo, 21-24 August 1995.	E
119	IOC Workshop on Ocean Colour Data Requirements and Utilization; Sydney B.C., Canada, 21-22 September 1995.	E
120	International Training Workshop on Integrated Coastal Management; Tampa, Florida, U.S.A., 15-17 July 1995.	E
121	Atelier régional IOC-CERESCOR sur la gestion intégrée des zones littorales (ICAM), Conakry, Guinée, 18–22 décembre 1995	F
122	IOC-EU-BSH-NOAA-(WDC-A) International Workshop on Oceanographic Biological and Chemical Data Management, Hamburg, Germany, 20-23 May 1996	E
123	Second IOC Regional Science Planning Workshop on Harmful Algal Blooms in South America; Mar del Plata, Argentina, 30 October–1 November 1995.	E, S
124	GLOBEC-IOC-SAHFOS-MBA Workshop on the Analysis of Time Series with Particular Reference to the Continuous Plankton Recorder Survey; Plymouth, U.K.,4-7 May 1993.	E
125	Atelier sous-régional de la COI sur les ressources marines vivantes du Golfe de Guinée ; Cotonou, Bénin, 1-4 juillet 1996.	E

No.	Title	Languages
126	IOC-UNEP-PERSGA-ACOPS-IUCN Workshop on Oceanographic Input to Integrated Coastal Zone Management in the Red Sea and Gulf of Aden. Jeddah, Saudi Arabia, 8 October 1995.	E
127	IOC Regional Workshop for Member States of the Caribbean and South America GODAR-V (Global Oceanographic Data Archeology and Rescue Project); Cartagena de Indias, Colombia, 8-11 October 1996.	E
128	Atelier IOC-Banque Mondiale-Sida/SAREC-ONE sur la Gestion Intégrée des Zones Côtières ; Nosy Bé, Madagascar, 14-18 octobre 1996.	E
129	Gas and Fluids in Marine Sediments, Amsterdam, the Netherlands; 27-29 January 1997.	E
130	Atelier régional de la COI sur l'océanographie côtière et la gestion de la zone côtière ;Moroni, RFI des Comores, 16-19 décembre 1996.	E
131	GOOS Coastal Module Planning Workshop; Miami, USA, 24-28 February 1997	E
132	Third IOC-FANSA Workshop; Punta-Arenas, Chile, 28-30 July 1997	S/E
133	Joint IOC-CIESM Training Workshop on Sea-level Observations and Analysis for the Countries of the Mediterranean and Black Seas; Birkenhead, U.K., 16-27 June 1997.	E
134	IOC/WESTPAC-CCOP Workshop on Paleogeographic Mapping (Holocene Optimum); Shanghai, China, 27-29 May 1997.	E
135	Regional Workshop on Integrated Coastal Zone Management; Chabahar, Iran; February 1996.	E
136	IOC Regional Workshop for Member States of Western Africa (GODAR-VI); Accra, Ghana, 22-25 April 1997.	E
137	GOOS Planning Workshop for Living Marine Resources, Dartmouth, USA; 1-5 March 1996.	E
138	Gestión de Sistemas Oceanográficos del Pacífico Oriental; Concepción, Chile, 9-16 de abril de 1996.	S
139	Sistemas Oceanográficos del Atlántico Sudoccidental, Taller, TEMA;Furg, Rio Grande, Brasil, 3-11 de noviembre de 1997	S
140	IOC Workshop on GOOS Capacity Building for the Mediterranean Region; Valletta, Malta, 26-29 November 1997.	E
141	IOC/WESTPAC Workshop on Co-operative Study in the Gulf of Thailand: A Science Plan; Bangkok, Thailand, 25-28 February 1997.	E
142	Pelagic Biogeography ICoPB II. Proceedings of the 2nd International Conference. Final Report of SCOR/IOC Working Group 93; Noordwijkerhout, The Netherlands, 9-14 July 1995.	E
143	Geosphere-biosphere coupling: Carbonate Mud Mounds and Cold Water Reefs; Gent, Belgium, 7–11 February 1998.	E
144	IOC-SOPAC Workshop Report on Pacific Regional Global Ocean Observing Systems; Suva, Fiji, 13-17 February 1998.	E
145	IOC-Black Sea Regional Committee Workshop: 'Black Sea Fluxes' Istanbul, Turkey, 10-12 June 1997.	E
146	Living Marine Resources Panel Meeting, Paris, France, 23-25 March 1998.	E
147	IOC-SOA International Training Workshop on the Intregration of Marine Sciences into the Process of Integrated Coastal Management, Dalian, China, 19-24 May 1997.	E
148	IOC/WESTPAC International Scientific Symposium – Role of Ocean Sciences for Sustainable Development Okinawa, Japan, 2-7 February 1998.	E
149	Workshops on Marine Debris & Waste Management in the Gulf of Guinea, 1995-97.	E
150	First IOCARIBE-ANCA Workshop Havana, Cuba, 29 June-1 July 1998.	E
151	Taller Pluridisciplinario TEMA sobre Redes del Gran Caribe en Gestión Integrada de Áreas Costeras Cartagena de Indias, Colombia, 7-12 de septiembre de 1998.	S
152	Workshop on Data for Sustainable Integrated Coastal Management (SICOM) Maputo, Mozambique, 18-22 July 1998	E
153	IOC/WESTPAC-Sida (SAREC) Workshop on Atmospheric Inputs of Pollutants to the Marine Environment Qingdao, China, 24-26 June 1998	E
154	IOC-Sida-Flanders-SFRI Workshop on Ocean Data Management in the IOCINCWIO Region (ODINEA project) Capetown, South Africa, 30 November-11 December 1998.	E
155	Science of the Mediterranean Sea and its applications UNESCO, Paris 29-31 July 1997	E
156	IOC-LUC-KMFRI Workshop on RECOSCIX-WIO in the Year 2000 and Beyond, Mombasa, Kenya, 12-16 April 1999	E
157	'98 IOC-KMI International Workshop on Integrated Coastal Management (ICM), Seoul, Republic of Korea 16-18 April 1998	E
158	The IOCARIBE Users and the Global Ocean Observing System (GOOS) Capacity Building Workshop, San José, Costa Rica, 22-24 April 1999	E
159	Oceanic Fronts and Related Phenomena (Konstantin Fedorov Memorial Symposium) – Proceedings, Pushkin, Russian Federation, 18-22 May 1998	E
160	Under preparation	
161	Under preparation	
162	Workshop report on the Transports and Linkages of the Intra-americas Sea (IAS), Cozumel, Mexico, 1-5 November 1997	E
163	Under preparation	
164	IOC-Sida-Flanders-MCM Third Workshop on Ocean Data Management in the IOCINCWIO Region (ODINEA Project), Cape Town, South Africa, 29 November – 11 December 1999	E
165	An African Conference on Sustainable Integrated Management; Proceedings of the Workshops. An Integrated Approach, (PACSICOM), Maputo, Mozambique, 18 –25 July 1998	E, F
166	IOC-SOA International Workshop on Coastal Megacities: Challenges of Growing Urbanization of the World's Coastal Areas; Hangzhou, P.R. China, 27 –30 September 1999	E
167	IOC-Flanders First ODINAFRICA-II Planning Workshop, Dakar, Senegal, 2-4 May 2000	E
168	Geological Processes on European Continental Margins; International Conference and Eight Post-cruise Meeting of the Training-Through-Research Programme, Granada, Spain, 31 January – 3 February 2000	E
169	International Conference on the International Oceanographic Data & Information Exchange in the Western Pacific (IODE-WESTPAC) 1999, ICIWP '99, Langkawi, Malaysia, 1-4 November 1999	***under preparation***
170	IOCARIBE-GODAR-I Cartagenas, Colombia, February 2000	***under preparation***
171	Ocean Circulation Science derived from the Atlantic, Indian and Arctic Sea Level Networks, Toulouse, France, 10-11 May 1999	E
172	(*Under preparation*)	
173	The Benefits of the Implementation of the GOOS in the Mediterranean Region, Rabat, Morocco, 1-3 November 1999	E, F
174	IOC-SOPAC Regional Workshop on Coastal Global Ocean Observing System (GOOS) for the Pacific Region, Apia, Samoa, 16-17 August 2000	E
175	Geological Processes on Deep-water European Margins, Moscow-Mozhenka, 28 Jan.-2 Feb. 2001	E
176	MedGLOSS Workshop and Coordination Meeting for the Pilot Monitoring Network System of Systematic Sea Level Measurements in the Mediterranean and Black Seas, Haifa, Israel, 15-17 May 2000	E
177	*(Under preparation)*	
178	*(Under preparation)*	
179	*(Under preparation)*	
180	Abstracts of Presentations at Workshops during the 7th session of the IOC Group of Experts on the Global Sea Level Observing System (GLOSS), Honolulu, USA, 23-27 April 2001	E
181	*(Under preparation)*	
182	*(Under preparation)*	
183	Geosphere/Biosphere/Hydrosphere Coupling Process, Fluid Escape Structures and Tectonics at Continental Margins and Ocean Ridges, International Conference & Tenth Post-cruise Meeting of the Training-through-Research Programme, Aveiro, Portugal, 30 January-2 February 2002	E
184	*(Under preparation)*	
185	*(Under preparation)*	
186	*(Under preparation)*	
186	*(Under preparation)*	
187	Geological and Biological Processes at deep-sea European Margins and Oceanic Basins, Bologna, Italy, 2–6 February 2003	E
188	Proceedings of 'The Ocean Colour Data' Symposium, Brussels, Belgium, 25-27 November 2002	E
189	Workshop for the Formulation of a Draft Project on Integrated Coastal Management (ICM) in Latin America and the Caribbean (LAC), Cartagena, Colombia, 23–25 October 2003 Taller de Formulación de un Anteproyecto de Manejo Costero Integrado (MCI) en América Latina y el Caribe (ALC), Cartagena, Colombia, 23–25 de Octubre de 2003	E F ***(electronic copy only)***
190	First ODINCARSA Planning Workshop for Caribbean Islands, Christchurch, Barbados, 15–18 December 2003	E ***(electronic copy only)***
191	North Atlantic and Labrador Sea Margin Architecture and Sedimentary Processes — International Conference and Twelfth Post-cruise Meeting of the Training-through-research Programme, Copenhagen, Denmark, 29–31 January 2004	E
192	Regional Workshop on Coral Reefs Monitoring and Management in the ROPME Sea Area, Iran I.R., 14–17 December 2003	E ***(under preparation)***
193	Workshop on New Technical Developments in Sea and Land Level Observing Systems, Paris, France, 14–16 October 2003	E ***(electronic copy only (under preparation***
194	IOC/ROPME Planning Meeting for the Ocean Data and Information Network for the Central Indian Ocean Region	
195	Workshop on Indicators of Stress in the Marine Benthos, Torregrande-Oristano, Italy, 8–9 October 2004	E
196	International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean within a Global Framework, Paris, France, 3–8 March 2005	E
197	Geosphere-Biosphere Coupling Processes: The TTR Interdisciplinary Approach Towards Studies of the European and North African Margins; International Conference and Post-cruise Meeting of the Training-Through-Research Programme, Morocco, 2-5 February 2005	E
198	Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean, Grand Baie, Mauritius, 14–16 April 2005	E