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(of Unesco)

Eighth Session of the International Co-ordination
Group for the Tsunami Warning System in the Pacific

Suva, Fiji, 13-17 April 1982

SUMMARY REPORT

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1. OPENING OF THE SESSION

1 The Eighth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) was opened by its Chairman, Mr. G. Dohler, at 10.00 on Tuesday, 13 April 1982, at the South Pacific Bureau for Economic Co-operation (SPEC) Headquarters, Suva, Fiji. He welcomed the participants and invited Mr. Sakeasi Waqanivavalagi, Minister of State for Lands and Mineral Resources, to address the Group.

2 Mr. Waqanivavalagi extended a warm welcome and best wishes to the participants. He remarked that tsunamis are events that mankind is bound to view with increasing seriousness. No country can isolate itself from the inevitable dangers and effects of tsunamis and therefore it is vitally important to examine jointly ways and means to take adequate precautions, particularly through tsunami warning systems, for the safety of lives in the event of such disasters. He noted that Fiji made certain steps to educate the people and bring about an awareness of the effects of tsunamis and earthquakes. The Minister further stated that this Session of the International Co-ordination Group will give the opportunity to monitor, report on, co-ordinate, establish and plan improvements to tsunami warning systems by programmes of benefit to Member States of IOC whose coastal areas are potentially threatened by tsunamis. In his closing remarks he said he felt sure that constructive and fruitful discussion would take place. The full text of his address is presented in Annex IV of the Summary Report.

3 The Chairman thanked Mr. Waqanivavalagi and called upon Mr. H. Plummer, Head of the Fiji Delegation, to address the Session. Mr. Plummer gave a welcoming speech to the participants on behalf of the Fiji Delegation and the staff of the Mineral Resources Department.

4 The Chairman thanked Mr. Plummer for the arrangements made, and, on behalf of the participants, expressed his gratitude for the work carried out by the local Organizing Committee. He then called on the Assistant Secretary, Dr. I. Oliounine.

5 Speaking on behalf of IOC, Dr. I. Oliounine expressed his gratitude to the Government of Fiji for hosting the meeting and providing such fine facilities. He emphasized further that IOC plays and will play a decisive role in the future on ocean studies and investigations. Each day sees the emergence of increasing interests and demands on the Commission, above all with respect to the developing countries. The role of ICG/ITSU is of profound importance for coastal populations and industries in developed as well as in developing countries of the Pacific that are threatened by tsunamis. The socio-economic development of Pacific nations, particularly that of island countries, must take fully into account the effects of natural disasters such as tsunamis, and therefore depends on the scientific investigation and prediction of such natural phenomena as tsunamis. Finally, he noted that the Secretary of IOC considers this Session as an important landmark in the development of the Pacific Tsunami Warning System.

6 The Chairman thanked Dr. Oliounine for his pertinent remarks and emphasized the need for the Group to study carefully the responsibility and efforts required to meet the demands of the future.

7 The Chairman then called upon participants to observe a minute's silence in honour of those scientists and administrators who had passed away during the intersessional period.

8 The List of Participants is given in Annex III.

2. ADMINISTRATIVE ARRANGEMENTS FOR THE SESSION

2.1 ADOPTION OF THE AGENDA

9 The Provisional Agenda was adopted without amendment and is given in Annex I.

2.2 ELECTION OF THE RAPPORTEUR

10 Mr. N.M. Ridgway (New Zealand) was unanimously elected Rapporteur of the Session.

2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

11 The IOC Assistant Secretary, Dr. I. Oliounine, explained the timetable, identified changes in the list of documents, and briefly reviewed the documentation. He drew the attention of participants to a number of information documents which had become available since distribution of the Provisional List of Documents.

12 The Group agreed that its work would normally be carried out in plenary and that small ad hoc sessional groups should be established, if necessary, to consider specific problems to facilitate the work of the Group. Mr. I. Everingham, the Secretary of the Local Organizing Committee, outlined technical and administrative arrangements.

3. INTERSESSIONAL ACTIVITIES

3.1 REPORTS BY THE CHAIRMAN OF THE GROUP AND OF THE IOC SECRETARIAT

13 The Chairman in his report reviewed the activities of the Group during the intersessional period 1980-1982, and actions he had undertaken on behalf of the Group during this period. He stated the adoption of the Summary Report of the Group's Seventh Session by the IOC Executive Council at its Thirteenth Session held in June 1980 in Paris. The Chairman especially stressed the reasons for seeking extra-budgetary funding to expand and improve the present Tsunami Warning System in the Pacific and the need for education and training for different groups and individuals as suggested in the Recommendations of the Group's Seventh Session. He drew the attention of participants to the initiative of the United States of America in the installation of Geostationary Operational Environmental Satellite (GOES) platforms in South America and encouraged

the representatives of countries involved to explain in detail the usefulness of these stations and the experience gained in installing and maintaining these observation systems.

14 The Chairman informed the Session of his response to the IOC questionnaire on budgetary requirements for 1984/1985. He advised the Secretary IOC that funds requested by the International Co-ordination Group at its last session in Chile, are needed for an effective and efficient International Tsunami Warning System for the Pacific and for the educational programme for those living in countries whose coastal areas are threatened by tsunamis.

15 The Chairman further expressed his concern that although much work had been done since 1965 in the dissemination of the data required for the operation of the International Tsunami Warning System, the goal of obtaining the response within one hour after the event from the nearest gauging stations has not been achieved.

16 The Chairman reported on his visits in 1981 to Japan to chair the session on Harbour Oscillations by Long Waves and Tsunamis at the IUGG International Tsunami Symposium, and to Paris to the IOC Headquarters to discuss the preparations for the Eighth Session of the Group.

17 In closing his report the Chairman especially stressed the fact that the goal of having an efficient warning system can only be achieved if today's technology is employed effectively within the Pacific region and appropriate scientific and technological training, as well as public education and awareness of the dangers of tsunamis, are carried out on an ongoing basis.

18 The IOC Assistant Secretary reported on the status of implementation of the Resolutions and Recommendations of the Group's Seventh Session. He noted with appreciation the decision of the Canadian Government to provide financial support to Mr. G. Dohler, who had agreed to take up the position of Associate Director at ITIC for a period of one year. In the meantime, it is hoped that Member States of the International Co-ordination Group will put forward nominations for the post of Associate Director in order to fill the post upon Mr. Dohler's return to Canada.

19 The Assistant Secretary drew the attention of the Group to the implementation of Recommendation ITSU-VII.2 by which ITSU Member States were advised to apply for extra-budgetary funds such as those made available by the UNDP to support the Tsunami Warning System in the Pacific. The IOC Assistant Secretary stressed the importance for National Tsunami Project Leaders to urge their governments to approach UNDP directly with requests to support the project and for Member States concerned to give appropriate priority to an expanded ITSU programme and network as laid down in the project.

20 Speaking about the implementation of Recommendation ITSU-VII.4, the IOC Assistant Secretary expressed concern about the fact that no national tsunami committee informed the IOC Secretariat on their activities in the field of improving and implementing educational programmes on tsunamis in their respective countries.

- 21 The Group noted with appreciation the reports of the Chairman of the Co-ordination Group and of the IOC Assistant Secretary.
- 22 The Group concurred with the views expressed by the Chairman and the IOC Assistant Secretary, and agreed that information contained in the reports will be taken up under the relevant items of the agenda.
- 23 The Group urged Member States to submit information on a regular basis to the IOC Secretariat and the International Tsunami Information Center (ITIC) on their activities in the field of tsunami warning and research.

3.2 REPORT OF THE DIRECTOR OF ITIC

- 24 The Director of ITIC, Dr. G. Pararas-Carayannis, called the attention of the Delegates to the International Tsunami Information Center Progress Report for 1980-1982. He noted the highlights of the report, in particular, Tsunami Warning System automation, new reporting stations, visiting scientist programme.
- 25 On Tsunami Warning System (TWS) automation, the Director's report broke down the TWS response performance into the three operational components of data acquisition, data analysis and dissemination of information, and reviewed the progress that has been made by the Pacific Tsunami Warning Center (PTWC) in automating these components by the installation of data-gathering devices and the Advanced Operating System (AOS) which permits multiple use of, and access to, the computer system.
- 26 On new reporting stations, he elaborated on efforts to bring new stations into the Pacific Tsunami Warning System, along the coast of South America and in the southwest Pacific, and commented on the automated tsunami platforms installed by the U.S. National Weather Service and the new conventional tide gauges installed at Lyttleton Harbour, New Zealand, and at Waglan Island in the Yellow Sea.
- 27 Regarding liaison, the ITIC report elaborated on the Center's very important role of meeting the needs of the general public for education in tsunami preparedness and in responding to inquiries for tsunami data and information throughout the world. ITIC liaison in the operational aspects of the Tsunami Warning System has led to a number of improvements and the solution of many problems related to instrumentation, communication and preparedness.
- 28 The Director of ITIC paid special attention to the preparation of a number of publications during the intersessional period. The Center has continued the publication of its Progress Reports, the Tsunami Newsletter and the Tsunami Reports. New publications that have been completed include a Tsunami Bibliography, an Historical Catalog of Tsunamis in the Samoan Islands, and an article entitled "The Impact of Tsunamis on Society".

29 The Group paid particular attention to information on two important tsunami training exercises related to predisaster planning and the mitigation of tsunami effects, which have been conducted and co-sponsored by ITIC. The form and methods of such training exercises have been standardized and made available to ITSU Member States in the hope that training workshops will be undertaken to improve disaster preparedness in other Pacific countries. Educational material has been published and distributed by ITIC.

30 ITIC fulfills its mandate of monitoring tsunami research by its continuous interaction with individual scientists and institutions involved in tsunami work by reviewing, recommending or endorsing tsunami research, particularly focusing attention on the operational requirements and improvements of the Tsunami Warning System. The ITIC report summarized a research programme which provides for the real-time evaluation of seismic parameters, for a long-term observational programme, for the development of techniques of amplitude run-up and risk prediction, and for the collection and compilation of suitable tsunami data that will permit the analysis of risk and verification of numerical models.

31 The Group stressed the need to increase support to ITIC.

32 The Group urged experts involved in the preparation of the International Tide Gauges Catalogue to complete their work in due course and requested the IOC Secretary to investigate the possibility of publishing it before November 1982.

33 The Group noted the importance of the Tsunami Bibliography and invited the IOC Secretary to investigate ways of distributing it in microfiche. The number of entries was estimated at close to 4,000.

3.3 NATIONAL REPORTS

34 The Group was presented with national reports of participating countries. The Chairman submitted Canada's report on behalf of Mr. S.O. Wigen, who was unable to attend. Written reports were also received by the IOC Secretariat from Chile, Hong Kong and Papua New Guinea.

35 These reports clearly indicated that Member States concerned have made considerable efforts to improve the Tsunami Warning System in the Pacific. Some major items mentioned in the reports are summarized below.

36 The Delegate of Canada reported that a new automatic tide gauge station planned at Bamfield, B.C., is expected to be ready for satellite interrogation by 1983 and that pressure sensors, capable of high speed sampling for tsunami recording, can be deployed at a depth of 2,500 m off the Canadian west coast. Special attention was paid to the need for certain lines of research which include the assembling of knowledge of past tsunamis, and the evaluation of the probable response of warning system gauges to any tsunami. To develop these concepts, the Delegate of Canada recommended that a task team be established to prepare a Master Plan for International Tsunami Warning System operations, incorporating operations, planning and research.

- 37 The Delegate of Fiji stated that five seismic stations telemetered from Suva were installed by the Japanese Aid Programme late in 1981 and this brought the total to 14 seismic stations throughout Fiji. By 1983 it will be possible to locate earthquake epicentres rapidly. However, to make use of this information in the mitigation of tsunami damage, a system for rapid communication to the public is an essential requirement. Mr. Gordon Burton, Director of PTWC, commented on the excellent communication link between the Center and Nadi and the important role that Fiji plays in the Pacific Tsunami Warning System.
- 38 The Delegate of Japan described his country's warning procedures and the advances made in automating their warning system. The Permanent Ocean Bottom Seismograph Observation System (OBSOS) off the south coast of the Tokai District, Japan, is operating successfully, and another OBSOS system, due for completion in 1985, is to be set up in the southern Kanto area off Tokyo.
- 39 The Delegate of New Zealand stated that the Lyttleton tide gauge is now in operation as a participating tide station. He described the intensive programme of training and education with respect to natural disasters, which has been adopted by the Ministry of Civil Defence.
- 40 The Delegate of Peru reported that a new tide gauge station has been established at the island of Lobos de Afuera, 35 miles off the Peruvian coast. The Tsunami Detection Platform installed in Punta Callao by the U.S. National Weather Service is experiencing some minor problems. A real-time seismic activity detection and analysis system is to be installed in 1982 and will increase the seismic detection capabilities in the central region of Peru.
- 41 The Delegate of the Philippines reported that disaster risk maps, including data on tsunami occurrences, are being prepared for most of the vulnerable areas. Some problems that previously occurred in the transmission of messages between Legaspi Tide Station and Honolulu have now been overcome. An intensive educational programme has been initiated to minimize the disastrous effects of tsunamis, effects which the Philippines experienced so tragically in 1976 when 8,000 people were killed.
- 42 The Delegate of Tonga described the vulnerability of Tonga islands to earthquakes. Seismic stations were temporarily operated some years ago by Cornell University. The Australian National University set up four seismic stations in 1981 but these are now in the process of being removed.
- 43 The Delegate of the U.S.A. described improvements that have been made in automatic data processing and in communications instrumentation by the installation of a high-speed paper-tape punch for teletypewriter messages. Four experimental tide station platforms were installed at Easter Island and Antofagasta (Chile), La Punta, Callao (Peru) and Galápagos Islands (Ecuador). The platforms transmit data, via GOES, to PTWC, but some technical and maintenance problems are being experienced at present. Many of the US tide gauges have been automated and PTWC can contact these stations and receive water level data automatically.

44 Chile reported that twelve tide stations and 21 seismic stations participate in the Warning System. Exercises involving the tidal stations are rapidly carried out and response times have been reduced to a minimum. The 21 seismic stations include five new ones which are telemetered from the University of Chile, Santiago.

45 Hong Kong reported on the participation of the Royal Observatory in the Warning System. Four tide gauges are operated and two of these are telemetered from the Royal Observatory. Another tide gauge is being installed at Waglan Island and will have a telecommunication link with the Observatory.

46 A report from Papua New Guinea informed the Group that tsunami monitoring is being carried out under the responsibility of the Geophysical Observatory Section (Port Moresby) of the Geological Survey of Papua New Guinea. Rabaul Volcanological Observatory participates in tsunami monitoring and has access to records of two tide gauges: one belonging to the University of Hawaii, and the other maintained by the Papua New Guinea Department of Works.

47 The Group noted the value of the national reports and requested other Member States of the ICG/ITSU to submit written reports, not later than July 1982, for subsequent distribution by the IOC Secretariat. The Group urged the Director, ITIC, to publish the summary of the most important reports in the first issue of ITIC Newsletter after July 1982.

48 The Group concurred with the proposal made by the Delegate of Canada on the Master Plan for International Tsunami Warning System operations.

49 The Group adopted Resolution ITSU-VIII.1.

4. FUTURE ACTIVITIES

4.1 CONSIDERATION OF RECOMMENDATIONS FROM THE IUGG TSUNAMI COMMISSION MEETING HELD IN SENDAI/OFUNATO/KAMAISHI, JAPAN 25-26 MAY 1981

50 The Director of ITIC, Dr. G. Pararas-Carayannis, was asked to comment on the IUGG Tsunami Commission meeting which he and the Chairman attended in Japan. Dr. Pararas-Carayannis reviewed the Resolutions and Recommendations that were of interest to the ITSU Group.

51 The Group regretted that the proceedings of the last two meetings of the IUGG Tsunami Commission have not yet been published.

52 Special attention was paid to the Recommendation of the IUGG Commission to co-ordinate ITSU and IUGG meetings to make possible joint attendance. The highlights of the discussions are contained in the Summary Report under Agenda Item 8.

4.2 ESTABLISHMENT OF REGIONAL CENTRES TO IMPROVE THE TSUNAMI WARNING SYSTEM IN THE PACIFIC

- 53 The Director of ITIC and the Vice-Chairman of IOC/ITSU, Capitán de Fragata César Vargas Faucheux, were asked to comment on the work of the ad hoc Task Team established at ITSU-VII to examine the feasibility of establishing Regional Warning Centres in critical areas of the Pacific, and to explore the possibility of international funding for that purpose.
- 54 They reported that some Task Team members had met and that action on these matters was taken. Specifically, a proposal for extra-budgetary funding was forwarded to the Secretary of IOC for submission to appropriate international funding agencies. Draft proposals for regional centers in South America and in Indonesia had been prepared.
- 55 The Director of ITIC quoted from his report on the subject that Regional Tsunami Warning Centres could be established in Western Samoa, Fiji, the Philippines, the Solomon Islands, or in any region where tsunami frequency is high, and that appropriate instrumentation and communications would be needed. Furthermore, a well co-ordinated and multi-faceted programme of tsunami preparedness would be necessary to assure the effectiveness of such Regional Centres.
- 56 The Vice-Chairman informed the Group of his preparation of a proposed project for organizing a Regional Tsunami Warning System for the South-East Pacific formed by Colombia, Ecuador, Peru and Chile.
- 57 The concept of Regional Warning Centres was discussed by the Group and the consensus was that national authorities in the risk areas should define their requirements in a better way in determining the establishment of Regional Warning Centres, or where these Centres should be placed. A careful review of the effectiveness of such Regional Centres should be made, and national interest, commitment and priority should be established.
- 58 A proposal was presented to the Group for a preparatory mission to evaluate the mitigation of the tsunami hazards in the Pacific and the possible development of Regional Tsunami Warning Centres. The purpose of the proposed mission would be to determine the precise objectives and work plan for establishing the necessary understanding with national officials in participating Member countries.

4.3 TRAVEL-TIME CHARTS

- 59 Mr. Mark Spaeth, U.S.A., reported on the status of new travel-time charts. He stated that these charts were initially prepared manually, using depths taken from hydrographic charts. In the late 1960s a computer programme was developed and used to provide a first rough draft of the charts. Final drafting was carried out at the Headquarters of the U.S. National Oceanic and Atmospheric Administration, and copies made by photographic reproduction. Charts were produced for particular tide stations and they permitted the arrival times of tsunamis from the earthquake epicentre to be determined.

Currently, however, the PTWC does not use the travel-time charts operationally. Instead, a series of epicentral locations throughout the Pacific have been arbitrarily selected and travel times to the warning points established. When an earthquake occurs, travel times are interpolated from the precomputed epicentres. This is a rapid and efficient method which takes advantage of available computer capacity. The programme used by NOAA to prepare the original travel-time charts still exists, but the computer on which the calculation was run is no longer available. The preparation of the charts at present involves manual drafting and is rather expensive.

60 It was pointed out that the basic assumption made in the construction of the travel-time charts was that the tsunami speed was a simple function of depth and this was rather simplistic. It is now apparent that a number of factors need to be considered in determining the actual tsunami speed. The system now used at PTWC is reasonably accurate but tends to give earlier arrival times than may actually be the case in order to provide a margin of safety.

61 The Group pointed out that travel-time charts were extremely valuable to participants in the Tsunami Warning System.

62 The Group adopted Resolution ITSU-VIII.2.

4.4 IMPROVEMENT OF INFORMATION, COMPILING AND EXCHANGE SCHEME

63 In the absence of the Director of the World Data Center A-Tsunami, the Chairman provided the summary of the Report on the activities of the Centre. In the presentation he placed particular emphasis on the importance of submitting all kinds of data on tsunamis on a regular basis to the WDC A-Tsunami. The Chairman reminded Delegates that the Centre will welcome voluntary contributions of scientific data related to tsunamis. He suggested that timely submission of data is necessary to facilitate the international data exchange and to improve the data services rendered to the user.

64 The Group noted with satisfaction the volume and wide scope of work carried out by the Centre. The actions of the Centre with respect to the increase of current holdings such as mareograms, effect photographs, seismic source data, etc. were appreciated by delegates. The Group fully agreed with actions proposed by the Chairman and urged the countries concerned to ensure that their observation sites and data centres provide data and information such as films and photographs, to the WDC A-Tsunami and ITIC on a regular basis and free of charge.

65 The Group called on the Director and Associate Director of ITIC to establish close operational contacts with the WDC A-Tsunami and its Director in order to work out co-ordinated plans for improving the services and for avoiding costly duplication of effort.

66 Mr. Mark Spaeth, of the U.S.A. Delegation, reported on a study made by a Task Team which was established at the Seventh Session of ICG/ITSU to prepare a plan and implementation programme for the modification of procedures for the issuance of tsunami

watches and warnings. Proposed changes on the operation of the PTWC were submitted to the Delegates for consideration and approval.

67 The Group fully supported proposed improvements for the PTWC Watch and Warning Procedures which will work as follows:

- When an earthquake which could be tsunamigenic occurs, the area surrounding the epicentre which could be struck by a tsunami within three hours after the occurrence of the earthquake will be placed in Warning Status.
- Areas within three to six hours tsunami travel time of the epicentre would be placed in Watch Status.
- Every hour, until the presence or absence of a tsunami is confirmed, the areas in Watch and Warning Status would be expanded by the area that would be covered by the projected tsunami in an additional hour.
- If a major tsunami is detected, the area in Warning Status would be immediately expanded to cover the whole Pacific. If a small tsunami is detected, the Watch and Warning Status areas would be extended every hour until the PTWC was certain that no further danger existed, at which time the Watch and Warning Status would be cancelled. If no tsunami is detected by tide stations near the epicentral region, the Watch and Warning Status would likewise be cancelled.

68 To facilitate operations at the PTWC, any country or island group that lies partly within the Warning area would come under Watch Status. This would not prevent National Warning Centres from declaring a Watch or Warning Status selectively within their countries.

69 It should be pointed out that, if this new procedure is adopted, many more warnings will be issued than in the past. However, most will be limited to areas within four or five hours tsunami travel time of the epicentre.

70 All Watch and Warning messages will be sent to all dissemination agencies participating in the Pacific Tsunami Warning Systems. Each message will specify the countries and area to which Watch or Warning Status applies.

71 The Group was further informed on the necessity to make appropriate changes to the communication plan and agreed that a copy of this change should be distributed well in advance of the implementation programme. The Group recommended that ways be found to implement the proposal which is of great benefit to all Member States of the Pacific.

72 The Group adopted Resolution ITSU-VIII.3.

5. PROPOSALS TO ENHANCE TRAINING AND EDUCATION OF TSUNAMI SPECIALISTS OF DEVELOPING MEMBER STATES OF THE REGION, AND REGIONAL CO-OPERATION

5.1 ORGANIZATION OF WORKSHOPS ON THE TECHNICAL ASPECTS OF TSUNAMI ANALYSES, PREDICTION AND COMMUNICATIONS

73 The Director, ITIC, referred the participants to his Progress Report for 1980-1982. He noted that during the intersessional period ITIC conducted two important training exercises and workshops. The first training workshop was given in Hawaii to a group of meteorological technicians from the Micronesian Islands at the end of 1980.

74 In August 1981 a tsunami training exercise was organized by ITIC and the State of Hawaii Civil Defense Agency to familiarize officials in local and state government agencies with problems of predisaster planning and in the mitigation of tsunami effects. All IOC/ITSU Member States were invited to participate in the exercise and some countries were represented. Copies of all material related to this exercise were sent to all the tsunami national contacts of ITSU Member States by ITIC. The scenario and methodology developed for, and implemented during, the exercise could be adopted by other ITSU Member States in stimulating awareness of civil defence functions, facilities and procedures, for other areas of the Pacific, and as the basis for similar training.

75 The Group commended ITIC on its work in the organization of training exercises.

76 The Delegates of four Member States (Canada, Chile, the Philippines, U.S.A.) stressed the importance of exchange of educational, bibliographic and teaching material.

77 The Group unanimously agreed that wider information and educational material exchange is needed and recommended that Member States attempt to arrange for the full, free and rapid distribution of publications on the latest developments in the field, including any tsunami films.

78 The Group requested the IOC Secretary to take urgent steps to expedite the purchase of copies of the television film "In Search of Tsunamis".

5.2 VISITING SCIENTIST PROGRAMME

79 The Assistant Secretary of IOC outlined the terms of the programme. He referred to the ITIC Director's report regarding the implementation of the IOC-supported programme during the intersessional period. A number of scientists and administrators were given the opportunity to visit ITIC, and to familiarize themselves with the operational procedures of the Pacific Tsunami Warning Center and of the Hawaii Department of Civil Defense. Acknowledging the role of ITIC in the successful implementation of the programme, he expressed the wish to see more output from the programme for the benefit of other Member States of ITSU and for the Tsunami Warning System. He asked the Group to study carefully possible ways to achieve that goal.

80 The Chairman observed that the ITIC visiting scientist programme has sponsored scientists for rather short visits to ITIC which have not always resulted in tangible benefits to the Pacific Tsunami Warning System, and that future visiting scientists or administrators to ITIC, PTWC or elsewhere should have well-defined programmes of work and objectives for their visits. He invited the Group to study the possibilities of bringing experts not only into the central point but also to take them to regions which have a well-established tsunami warning system, computing facilities and expertise.

81 The ITIC Director explained that indeed the visits of scientists to ITIC under this programme are too short to result in significant benefits to the Tsunami Warning System, but that he regards the programme as being for the most part successful since all visiting scientists have had specific plans of work which have been concluded with final reports upon the completion of the visits. Furthermore, he commented that under the constraints of the programme he considered tsunami preparedness as the most important aspect in the selection of visitors to the Center.

82 The ITIC Director requested the Group's guidance in establishing additional criteria for selection of visiting scientists.

83 The Delegate of New Zealand stressed that the principal criteria should be that the visiting scientist programme should be of benefit not only to an individual but to the Group and to the System as a whole.

84 The Delegate of Fiji proposed that a questionnaire be prepared and sent to Member States for comments on the criteria for selection of experts for the visiting programme.

85 The Group believed that any expert, and not only a scientist, could be a candidate for selection.

86 The Group agreed to change the name of the programme to the Visiting Experts Programme, since such a designation was more general in scope.

87 The Group requested the Director and Associate Director of ITIC, in consultation with the IOC Secretary, to develop a questionnaire on criteria for selection of experts for the programme and recommended that selection be made jointly by ITIC and the IOC Secretariat.

88 The Group adopted Recommendation ITSU-VIII.1.

5.3 UNDP TSUNAMI PROJECTS

89 The Chairman informed the Group on the action taken relevant to the implementation of Recommendation ITSU-VII.2 by which developing Member States were recommended to apply for extra-budgetary funds, from UNDP for example, to support the establishment of a denser network of automated tide gauges in the Pacific, communication and telemetry links to seismic and tide gauges, training of personnel, and

maintenance of the system. The same Recommendation asked the Secretary IOC to approach financing organizations informing them of the urgency of implementation of the project. The Chairman invited the Assistant Secretary IOC to inform the Group on the status of the project.

90 The IOC Assistant Secretary informed the Group that the proposal entitled "Tsunami Warning System in the Pacific - An Inter-regional Project" was submitted by Unesco to UNDP for consideration in late 1979 under normal procedure, but no response had been received. Consultations with Mr. Dohler were held in the IOC Secretariat on 2 October 1981 and it was deemed necessary to approach UNDP again with a funding request for preparatory assistance in order to update the project document. Mr. Wigen and the Director of ITIC met at Mr. Dohler's office in late October 1981 to draft a proposal for preparatory assistance and to plan study missions to the countries concerned in order to revise the project document. The IOC Secretariat modified the proposal in accordance with the standard format for proposals for UNDP financing, and submitted it in February 1982 through Unesco.

91 The IOC Assistant Secretary reported further that in the middle of March 1982 UNDP responded on the Inter-regional Project, "Mitigation of Tsunami Hazards in the Pacific", and confirmed that they are not in a position at the moment to consider the request. They promised, however, to review the proposed project in terms of their "pipeline list of projects". This means that UNDP is interested in the proposal and we should wait for a more auspicious moment to raise the subject.

92 The Group felt that, despite this, it would be helpful to stress to thw UNDP the urgent need of this project, and urged the IOC Secretary to attempt to arrange one of the missions proposed in the document at the earliest possible opportunity. .

93 The Chairman asked the UNDP Representative, Mr. A.N. Holcombe, to comment. He indicated that their South Pacific Mission had not yet been involved in this field but gave some advice on the ways such emphasis should be applied. He felt that a multi-purpose programme for the mission, including, for example, tropical cyclones, would help to get UNDP support.

94 The Delegate of the U.S.A. noted that the hurrican storm surge problem had already been discussed during this Session, and that the support of the meteorological community should be solicited, in keeping with the multi-purpose concept, so as to strengthen our argument for UNDP assistance.

96 The Delegate of Tonga requested the ICG/ITSU to recommend to the Disaster Preparedness Workshop to be held in Honolulu late April 1982 the potential multi-purpose application of Tsunami Warning System components but concentrating on the need for a Tsunami Warning System, including a regional centre in the South Pacific.

97 The Delegate of the Philippines stressed the fact that the Tsunami Warning System is the only system linking nations of the Pacific that can warn the people.

98 The Group noted that as time elapses after the occurrence of a damaging tsunami the support declines.

99 Based on a recommendation made by the Chairman, the Group urged IOC Member States to contribute to the IOC Trust Fund in order to finance the planned missions. Furthermore, the Group urged the Member States concerned to address UNDP directly to consider the financing of tsunami projects and to give them high priority.

100 CCOP/SOPAC expressed concern at the communications difficulties experienced in the South Pacific, especially in countries with many small islands, and strongly recommended that IOC take immediate steps to study possible ways of financial support to the communication of tsunami warnings in the South Pacific. The Chairman agreed that while the PTWC-to-national communications worked satisfactorily, the communication problems within developing countries have not been resolved. The Delegate of the U.S.A. commented that this applied also to U.S.A. along the long Alaskan coastline.

101 The Group agreed that each nation should do its utmost to expand and improve their relevant communication systems.

102 The Group adopted Resolution ITSU-VIII.4.

6. PROPOSALS FOR DRAFT PROGRAMME AND FOR SHORT-TERM AND MEDIUM-TERM BUDGETS

103 The subject was introduced by the IOC Assistant Secretary, who stressed the need to define action items and to make the necessary recommendations for 1983. He placed particular emphasis on the importance of providing guidance to the Secretary regarding the Unesco Medium-term Plan 1984-1989. He further informed the Group that the activities proposed by ITSU for 1982 were funded through the IOC Regular Programme budget in accordance with the recommendations of ITSU-VII.

104 The last Session of the IOC Executive Council, EC-XV, approved, with some minor changes, the proposals for 1984-85 made by ITSU-VII, and the proposals received from the Chairman of ICG/ITSU in his response to the IOC questionnaire on "1984-1985 Programme and Budget Submission". The IOC Executive Council provided guidance on the preparation of proposals to be submitted to the Twelfth Session of the IOC Assembly for adoption and submission to the Director-General for presentation to the Twenty-second Session of the Unesco General Conference in 1983.

105 The Group adopted Recommendation ITSU-VIII.2.

7. OTHER BUSINESS

106 The Delegate of the U.S.A. reviewed comments made during the Session regarding the needs of Members for more rapid information on earthquakes and detection of tsunamigenic events, and stated that a 30 percent improvement in the response times for issuing a Watch on regional warning may be possible by the more rapid acquisition of seismic data by PTWC.

- 107 The Delegate of New Zealand suggested a questionnaire to all seismic observatories regarding their response capabilities, and noted that Tsunami Dummies tested only tide station capability and not seismic response capability.
- 108 The Group agreed to invite experts to prepare and distribute the questionnaire and compile the responses for further action. It noted that collection could best be carried out through national contacts.
- 109 The Delegates of the U.S.A. and Fiji agreed to draw up a plan of action and to carry out a pilot study for the South Western Pacific.
- 110 The Group agreed that the report should be completed within the next three months.
- 110 The Chairman brought to the attention of the Group a letter by the Chairman of the Joint IOC/WMO Working Committee for IGOS, Mr. G. Holland, regarding a proposal to use Tsunami Warning System gauges for the measurements of sea level and to provide on a short-term interval basis mean sea level data, which would benefit the oceanographic programmes of the World Climate Research Programme (WCRP).
- 111 The Assistant Secretary IOC gave background information on this proposal.
- 112 The Group felt that this was a further example of the multi-purpose use of tidal data and agreed that the project should be supported.
- 113 The development of GOES stations was discussed and the experimental nature of this U.S. network was noted.
- 114 The Group agreed that this was the appropriate technology and could be employed at all critical stations in the Pacific, making use of all available satellites.
- 115 The Delegate of Fiji presented a paper entitled "Stratospheric dust-veils from explosive-type volcanoes - a neglected global hazard?"
- 116 The Group recommended that the paper should be forwarded to Unesco to be considered by the Task Force on Natural Hazards.
- 117 The IOC Assistant Secretary proposed that an ICG/ITSU Handbook containing practical information relating to the Group should be published during each intersessional period.
- 118 The proposal was welcomed by the participants. The Group urged the IOC Secretary, in consultation with the Chairman and the Director, ITIC, to prepare and publish the first issue during the intersessional period and not later than six months prior to the next Session.

119 The Group requested Member States participating or wishing to participate in ICG/ITSU activities to keep the Secretariat of IOC informed of all changes of the Handbook's content, particularly insofar as national contacts and members of ICG/ITSU subsidiary bodies are concerned.

8. DATE AND PLACE OF NEXT SESSION

120 The Group agreed with the Resolution of the IUGG Tsunami Commission which endorsed the co-ordination of ITSU and IUGG meetings to enable joint attendance. Furthermore, the Group agreed to attempt to hold the Tenth ICG/ITSU meeting in Sidney, British Columbia, Canada, in August 1985 in conjunction with the 1985 International Tsunami Symposium. However, the Ninth Session of ICG/ITSU should be held as planned in January/February 1984.

121 The Group recommended that the IOC Secretary ask Member States to submit an invitation to host the Ninth Session of ICG/ITSU.

122 The Group expressed its strong desire to hold the Ninth Session in Honolulu.

123 The Delegate of the U.S.A. agreed to pass the request to his Government.

124 The IOC Assistant Secretary drew the attention of the Group to the fact that two meetings in the period 1982-1985 will have additional financial implications and that a special recommendation is needed.

125 The Group adopted Recommendation ITSU-VIII.3.

9. ADOPTION OF THE SUMMARY REPORT, RESOLUTIONS AND RECOMMENDATIONS

126 The Group adopted the Summary Report, Resolutions and Recommendations and requested the Chairman to endorse the final edited version to be prepared by the IOC Secretariat.

10. CLOSURE OF THE SESSION

127 The Chairman of the International Co-ordination Group for the Tsunami Warning System in the Pacific, before closing the Session, expressed his satisfaction with the work performed and the frank and open atmosphere that had prevailed during the debates. He highlighted the various achievements made by the Group during the Session.

128 Finally, the Chairman extended his thanks, on behalf of all participants, to the Secretariat and the Local Organizing Committee for their valuable services and kind hospitality.

129 The Session was closed at 12.00 on 17 April 1982.

ANNEX I

AGENDA

1. Opening of the Session
2. Administrative arrangements for the Session
 - 2.1 Adoption of the Agenda
 - 2.2 Election of the Rapporteur
 - 2.3 Conduct of the Session, timetable and documentation
3. Intersessional activities
 - 3.1 Reports by the Chairman of the Group and of the IOC Secretariat
 - 3.2 Report of the Director of ITIC
 - 3.3 National Reports
4. Future activities
 - 4.1 Consideration of Recommendations from the IUGG Tsunami Commission Meeting, held in Sendai/Ofunato/Kamaishi, Japan, 25-26 May 1981
 - 4.2 Establishment of Regional Warning Centers to improve the Tsunami Warning System in the Pacific
 - 4.3 Travel-time charts
 - 4.4 Improvement of information, compiling and exchange scheme
5. Proposals to enhance training and education of tsunami specialists of developing Member States of the region, and regional co-operation
 - 5.1 Organization of workshops on the technical aspects of tsunami analyses, prediction and communications
 - 5.2 Visiting scientist programme
 - 5.3 UNDP Tsunami projects and basis for formulation of such proposals
6. Proposals for draft programme and for short-term and medium-term budgets
7. Other business

8. Date and place of next Session
9. Adoption of the Summary Report, Resolutions and Recommendations
10. Closure of the Session

ANNEX II

RESOLUTIONS AND RECOMMENDATIONS ADOPTED BY
THE INTERNATIONAL CO-ORDINATION GROUP FOR
THE TSUNAMI WARNING SYSTEM IN THE PACIFIC
AT ITS EIGHTH SESSION

RESOLUTION ITSU-VIII. 1

DEVELOPMENT OF A MASTER PLAN FOR INTERNATIONAL
TSUNAMI WARNING OPERATIONS

The International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU),

Being concerned that resources for the improvement of the international Tsunami Warning System be most effectively utilized,

Recognizing the need for correlation of international operation, planning and research to achieve this objective,

Noting the high efficiency of the Tsunami Research Plan prepared by the U.S. National Science Foundation,

Recommends that experts nominated for a mission in relation to the mitigation of tsunami hazards in the Pacific would develop a Master Plan for International Tsunami Warning System Operations,

Urges the IOC Secretary to take appropriate action for circulating it to Member States for their comments,

Recommends further that the experts prepare concepts of the implementation of a Master Plan twelve months after approval,

Requests the IOC Secretary to provide support to the preparation, publication and distribution of a Master Plan.

RESOLUTION ITSU-VIII.2

PREPARATION OF ADDITIONAL TRAVEL-TIME CHARTS

The International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU),

Considering the usefulness of the travel-time charts in ensuring the proper functioning of local emergency preparedness and warning dissemination activities,

Taking into account the necessity of preparing additional charts for utilization in disseminating tsunami warnings in recipient areas,

Requests the Director, ITIC, through the assistance of NOAA - National Weather Service, USA, to prepare additional travel-time charts as required for effective operation of the Tsunami Warning System,

Recognizing that additional financial support is necessary for the preparation of such travel-time charts,

Further requests the Secretary IOC to study possibilities of mobilizing financial support to carry out this task.

RESOLUTION ITSU-VIII.3

ESTABLISHMENT OF TSUNAMI WARNING PROCEDURES

The International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU),

Having received the report of the ITSU Task Team on a Study of Tsunami Watch and Warning Procedures,

Noting current practices of the Pacific Tsunami Warning Center (PTWC),

Recommends that PTWC begin issuing Watches and Warnings on a time-stepped basis when there is no clear evidence that a Pacific-wide tsunami danger exists,

Recommends further that the initial warning cover areas within three hours tsunami travel time of the epicentre and the initial watch cover areas within three to six hours tsunami travel time of the epicentre. Both areas are to be expanded every hour until it is determined that a danger to the entire Pacific exists or that no further danger exists,

Requests that these procedures be made effective from 1 October 1982.

RESOLUTION ITSU-VIII.4

ESTABLISHMENT OF TSUNAMI WARNING SYSTEMS AND
IMPROVEMENT OF PRESENT COMMUNICATIONS

The International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU),

Being aware of the fact that many nations of the South Pacific with dense populations separated by wide expanses of water,

Recognizing that their present communications are insufficient and/or lacking between these centres,

Stressing the fact that the installation or improvement of the Pacific Tsunami Warning System in the area should include not only the collection of data through automated tidal gauging stations but must provide the means of delivering warnings in adequate time to endangered areas,

Agrees that such systems could also be used and serve in other emergencies such as warning of storm surges, floods or in mitigation of cyclone disasters,

Recommends that the highest possible priority be given to the installation of national and/or regional Tsunami Warning Systems appropriate to the nations concerned,

Recommends further that Member States approach UNDP and other bilateral/multi-lateral donors for assistance in the planning, provision and installation of national and/or regional systems,

Recommends also that adequate finances be included for the required communications for rapid dissemination and reception of emergency warnings on a national or regional basis.

RECOMMENDATION ITSU-VIII. 1

VISITING SCIENTIST PROGRAMME

The International Co-ordinating Group for the Tsunami Warning System in the Pacific (ICG/ITSU),

Noting that the degree of success of the Visiting Scientist Programme has been variable,

Recognizing that the requirements of the Members would, in some cases, be better served by persons expert in other fields of education, instrumentation, communications, disaster preparedness or computer technology, as well as the scientific disciplines,

Noting further that this would involve no significant alteration of the budget presently set aside for the programme,

Recommends that the Visiting Scientist Programme be redesignated the Visiting Expert Programme,

Requests the Director, ITIC, to prepare and circulate, in consultation with the Chairman and the IOC Secretariat, a questionnaire to National Contacts seeking the following information:

1. a list of national priorities for the elements noted above;
2. a list of scientific and technical experts and individuals interested in taking part in the Visiting Expert Programme; and
3. a list of training and education requirements in order of priority,

Encourages other Members with a well-established Tsunami Warning System, computing facilities and expertise to provide assistance in the implementation of the programme.

RECOMMENDATION ITSU-VIII. 2

PROPOSED ACTIVITIES AND BUDGET

The International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU),

I

Having considered the budget and programme of ITSU for 1982,

Recognizing that the budget for the Tsunami Warning System programme for 1983 has already been established,

Recommends that the 1983 budget should take into account the following line items:

- Activities of the International Tsunami Information Center
- Support for the Director and Associate Director, ITIC, to carry out post-tsunami surveys
- Living allowance and travel for the Associate Director, ITIC
- Support for a study mission of a group of tsunami experts to the countries of the region to determine the precise objectives and work plan for the development of the International Tsunami Warning System in the Pacific
- Staff attendance at subject-related meetings and conferences
- Consultants and visiting experts programme
- Technical studies related to: communications, observations, prediction methods and/or warning centre operations
- Publications, including the new ITSU Handbook, recommended by this meeting,

Requests the Secretary IOC to allocate money for the above-mentioned activities in accordance with established priorities.

II

Noting that the Fifteenth Session of the IOC Executive Council has approved a prospective budget for the 1984-1985 timeframe based on the proposals made by ITSU-VII and the Chairman of the Group,

Further noting Recommendation ITSU-VIII.3 by which this meeting has agreed to hold two meetings during the period 1982-1985,

Requests the Secretary / to secure sufficient additional funds to support the successful conduct of ITSU-X scheduled to be held in Sidney, British Columbia, Canada, in 1985.

III

Bearing in mind the necessity to provide guidance to the IOC Secretariat on the Unesco Medium-Term Plan 1984-1989,

Recommends that the Secretary anticipate and secure appropriate funds to support the following programmes:

1. A survey of the data requirements for the Pacific-wide Tsunami Warning System sufficient to provide adequate warnings for teleseismic events (e.g. confirming the existence of tsunami waves within one hour after a seismic event);
2. A review of communications facilities and requirements with special emphasis on the adoption of satellite telemetry technology where feasible to minimize response times after seismic events occur;
3. Missions to the countries of the region to provide assistance in the further development of regional tsunami warning centres and of a Pacific-wide Tsunami Warning System; and
4. An educational programme for the general public, including materials in the form of brochures, slides and films providing information and guidelines on evacuation procedures and disaster preparedness.

RECOMMENDATION ITSU-VIII.3

IMPROVEMENT OF CO-OPERATION WITH THE IUGG
TSUNAMI COMMITTEE AND PLACE AND TIME OF
THE NEXT TWO SESSIONS

The International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU),

Taking note of the IUGG Tsunami Committee, Japan, 25-28 May 1981 Resolution to endorse the co-ordination of ITSU and IUGG meetings in conjunction to make possible joint attendance,

Believing this will maximize the use of funding for the attendance of experts and country delegates,

Noting that an IUGG meeting with a Tsunamis Symposium included (which does not occur in every IUGG meeting) is scheduled for Sidney, British Columbia, Canada, in August 1985,

Understanding that it has been made clear and resolved that all ICG-ITSU meetings will always be held in a Pacific country,

Recognizing that there will be 41 months between the present Eighth Session and the Sidney, Canada, August 1985 IUGG meeting,

Accepts with appreciation a kind invitation of Canada to have the Tenth Session of ICG/ITSU in Canada, in juxtaposition with the IUGG Tsunamis Symposium,

Invites IOC Member States of the Pacific to study possibilities for holding the Ninth Session of ICG/ITSU in one of the Pacific countries, preferably Hawaii, USA,

Decides that flexibility in timing and location of meetings will maximize attendance and minimize funding and should be kept in mind for all future Sessions of ICG/ITSU,

Requests the Secretary IOC to note well and fund accordingly the necessity of shortening slightly the next two biennial Sessions from two years to approximately 21 months to the Ninth Session, and beyond that approximately 20 months to the Tenth Session. Otherwise the intersessional time will be inordinately long and impetus of Projects will be jeopardized.

ANNEX III

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Capt. D. NAIDU
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Ministry of Home Affairs

ANNEX IV

OPENING ADDRESS BY MR. SAKEASI WAQANIVAVAGI,
MINISTER OF STATE FOR LANDS AND MINERAL RESOURCES
OF FIJI, AT THE EIGHTH SESSION OF THE INTERNATIONAL
CO-ORDINATION GROUP FOR THE TSUNAMI WARNING SYSTEM
IN THE PACIFIC

Mr. Chairman, honourable delegates, ladies and gentlemen,

My Government is greatly honoured to host the Eighth Session of the International Group for the Tsunami Warning System in the Pacific, and it is a great privilege for me to address such an eminent gathering of geoscientists and others who are closely connected with this important aspect of the Tsunami Warning System.

I extend to you a warm welcome. I hope that those of our guests who have travelled great distances from countries outside Fiji would take this opportunity to see something of what we are doing in connection with earthquake and Tsunami Warning Systems.

Tsunamis and Tsunami Warning Systems which are the subjects of your Conference, are matters which mankind is bound to view with increasing seriousness. We are constantly reminded of events of tsunamis which have endangered many lives and caused great devastations. No country can isolate itself from the inevitable dangers and effects of tsunamis and therefore it is vitally important to examine ways and means to improve the communication system whereby people can be alerted to take adequate precautions for the safety of their lives in the event of such happenings.

I would say that Fiji has been fortunate to have very few reports of the occurrence of tsunamis, probably because in the past they have not been recognized as such. In an effort to educate the people and bring about an awareness of the effects of tsunamis and earthquakes, the Mineral Resources Division of the Ministry of Lands and Mineral Resources in 1975 issued out information pamphlets, and the response from the people was most encouraging.

Your gesture in getting together to formulate some clearly defined strategies aimed at sharing your knowledge and technology with those less fortunate is an obvious sign of recognition of this important issue. This International Conference will give you the opportunity to monitor, report on, co-ordinate, establish and plan improvements to Tsunami Warning Systems by programmes most beneficial to countries belonging to the IOC (Intergovernmental Oceanographic Commission) and whose coastal areas are potentially threatened by tsunamis.

I note from the background papers on this meeting the great strides being made in communications technology which may have the potential to realize one of the goals of IOC-ITSU, which is to reduce reaction times to a tsunamigenic event to one hour from event to warnings being received throughout the Pacific. However, it will

need no doubt your persistent and ingenious efforts to adapt this technology to your particular warning systems. It will also need requisite funding being provided, which, if my perception of the background papers is correct, has not sometimes been made very abundantly available to expeditiously carry out the projects identified by the previous Sessions of ICG-ITSU. I entreat the representatives here of those organizations having access to appropriate funding sources for ICG-ITSU projects, to hear your call most strongly at this meeting and act accordingly.

Besides the one hour "reaction-time" goal I have mentioned before, there is the evolving problem of warning systems for areas of regional, as opposed to Pacific-wide, scale. This will take even more ingenuity and effort to create effective warning systems because of the shorter distances involved. Meanwhile I see your efforts on public education on preparedness for tsunamis as being very important.

In the final analysis all of the public cannot be expected to be warned by radio, press or any other media, of a tsunamigenic event which is very close to their nation's shores. In this case the public living on coastal areas must be taught and constantly reminded what to do if they get nature's own warning of a possible tsunami, i.e. feeling a large earthquake taking place. Incidentally, I commend the initiative of the Sports and Social Committee of my Mineral Resources Department in making available some informative and attractive shirts in this respect.

Ladies and Gentlemen, whilst you have a heavy commitment with this Conference, I would, however, wish you a very enjoyable stay so that you can take away with you some pleasant memories of Fiji. I hope the weather is kind to you.

I am confident that in such a gathering some constructive and fruitful discussion will take place and I pray for a most successful Conference.

ANNEX V

LIST OF ABBREVIATIONS AND ACRONYMS

AOS	Advanced Operating System
CCOP/SOPAC	Committee for Co-ordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas
ICG	International Co-ordination Group
IGOSS	Integrated Global Ocean Services System
IOC	Intergovernmental Oceanographic Commission
ITIC	International Tsunami Information Center
IUGG	International Union of Geology and Geophysics
NOAA	National Oceanographic and Atmospheric Administration
OBSOS	Ocean Bottom Seismograph Observation System
PTWC	Pacific Tsunami Warning Center
SPEC	South Pacific Bureau for Economic Co-operation
TWS	Tsunami Warning System
UNDP	United Nations Development Programme
UN ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
WDC	World Data Center
WMO	World Meteorological Organization