



TSUNAMI NEWSLETTER

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**International
Tsunami
Information
Center**



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UNESCO
INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
COMMISSION OCEANOGRAPHIQUE INTERGOUVERNEMENTALE
COMISSAO OCEANOGRAFICA INTERGOVERNAMENTAL
МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ
الاتحاد الدولي للبحر والعلوم البحرية

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Dr. George Pararas-Carayannis

TSUNAMI NEWSLETTER is published by the International Tsunami Information Center to bring news and information to scientists, engineers, educators, community protection agencies, and governments throughout the world.

We welcome contributions from our readers.

The International Tsunami Information Center (ITIC) is maintained by the U.S. National Oceanic and Atmospheric Administration (NOAA) for the Intergovernmental Oceanographic Commission (IOC). The Center's mission is to mitigate the effects of tsunamis throughout the Pacific.

MEMBER STATES

Present membership of the IOC International Coordination Group for the Tsunami Warning System in the Pacific (ITSU) comprises of the following States:

AUSTRALIA
CANADA
CHILE
CHINA
COLOMBIA
COOK ISLANDS
DEMOCRATIC PEOPLE'S
REPUBLIC OF KOREA
ECUADOR
FIJI
FRANCE
GUATEMALA
INDONESIA
JAPAN
MEXICO
NEW ZEALAND
PERU
PHILIPPINES
REPUBLIC OF KOREA
SINGAPORE
THAILAND
UNION OF SOVIET SOCIALIST
REPUBLICS
UNITED KINGDOM (HONG KONG)
UNITED STATES OF AMERICA
WESTERN SAMOA

News Events

Moderately Strong Quake Shakes Central Philippines

A moderately strong earthquake shook the central Philippines on October 13, 1990. There were no reports of casualties or major damage. The earthquake measured 5.7 on the Richter scale, and was centered below the Sulu Sea, about 78 miles southwest of Dumaguete City on Negros island. The earthquake's epicenter was about 410 miles south of Manila.

Powerful 6.6 Quake Rattles Iran

A powerful earthquake struck about 930 miles southeast of Tehran outside of Iranian territory, Iran's official Islamic Republic News Agency reported on September 26, 1990.

The quake, measuring 6.6 on the Richter scale, struck shortly after 7 p.m. and was felt in southeastern border areas of Iran including Zahedan, a provincial capital near the borders of Afghanistan and Pakistan.

Earthquake Jolts Northeastern Taiwan

A strong earthquake shook northeastern Taiwan August 14, 1990 but there were no immediate reports of casualties or damage, government authorities reported. The Central Weather Bureau said the quake registered a preliminary reading of 6.0 on the open-ended Richter scale. Its epicenter was located at sea about 29 miles southeast of Ilan on Taiwan's northeastern coast. The tremor was felt in Taipei.

Strong Alaskan Quake

A moderately strong earthquake August 13, 1990 shook the Kenai Peninsula south of Anchorage, knocking objects from store shelves and rattling residents as far as 400 miles away. The quake measured 5.6 on the Richter scale. There were no reports of losses, injuries or tsunamis.

Earthquake in Hawaii

An earthquake centered near Kawaihae on the Island of Hawaii rocked the islands as far away as Honolulu at 7:37 p.m., on August 1, 1990. There were no immediate reports of major damage or injury, police and civil defense officials said. The quake was measured at a magnitude of 4.7 on the Richter scale at the Pacific Tsunami Warning Center.

Quake Rumbles Along New Madrid Fault

An earthquake shook parts of Illinois, Kentucky, Arkansas, Missouri and Tennessee in the United States on September 26, 1990. No major damage was reported. The quake was felt at 8:19 a.m. Central time. It registered 4.6 on the Richter scale and was centered along the New Madrid fault 40 miles north of New Madrid, Mo., according to Don Kelly, a spokesman for the U.S. Geological Survey in Reston, VA. New Madrid has been the site of some of the greatest earthquakes in U.S. history. The New Madrid fault line runs from Marked Tree, Ark., to southern Illinois

News Events

and has hundreds of small quakes every year. There were no reports of damage.

Earthquakes Hit Iran, Indonesia, Mariana Islands, California in November

A powerful earthquake measuring 6.6 on the Richter scale hit a mountainous area of southern Iran, killing more than 20 people and leaving 21,000 homeless. Earthquakes were felt in the Indonesian province of Irian Jaya, the Mariana Islands, the Aleutian Islands, and along the California and Nevada border, in the week ending November 9, 1990.

Eruption of Mount St. Helens

Without warning, Mount St. Helens rumbled to life in the first week of November 1990, shaking violently and sending an ash cloud soaring 30,000 feet above Washington State. Scientists called it a minor eruption, but it was the strongest to occur during the past 10 months.

The International Decade for Natural Disaster Reduction is at the close of its first year. A secretariat has been established in Geneva and a director appointed. According to the Office of the U.N. Disaster Relief Coordinator, there are now 71 countries with national committees working to ensure that their priorities are reflected in the Decade's activities. Much of the past year has been spent planning.

International Decade For Natural Disaster Reduction

The Decade Concept

Natural disasters have killed close to 3 million people worldwide, disrupted over 820 million lives, and caused more than \$100 billion in property damage in the last two decades. Continuation of such losses into the 21st century is tragically unnecessary: scientific knowledge exists today that can reduce the toll of natural disasters.

1990 marked the start of the U.N.-declared International Decade for Natural Disaster Reduction (IDNDR) and the Congressionally-endorsed U.S. Decade (USDNDR). The objective is to advance and improve application of scientific and technical knowledge to reduce life loss, property damage and social and economic disruption from natural hazards.

In the United States, a national committee for the Decade, housed in the National Research Council, serves to catalyze domestic efforts in disaster reduction, work closely with the federal Subcommittee for Natural Disaster Reduction and link international with U.S. initiatives.

Commitment and action by state and local government, private businesses, professional and technical societies, voluntary organizations and individuals are critical to reducing losses from natural disasters in this country. The first step is to build on existing efforts; the challenge is to develop disaster reduction programs compatible with

community goals.

Tsunami Inundation Modeling Exchange

A two-year demonstration project to develop a methodology for estimating tsunami flooding areas and to transfer this technology to developing countries is proposed to the Intergovernmental Oceanographic Commission (IOC) as part of the International Decade of Natural Disaster Reduction (IDNDR). Matching funds will be provided by Japan, the United States, USSR, and Canada.

1. Background

During the Tsunami 1989 meetings in the USSR, an ad hoc committee was formed to suggest projects to the IOC as part of the IDNDR. The committee, composed of ITSU and IUGG Tsunami Commission members, collected 19 suggestions from Japan, the United States and the Soviet Union. In January 1990, these suggested projects were evaluated using the criteria of value, affordability and duration. From this process, four candidate projects were sent to the international tsunami community for comment. From the four, the tsunami inundation project received the greatest support from the community as having the potential to mitigate the tsunami hazard. In June 1990, the ad hoc committee tasked Drs. Bernard, Shuto and Murty to draft an outline of the project by September 15. The three scientists assembled this draft proposal during a Run-up Workshop in California in August 1990.

International Decade For Natural Disaster Reduction

2. Plan

Step 1. Establish a Tsunami Inundation Modeling Center at Tohoku University under the Direction of Professor Nobuo Shuto and form a steering committee to oversee the project.

Step 2. Select the appropriate methodology to estimate tsunami inundation.

Step 3. Initiate a technology transfer project to developing countries with the following procedure:

- * Developing country sends visiting scientist to Center.
- * Scientist is trained to use the model with standardized experiments.
- * Developing country selects a site within the country to estimate tsunami inundation. Visiting scientists conduct the experiment under close supervision.
- * Model is transferred to developing country computers using expertise from the Center.
- * Periodic upgrades of the model will be provided by the Center.

3. Products: This demonstration project will produce inundation maps for selected sites to be used for tsunami hazard planning. More importantly, the project will transfer the methodology to estimate tsunami inundation to developing countries through a process of

training, experimentation, installation of computer codes and upgrading as needed.

4. Oversight: An international steering committee will be formed to provide scientific and policy guidance to the Center. The committee will approve the science plan from developing countries, approve the budget for the Center, prepare proposals to IOC, review Center operations, and solicit support from other countries.

IDNDR - International Conference 1990

The International Decade for Natural Disaster Reduction (IDNDR) International Conference 1990 was held during 27 September - 3 October 1990 in Yokohama and Kagoshima, Japan. This conference was organized by the Japanese Government, City of Yokohama, Kagoshima prefecture, and the United Nations Center for Regional Development (UCRD), with the cooperation of the Japan International Cooperation Agency and Kanagawa Prefecture. The program included topics such as Launching of the IDNDR; International Cooperation for Natural Disaster Reduction; Changes in Urban Structure of Modern Cities and Disasters; Regional Development and Disaster Reduction; and Disaster Reduction and Citizen's Participation.

For summary information, contact the Director, IDNDR Promotion Office, Disaster Prevention Bureau, National Land Agency, 1-2-2, Kasumigaseki,

International Decade For Natural Disaster Reduction

Chiyoda-ku, Tokyo, 100 Japan, telephone 03-501-6996 (Japan).

U.S. National Landslide Information Center

Almost every day another landslide disaster occurs somewhere in the world. Nearly every time there is heavy rainfall, an earthquake, a volcanic eruption, strong wave action on a shoreline or some ill-considered alteration of sloping land by humans, landslides occur.

In an effort to confront this landslide problem, the U.S. Geological Survey (USGS) is developing the National Landslide Information Center (NLIC) in concert with the International Decade for Natural Disaster Reduction. The NLIC will operate primarily from offices in Golden, Colorado, and will be a multifunctional enterprise dedicated to the collection, analysis, and distribution of data and information on all aspects of the world landslide problem. Over the next decade, the USGS will build the NLIC into a flexible program to serve landslide researchers, geotechnical practitioners engaged in landslide stabilization, governmental entities interested in landslide-related policy, and all others concerned with landslide hazard analysis and mitigation. The NLIC is intended to become a permanent operational activity of the USGS with ties throughout the world for exchanging information, reporting landslide events, and issuing adviso-

ries, forecasts, and warnings about impending landslide activity.

Interested persons should contact William M. Brown III, National Landslide Information Center, U.S. Geological Survey, BGRA, P.O. Box 25046, 966 Federal Center, Denver, CO 80225; telephone (800) 654-0200; (303) 236-0616; fax: (303) 236-0618

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Visitors from USSR

Dr. Viacheslav Gusiakov, Chief of the Tsunami Laboratory and Dr. Vassili Titov, Applied Mathematician, both from the Computing Center of the USSR Siberian Academy of Sciences from Academpozodok (near Novosibirsk) visited the Alaska and the Pacific Tsunami Warning Centers in Palmer, Honolulu, and ITIC. Dr. Gusiakov was accompanied by his wife, Zena. The two Soviet scientists spent a total of approximately 3 weeks at the two Centers working on an Interactive Computer Simulation System developed in the USSR.

ITIC Coordination and Informational Services

During the latter part of 1990, ITIC provided coordination, information, exchange of data and assistance to individual scientists and organizations in the following countries: Philippines, Sierra Leone, French Polynesia, Indonesia, New Zealand, Japan, China, Canada, The Netherlands, Australia, USA, West Germany, Italy, USSR, Chile, Korea, Austria, Greece, Colombia, Peru, India, and Guatemala.

ITIC Participation in leading UNESCO-ROSTSEA Meeting of Experts on the Promotion of International Cooperation in Seismology in the Western Pacific and Southeast Asia

In July 1990, the Director of ITIC, Dr.

George Pararas-Carayannis, participated in an organizational meeting/workshop on the need for seismological cooperation in the Western Pacific and Southeast Asia. The meeting was sponsored by UNESCO-ROSTSEA (Regional Office of Science and Technology in Southeast Asia), and it was organized by the Philippine Institute of Volcanology and Seismology in the Philippines. Participants at the meeting were geoscientists from the countries in their regions, including the Philippines, New Zealand, Indonesia, Japan, Malaysia, and the People's Republic of China.

During the workshop, the ITIC Director gave two presentations on Earthquake Prediction and on the International Tsunami Warning System. Also, he participated in the organizational meeting regarding the needs and areas of concern for international cooperation. As a result of this meeting, an Association for Seismological Cooperation in the Western Pacific and Southeast Asia (ASCWP) was established.

The results of this organizational meeting were summarized in a report. Most of the countries involved in the meeting are also members of ICG/ITSU and are currently involved in data exchange efforts, but not on a real-time basis. The emphasis of the meeting was to assist countries in the region with real-time or near real-time exchange of seismic data which will improve the earthquake preparedness

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and will also make them better partners in the Tsunami Warning System. Also, the Director of ITIC used the opportunity to promote the proposed Regional Tsunami Warning System in the Southwest Pacific, a program which would greatly benefit the proposed effort. Continuous cooperation, particularly on the exchange of seismic information, could be of great benefit to an improved Tsunami Warning System in the region. This need was emphasized to the representatives of the Meteorological and Geophysical Agency of Indonesia, of the Wellington Observatory in New Zealand, the State Seismological Bureau in the People's Republic of China, and the Philippine Institute of Volcanology and Seismology.

Coordination Visit at the Computing Center of the USSR Academy of Sciences in Akademgorodok, USSR, July 22-31, 1990

At the invitation of the Computing Center of the USSR Academy of Sciences, the Director of ITIC, Dr. George Pararas-Carayannis visited Akademgorodok, USSR, in late July 1990 for the purpose of coordinating preparation of the final reports from ITSU-XII, exchange of data and the development of an Interactive Tsunami Modelling System on small, inexpensive PC's.

The Computing Center has begun preliminary work on such a PC modeling system and has developed a few

analytical solutions for tsunami generation, propagation and terminal forecasting based on empirical relationships and assumptions of tsunami generation, which are all characteristic of the region. Based on the review and assessment of this prototype modelling system by the Director of the ITIC and the Soviet scientists, recommendations were made for its improvement and for adoption in other regions of the Pacific.

This Interactive Tsunami Modelling System is a very attractive concept, because it can be easily adapted to any region at minimum cost, and because its development will result in better procedures facilitating the decision making process in the prompt issuing of tsunami information and warnings, particularly on a regional basis.

Coordination with UNDP

In July, the ITIC Director, Dr. George Pararas-Carayannis, contacted UNDP in New York to coordinate the pending proposal on the establishment of an early warning Tsunami Warning System in the Southwest. A five-year Master Plan for the region was previously submitted to UNDP. Also, ITIC has worked continuously to obtain commitments and support for the project in terms of counterpart contributions and the development of a technical support base.

Furthermore, ITIC has cooperated with many other international agencies and

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organizations in identifying needs for international cooperative programs in disaster mitigation, along the principles of the International Decade (IDNDR).

The Director of ITIC brought to the attention of UNDP officials the UNESCO-ROSTSEA-sponsored meeting of experts for the promotion of International Cooperation in Seismology in the Western Pacific and South-east Asia, and informed them of the Association for Seismological Cooperation in the Western Pacific and South-east Asia (ASCWP) which was established in June of this year.

Furthermore, the ITIC Director informed UNDP on the mandate of the Association to promote international cooperation in the region for the exchange of seismic data, the understanding of tectonic processes and the mitigation of the effects of earthquake and tsunami disasters.

Also, he pointed out to these officials that ITSU Member States represented at this meeting endorsed the goals of this project for the development of a Regional Tsunami Warning System, as the goals of this project complement very well the objectives of the Association for the mitigation of earthquake disasters. The Director of ITIC expressed his optimism that UNDP will decide favorably on the pending Tsunami project, particularly in view of committed counterpart contributions and support from the region and from

the other international organizations.

ITIC Provides Assistance and Information to Sydney Water Police

Mr. Larry Malone, of the Sydney Water Police of New South Wales, Australia, corresponded with ITIC regarding the responsibilities of his organization for protection of life and property along the coastal areas of New South Wales. ITIC provided Mr. Malone pertinent information on tsunamis that have occurred in Australia and provided brochures and informational and educational materials for use by the Sydney Water Police.

Five-Year Master Plan for the Development of a Regional Tsunami Warning System in the Southwest Pacific

The International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU), at its Twelfth Session in Novosibirsk, USSR, August 7-10, 1989, included in its agenda improvements of the Tsunami Warning System. Under this agenda item, and in discussing development of the Regional Tsunami Warning Systems, the Director of ITIC reported on the preparation of a Five-Year Master Plan for the Development of a Regional Tsunami Warning System in the Southwest Pacific, which was undertaken by ITIC for the United Nations Development Program (UNDP). This report was needed to support the project document and proposal submitted to UNDP for consideration and funding

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by the IOC Secretariat (Dr. K. Kitazawa).

In discussing this particular item at ITSU-XII, the Group expressed its appreciation for the efforts made by the IOC Secretariat in preparation of this project, and agreed to provide technical advice in implementing the project. The Group also agreed that the Five-Year Master Plan, once completed and approved, should be distributed to all ITSU Member States with a request for their review indicating to the IOC Secretariat, their willingness to provide possible assistance in implementing the plan and their interest in participating in the activities of the advisory group.

The Five-Year Plan was completed by ITIC, was submitted to UNDP, and was favorably received. Presently it is being reviewed by UNDP in conjunction with the project document and the proposal for funding. On September 25, final copies of this Five-Year Master Plan were submitted by the Director of ITIC to UNDP, and to all other ITSU National Contacts requesting review of this document and, as agreed at ITSU-XII, requesting comments and expression of interest in participating in the activities of the advisory group that will assist with implementation of this project.

ITIC Participation at INSMAP 90

On 15-19 October 1990, the Director of ITIC, Dr. George Pararas-Carayannis,

attended the International Symposium on Marine Positioning (INSMAP 90) at the Rosenstiel School of Marine and Atmospheric Science at the University of Miami, in Miami, Florida. The International Symposium was organized by the Marine Technology Society and attracted numerous scientists from all over the world, representing a variety of disciplines.

The ITIC Director was invited by the organizers of the meeting to present a talk setting the theme for the Tsunami Session of the Symposium. His presentation was entitled "The Importance of Geodetic Parameters in the Understanding and Mitigation of Tsunami Hazard." In addition to this presentation, and on behalf of Mr. Tom Sokolowski, the Director of the Alaska Tsunami Warning System, who was unable to attend, Dr. Pararas-Carayannis presented a paper entitled "Expert System in Tsunami Hazard Mitigation." The following presentations were made in the Tsunami Session of INSMAP 90.

1. The Importance of Geodetic Parameters in the Understanding and Mitigation of Tsunami Hazard
(George Pararas-Carayannis)
2. Bathymetry and Tsunami Predictions
(Narendra Saxena)
3. Observational Requirement for the Tsunami Warning System in Canada
(W.J. Rapatz and T.S. Murty)

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4. Expert System in Tsunami Hazard Mitigation
(T.J. Sokolowski)

5. Positioning for Non-Linear Numerical Modeling of Tsunami Generation and Propagation in the St. Lawrence Estuary
(M.I. El-Sabh and J. Chasse)

6. Tsunami Hazards in the Mediterranean Sea and Marine Positioning Requirements
(Stefano Tinti)

7. Relevance of Bathymetry for Tsunami Run-up Modeling
(Z. Kowalik)

Dr. T.S. Murty summarized the results of the Tsunami Session and presented them to the general session at the final day of the meeting. Participation at INSMAP 90 was very fruitful and future participation by tsunami scientists should be encouraged. The Tsunami program can benefit from the new satellite geodetic and other technology which is being developed.

ITIC Participation at Meeting of ISPMNH

While in Miami for INSMAP 90 in October, the Director of ITIC met with Dr. Mohammed El-Sabh and Dr. Tad Murty, both officers of the International Society for the Prevention and Mitigation of Natural Hazards (ISPMNH), to discuss the organization of the 1991 Conference on Natural Hazards which

was to be held in Cairo, Egypt under the sponsorship of the Society. During this meeting, the consensus of the opinion was that, if international problems persisted in the Middle-East, and because of the difficulty of traveling to this area, the organizers would have to establish new dates and location for the Hazards 91 Conference.

IOC/ITSU

LIST OF NATIONAL CONTACTS OF ICG/ITSU

The following is a list of National Contacts of IISU members on file at the ITIC office. Please inform ITIC if there are any changes.

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**Progress by the Ad Hoc Group for
Tsunami Public Education and
Awareness**

As a result of recommendations, the appointed Ad Hoc Group reported the progress made regarding the Terms of Reference of the group for Tsunami Public Education and Awareness, an action item from ITSU-XII. As a result of the survey conducted by the Ad Hoc Group an outline has been provided regarding the general and specific objectives for such a program on educational materials for students and the general public. A time schedule of 21 months has been proposed for completion of the project.

The next task for the Group will be to use this outline and recommendations in order to develop specific educational and awareness materials within the projected time schedule, or as close to it as funding and resources will allow.

**Fourth Session of the IOC Committee
on Ocean Processes and Climate,
Paris, 27 February - 1 March 1991**

The Fourth Session of the IOC Committee on Ocean Processes and Climate will be held from 27 February - 1 March 1991 at Unesco Headquarters.

For more information write to Secretary, Intergovernmental Oceanographic Commission, Dr. Gunnar Kullenberg, Unesco - 7, Place de Fontenoy - 75700 Paris, Cable address:

Unesco Paris - telex: 204461 Paris - fax: (33) (1) 40 56 93 16

Fifth Session of the Committee for Training, Education and Mutual Assistance in the Marine Sciences (TEMA), Unesco Headquarters, Paris, 25 February - 1 March 1991

The Fifth Session of the Committee for Training, Education and Mutual Assistance in the Marine Sciences (TEMA) will be held at Unesco Headquarters, Paris, 25 February - 1 March 1991. The Session will be opened on Monday, 25 February 1991, by the Chairman of the Committee for TEMA, Professor Ulf Lie.

For more information on the TEMA meeting write to Secretary, Intergovernmental Oceanographic Commission, Dr. Gunnar Kullenberg, Unesco - 7, Place de Fontenoy - 75700 Paris, Cable address: Unesco Paris - telex: 204461 Paris - fax: (33) (1) 40 56 93 16

Twenty-fourth Session of the Executive Council, Unesco, Paris, 5-6 March 1991

The Twenty-fourth Session of the Executive Council of the Intergovernmental Oceanographic Commission (IOC) will be held on 5 and 6 March 1991 at Unesco House, Paris.

For more information write to Secretary, Intergovernmental Oceanographic Commission, Dr. Gunnar

Kullenberg, Unesco - 7, Place de Fontenoy - 75700 Paris, Cable address: Unesco Paris - telex: 204461 Paris - fax: (33) (1) 40 56 93 16

Sixteenth Session of the Assembly, Unesco, Paris, 7-22 March 1991

The Sixteenth Session of the Assembly of the Intergovernmental Oceanographic Commission (IOC) will be held from 7 to 22 March 1991. The meeting will be held in Room II at Unesco House, Paris. The Session will open at 10.00 on 7 March 1991.

For more information write to Secretary, Intergovernmental Oceanographic Commission, Dr. Gunnar Kullenberg, Unesco - 7, Place de Fontenoy - 75700 Paris, Cable address: Unesco Paris - telex: 204461 Paris - fax: (33) (1) 40 56 93 16

National and Area Reports

New National Contact for Peru

Admiral Guillermo Devoto Elias recently took over as Director of Hidrografia y Navegacion of the Peruvian Navy, the agency in Peru charged with the responsibility for the Tsunami Warning System. Admiral Elias is now Peru's designated National contact for the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) succeeding Admiral Jorge del Aguila Sanchez.

Instituto Hidrográfico de la Armada de Chile - Name Change

The Instituto Hidrográfico de la Armada in Chile which is responsible for the Tsunami Warning System has changed its name. Since October 24, 1990, the "Instituto Hidrográfico de la Armada de Chile" has changed its name to "Servicio Hidrográfico y Oceanográfico de la Armada de Chile" (Hydrographic and Oceanographic Service of the Chilean Navy, or SHOA). Commander Hugo Gorziglia is the Acting Director of SHOA.

Flood Proofing Conference and Exposition

The Association of State Floodplan Managers conducted the United States' first conference on flood proofing buildings. It was held November 28-30, 1990, at the Hyatt Regency Woodfield, Schaumburg, Illinois. The objectives were to share information on flood proofing technology and government activities that implement or fund

measures to alter buildings to protect them from flood damage.

Speakers included representatives of federal, state, and local agencies, researchers, homeowners associations, businesses, consultants, manufacturers, and contractors. Topics covered included relocation, elevation, floodwalls, dry and wet flood proofing, funding programs, technical assistance and more. An exposition of flood proofing equipment, techniques, and government programs was held in conjunction with the conference.

Cooperating parties included the U.S. Army Corps of Engineers, National Flood Proofing Committee, the Federal Emergency Management Agency, the Federal Insurance Administration, and the Illinois Association for Floodplan and Stormwater Management. Conference Brochures and Exhibitor's Brochures are available from Midwest Flood Proofing Conference, 153 Nanti, Park Forest, IL 60466, telephone (708) 747-5273.

Tsunami Travel Time Calculations

The International Co-ordination Group for the Tsunami Warning System in the Pacific at its XII session (Novosibirsk, USSR, 7-10 August 1989) "requested the Krasnoyarsk Computing Center, through appropriate arrangements with IOC, to provide algorithms and software for tsunami travel time calculations with the use of personal computers to interested countries and

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organizations" (ITSU-XII Summary Report, paragraph 14). The following is a short description of the "Luch" system proposed by the Krasnoyarsk Computing Center, according to the recommendation of ITSU-XII mentioned above. Those interested in such a system and wishing more information should write to the IOC Secretariat or contact directly Krasnoyarsk Computing Center at the following address:

Professor Yu. Shokin, Director
Computing Center
Siberian Division of the USSR Academy
of Sciences
660036 Akademgorodok, Krasnoyarsk
36
USSR

Luch System

The Computing Center of the Siberian Branch of the USSR Academy of Sciences (Krasnoyarsk) has developed a system called "Luch" (or "beam" in English), to determine the kinematic (time) characteristics of tsunami waves.

The system makes possible the calculation of tsunami wave propagation times from the origination point or ellipsoid over an ocean of variable depth and geometry.

The mathematical model allows the solution of the problem by computing time isochrones of tsunami propagation by using the "ray" method. In the algorithm, special attention is given to the passage of caustics.

The adequacy of the mathematical model with the physical process under study and the accuracy of the algorithms were tested with historical data (about 2567 control events). Analysis showed the deviations to be sufficiently small for distant sources and not to exceed 3%, or 2 minutes, per hour of wave propagation.

The system has been adopted for the IBM PC/AT type personal computer and was initially presented to UNESCO experts at the XII session of the International Coordination Group on Tsunami Warning Systems.

The interactive variant of the "Luch" system consists of a set of subsystems providing efficient work with sets of data (bathymetry, earthquake data, characteristics of the coastline, etc.).

This work was completed under contract of the Computing Center of the Siberian Branch of the USSR Academy of Sciences (Krasnoyarsk) with the Intergovernmental Oceanographic Commission (UNESCO). An atlas of tsunami travel time propagation for the stations of Pacific Tsunami Warning System in the Pacific Ocean has been prepared. The algorithms and programs are adaptable to the IBM 360/370 type of personal computers.

The interactive package allows the computation for specific ocean regions stored in the system archive, modification of models, the ability to carry out computation of wave propagation, and

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the formation of the necessary tsunami travel time charts. A study of mathematical models and algorithms, as well as some results of computing experiments, done by the "Luch" system have been published in the following paper:

Yu.I. Shokin, L.B. Chubarov, V.A. Novikov, A.N. Sudakov "Calculations of Tsunami Travel Time Charts in the Pacific Ocean" - Science of Tsunami Hazards, 1987, v.5, N 12, pp. 85-114.

Second UJNR Tsunami Workshop, East-West Center - University of Hawaii, Honolulu, USA, 4-7 November 1990

The second UJNR Tsunami Workshop took place on 4-7 November 1990 at the East-West Center, University of Hawaii, Honolulu, Hawaii, USA. The meeting was opened by J. Lander and T. Uda, who were the co-conveners. The following presentations were made during the first two days of this workshop:

Topic A: *Predictions and Observations of Tsunami Behavior in Coastal Waters and on Land*, J. Lander, moderator, 1st session.

Tsuji, Y., *Decay of Initial Crest of the 1960 Chilean Tsunami: Scattering of Tsunami Waves Caused by Sea Mounts and the Effects of Dispersion*.
Gonzales, F., *Alaskan Bight Tsunamis of 1987-1988*.

Iwasaki, S., *On the Generation Mechanism of the Low Frequency T Phase due to Tsunami Earthquakes*.

Heberstreit, G., *Modeling Implication of the 1985 Chilean Tsunami*.

Tsuji, Y., and T. Yanuma, *Observation of Standing Edge Waves Trapped on the Shelf of Makurazaki Coast*.

Lockridge, P., *Correlation of Local Tsunami Run-up Heights with Tsunami Far-Field Damage*.

Matsutomi, H., *Impulsive Force of Timbers Drifted by Tsunamis*.

Goto, T., *Simulation Models of Oil and Timbers Spread thru to Tsunamis*.

Round table discussion of topic A, led by the morning presenters with contributions from attendees. J. Lander and T. Uda conductors.

Topic B: *Applications of Numerical Modeling to Improved Travel Time Predictions, Source Region Definition, Inundation, and Run-up Prediction*, Z. Kowalik, moderator 1st Session. G. Carrier, moderator 2nd Session.

Liu, P. and Sung B. Yoon, *Stem Waves Along A Breakwater*.

Yamaki, S., and T. Uda, *Numerical Simulation and Experimentation on Tsunami Run-Up*.

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Carrier, G., *Tsunami Propagation from a Finite Source*.

Imamura, F., *Numerical and Hydraulic Experiments for Non-Linear Dispersive Waves*.

Yeh, H., *On a Leading Wave of a Tsunami Bore*.

Loomis, H., *A Least Squares Estimate of a Tsunami Source from Gaule Record*.

Shuto, N., *Numerical Forecasting for Near-Field Tsunamis in the Sanriku District*.

Mader, C., *Modeling Tsunami Flooding*.

Uda, T., *Experiment on Two Dimensional Transformation of Non-Linear Long Waves Propagating on Slope*.

Kowalik, Z., *Numerical Modeling of Tsunami Run-Up*.

Synolakis, C., *Impression from the First International Workshop on Long Wave Run-Up*.

Round table discussion of topic B led by presenters with contributions from attendees. Carrier and Kowalike, moderators.

Topic C: *Protective Measures in Japan and the U.S. with Regard to the Use of Numerical Models and the Design Tsunami Concept*. Mader, moderator,

1st Session. G. Curtis, moderator 2nd Session.

Curtis, G., *Inundation and Tsunami Waves*.

Preuss, J., *Urban Planning to Reduce Tsunami Risk as a Complex Set of Hazards - Grays Harbor, Washington and Lima, Peru*.

Okada, M., *Ocean Bottom Pressure Gauge for Tsunami Warning System in Japan*.

Okal, E., J. Talandier, and D. Reymond, *Automatic Estimations of Tsunami Risk Following a Distant Earthquake Using the Mantle Magnitude M_m* .

Satake, K., *Real-Time Determination of Earthquake Size and Focal Mechanism and Its Application to Tsunami Warnings*.

Bernard, E., *Assessment of Project THRUST: Past, Present and Future*.

Round table discussions of topic C by presenters with contributions from attendees. Mader and Curtis, coordinators.

Following the two-day workshop, participants left for a field trip at Hilo, Hawaii.

The following is a list of participants of the Second UJNR Workshop on Tsunamis:

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Hazards 91 International Symposium on Geophysical Hazards in Developing Countries and Their Environmental Impacts

Please note that this conference which was scheduled for 21-27 April, 1991, to be held in Cairo, Egypt, is being re-scheduled with a change of venue, due to the crisis in the Middle East.

The conference is now scheduled for 4-9 August, 1991 (the week before the IUGG conference in Vienna). The new location is Perugia, Italy, which is about two hours by shuttle bus from Leonardo da Vinci International Airport in Rome. Hazards 91 will be held in the facilities of the European-Mediterranean Focal Point for Natural Hazards at the Water Resources Research and Documentation Center (WARREDOC). The Co-Chairmen of the Organizing Committee are:

1. Professor F. Siccardi (Italy)
2. Professor M.I. El-Sabh (Canada)
3. Professor A.F. Abdel-Latif (Egypt)

Travel/Accommodation

Participants from the United States and Canada will benefit from a new travel/accommodation package which will include a stopover in Vienna following Hazards 91 meeting for those who would like to participate in the IUGG Congress. Pre- and post-symposium tours to Greece, Egypt, Israel and other attractive places will be offered. MISR

Travel, New York, is presently negotiating a new rate, details of which will be mailed very shortly, together with registration forms.

This international symposium is the fourth in the continuing interdisciplinary series begun in 1982, with the first being held in Honolulu, USA. The second one was held in Rimouski, Canada in 1986 and the third meeting in Ensenada, Mexico during 1988. The objectives of this series of symposia on natural and man-made hazards are to promote the advancement of hazard sciences, to perceive and explore those aspects that may be similar among some of the various hazards, to review the newest developments in a few selected fields and also to outline new directions for future research.

Under the umbrella of HAZARDS 91, several symposia and workshops will be held, dealing with all aspects of natural and technological disasters, with particular emphasis on those occurring in developing countries. Keynote speakers, special invited lectures and contributed papers on current practices and research activities will be grouped into the following themes:

- Cyclones and other severe weather systems
- Storm surges and their coastal effects
- Tsunami generation and propagation
- Biotoxins and other marine natural hazards
- Air and water pollution

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- Floods and droughts
- Ice-related hazards
- Earthquakes, landslides and snow avalanches
- Soil erosion
- Deforestation and desertification
- Climatic changes and their impacts
- Risk assessment problems
- Preparedness, mitigation and management
- The IDNDR: a perfect chance to put hazard research into practice

The International Society for the Prevention and Mitigation of Natural Hazards (NHS) is the principal scientific organization sponsoring HAZARDS 91. The meeting is co-sponsored by the following organizations:

The Tsunami Society
The International Association for the Physical Sciences of the Oceans (IAPSO)
IAPSO Commission of Marine Natural Hazards
Academy of Scientific Research and Technology, Egypt
International Tsunami Information Center

Other organizations wishing to be considered for sponsorship should contact either Dr. T.S. Murty, chairman of the Scientific Committee or Dr. Mohammed I. El-Sabh, chairman of the Organizing Committee.

Call for Papers: The Organizing Committee invites all scientists, engineers

and policy makers involved in natural and technological hazards to participate actively in HAZARDS 91.

Authors are invited to submit extended abstracts of 2-3 pages (up to 40 lines per page). To maintain a high scientific standard, it is thought that extended abstracts will help in a better screening of the submitted papers. An original and two copies of the extended abstracts should be sent to the chairman of the Scientific Committee, Dr. T.S. Murty. Camera-ready abstracts should be typed on 216 x 270 mm paper with 25 mm margins. Spacing between lines should be 1.5 mm. Elite 12 type is preferred. The heading block should include the following items on successive lines (i) the title in capital letters, and (ii) the name(s) of the author(s) in upper and lower case letters, and affiliation. There should be a two-line space between the heading block and the text. All lines including the title, names and text are to be typed left-justified.

A volume of the extended abstracts will be pre-published and will be made available to the participants prior to the meeting. All manuscripts will go through careful and full editorial standards and only good quality papers will be included in the final proceedings of the Symposium to be published in a special issue of Natural Hazards.

In view of the revised dates for the conference, the deadline for receiving

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abstracts has been extended to 1 April, 1991. Please send your abstract to:

Dr. T.S. Murty
Chair, Scientific Committee
Institute of Ocean Sciences
P.O. Box 6000
9860 West Saanich Road Sidney, B.C.
V8L 4B2
CANADA
Tel: 604-363-6311
FAX: 604-363-6746
Telemail: IOS.BC
Telex: 0636700764

or

Professor Mohammed I. El-Sabh
Chairman, Organizing Committee
HAZARDS'91
Department d'Océanographie
Universite du Quebec a Rimouski
300 Allee des Ursulines
Rimouski, Quebec
Canada
G5L 3A1
Telephone: (418) 724-1707
Telefax: (418) 723-7234
Telex: 051-31623

Those of you who sent your abstracts earlier, please indicate to the Chairman of the Scientific Committee, if you plan to participate in the conference in view of the new location and time. If we do not hear from you by April 1, 1991, your abstract will be deleted.

For further information, and in order to receive the latest circular, please write to either Dr. T.S. Murty, Chairman of the International Scientific Committee,

or to Professor M.I. El-Sabh, Chairman of the Organizing Committee.

Disaster Advisory Committee Created

The International Disaster Advisory Committee has been established to advise USAID and the office of U.S. Foreign Disaster Assistance on private sector initiatives to support international disaster preparedness, mitigation and relief activities. For more information contact Mr. Oliver Davidson, Executive Director, AID/OFDA/IDAC, Room 1262-A NS, Department of State, Washington, D.C. 20253, U.S.A.

Sea-Level Rise Project

Physical and Human Response to Sea-Level Rise, a project of the Commission on the Coastal Environment (CCE). Convener: Eric Bird, Department of Geography, University of Melbourne, Parkville, Victoria 3052, Australia.

The predictions of global warming due to the "Greenhouse Effect", and of a consequent world-wide sea level rise in the next few decades, have stimulated discussion and research in many countries. Members of the IGU Commission on the Coastal Environment have contributed to projects initiated by UN agencies, and by national governments and science foundations, and material from these is being assembled for a world-wide review of the physical and human responses to sea level rise. A preliminary report will be available only to commission members.

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Historic Tsunami Data

The National Geophysical Data Center (NGDC) and the collocated World Data Center A for Solid-Earth Geophysics have compiled a unique set of data bases. They include digital historic tsunami data, tide gauge records, photographs, bathymetric data, and technical publications. Currently the data base consists of about 6,600 records and represents events from 49 B.C. to the present. Also available is a set of 20 35-mm slides of tsunami, tide gauge records, and bathymetric data. For more information, contact National Geophysical Data Center, NOAA, Code E/GC4, 325 Broadway, Boulder, CO 80303, U.S.A. Telephone: (303) 497-6337.

American Association for the Advancement of Science (AAAS) Annual Meeting. Washington, D.C.: 14-19 February, 1991

Included in this year's conference will be sessions on sea-level rise, responsibilities of scientists and engineers in environmental debates, coastal erosion and coastal zone management, multiple-use ecosystem management, risk perception and public policy and earthquake prediction and validation. Further information can be obtained from the American Association for the Advancement of Science, 1333 H Street, N.W., Washington, D.C. 20005, (202) 326-6400.

Seminar on Training for Disaster Reduction. Disaster and Emergency Reference Center (DERC), Delft University. Cairo, Egypt: February 1991

DERC's second international meeting on disaster management educators to review training and training materials dealing with earthquake and flood mitigation. Seminar participants will assess what new educational materials are needed and select consultants to create those materials.

A number of fellowships to attend the conference are available to qualified persons from developing countries. Persons interested in participating should send a short resume to the Disaster and Emergency Reference Center, Delft University of Technology, P.O. Box 5048, 2600 GA Delft, The Netherlands; tel: (015) 78 44 08; fax: (015) 78 65 22; telex: 3815 butud nl for derc.

XVII Pacific Science Congress, Pacific Science Association and others. Honolulu, Hawaii: May 27-June 2, 1991

The Pacific Science Association will hold the XVII Pacific Science Congress in Honolulu, Hawaii on May 27-June 2, 1991.

The theme is "Towards the Pacific Century: The Challenge of Change." This international, inter-disciplinary

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meeting is sponsored by the University of Hawaii, the East-West Center and the Bishop Museum in cooperation with the U.S. National Academy of Sciences.

Scientists, scholars, administrators, government officials and members of the business community who are interested in issues which affect the peoples and environments of the Pacific are encouraged to attend. Individuals wishing to organize sessions or organizations interested in holding meetings in association with the Congress should contact the Congress Secretariat immediately.

All correspondence should be addressed to:

XVII Pacific Science Congress Secretariat
2424 Maile Way, Fourth Floor
Honolulu, HI 96822 USA
PHONE - (808) 948-7551
TELEX - 6504047720
FAX - (808) 942-9008
BITNET - psc@uhccux.bitnet
Dr. Nancy Davis Lewis, Secretary General
Linda Pearsall, Congress Manager

Topics

In addition to the traditional focus on research, this Congress will address policy issues and the application of science to regional problems. The title of the Congress and its six themes are:

Towards the Pacific Century: The Challenge of Change

- Global Environmental Change—Pacific Aspects
- Population, Health and Social Change
- Science and Culture
- Biological Diversity
- Technologies for Development: Perspectives for the 21st Century
- Dynamics of the Earth and the Heavens: The Pacific Arena

Contributed papers and poster presentations will also be organized into general sessions which will complement the Congress themes. The nineteen Scientific Committees of the Pacific Science Association have been invited to develop sessions reflecting their topic of interest.

The Scientific Committees are: Agricultural Sciences; Botany; Coral Reefs; Ecology, Conservation and Environmental Protection; Economics; Entomology; Forestry; Freshwater Sciences; Geography; Information Sciences and Technology; Marine Sciences; Material Sciences and Technology; Meteorology and Atmospheric Sciences; Museums and Similar Institutions; Nutrition; Public Health and Medical Sciences; Science Communication and Education; Social Sciences and Humanities; and Solid Earth Sciences.

The program of the XVII PSC will include invited paper sessions, plenary speakers, general sessions and poster

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speakers, general sessions and poster sessions. Opportunities are also available for round-table and panel discussions.

Scientific Excursions, Field Trips

Scientific excursions will be held before, during and after the Congress in the Hawaiian Islands and in one or more Pacific countries. These will focus on particular topics and will provide participants opportunities to visit relevant sites with experts. In addition, field trips of a more general nature will be held.

UCLA International Conference: Impact of Natural Disasters, University of California at Los Angeles International Studies and Overseas Programs and others. Los Angeles, California: 10-12 July, 1991

This conference will address the economic, environmental, legal, health, physical, technological, political, and social impacts of earthquakes, windstorms, floods, volcanic eruptions, wildfire, droughts, and environmental problems. The aim is to bring together academic, government, and private industry experts to present research results and past experiences and to discuss the agenda for future research, mitigation, and policy development. Persons wishing to present papers should submit an abstract of approximately 1,000 words, together with a short curriculum vitae, by December 15, 1990, to Samuel Aroni, Conference

Chair, GSAUP, UCLA, Los Angeles, CA 90024; (213) 825-7430; fax: (213) 206-5566; e-mail: iaq2sa1@uclamvs.bitnet.

Sixth Australia-New Zealand Conference on Geomechanics - Geotechnical Risk: Identification, Evaluation, and Solutions. Christchurch, New Zealand: 3-7 February, 1992.

In support of the International Decade for Natural Disaster Reduction, the Sixth Australia-New Zealand Conference on Geomechanics will focus on geotechnical hazards. The conference organizers invite the submission of abstracts on geotechnical risk and other topics associated with hazards and risks in geomechanics. Abstracts are due November 30, 1990. For details, contact the Convener, Sixth ANZ Conference, Soils and Foundations Ltd., P.O. Box 451, Christchurch, New Zealand; tel: (64) 3 798-432; fax: (64) 3 667-780.

Sixth International Symposium on Landslides. Christchurch, New Zealand: 10-14 February, 1992

Held in conjunction with the above-mentioned conference on geotechnical risk, this symposium will include presentations on landslide investigations, stability analysis techniques, stabilization and remedial works, landslide hazard assessment, seismicity and landslides, landslides and reservoirs, open-pit mine slopes and slope

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from prospective authors are due November 30, 1990. For more information, contact ISL 1992 Secretariat, c/o Guthrey's Pacific Ltd., P.O. Box 22-255, Christchurch, New Zealand; fax: (64) 3 790-175; telex: NZ4243 Guthreys.

Symposium on Tsunami Disaster Reduction

Vienna, Austria, 19 AUGUST 1991

The Tsunami Commission's 15th International Tsunami Symposium will focus on research that leads to disaster reduction. The one-day symposium will emphasize tsunami observation, physical processes of tsunami evolution and hazard reduction through assessment techniques and warning systems.

Researchers are invited to send abstracts to the convenor: Dr. E.N. Bernard, Chairman, Tsunami Commission, NOAA/PMEL/Bldg. 3 - Bin C15700, 7600 Sand Point Way N.E., Seattle, WA 98115-0070 USA, or FAX (206) 526-6815.

New Publications

Collected Papers "Tsunami Investigations," N 4, is published by the Soviet Geophysical Committee (Moscow, 1990, 95 p.). It contains nine papers:

- Dotsenko S.F., Soloviev S.L. Mathematical modelling of tsunami generation processes by oceanfloor movements
- Dotsenko S.F., Soloviev S.L. A comparative analysis of tsunami generation by piston-like and membrane bottom movements
- Korsunskii S.V., Selezov I.T. Generation of tsunami waves by a seismic-type source at the bottom surface
- Bobrovich A.V. Generation of waves and eddies in the ocean by submarine earthquakes
- Zvolinskii N.V., Sekerzh-Zen'kovich S.Ya. Free and forced gravitational waves in a double-layer liquid
- Arguchintsev A.V., Terletskii V.A. On the solution of the inverse tsunami problem within the framework of a two-dimensional model by means of optimal control methods
- Aleshkov Yu.Z. Propagation of longwaves at the surface of variable-depth liquid
- Karev V.Yu., Simonov K.V., Chubarov L.B., Shokin Yu.I. A computational experiment in the tsunami problem: a

detailed tsunami-zoning of Kamchatka's Pacific coast

- Pyatetskii A.V., Yakovlev V.V. Interaction of knoidal waves with systems of axisymmetrical obstacles of great transverse dimensions

Collected Papers have been edited by Professor S.L. Soloviev and Dr. A.V. Bobrovich. Papers are written in Russian, but there are also short English abstracts.

Pacific Tsunami Warning Center

The Pacific Satellite Sea-Level Network now consists of 68 DCPs

PTWC has 17 DCPs: Adak, Baltra Island, Caldera, Chatham Islands, Dutch Harbor, Easter Island, Juan Fernandez, Kodiak, La Libertad, La Punta, Malakal Island, Midway Island, Rarotonga, San Felix Island, Socorro Island, Valparaiso and Wake Island. All are functioning except Socorro Island.

NWS has 2 meteorological/tsunami DCPs: Johnston Island and Tern Island, French Frigate Shoals. All are functioning.

Dr. Wyrтки, NOAA/TOGA, has 14 DCPs: Funafuti, Honiara, Kanton, Kapingamarangi, Kiritimati, Majuro, Nauru, Noumea, Nuka Hiva, Penrhyn, Pohnpei, Rabaul, Santa Cruz, and Tarawa. All are functioning except Rabaul.

Dr. Enfield, NOAA/TOGA, has 2 DCPs: Lobos de Afuera Island, Peru; and Arica, Chile. All are functioning.

33 NGWLMS DCPs in the Pacific Basin report via GOES and dedicated circuits to PTWC.

Hawai'i State Civil Defense has 6 LARCs: Ka-poho, Hawai'i; Ka-hului and Lâ-hainâ, Maui; Hale-iwa, O'ahu; and Port Allen and Nâ-wiliwili, Kaua'i. All are functioning.

Seismic Summary (May 1990 to press time)

Event No.	Event	Location	Action Taken
1989-12 (accidental deletion)	Oct 2 1548Z 6.7	Amchitka Island, Alaska 50.8N 179.1W	Tsunami information bulletin issued
1990-6	May 07 0002Z 6.5	Panama-Costa Rica border 06.9N 082.4W	No tsunami information bulletin issued
1990-7	May 12 0450Z 6.5	Sakhalin Island, USSR 48.8N 142.0E	No tsunami information bulletin issued
1990-8	May 20 0222Z 7.4	Sudan 06.2N 032.4E	No tsunami information bulletin issued
1990-9	June 14 0741Z 6.8	Payan Island, Philippines 11.7N 122.0E	Tsunami information bulletin issued
1990-10	June 20 2100Z 7.5	Caspian Sea 38.9N 050.0E	No tsunami information bulletin issued
1990-11	July 16 0727Z 7.7	Luzon, Philippines 15.5N 121.1E	Regional Tsunami Warn- ing and Watch issued
1990-12	July 27 1238Z 7.3	Vanuatu Region 14.3S 167.7E	Tsunami information bulletin issued
1990-13	Aug 17 1307Z 7.0	Vanuatu 12.2S 160.9E	Tsunami information bulletin issued
1990-14	Nov 6 2015Z 7.1	120 miles northwest of Attu, Alaska 53.6N 170.1E	Tsunami information bulletin issued
1990-15	Nov 15 0234Z 6.6	Northwestern Sumatra 02.5N 097.2E	No tsunami information bulletin issued