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DTIC QUALITY INSPECTED 3

# TSUNAMI NEWSLETTER - January 1997

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*The TSUNAMI NEWSLETTER is published semi-annually in January and July by the International Tsunami Information Center (ITIC) to bring news and information to scientists, engineers, educators, community protection agencies, and governments throughout the world.*

*We welcome contributions from our readers.*

*Organized under the auspices of UNESCO's Intergovernmental Oceanographic Commission (IOC), the ITIC is maintained jointly by the National Oceanographic and Atmospheric Administration (NOAA) and the IOC. The Center's mission is to mitigate the effects of tsunamis throughout the Pacific.*

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# TABLE OF CONTENTS

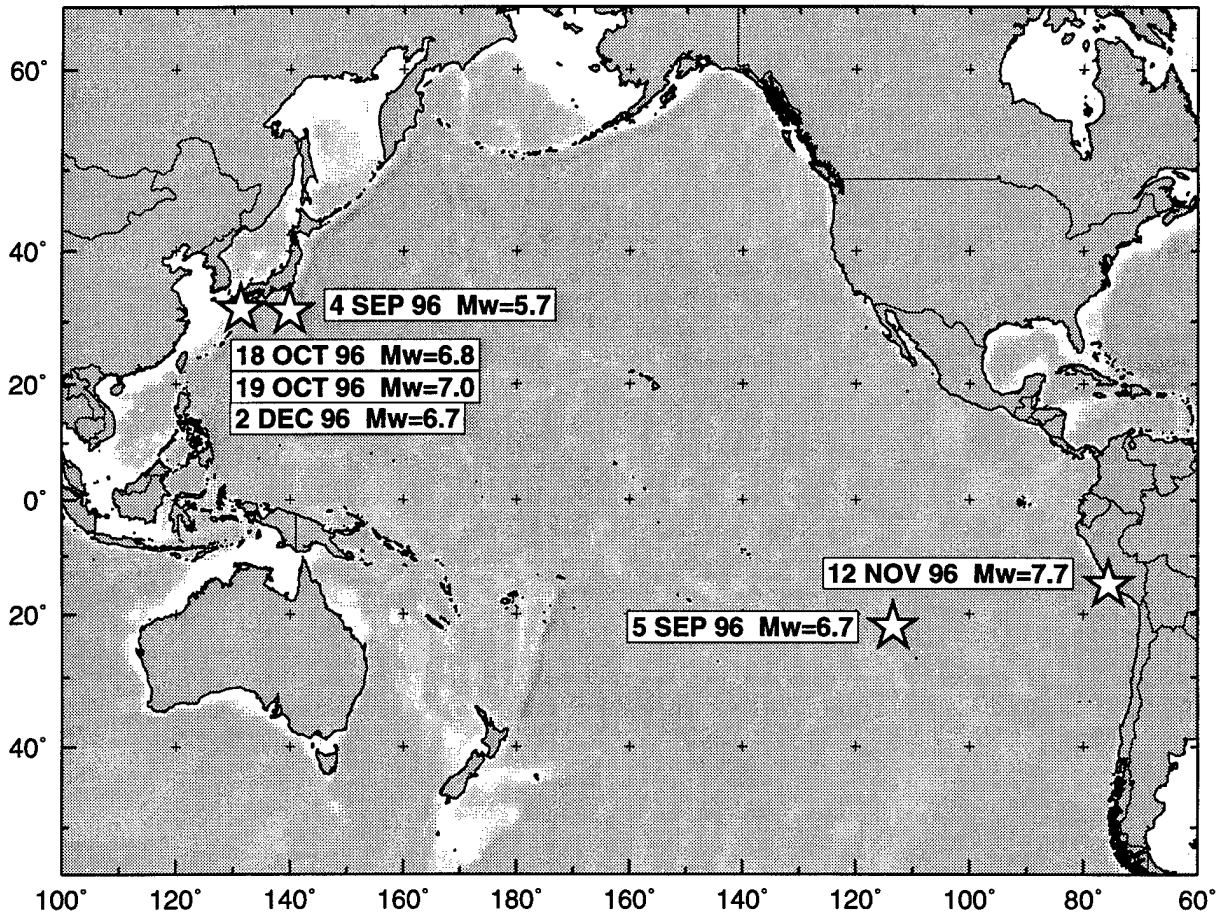





DTIC QUALITY INSPECTED 3

# TSUNAMI REPORTS: JULY - DECEMBER 1996

Six tsunamis occurred in the second half of 1996. Thankfully, all of them were small and none caused any reported damages or casualties. One of the tsunamis, observed in the Izu Islands of Japan, is inferred to have been caused by a possible magma injection into the sediments. Another tsunami was observed to have been generated by an earthquake near Easter Island associated with the East Pacific Rise mid-ocean spreading ridge system. The other four tsunamis were caused more normally by earthquakes associated with subduction.




*Epicenters of tsunamigenic earthquakes in the Pacific area that occurred in the second half of 1996. None were destructive.*

## September 4, 1996, $M_s$=5.1, $M_w$=5.7, Izu Islands, Japan

### Earthquake Parameters:

*(from NEIC Preliminary Determination of Epicenters)*

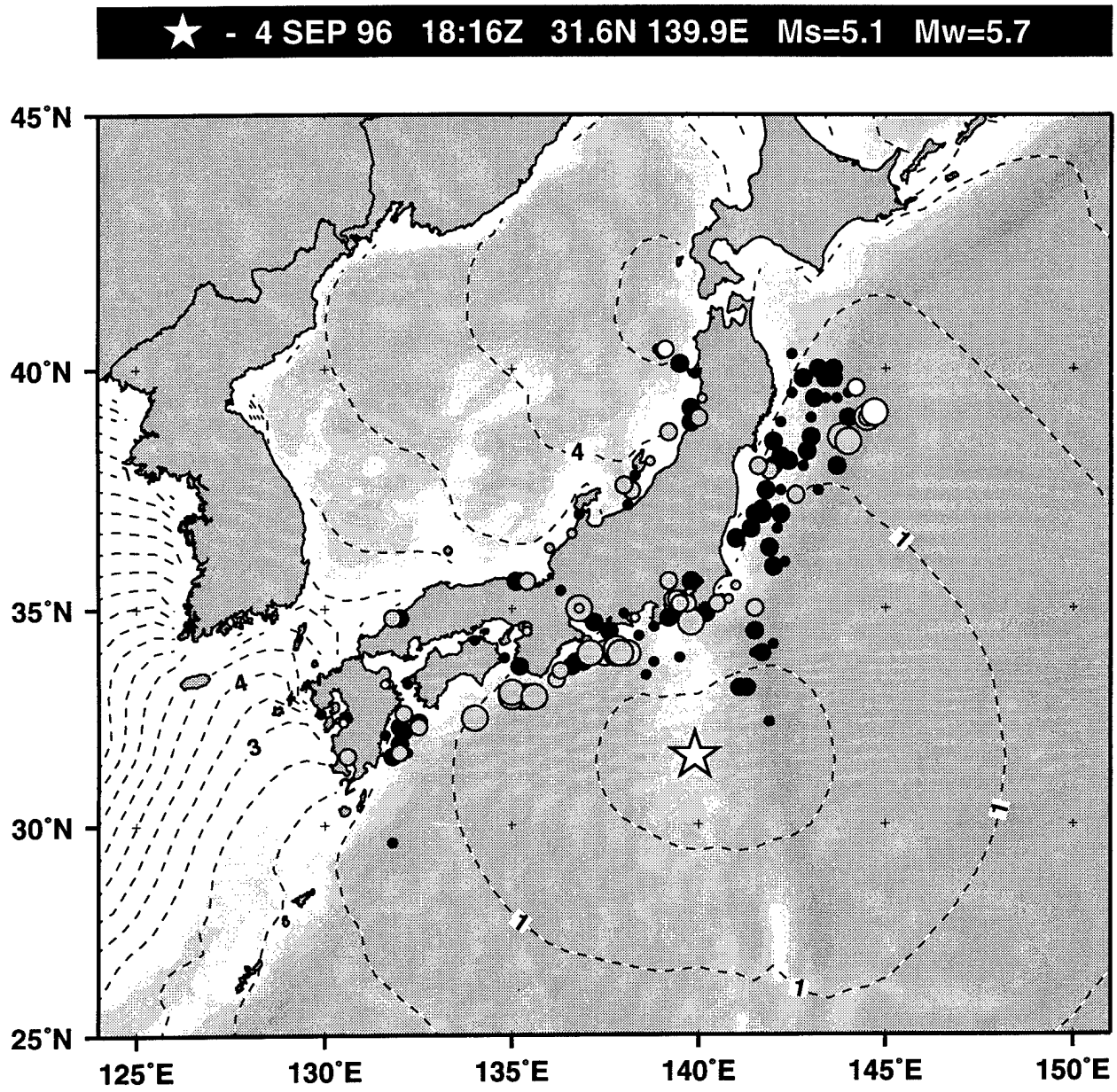
| | |
|---|---|
| Origin Time: | September 4, 1996 18:16:01.9Z |
| Coordinates and Depth: | 31.555°N, 139.931°E 33 km |
| Magnitudes: | mb=5.4, $M_s$=5.1, $M_w$=5.7 (GS), $M_w$=5.7 (HRV), Mo=4.4x$10^{17}$ N-m (GS), Mo=4.0x$10^{17}$ N-m (HRV) |
| Region: | Izu Islands, South of Honshu, Japan |

### Selected Maximum Wave Heights (peak-to-trough):

| | |
|---|---|
| Hachijo-jima, Japan | 0.26 m |
| Okada, O-shima, Japan | 0.20 m |
| Miyake-jima, Japan | 0.16 m |

### Tsunami Magnitude: 7.5

Based on the amplitude of the tsunami on tide gauges located in the Izu Islands, Katsuyuki Abe of the University of Tokyo estimates a tsunami magnitude, $M_t$=7.5. This is much larger than any of the seismic magnitudes, and thus the earthquake is classified as a "tsunami earthquake".




**HISTORICAL TSUNAMIGENIC EARTHQUAKES WITHIN 1000 KM.**

| TSUNAMI EFFECT | EARTHQUAKE MAGNITUDE (Ms) |
|---|---|
| ○ DISTANT DAMAGE | ○ 8.0 OR GREATER |
| ◎ LOCAL DAMAGE | ○ 7.0 TO 7.9 |
| ● NO DAMAGE | ∘ 6.9 OR SMALLER |

*A relatively small, Mw=5.7, earthquake on September 4, 1996, in the Izu Islands of Japan produced a small tsunami measured on nearby gauges. The mechanism of tsunami generation may have been magma injection beneath the sediments. [Historical data in this figure, and others like it in the newsletter, are taken from the US National Geophysical Data Center's tsunami database. The ocean depth is qualitatively indicated by shades of gray, with shallower water given lighter tones. Estimated tsunami travel times were computed using software developed by Paul Wessel for PTWC. The map was drawn using Generic Mapping Tools software.]*

## Interpretation

Kenji Satake of the Geological Survey of Japan reports that the event seems very similar to the 1984 Torishima tsunami earthquake, which has been interpreted as a magma injection beneath the sediments (Kanamori, et al., *J. Geophys. Res.*, V.98, B4, 6511-6522, 1993). Furthermore, at least some of the anomalously large readings may be attributable to unusual tsunami propagation along the Izu-Bonin-Mariana ridge system (Satake and Kanamori, *J. Geophys. Res.*, V.96, B12, 19933-19939, 1991).

# September 5, 1996, $M_s$=7.0, $M_w$=6.7, Easter Island Region

## Earthquake Parameters:

*(from NEIC Preliminary Determination of Epicenters)*

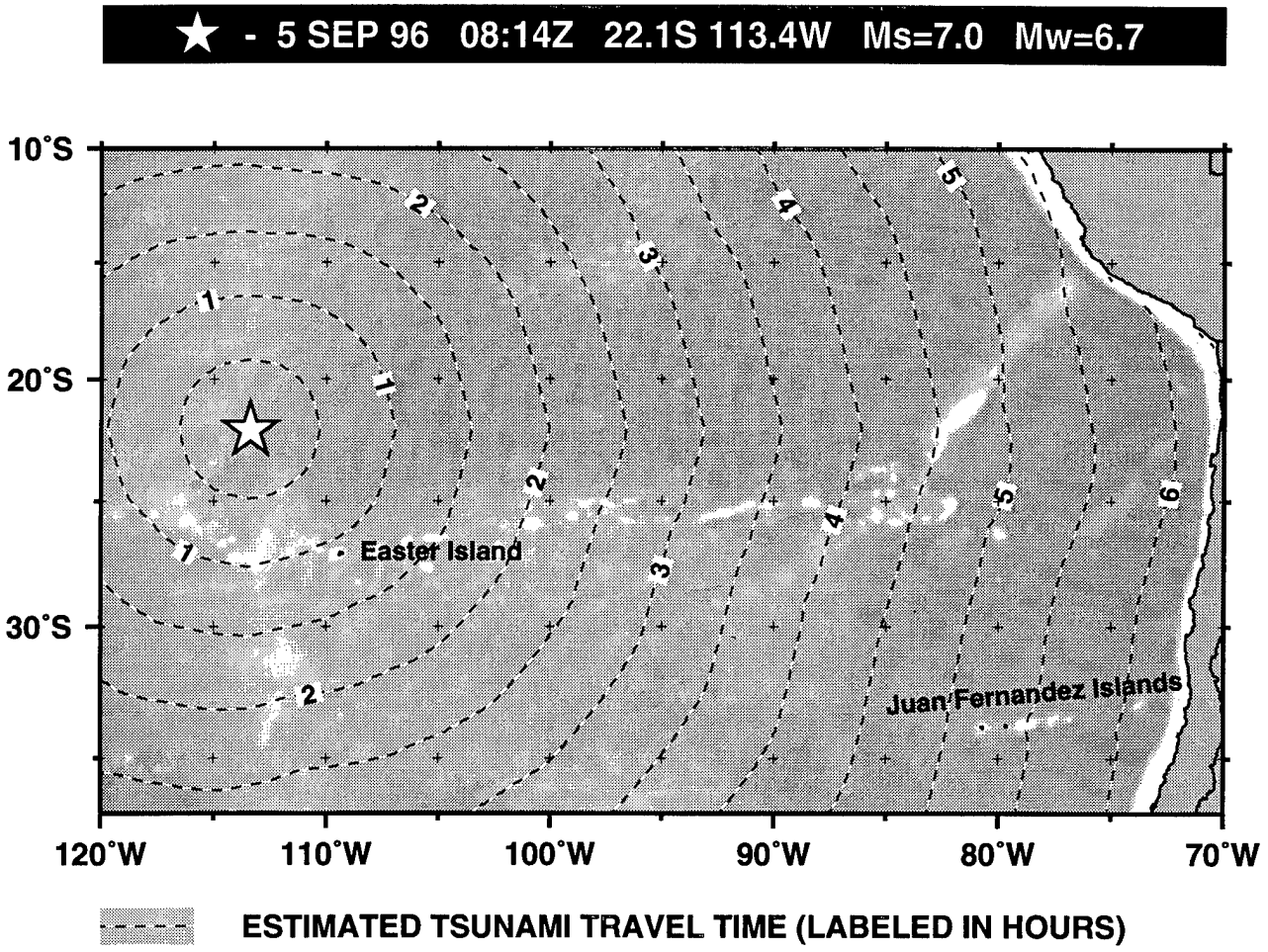
| | |
|---|---|
| Origin Time: | September 5, 1996 08:14:14.4Z |
| Coordinates and Depth: | 22.118°S, 113.436°E 10 km |
| Magnitudes: | mb=6.2, $M_s$=7.0, $M_w$=6.7 (GS), $M_w$=6.9 (HRV), Mo=1.3x$10^{19}$ N-m (GS), Mo=2.5x$10^{19}$ N-m (HRV) |
| Region: | East Pacific Rise north of Easter Island |

## Selected Maximum Wave Heights (peak-to-trough):

Easter Island, Chile ..... 0.18 m
Juan Fernandez, Chile ..... 0.09 m
Not observed on other gauges in the SE Pacific

## Description

This is the largest earthquake on record to occur along the East Pacific Rise, and it is the only known tsunamigenic earthquake from this mid-ocean ridge system.




*A small tsunami, observed on gauges at Easter Island and Juan Fernandez, was generated by an Mw=7.0 earthquake along the East Pacific Rise. No other tsunamigenic earthquakes are known to have occurred along this spreading ridge system.*

## October 18, 1996, $M_s$=6.6, $M_w$=6.8, Kyushu, Japan

### Earthquake Parameters:

*(from NEIC Preliminary Determination of Epicenters)*

| | |
|---|---|
| Origin Time: | October 18, 1996 10:50:20.8Z |
| Coordinates and Depth: | 30.568°N, 131.093°E 10 km |
| Magnitudes: | mb=6.0, $M_s$=6.6, $M_w$=6.8 (GS), $M_w$=6.8 (HRV), Mo=1.5x$10^{19}$ N-m (GS), Mo=1.8x$10^{19}$ N-m (HRV), Mo=1.7x$10^{19}$ N-m (PPT) |
| Region: | Near the southeast coast of Kyushu, Japan |

### Selected Maximum Wave Heights (peak-to-trough):

Tanegashima, Japan ..... 0.17 m

## October 19, 1996, $M_s$=6.6, $M_w$=7.0, Kyushu, Japan

### Earthquake Parameters:

*(from NEIC Preliminary Determination of Epicenters)*

| | |
|---|---|
| Origin Time: | October 19, 1996 14:44:40.7Z |
| Coordinates and Depth: | 31.885°N, 131.468°E 22 km |
| Magnitudes: | mb=6.3, $M_s$=6.6, $M_w$=7.0 (GS), $M_w$=6.8 (HRV), Mo=3.2x$10^{19}$ N-m (GS), Mo=1.9x$10^{19}$ N-m (HRV), Mo=2.1x$10^{19}$ N-m (PPT) |
| Region: | Near the southeast coast of Kyushu, Japan |

### Selected Maximum Wave Heights (peak-to-trough):

Miyazaki, Japan ..... 1.10 m
Nichinan, Japan ..... 0.40 m
Tanegashima, Japan ..... 0.14 m
Shikoku, Japan ..... minor tsunami observed

### Description

With a moment magnitude of 7.0, this event is the largest in a series of earthquakes occuring in the latter half of 1996 near the southeast coast of Kyushu, Japan. Three of those earthquakes produced measurable tsunamis, and this event produced the largest tsunami wave measuring 1.10m at Miyazaki, the coastal capital city of the Miyazaki Prefecture of Kyushu.

## November 12, 1996, $M_s$=7.3, $M_w$=7.7, Near the Coast of Peru

### Earthquake Parameters:

*(from NEIC Preliminary Determination of Epicenters)*

| | |
|---|---|
| Origin Time: | November 12, 1996 16:59:44.0Z |
| Coordinates and Depth: | 14.993°S, 75.675°W 33 km |
| Magnitudes: | mb=6.5, $M_s$=7.3, $M_w$=7.7 (GS), $M_w$=7.7 (HRV), Mo=3.7x$10^{20}$ N-m (GS), Mo=4.4x$10^{20}$ N-m (HRV) |
| Region: | Near the coast of Peru, south of Lima |

### Selected Maximum Wave Heights (peak-to-trough):

Calloa, Peru ..... 0.25 m
Arica, Chile ..... 0.35 m
Caldera, Chile ..... 0.21 m

Of the water level gauges in the Pacific accessible by PTWC, the ones above are the only ones observed with a tsunami from this event.

### Description

This earthquake killed at least 14 persons, injured over 500, destroyed 4,000 dwellings, and left 12,000 homeless. No injuries or destruction, however, were reported from the relatively minor tsunami observed along the coasts of Peru and Chile.

## December 2, 1996, $M_s$=6.6, $M_w$=6.7, Kyushu, Japan

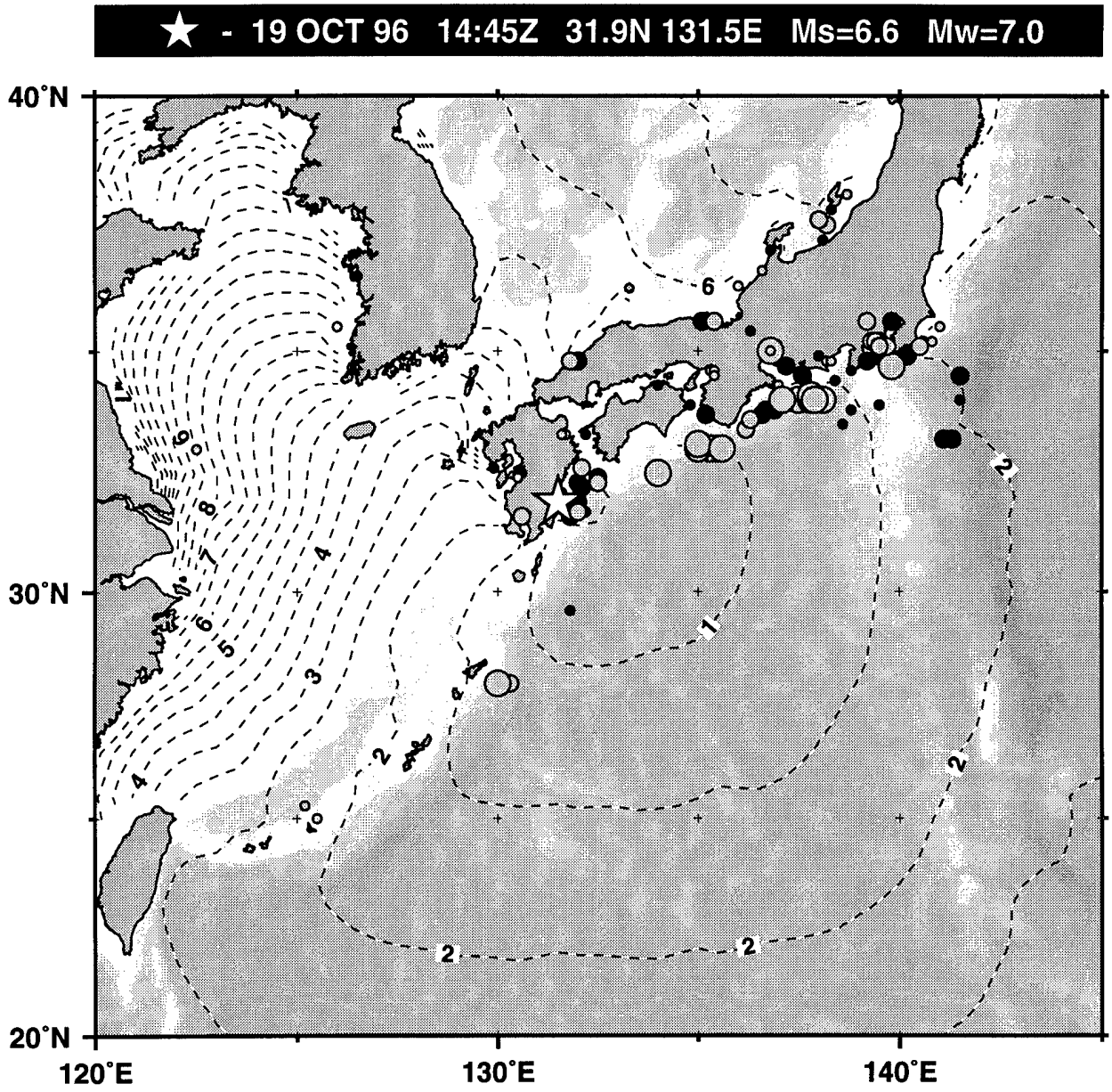
### Earthquake Parameters:

*(from NEIC Preliminary Determination of Epicenters)*

| | |
|---|---|
| Origin Time: | December 2, 1996 22:17:59.2Z |
| Coordinates and Depth: | 31.789°N, 131.314°E 49 km |
| Magnitudes: | mb=6.0, $M_s$=6.6, $M_w$=6.7 (GS), $M_w$=6.8 (HRV), Mo=1.4x$10^{19}$ N-m (GS), Mo=1.6x$10^{19}$ N-m (HRV) |
| Region: | Near the southeast coast of Kyushu, Japan |

### Selected Maximum Wave Heights (peak-to-trough):

Nichinanaburatsu, Japan ..... 0.21 m
Hyugahososhima, Japan ..... 0.04 m

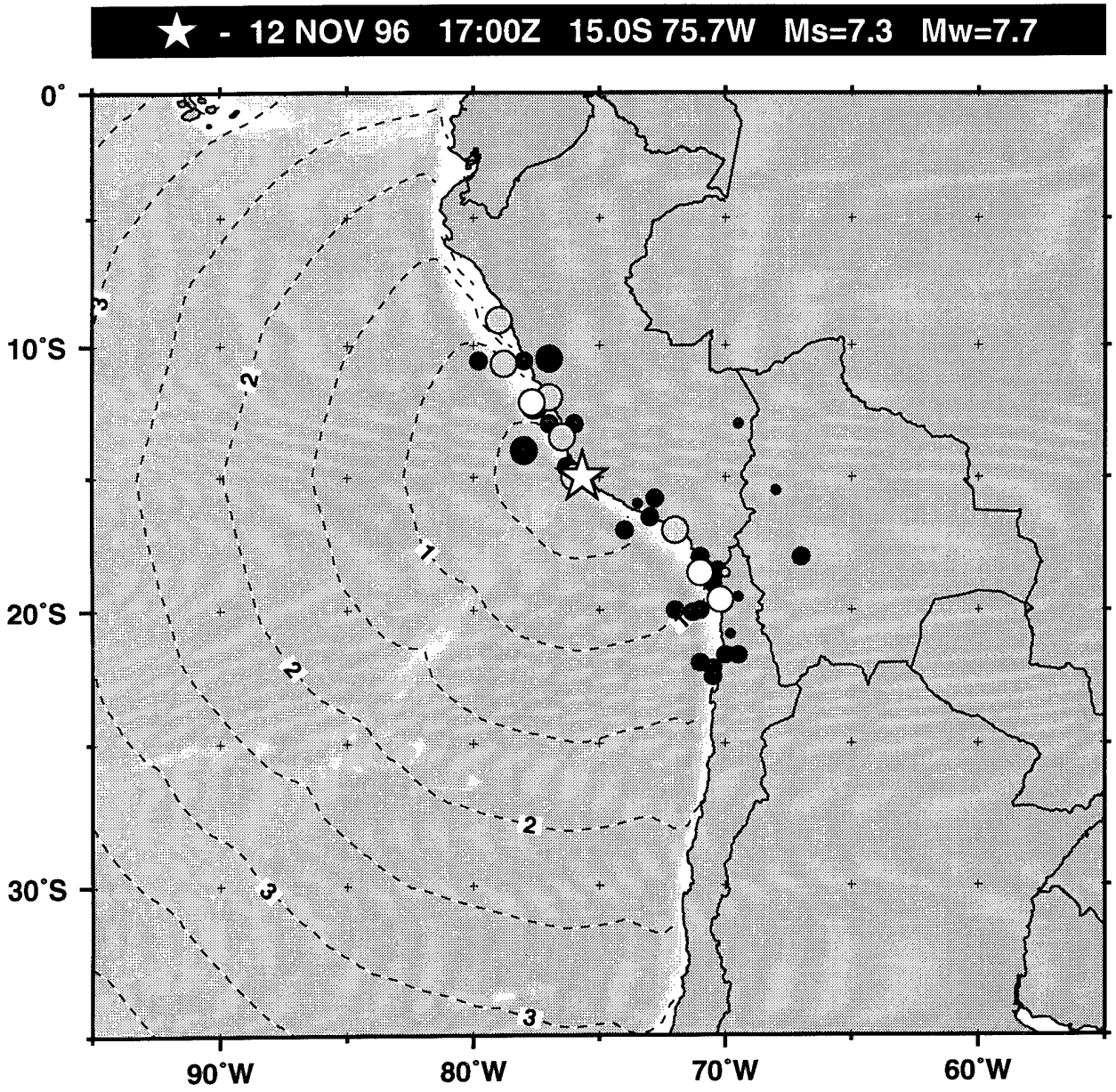



ESTIMATED TSUNAMI TRAVEL TIME (LABELED IN HOURS)

**HISTORICAL TSUNAMIGENIC EARTHQUAKES WITHIN 1000 KM.**

| TSUNAMI EFFECT | EARTHQUAKE MAGNITUDE (Ms) |
|---|---|
| ○ DISTANT DAMAGE | ○ 8.0 OR GREATER |
| ◎ LOCAL DAMAGE | ○ 7.0 TO 7.9 |
| ● NO DAMAGE | ∘ 6.9 OR SMALLER |

*This is the largest of three tsunamigenic earthquakes - October 18 and 19, and December 2 - to occur near the southeast coast of Kyushu, Japan. Although none of the tsunamis caused damage, waves from this event measured 1.1m at Miyazaki, very near the epicenter.*

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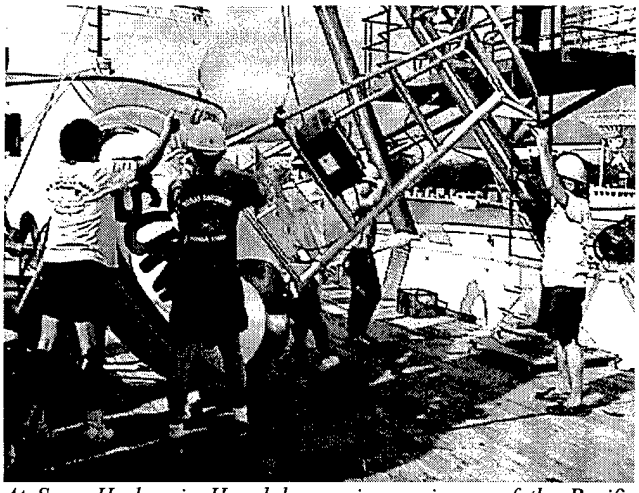
*A major earthquake struck the south-central coast of Peru killing at least 14 persons and injuring over 500. The earthquake also generated a small non-destructive tsunami, that was measured on gauges along the coasts of Peru and northern Chile*

# RECENT ACTIVITIES

*The following section contains reports about recent tsunami mitigation activities that have taken place on local, national, or international levels.*

## First Deep Sea Tsunami Sensors and Buoys for Operations

A real-time reporting mid-ocean tsunami detection and measurement system designed by the US Pacific Marine Environmental Laboratory (PMEL) was tested in deep waters off Hawaii in March, 1997. Six of the systems are scheduled to be deployed in the north and east Pacific over the next few years to aid tsunami warning centers in their efforts to more accurately predict a tsunami's impact. The systems are unique for two important reasons: (1) they enable measurements to be made in strategic mid-ocean locations where other types of instrumentation such as tide gauges cannot be sited, and (2) they allow a more direct measurement of the waves, unaltered by non-linear shallow water and shoreline effects. For more information on the bouy systems and other tsunami-related activities of PMEL, visit their web site: **http://www.pmel.noaa.gov/tsunami/**



*At Snug Harbor in Honolulu, marine engineers of the Pacific Marine Environmental Laboratory and the University of Hawaii prepare a tsunami bouy for testing at sea. The buoy is part of a deep sea tsunami detection and real-time reporting system that will be used to enhance the tsunami warning centers ability to evaluate a tsunami as it propagates in the deep ocean.*

## Pacific Tsunami Museum Update

On November 25, the Governor of the State of Hawaii, The Honorable Benjamin Cayetano, held a press conference to declare January 1997 as "Tsunami Awareness Month" and he urged Hawaii's citizens to learn about the potential dangers of tsunamis.

*The Honorable Benjamin Cayetano, Governor of the State of Hawaii (center, behind proclamation), declares January, 1997, as "Tsunami Awareness Month." Others in the photo are (from left to right): Robert Fujimoto - Pacific Tsunami Museum Vice-President, Carol VanCamp - General Manager of Hilo's Prince Kuhio Plaza, Jim Wilson - Museum President, Susan Tissot - Museum Executive Director, Peter Muller - Museum Board Member, The Honorable Stephen Yamashiro - Hawaii County Mayor, Chip McCreery - ITIC Director, and Bruce Turner - PTWC Geophysicist.*

The proclamation was prompted by, and was also the formal announcement of, a new name for the former Hilo Tsunami Museum, now to be called to Pacific Tsunami Museum to more accurately reflect the international scope of their current and future activities. In addition, the museum formally announced it is now launching a US$1.5 million fundraising drive and hopes to formally open its doors to the public in late 1998.

*Walter Dodds, CEO of First Hawaiian Bank, announces on May 22, 1997, that the Bank is donating the Bishop Trust Building, in front of which he stands, to the Pacific Tsunami Museum to serve as its new home.*

On May 22, 1997, the Museum announced in a press conference that First Hawaiian Bank is donating the Bishop Trust Building located along the Hilo waterfront, as a new home for the Museum. The handsome building was designed in the 1930's by C.W. Dickey, a prominent

architect who designed many of Hawaii's more notable structures including the Honolulu Academy of Arts Building. Although located in the tsunami inundation zone, the building survived the devastating 1946 and 1960 tsunamis with only "a little sand in the lobby," according to Walter Dodds, CEO of the Bank. The Museum is very grateful for the generous donation, and anticipates it will add momentum to its other fundraising efforts.

Further information about the Museum can be found at their website: ***http://www.planet-hawaii.com/tsunami/***

# TSUNAMI WARNING SYSTEM IN THE PACIFIC

## ITSU Officers and National Contacts Update

**Japan National Contact** Mr. Yoshihiro Sawada has been designated by Japan as their new national contact for ITSU, succeeding Mr. Hiromu Yoshida.

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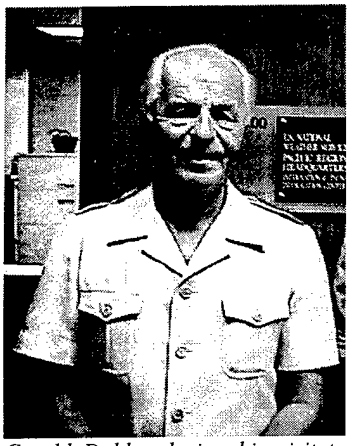
# INTERNATIONAL TSUNAMI INFORMATION CENTER (ITIC)

*ITIC continues to receive many international visitors who participate in tsunami mitigation activities in their respective countries.*

## Gerald Dohler



*Gerald Dohler during his visit to ITIC in December, 1996.*

Gerald Dohler, a former Chairman of ITSU and Associate Director of ITIC, visited ITIC and the Pacific Region Headquarters of the US National Weather Service while on vacation in Hawaii with his wife in December. Dr. Dohler is now retired and living in Ottawa, Canada.

## Hiroo Uchiike and Keiji Doi

Hiroo Uchiike, Director of the Administrative Division, and Keiji Doi, Chief of the Seismological Research Coordination Section, of the Seismological and Volcanological Department of the Japan Meteorological Agency, visited ITIC and PTWC in February, 1997 during

*Richard Hagemeyer, ITSU National Contact for the U.S.A,. with Hiroo Uchiike and Keiji Doi of the Japan Meteorological Agency outside ITIC.*

a trip they made to the USA to discuss the "Pan Pacific Natural Disaster Watch Network" initiative with their American counterparts including Richard Hagemeyer, Pacific Region Director of the Nationa Weather Service as well as ITSU National Contact for the U.S.A. Hiroo is a former ITSU National Contact for Japan.

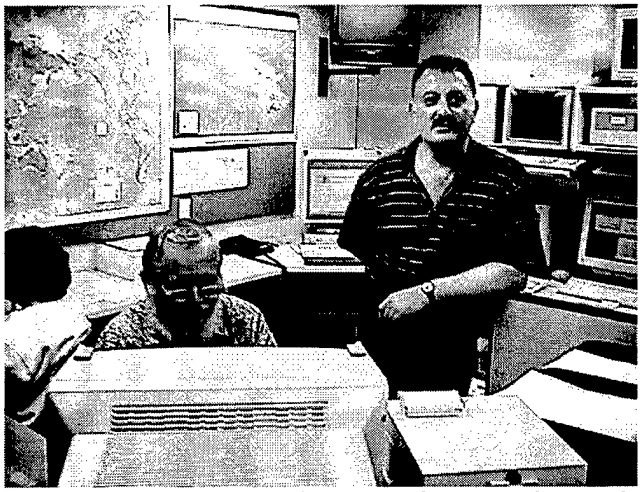
## Viacheslav Gusiakov and Dennis Sigrist

The simultaneous visits to ITIC of Viacheslav Gusiakov, Director of the Tsunami Laboratory at Novosibirsk, Russian Federation, and Dennis Sigrist, former Acting Director of ITIC now living in Oregon, in early December, 1996, was only coincidental. Slava was in the U.S. to discuss a variety of issues including future enhancements to the Tsunami Laboratory's Expert Tsunami Database that could make it more useful to U.S Emergency Managers. Dennis was in Hawaii on vacation to visit family members, and he just dropped by.

*Slava Gusiakov (left), Head of the Tsunami Laboratory at Novosibirsk, and Dennis Sigrist (right), former ITIC Acting Director interupt the ITIC Director, Chip McCreery (center), from his work on the Newsletter for a picture.*

## Phil Parker

Phil Parker, who works with Peter Noar, ITSU National Contact for Australia, at the Bureau of Meteorology in Melbourne, passed through Hawaii in March, 1997, on his way back home from a meeting. Phil is actively involved with tsunami-related issues faced by Australia,and he took the opportunity in Hawaii to visit ITIC and PTWC.



*Mike Blackford (left), Geophysicist-in-Charge at the Pacific Tsunami Warning Center, explains some of the Warning Center's procedures to Phil Parker (right) of Australia's Bureau of Meteorology.*

# INTERNATIONAL DECADE FOR NATURAL DISASTER REDUCTION (IDNDR)

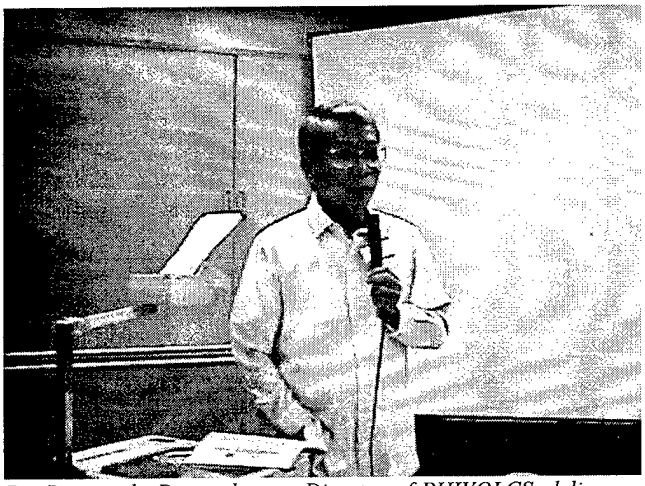
## World Disaster Reduction Day

World Disaster Reduction Day is Wednesday, October 8, 1997, and the theme is **"Water: Too much ... too little ... Leading cause of natural disasters."** Without water, life is not possible; water is a source of life. At the same time, too much water is dangerous. Too much or too little water is also the most common feature of natural disasters. Coastal and river flooding, for example, are the most frequent natural disasters and are increasing more rapidly than any other disaster. drought (the other side of the same coin) is still the disaster that affects more people than any other. This is why the World Disaster Reduction Day campaign for 1997 is dedicated to the links between water, disasters, and development.

# RECENT MEETING REPORTS

## Regional Meeting for Earth Sciences Cooperation

The Regional Meeting for Earth Sciences Cooperation was held at the Sulo Hotel in Quezon City, Philippines on 10-13 December 1996. It was sponsored by UNESCO's Regional Office for Science and Technology for Southeast Asia (ROSTEA), and was hosted by the Philippine Institute of Volcanology and Seismology (PHIVOLCS).



*Dr. Raymundo Puyongbayan, Director of PHIVOLCS, delivers a few opening remarks.*

In attendance were representatives from Japan, China, Taiwan, Vietnam, Thailand, Malaysia, the Philippines, Australia, and New Zealand. Also participating were remote sensing experts from France and Germany, ROSTEA's Programme Specialist for the Earth Sciences, and the ITIC Director.

*PHIVOLCS is in the process of building, and occupying, a new facility that will include offices, computer facilities, a library, a reception hall, an auditorium, and visitor quarters.*

The meeting covered a wide variety of topics including: seismic monitoring networks, active faults and paleoseismology, tsunamis and tsunami warning, seismic hazards mapping, and seismic risk assessment. Recommendations for the region with relevance to tsunamis include: 1) each country should have at least one three-component broadband seismic station; 2) each country with a tsunami risk should be able to rapidly locate and size potentially tsunamigenic earthquakes; 3) information on earthquakes with M>6 should be immediately shared with all countries; 4) each country should develop potential inundation maps or evacuation zones, and should consider utilizing the IOC's Tsunami Inundation Modeling Exchange (TIME) program in that effort; 5) each country needs to have fine scale bathymetry (to 1000m) and nearshore topography (to 100m) to model potential tsunami runups; 6) each country is encouraged to establish water level gauges along costlines susceptible to tsunamis; 7) tsunami information should be integrated into GIS databases; 8) training on mapping and documentation of tsunami effects should be conducted; and 9) the use of remote sensing and GPS satellites for measuring tsunamis should be studied.

## Science, Hazards, and Hazard Management - The Second Caribbean Conference on Natural Hazards and Disasters

*Report contributed by Jim Lander.*

A Workshop was held in Kingston, Jamaica on October 9-12, 1996 with about 100 participants from many of the Caribbean islands and countries. Many types of natural hazards were considered including hurricanes, earthquakes, volcanos, landslides, but only a single paper by James Lander was presented for tsunamis. His paper, Caribbean Tsunamis: an Initial History, was presented to begin to increase their awareness of a tsunami hazard larger than they realize. The initial history gives information on 50 tsunamis which were reported in internationally available sources. (Fig. 1) Of these, fifteen have caused damage and there have been 153 fatalities. These figures will almost certainly increase with a more indepth study. This compares with 11 damaging tsunamis in Alaska and 122 fatalities. They have a hazard from teletsunamis as the 1755 Lisbon tsunami put waves up to the second story at Saba and effected many of the islands. Although there is about a nine hour travel time for a wave to cross the Atlantic without a warning systen and a plan they are very much like Hawaii in 1946.

Since most of the damaging tsunamis occurred before the recent large growth in development in the coastal areas,

another large tsunami has disasterous potential. It is not uncommon to see three or more cruise ships docked and hundreds of tourists on the pier. It would be wise to fully understand the extent and nature of the hazard by a more detailed study done by local investigators and take appropriate actions before a destructive wave than afterwards. The paper generated many questions and requests for copies. There will be another workshop in Barbados in about 2 years. As there is little local expertise in tsunamis in the Caribbean it is important to involve the tsunami research and warning community now concentrating on the Pacific and Mediterranean areas also with the Caribbean area.

## Caribbean Tsunami Workshop

*Report contributed by Aurelio Mercado Irizarry of the University of Puerto Rico*

During June 11-13, 1997, the first Caribbean Tsunami Workshop was held at the University of Puerto Rico, Mayaguez Campus. The sponsor was the University of Puerto Rico Sea Grant College Program, with the following co-sponsors: Puerto Rico Civil Defense, Puerto Rico's Department of Natural and Environmental Resources, U.S. Army Corps of Engineers, and the Sandia National Laboratories. The main purpose of the workshop was to present to the audience the fact that tsunamis are a reality in the Caribbean (as a matter of fact, Prof. James Lander, University of Colorado, showed that tsunami-related deaths in the Caribbean are higher than the the sum of all tsunami-related deaths in Alaska, Hawaii, and the U.S.A. east coast!), show potential tsunamigenic Caribbean sources, and discuss the need to establish some type of early warning system, and to do it before waiting for a disaster to occur first.

For this reason, all of the eastern Caribbean Emergency Response Coordinators were invited, and personnel from the following island/nations attended: Aruba, St. Croix, Montserrat, Anguilla, St. Vincent and the Grenadines, Antigua, Barbados, Tortola, St. Kitts, St. Maarten (Netherlands), Turks & Caicos, Trinidad & Tobago, Jamaica, Bahamas, St. Thomas, the Dominican Republic, and Puerto Rico. In addition, the Caribbean Disaster Emergency Response Agency and various Caribbean Meterological Centers were represented.

After the scheduled presentations, a day of panel discussion was held in which four groups were created among the ones present, covering the topics of Education, Warning, Management, and Research. A comprehensive resolution was drafted to cover the topics discussed. It is expected that each of the Emergency Coordinators present will present this resolution to their respective heads of government.

## International Workshop on Tsunami Mitigation and Risk Assessment

*Meeting summary provided by George Curtis.*

This conference was held from August 21-24, 1996 in Petropavlovsk-Kamchatskiy, Russian Federation. The conference was hosted by the Russian Academy of Science,


*Participants of the Tsunami Risk Assessment and Mitigation Workshop pose in front of the Institute of Volcanology at Petropavlovsk-Kamchatskiy where the workshop was held.*

and was convened by Viacheslav K. Gusiakov at the Institute of Volcanology in Petropavlovsk. There were sixteen foreign participants from Korea, Japan, France, and the U.S., and about twenty participants from the Russian Federation.

Approximately half-day sessions were held on each of the following topics, conducted by co-convenors knowledgeable in each field: 1) paleotsunami research, 2) historical catalogs and databases, 3) seismo-tectonics of tsunamis, 4) numerical models of tsunami behavior, 5) methods of calculating tsunami risk, 6) tsunamis and other hazards, 7) mitigation and countermeasures, and 8) tsunami data centers. The coverage in some areas was extensive, while several concentrated only on selected factors. The primary language was English, and interpretation was provided as needed.

Dr. Gusiakov is coordinating each co-convenor's contributions for a formal report with recommendations that will be published by the Intergovernmental Oceanographic Commission.

## Tsunami Symposium

The 17th International Tsunami Symposium was held in Melbourne, Australia, on July 2-4, 1997, in conjunction with the Joint Assemblies of IAMAS and IAPSO. This was the first time that the International Tsunami Commission held its symposium with one of its sponsoring associations except during the IUGG General Assemblies, and also the first symposium held in the Southern Hemisphere since the 1974 Symposium in Wellington, New Zealand. Dr. Roger Braddock served as the local convener and will serve as the editor of the papers selected for publication through Kluwer Academic Publishers. A total of 40 papers were presented in 10 sessions chaired by Dr. V. Gusiakov, Dr. K. Satake, Dr. E. Pelinovsky, Dr. N. Shuto, Dr. F. Gonzalez, Dr. W. DeLange, and Dr. E. Bryant. Authors were present from Australia (6), Indonesia (2), New Zealand (2), Japan (18), Russia (4), Greece (2), Turkey (1), and the United States (5). On average, there were about 30 attendees in each session. Whenever it was possible, the presentations were followed with a lively question and answer period.

# UPCOMING MEETING ANNOUNCEMENTS

## Waves 97 - The Third International Symposium on Ocean Wave Measurement and Analysis

***November 3-7, 1997, Ramada Plaza Resort, Virginia Beach, Virginia, USA***

*Sponsors: The Coastal Zone Foundation, American Society of Civil Engineers*

*Contact: Waves 97 Headquarters, c/o Dr. Billy L. Edge, Ocean Engineering Program, Dept. of Civil Engineering, Texas A&M University, College Station, TX 77843-3136, USA; tel. 409-845-4515; fax 409-862-1542; email b-edge@tamu.edu; URL http://www.tamu.edu/waves97/*

Professionals, researchers, and all interested persons are welcomed and encouraged to participate in an international exchange of information and views geared to promote communication, technology transfer, improved design, theoretical hydrodynamics, and practical solutions as well as present case histories relating to wave measurement and analysis. Topis for the meeting include: wave measurement and analysis, **tsunamis**, surges, and seiches, laboratory generation and measurement, wave forecasting and calibration, and coastal flooding.

## Nineteenth Annual Conference of the Western States Seismic Policy Council

***Victoria, British Columbia, November 4-7, 1997***

*For information contact: WSSPC, 121 Second Street, Fourth Floor, San Francisco, CA 94105; tel. 415-974-6435; fax 415-974-1747; email wsspc@wsspc.org; URL http://www.wsspc.org*

This four-day meeting includes the WSSPC **Tsunami** Hazard Mitigation Symposium to be held on November 4. The Symposium will begin an effort to coordinate and implement **tsunami** hazard mitigation plans in a systematic and comprehensive manner. It will focus on the best policies given the current technology and knowledge of the hazard, to emphasize mitigation along populated coastal areas and to identify emergency management needs in order to facilitate research. The Symposium will include sessions on the **Tsunami** Warning Centers, the National **Tsunami** Hazard Mitigation Program, and Efforts in Reducing **Tsunami** Risks.

## Modern Methods and Facilities in Oceanological Investigations

***November 15-17, 1997; Moscow, Russian Federation***

*Sponsors: Russian Academy of Sciences, Russian Ministry of Science and Technologies, Russian Academy of Nature Sciences, Scientific Coordination Center for Tsunamis*

*Contact: tel 7-095-124-87-01 or 7-095-124-87-10; fax 7-095-124-59-87*

This meeting is the Third International Scientific and Technical Conference. It will consist of several working groups including: 1) modern state and perspectives of the development of oceanological techniques; 2) distance ocean sounding (methods of measurement); 3) Underwater apparatus (inhabited and telecontrolled), robotics (manipulators), 4) microprocessor techniques in oceanological instrument engineering, 5) hydroacoustics, marine seismology, and seismometry, and 6) instrumental monitoring of the ocean environment.

## Fall Meeting of the American Geophysical Union

***December 8-12, 1997 San Francisco, California, USA***

*Sponsor: American Geophysical Union*

*Contacts for Session U12: Peter Ward; USGS; 345 Middlefield Road, MS977; Menlo Park, CA 94025; tel 415-329-4736; email ward@andreas.wr.usgs.gov; or Lloyd Cluff; Chairman, California Seismic Safety Commission; Pacific Gas and Electric Company; P.O.Box 770000, Mail Code N4C; San Francisco, CA 94177, tel 415-973-2791; email lsc@pge.com*

*Contacts for Session T08: J. Sauber; Geodynamics Branch, NASA Goddard Space Flight Center; Greenbelt, MD 20771; tel 301-286-8586; fax 301-286-1616; email jeanne@steller.gsfc.nasa.gov; or R. Dmowska; Division of Engineering and Applied Sciences; Harvard University; 29 Oxford St.; Cambridge, MA 02138; tel 617-495-3452; email dmowska@esag.harvard.edu*

One of the Fall AGU meeting sessions (U12) is entitled "Hazard Mitigation: Use of Real-Time Information. Accurate information available just before, during, or immediately after hazardous events can be used to reduce life loss and property damage and to speed response and recovery. This session will look at examples of real-time data collection and analysis, how critical information can be communicated rapidly, and how agencies, businesses, and individuals put such information to use. The emphasis will be on natural hazards such as storms, floods, earthquakes, **tsunamis**, volcanic eruptions, landslides, wildfires, and space weather.

Another session (T08) is entitled "Seismotectonics of Shallow Subduction Zones". The session will focus on mechanisms that control the seismic potential of shallow subduction zones. Abstracts were solicited on observational, laboratory, and theoretical studies of: 1) seismic, geodetic, and **tsunami** slip inversions of large/great subduction earthquakes, old and recent, 2) tectonic aspects of source processes, i.e., asperities, barriers, and structural discontinuities that affect rupture propagation, 3) characteristics of **tsunamigenic** segments, e.g., where is the upper edge of the seismogenic zone, and is it always at that same depth for all large/great earthquakes in a segment, 4) amount of sediment, structure of incoming oceanic plate, etc., as influences on **tsunamigenic** character, and 5) rock mechanics laboratory results relevant to subduction earthquake source processes.

## Modern Prediction and Response Systems for Earthquake, Tsunami, and Volcanic Hazards

***April 27-28, 1998, Santiago, Chile***

*Sponsors: International Association of Seismology and Physics of the Earth's Interior (IASPEI), International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI)*

*Contact: Bruce A. Bolt, Department of Geology and Geophysics, University of California, Berkeley, CA, USA; fax 510-845-4816; email boltuc@socrates.berkeley.edu; or J. Gutierrez, Instituto Geográfica Militar, Santiago, Chile; fax 56-2-698-8278, email igm@reuna.cl*

This meeting is a contribution of the IASPEI Commission for the IDNDR. It is planned to respond to the United Nations' call for all governments, universities, and private organizations to strengthen their IDNDR activities on natural disaster reduction. Themes for the meeting include: 1) instrumental recording system status (earthquakes, volcanoes, and **tsunamis**), 2) data acquisition state-of-the-art technology, 3) Rapid assessment of hazards in urban areas including ocean run-up, 4) early warning satellite systems for monitoring seismic, volcanic, and **tsunami** hazards, and 5) interactions between scientists, engineers, and emergency organizations. Lectures on each major topic will be by selected distinguished experts. Short papers for oral or poster presentation are also invited. The official languages will be English and Spanish.

## LDG Tsunami Workshop

***May 25-27, 1998; Paris, France***

*Sponsor: European Union; Laboratoire de Geophysique (France); UNESCO*

*Contact: B. Massinon at massinon@ldg.bruyeres.cea.fr; or Fr. Schindele (Vice-Chairman of ITSU) at schindele@ldg.bruyeres.cea.fr; fax 33-1-69-26-70-23*

The conference will be devoted to **tsunamis** of tectonic origin, landslide-generated tsunamis, tsunamis of volcanic origin, and atmospheric tsunamis. Theoretical, experimental, numerical, and observational studies are welcomed. The number of participants is limited to 100. A circular will be dispatched in September, 1997. The deadline for submission of abstracts and registration is January, 1998. The workshop sessions will be organized around the following themes: 1) **tsunami** observations, 2) **tsunami** instrumentation, 3) **tsunami** prediction and simulations, 4) **tsunami** warning systems, and 5) **tsunami** mitigation.

## PACON 98: Eighth Pacific Congress on Marine Science and Technology

***June 16-20, 1998, Seoul, Korea***

*Sponsors: Korea Ocean Research and Development Institute; American Geophysical Union*

*Contact: N. Saxena, PO Box 11568, Honolulu, HI 96828, USA; tel 808-956-6163; fax 808-956-2580; email: saxena@wiliki.eng.hawaii.edu*

*Abstract Deadline: January 15, 1998*

The theme of PACON 98 is "Towards the 21st Century - A Pacific Era". It will bring together scholars and resource managers to address key issues concerning marine technology as related to the ocean economic potential of the region. Discussion topics include public policy, technology, economic and environmental research, and observations of the Pacific region. Specific technical sessions include: land reclamation/coastal zone development; climate change and development of the waterfront; marine application of GPS; **tsunamis**; marine environmental protection; ocean energy; and new developments in marine geologic mapping.

## Okushiri Tsunami Workshop 1998

***July 9-14, 1998, Sapporo and Okushiri, Japan***

*Contact: Fumuhiko Imamura; Disaster Control research Center; School of Engineering; Tohoku University; Aoba, Sendai 980-77; Japan; fax 81-22-217-7514; email imamura@tsunami2.civil.tohoku.ac.jp*

The year 1998 marks the fifth anniversary of the Hokkaido Nansei-oki **tsunami** which caused severe human and property damages on Okushiri Island. An international tsunami workshoop as the third in a series following the one at Catalina Island CA in 1990 and the one at Friday Harbor WA in 1995 will be held for two days at Sapporo. After the workshop the participants move to the island of Okushiri to attend the ceremony held by the Town and to visit several places at the island.

Major topics are as follows: 1) tsunamis around islands, 2) tsunamis generated by landslides and tectonic movement, 3) local tsunami runups, and 4) disater and reconstruction.

Abstract deadline: December 20, 1997.

## Early Warning Systems for the Reduction of Natural Disasters

***September 7-11, 1998, Potsdam, Federal Republic of Germany***

*Sponsors: German Federal Foreign Office, German Committee for the IDNDR, GeoForschungsZentrum Potsdam, International IDNDR Secretariat, UNESCO, ICSU SC/IDNDR, IUGG, IGU*

*Contact: GeoForschungsZentrum Potsdam (GFZ); Secretariat of LOC-EWC98; Telegrafenberg; D-14473 Potsdam, Germany; tel 49-331-288-1523; fax 49-331-288-1504; email ewc98@gfz-potsdam.de; URL http://www.gfz-potsdam.de/ewc98/*

The conference aims at critical assessment and discussion of successes, failures, potentials, and requirements for the effective use of Early Warning Systems (EWS) in disaster mitigation. The conference will: 1) offer existing "best practice" early warning system programs and intitutional capacities, 2) present the state-of-the-art in science and technology which is ready for application, and 3) discuss perspectives and requirements for future EWS. Accordingly, the conference aims at synoptic interdisciplinary presentation and discussion of the use of EWS for the detection of and appropriate reaction to imminent potential threats related to: 1) geo-hazards including tsunamis, 2) hydro-meterological hazards, 3) other envoironmental hazards including wild fires, and 4) man-made hazards.

## 8th Congress of the International Association of Engineering Geology

***Vancouver, British Columbia, Canada; September 21-25, 1998***

*For information contact: Ms. Kim Meidal, Secretariat, 8th Congress IAEG, c/o BC Hydro, 6911 Southpoint Drive, Burnaby, BC, Canada, V3N 4X8; Tel. 604-528-2421; Fax: 604-528-2558;*
*Email: kim.meidal@bchydro.bc.ca*

The 8th Congress of the International Association of Engineering Geology is scheduled for about a year from now. The general theme of the meeting is "Engineering Geology, A Global View from the Pacific Rim." Although the initial announcement doesn't specifically mention tsunamis, two of the meeting themes are "Engineering Geology and Natural Hazards" and "Coastal and Offshore Engineering". A complete announcememnt can be obtained by visiting the meeting website at the following URL:

http://www.bchydro.bc.ca/bchydro/IAEG/IAEG98.html

# PUBLICATIONS

## Science of Tsunami Hazards

*published by the Tsunami Society*

**Volume 14, Number 3**

Predicting tsunami amplitudes along the North American coast from tsunamis generated in the northwest Pacific Ocean during tsunami warnings, Paul M. Whitmore and Thomas J. Sokolowski

Damages to coastal structures in Awaji and Toban coasts due to the 1995 Hyogoken Nanbu Earthquake, Shigenobu Tanaka and Shinji Sato

Spectral decomposition in the wave propagator approach to finite -element tsunami modeling, Stefano Tinti, Elizabeth Bortolucci, and Alessio Piatanesi

Propagation and runup of tsunami waves generated by Mt. St. Augustine Volcano, Alaska, Jurgen Kienle, Zygmunt Kowalik, and Elena Troshina

**Volume 15, Number 1**

The minor destructive tsunami occurring near Antofagasta, northern Chile, July 30, 1995, Jorge Ramirez, Hernan Titichoca, James F. Lander, and Lowell S. Whiteside

The wave forms and directivity of a tsunami generated by and earthquake and a landslide, S. I. Iwasaki

Modeling the 1994 Skagway tsunami, Charles L. Mader

Investigation of wave characteristics induced by tsunami wave entering enclosed water areas, Leonid B. Chubarov, Zinaida I Fedotova, and Dmitrii A Shkuropatsky

## Tsunami Runup Mapping as an Emergency Management Preparedness Planning Tool: The 1929 Tsunami in St. Lawrence, Newfoundland

*A complimentary copy of this report was kindly sent to ITIC at the request of the author, Alan Ruffman, by Emergency Preparedness Canada.*

Emergency Preparedness Canada has recently published a two-volume report on a study of the November 18, 1929 tsunami that struck the Burin Peninsula of Newfoundland Canada with runups as high as 27m. Careful mapping of the runup data, gathered through oral histories of senior community members, shows that development is steadily encroaching into the 1929 inundation zone. The work was done by Alan Ruffman of Geomarine Associates Ltd. and was part of the Canadian framework for the International Decade for Natural Disaster Reduction. For information on the report and how it may be obtained, contact: Jacques Hénault; Emergency Preparedness Canada; 2nd Floor, Jackson Building; 122 Bank Street; Ottawa, Ontario K1A 0W6; tel 613-991-7072; fax 613-996-0995; email deval@epc.gc.ca

## Other Publications Received at ITIC

*The following recent tsunami-related publications were kindly sent to ITIC at no cost by the authors or publishers, and are gratefully acknowledged.*

A.A.Nikonov, Tsunami Occurrence on the Coasts of the Black Sea and the Sea of Azov, *Izvestiya, Physics of the Solid Earth*, Vol. 33, No. 1, pp. 77-87, 1997. (reprint)

Wolfgang Kron, Erich Plate, and Sabine Vollmer, *Natural Disasters and Disaster Reduction*, 75 pp., German IDNDR Committee, Potsdam Germany, 1996.

*Flooding and Insurance*, 79 pp., Munich Reinsurance Company, 1997.

## Tsunami Animations

Charles L. Mader has recently distributed a series of tsunami animations on CDROM that can be viewed on a personal computer. The animations are based on the SWAN numerical modeling code described in his book entitled *Numerical Modeling of Water Waves*. The series includes wave animations of many historical tsunamis, including the 1960- Chile tsunami at generation, in mid-ocean, and impacting the coast of Hilo, Hawaii. It also includes postulated tsunamis, as for example ones due to asteroid impacts, to a massive Hawaii landslide, and to a great Cascadia subduction earthquake. Information about the availability of the CDROM can be obtained by contacting: Mader Consulting Company; 1049 Kamehame Drive; Honolulu, HI 96825; Tel and Fax 808-396-9855.

## Tsunami Wave Hydrodynamics

*by Efim Pelinovsky (274p)*

This book is dedicated to the theory of hydrodynamics of tsunami waves at all stages: from the zone of wave generation to waves climbing a beach. Various mechanisms of tsunami wave generation by bottom deformation (piston, membrane, and running), seismic processes, underwater volcanic eruptions, and moving atmospheric perturbations are considered. Tsunami wave propagation is studied from the viewpoint of ray theory including the effects of wave trapping by bottom inhomogeneities and nonlinear effects. At the stage of the tsunami wave transformation in the coastal zone and their climbing a beach, the nonlinear effects become determining and various approximated theories are described in the book. Data from theoretical

models are used for the analysis and interpretation of the available empirical data on tsunami waves. Particular attention is paid to recent tsunamis, in particular, the Okushiri tsunami of 1993, Shikotan tsunami of 1994, and the 1996 tsunami on Sulawesi Island (Indonesia) - a research expedition in which the author took part. The problems of remote tsunami diagnostics and sediment transport in tsunami waves are also discussed.

The book is intended for specialists in geophysics and oceanology, as well as for students of related disciplines. For further information about the book, and how it can be obtained, contact Dr. Efim N. Pelinovsky; Applied Physics Institute; Academy of Sciences; Ul'Yanova 46; 603600 Gorky; RUSSIA, or email:

enpeli@appl.sci-nnov.ru

## Tsunamis Affecting Alaska, 1737-1996

The U.S. National Geophysical Data Center (NGDC), and the co-located World Data Center-A for Solid Earth Geophysics have compiled a unique set of tsunami-related products as part of a continuing program to support the interests of seismologists, engineers, oceanographers, and the general public. These data products include technical publications, photographs, and historic tsunami data.

The NGDC recently published the third in a series of informative publications about tsunamis by James F. Lander, entitled *Tsunamis Affecting Alaska, 1737-1996.* The catalog describes all known tsunamis that have affected Alaska in historic time, expanding the information provided in *United States Tsunamis, 1690-1988.* Detailed descriptive information is included to better characterize the tsunami hazard. The text is illustrated with pictures, tables, marigrams, and other figures. A separate section is included for the Prince William Sound event of 1964. The 195-page publication is available in soft cover format for US$15 plus shipping and handling.
To receive information about, or to order any of the NGDC tsunami-related products, contact: National Geophysical Data Center; 325 Broadway, E/GC4, Dept. 988; Boulder, CO 80303-3328; USA; tel 303-497-6277 fax 303-497-6513.

## Tsunami Publications List

*The following list of tsunami-related publications are compiled from the GeoRef database, searching all fields for the terms tsunami(s), tidal wave(s), and seismic sea wave(s). The entire database currently contains over two thousand tsunami references, but only those published in the years 1996 and 1997 are shown here. They are ordered first by year and second by author.*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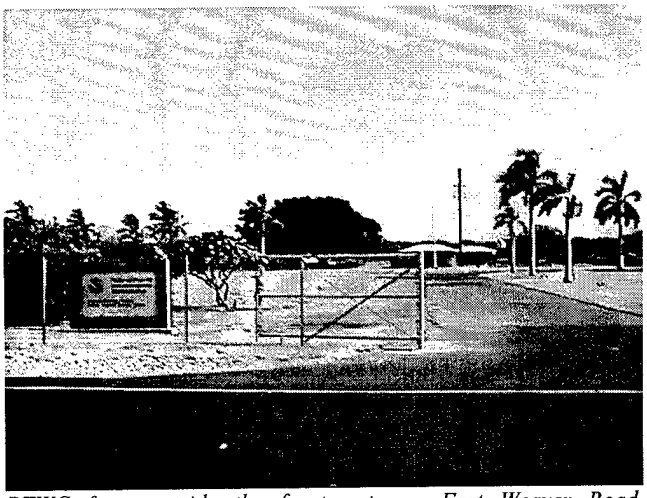
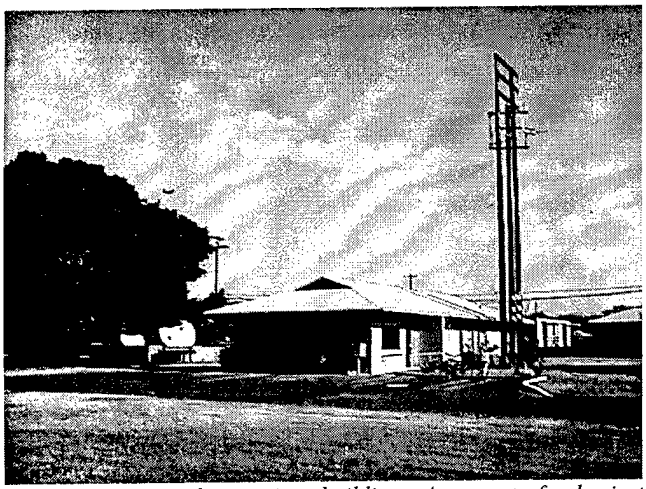
## PTWC Modernization Report

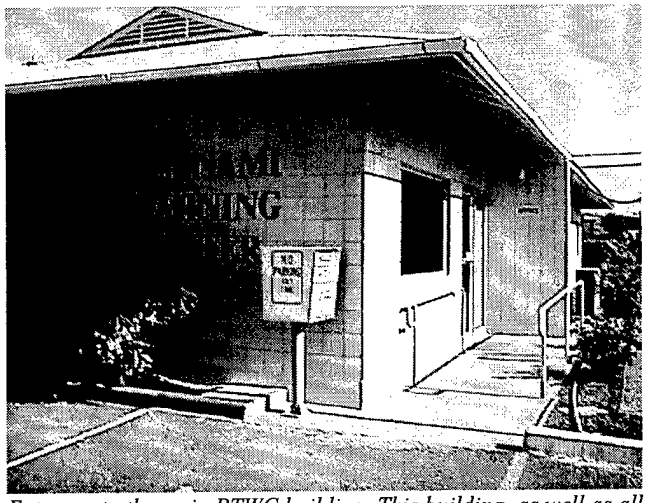
Several years ago, the Pacific Tsunami Warning Center (PTWC) began the start of a long modernization process that has included changes to nearly all aspects of the Center including facilities, signal transmission and processing equipment, message communications equipment, computers, and software. Although the effort is still continuing, much of the work has now been completed and is presented in the following photo report.



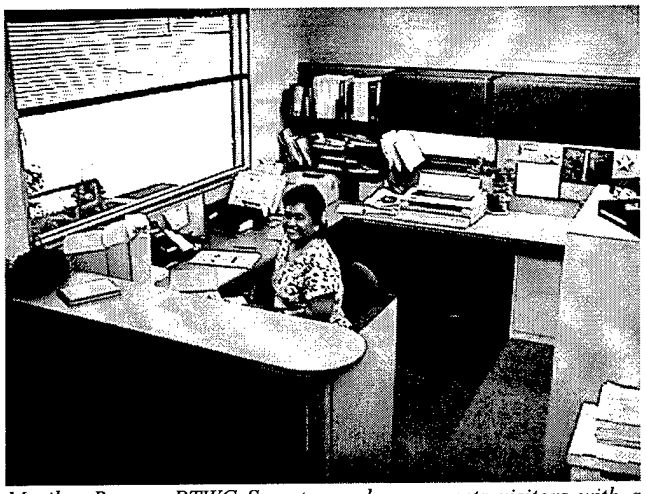
*PTWC from outside the front gate on Fort Weaver Road. Although the facility is now completely enclosed by a new security fence, visitors are still welcome. The grounds also contain four houses as living quarters for the watchstanding staff, and a fifth. house is being built.*



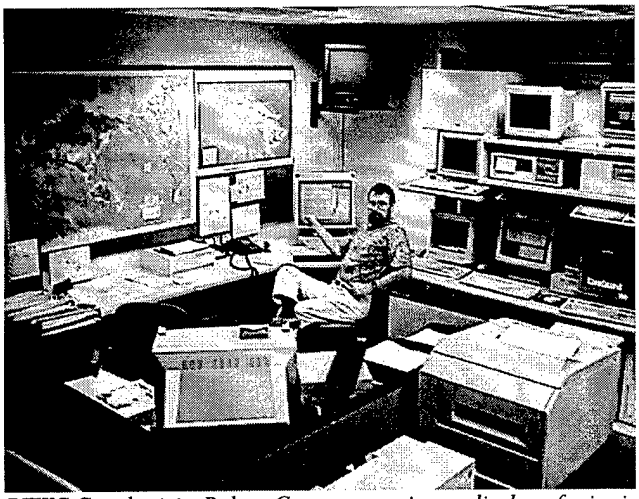
*The main office and operations building. A new set of poles just to the right of the building are for VHF radio antennas used to receive local seismic and water level data transmissions. To the left of the building are satellite antennas associated with a message dissemination circuit.*



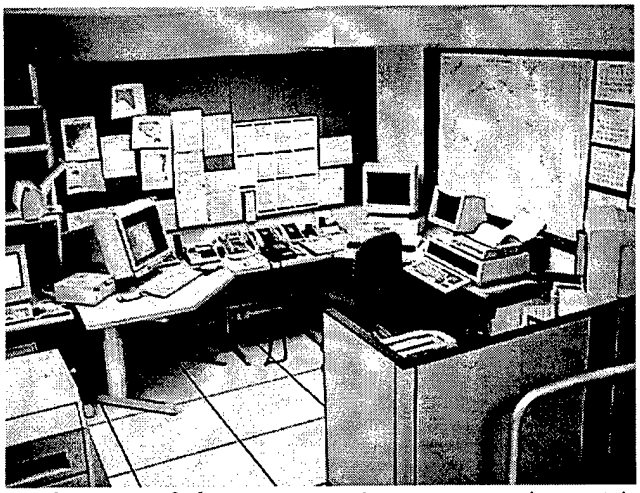
*Entrance to the main PTWC building. This building, as well as all other operations buildings and watchstander houses have recently been reroofed and painted. Even the mailbox in front of the building is new.*



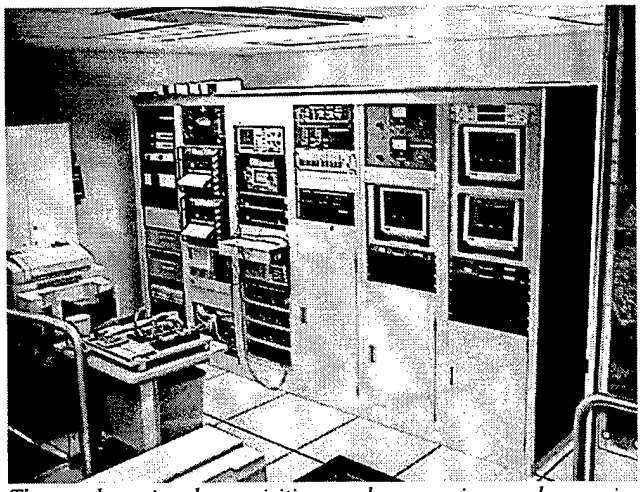
*Marilyn Ramos, PTWC Secretary, always greets visitors with a warm smile. Her office, along with all others, has been recently refurbished with more functional modern office furnishings.*



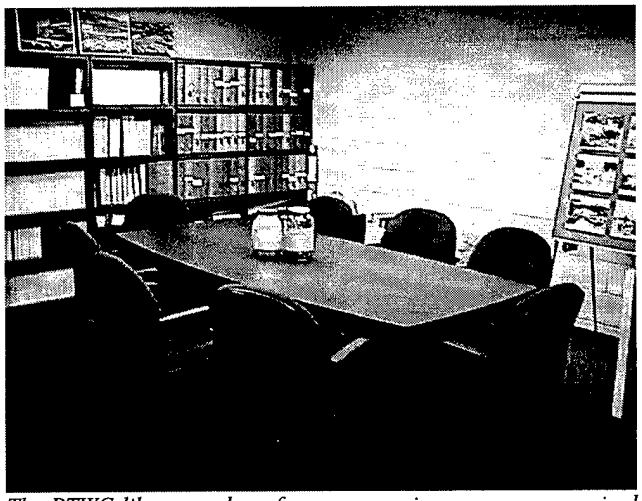
*PTWC Geophysicist Robert Cessaro examines a display of seismic signals on a computer in the main operations area. Workstation and micro computers in this area are for digital data acquisition and processing, as well as message generation and dissemination.*



*Another part of the main operations area contains certain communications equipment, and redundant back-up computers.*



*The analog signal acquisition and processing racks receive seismic and water level signals from a variety of sources, and by a variety of means. After amplification and filtering, most of the signals are then digitized for further processing by computers. These racks also contain seismic alarms that alert watchstanders whenever a certain seismic signal threshold is exceeded.*



*The PTWC library and conference room is now more organized and comfortable. It is used for staff meetings, and for briefings to small groups of visitors.*

*The staff offices are located behind the operations area.*

*Next to the main office is the Electronics Shop where the various seismic, water level, and communications equipment are built, tested, or repaired by a staff of electronics technicians.*

# Summary of Pacific Basin Earthquakes: July - December, 1996

## with Surface Wave or Moment Magnitudes Greater than or Equal to 6.5

*(data provided by PTWC, ATWC, JMA, and NEIC)*

| Event | Date | Location | Time UTC | Lat. | Lon. | Dep. (km) | Ms | Mw | Action | Issued UTC | Tsu-nami |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 96-26 | Jul 15 | Guerrero, Mexico | 2123Z | 17.6N | 101.0W | 18 | 6.5 | 6.6 | PTWC/TIB | 2216Z | |
| 96-27 | Jul 16 | Sulawesi, Indonesia | 1008Z | 1.0N | 120.3E | 33 | 6.4 | 6.6 | | | |
| 96-28 | Jul 22 | Sulawesi, Indonesia | 1420Z | 1.0N | 120.5E | 33 | 6.9 | 6.9 | PTWC/TIB | 1530Z | |
| 96-29 | Jul 23 | South of Fiji Islands | 0332Z | 26.8S | 177.2W | 33 | 6.4 | 6.5 | PTWC/TIB | 0436Z | |
| 96-30 | Aug 2 | Solomon Islands | 1255Z | 10.8S | 161.4E | 33 | 7.1 | 6.9 | PTWC/TIB | 1339Z | |
| 96-31 | Aug 5 | Tonga Islands | 0209Z | 15.3S | 173.1W | 41 | 6.7 | 6.7 | PTWC/TIB | 0300Z | |
| 96-32 | Aug 5 | Fiji Islands Region | 2238Z | 20.7S | 178.3W | 550 | 6.4* | 7.3 | PTWC/TIB | 2329Z | |
| 96-33 | Sep 5 | Easter Island Region | 0814Z | 22.1S | 113.4W | 10 | 7.0 | 6.7 | PTWC/TIB | 0908Z | Yes |
| 96-34 | Sep 5 | Taiwan Region | 2342Z | 21.9S | 121.5E | 20 | 6.6 | 6.6 | PTWC/TIB | 0043Z | |
| 96-35 | Sep 20 | Mindinao, Philippines | 0410Z | 7.5N | 126.3E | 33 | 6.4 | 6.6 | | | |
| 96-36 | Oct 14 | Solomon Islands | 2326Z | 7.1S | 155.6E | 24 | 6.9 | 6.7 | PTWC/TIB | 0013Z | |
| 96-37 | Oct 18 | Kyushu, Japan | 1050Z | 30.6N | 131.1E | 10 | 6.6 | 6.8 | PTWC/TIB | 1156Z | Yes |
| 96-38 | Oct 19 | Kyushu, Japan | 1445Z | 31.9N | 131.5E | 22 | 6.6 | 7.0 | PTWC/TIB | 1527Z | Yes |
| 96-39 | Oct 19 | Fiji Islands Region | 1454Z | 20.4S | 178.5W | 591 | 6.1* | 6.8 | | | |
| 96-40 | Nov 5 | Kermadec Is. Region | 0942Z | 31.2S | 180.0E | 369 | 5.9* | 6.7 | | | |
| 96-41 | Nov 6 | Bonin Islands Region | 2001Z | 28.0N | 143.5E | 9 | 6.5 | 6.4 | PTWC/TIB | 2040Z | |
| 96-42 | Nov 12 | Near Coast of Peru | 1700Z | 15.0S | 75.7W | 33 | 7.3 | 7.7 | PTWC/TIB | 1805Z | Yes |
| 96-43 | Dec 2 | Kyushu, Japan | 2218Z | 31.8N | 131.3E | 49 | 6.6 | 6.7 | | | Yes |
| 96-44 | Dec 22 | Eastern Sea of Japan | 1453Z | 43.2N | 138.9E | 227 | 6.0* | 6.5 | PTWC/TIB | 1529Z | |

* *indicates mb for the case of deeper focus earthquakes*

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