

Tsunami Newsletter



INTERNATIONAL TSUNAMI INFORMATION CENTER - ITIC



Pictured left to right: Mike Kitamura (for US Senator Akaka), US Congressman Eni Faleomavaega (American Samoa), Jeanne Johnston (1946 Hilo Tsunami survivor), Rev. John Clyde Millen, Chip McCreery (PTWC Geophysicist in Charge), Kumu John Lake, Helen Hagemeyer, John Kelly, Jr. (Director of the US National Weather Service), Jim Weyman (Acting NWS Pacific Region Director and Acting US ICG/ITSU National Contact), Willie Espero (Ewa/Waipahu District Hawaii State Representative) and Edward Teixeira (Hawaii Civil Defense).

PTWC renamed in honor of 'Dick' Hagemeyer

The Pacific Tsunami Warning Center was formally renamed the Richard H. Hagemeyer Pacific Tsunami Warning Center on December 1, 2001. The renaming ceremony, presided over by Acting Regional Director, Jim Weyman, took place outside the operations office on the grounds of the warning center in Ewa Beach, Hawaii. The name change is made in memory of the National Weather Service Pacific Regional Director, who died on October 24, 2001. Mr. Hagemeyer, was the National Representative for the United States to the International Coordinating Group for the Tsunami Warning System in the Pacific (ICG/ITSU). He is remembered for his strong support of the warning center and tsunami mitigation in general.

The Center was previously called The Honolulu Observatory, while under the US Department of Commerce's Coast and Geodetic Survey. At that time, it was the operational center for the original Seismic Sea Wave Warning System. This early detection and communication system began in 1948, in response to the destructive 1946 tsunami that killed 159 people in Hawaii and left many more injured or homeless. In 1970 the Honolulu Observatory was renamed the Pacific Tsunami Warning Center under the direction of the newly established National Oceanic and Atmospheric Administration. Operations at the Center will not be affected by the name change.

ITIC NEWS

MICHAEL BLACKFORD RETIRES

February 1, 2002 Michael Blackford retires as Director of ITIC. His 35 year career in the U.S. Federal Government included participation in earthquake research projects with a NOAA Environmental Research Laboratory, as well as work at the US Geological Survey, NOAA's West Coast & Alaska Tsunami Warning Center and the U.S. Nuclear Regulatory Commission. In 1991 he returned to NOAA to work at the Pacific Tsunami Warning Center, first as a staff geophysicist, and then in August 1991 as its Geophysicist-in-Charge. In October 1997 he became Director of the ITIC.

"While I'm retiring from a formal position, I'm not planning on retiring from the science of tsunamis very soon. I plan on staying in Hawaii for a number of months helping with various outreach programs and Tsunami Society's symposium in May and then returning to California to be closer to my family. I hope to start working this coming summer on the task of evaluating the Tsunami Warning System in the Pacific (ITSU), which was assigned to me at the 18th meeting of the ICG/ITSU in Cartagena last October. I also hope to assist those who are engaged in projects involved with upgrading the tsunami databases wherever and however I can."

LAURA KONG BECOMES ITIC DIRECTOR

Laura Kong started working at ITIC on December 31 and replaces Mike Blackford, as he retires. She holds a Doctorate degree in Marine Seismology from MIT/Woods Hole Oceanographic Institute in Massachusetts. Her experience in tsunami mitigation includes having been State Tsunami Advisor for the State of Hawaii for the past several years. She is presently Chair of the Hawaii State Earthquake Advisory Committee, a group she has been involved with since 1994. Previously, she was a geophysicist at PTWC from 1991-1993 and has worked at the USGS/Hawaiian Volcano Observatory and the University of Hawaii, Hawaii Institute of Geophysics. She did her post-doctoral research at the Earthquake Research Institute, University of Tokyo University, Japan. She comes to the position with expertise and experience in: 1. Rapid, robust, automated, intelligent data acquisition and analysis methods for evaluating local, regional, and teleseismic earthquakes for tsunamigenic potential, and dissemination of warning information; 2. Working with emergency response officials, the media, and the public, 3. Operational knowledge of international, national, and Hawai'i regional seismic networks, and familiarity with site installations, analog and digital radio and microwave telemetry schemes for waveform and parametric data sharing.

"I look forward to actively engaging Member States in improving their tsunami warning capabilities, and to establishing and re-invigorating partnerships between governmental agencies, scientists, and emergency managers so that we can collectively move forward into the 21st century. In the United States, the National Tsunami Hazard Mitigation Program (NTHMP) embarks on its second 5-year plan to reduce the impacts of tsunamis to US coastal areas with stable funding from the National Oceanographic and Atmospheric Administration; its successful State and Federal partnership highlights the importance of local emergency management considerations and priorities in implementing tsunami warning systems. Moreover, ITIC hopes that the infrastructure and resources established by the NTHMP will provide for better opportunities for collaboration and cooperation in the international arena.

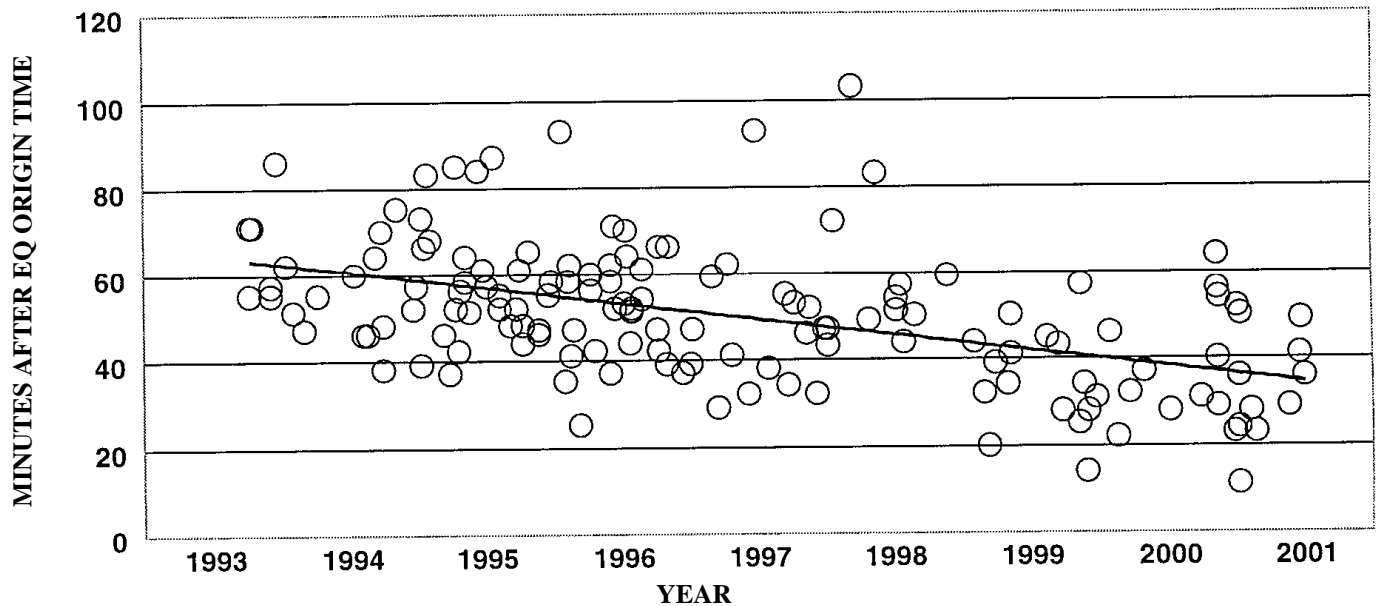
Tsunami warning systems and research scientists have already taken advantage of the leaps in information, computation, engineering, and telecommunications technology to make inroads into real-time earthquake source characterization, tsunami propagation and run-up modelling, and deployment of real-time instrumentation in the deep ocean and on remote islands or locations once deemed impossible. Significantly greater quantities of high-quality data can now be efficiently and rapidly acquired and quickly analyzed to provide warning center scientists and emergency officials with better information on which to base their decisions. Our challenge is now to ensure that all Member States, as well as other nations expressing interest, have access to these capabilities and products. Finally, in spite of all these wonderful advances, we must not forget that technology can only do so much, and that paramount to any successful tsunami hazard mitigation effort is a proactive education and public awareness program that reaches and prepares every citizen on how to respond to a potentially tsunamigenic earthquake."

JAMES WEYMAN IS ACTING ICG/ITSU U.S. NATIONAL CONTACT AND THE US TSUNAMI PROGRAM MANAGER

John Kelly, Jr., Director of the National Weather Service (NWS), appointed James (Jim) Weyman Acting Director of the NWS Pacific Region shortly after the untimely death of Richard Hagemeyer. Mr. Weyman is the Meteorologist-in-Charge of the Honolulu Forecast Office. Upon assuming his role as the Acting Regional Director, he became the Acting Tsunami Program Manager as well, a responsibility assigned to the Pacific Region Director according to the NWS Operations Manual. He is also the Acting National Contact to the International Coordinating Group for the Tsunami Warning System in the Pacific (ICG/ITSU).

Since assuming the position, Jim has attended a meeting of the National Tsunami Hazard Mitigation Program and met with scientists and emergency managers, who have briefed him on the program's goals. He oversaw the rededication of the Pacific Tsunami Warning Center (PTWC) as the Richard H. Hagemeyer PTWC and recently hosted a visit by the NWS Alaska Regional Director, Richard Przywarty. He took Mr. Przywarty to PTWC for a tour of the facilities and an explanation of the operations. In late January he went to Alaska, accompanied by new ITIC Director Laura Kong and Chip McCreery of PTWC, for a similar tour and presentation at the West Coast/Alaska Tsunami Warning Center in Palmer, Alaska.

TIME TAKEN TO ISSUE PTWC BULLETINS IMPROVING



The Pacific Tsunami Warning Center recently compiled data on the time of issuance of its bulletins measured relative to earthquake origin time (see graph above). The data show that since 1994 the elapsed time has been steadily decreasing, with a significant reduction beginning in about 1999. Average elapsed times have dropped from about 60 minutes in 1994 to less than 40 minutes now. This is an important performance improvement since quicker issuance times permit warning threatened areas closer to the epicenter and also provide additional evacuation time for those areas further away.

In addition, coastal areas can be alerted more quickly when there is no tsunami threat. This progress is the result of the overall modernization of the Center

since 1994 with faster computers and methodologies as well as a transition from analog helicorder seismic data to digital seismic data streams. The reduction in 1999 is due to the implementation of the USGS-designed "Earthworm" digital data exchange and processing system. Using this system, PTWC now receives data from about eighty broadband seismic sensors from across the Pacific for more rapid and accurate locations and magnitudes. Another reduction in bulletin issuance times is expected later this year when PTWC will begin using the earthquake's moment magnitude, M_w , instead of its Richter surface wave magnitude, M , for the magnitude criteria. M_w can be measured using seismic P waves that travel much faster than seismic surface waves needed for M . This should result in faster bulletins.

COMMENTS SOUGHT FOR UNISDR DOCUMENT

A paper entitled, "Natural Disasters and Sustainable Development: Understanding the Links between Development, Environment and Natural Disasters" is being discussed and revised as a contribution by United Nation's International Strategy for Disaster Reduction (UNISDR) to the World Summit on Sustainable Development (WSSD) to be held in Johannesburg in September 2002. The paper will enter its next cycle of discussion at the second meeting of the Preparatory Committee for WSSD to be held in New York this month. The ISDR Secretariat plans to continue developing this document by discussing it at additional sector stakeholder and regional meetings of ISDR. Revised and expanded versions will be presented at future meetings of the Preparatory Committee (New York in March, Jakarta in May 2002) and at the WSSD itself. In order to encourage comments to UNISDR, ITIC will fax or mail this document to any Member State parties unable to view it on the Web <http://www.unisdr.org/unisdr/wssdisdrdoc.pdf>

PTWC TECHNICAN VISITS SOUTH AMERICA



INOCAR technicians with PTWC's Nygard in La Libertad, Ecuador

Last November and December, Richard Nygard, Senior Electronic Technician at PTWC, visited three naval oceanographical, and/or hydrographic organizations in South America to perform system installations and upgrades, and training in support of the Pacific Tsunami Warning System.

In La Libertad, Ecuador, Nygard, with the assistance of personnel from [Instituto Oceanográfico de la Armada \(INOCAR\)](#), re-

activated the site and installed a new tsunami/tide system. The new system, comprised of a Vaisala 555 Data Collection Platform (DCP), Druck submersible pressure transducer, and Vaisala incremental encoder sensor, will provide more timely and accurate readings of water level. On site training was provided to INOCAR personnel on system programming, on-line testing, and maintenance requirements.

At [Base Naval del Callao](#), Peru, PTWC and Civilian Navy personnel upgraded the existing system from a Handar 540 system to the new Vaisala 555 DCP tsunami/tide system; containing a Druck submersible pressure transducer, Vaisala incremental encoder sensor, and wind, air/sea temperature, and barometric pressure meteorological sensors. Training was provided so that on-site Navy personnel could continue to perform on-site system maintenance

In Valparaiso, Chile, Nygard visited [Servicio Hidrográfico y Oceanográfico de la Armada \(SHOA\)](#), to provide system training and technical assistance. The formal classroom training to 9 SHOA Naval personnel consisted of an overview of the Vaisala tsunami/tide system, followed by instructions on system programming, on-line testing, and maintenance requirements. Additionally, on-site training was given at Valparaiso Harbor on the operation and installation of the Vaisala incremental encoder and PCMICIA modem. Finally, Nygard made a successful site visit to Coquimbo, Chile, to interface and test the Hydrolabs Quanta Water Quality system, and carried out a site survey in preparation for the future installation of a Vaisala incremental encoder system at this site.

PTWC would like to extend its appreciation to these organizations and their staff for their assistance in ensuring that technical requirements are continually met and enhanced, and for their support in regularly maintaining instrumentation critical to the continued operation of the Tsunami Warning System.

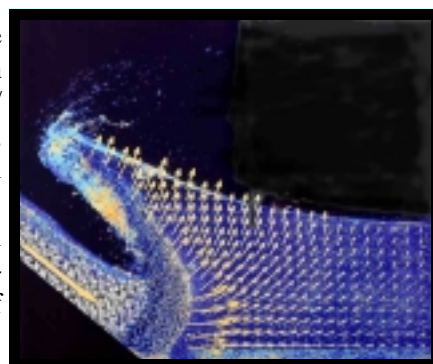
UPCOMING CONFERENCES

25-28 May, 2nd Annual Tsunami Symposium in Honolulu Hawaii. The Tsunami Society. East-West Center, University of Hawaii. Registration forms and additional information can be found at <http://www.sthjourn.org/stsa.htm>. For additional information call Mr. George Curtis, 808-963-6670, e-mail gcurtis@hawaii.edu, or Dr. Barbara Keating 808-956-8143, e-mail keating@soest.hawaii.edu.

In addition to the General Session (see below) the conference will include a session on National Hazard Mitigation, chaired by Eddie N. Bernard of PMEL and a workshop chaired by Barbara Keating of University of Hawaii. Field trips are also planned.

General Session—George Curtis, Chairman

- ◆ The Late Minoan Tsunami in the Eastern Mediterranean: A Re-Examination, Dale Dominey-Howes, Kingston University, UK
- ◆ Relations Between Tsunami Calculations and Their Physics, Zygmunt Kowalik, University of Alaska, AK
- ◆ Tsunami Vulnerability Assessment in Greece by using GIS, M. Papathoma, D. Dominey-Howes, Y. Zong, D. Smith, Coventry University, UK
- ◆ Tsunami Hazards in Canada, John J. Clauge, Adam Munro, Tad Murty, Simon Fraser University, Canada
- ◆ Geomorphic Evidence and C14 Dating Results for Tsunamis in Cyprus, Franziska Whelan and Dieter Kelletat, University of Bamberg, Germany
- ◆ Evidences of Tsunamis on Curacao, Bonair and Aruba, Anja Scheffers, University of Essen, Germany
- ◆ An Assessment of Tsunami Hazard and Risk in the Indonesian Region, Jack Rynn, Centre for Earthquake Research in Australia, Brisbane, Australia
- ◆ Evaluation of the Tsunami Hazards for Western Puerto Rico and Eastern Hispaniola in the Caribbean Sea Region, Aurelio Mercado and W. McCann, University of Puerto Rico, Mayaguez, Puerto Rico
- ◆ Elevated Strandlines - Not Tsunami Deposits on Lanai, Hawaii, Barbara H. Keating and Charles E. Hellsley, University of Hawaii, Honolulu, Hawaii, USA
- ◆ The Lituya Bay Mega-Tsunami, Charles L. Mader, Mader Consulting Co., Honolulu, HI, USA and Hermann M. Fritz, VAW, Zurich, Switzerland
- ◆ Queens Beach Tsunami Deposit - Baseline Study, Barbara H. Keating, University of Hawaii, Honolulu, HI
- ◆ The Landslide Origin of The Aleutian Tsunami of 1946 - Implications for Tsunami Warning, Gerard J. Fryer, University of Hawaii, Honolulu, Hawaii, USA
- ◆ Volcanically Generated Tsunamis, George Pararas-Carayannis, Honolulu, HI, USA
- ◆ Hydrodynamics of Megaclast Emplacement and Transport on a Shore Platform, Oahu, Hawaii, Riko Noor-mets, University of Stockholm, Sweden - Keith A. W. Crook and E. Anne Felton, University of Hawaii
- ◆ The Momentum of Tsunami Waves, Harold G. Loomis, Honolulu, HI, USA



Graphic—Hermann Fritz.

9-12 July 2002, Western Pacific Geophysics Meeting 2002, Wellington, New Zealand. **Ocean Sciences Special Session #10; Tsunami, Storm Surge, Relative Sea-Level and Coastal Change**, A special session proposed by A.C. Hinton (a,b) and W.P. de Lange (a) Department of Earth Sciences, University of Waikato, Private Bag 3105, Hamilton, New Zealand (b) School of Geography, Leeds University, Leeds, LS2 9JT, U.K. Email: a.c.hinton@leeds.ac.uk or w.delange@waikato.ac.nz. Please see <http://www.agu.org/meetings/wp02top.html> for details of the meeting and abstract submission deadlines.

The Pacific Rim is characterised by seismic activity and noted for major landslides, including those with submarine origins and from oceanic island coasts. The consequences of these events have often led to major tsunami affecting the shores of the Pacific Ocean. Much of the Pacific coast is also open to tropical cyclones and other large storms. Distinguishing palaeotsunami sedimentary sequences from those of storm surges, especially with poor, and often only localised, preservation of material, is an important issue that has only received a reasonable amount of attention in the last decade. Furthermore, there are examples of apparently excellent preservation of beaches raised by tectonic activity that have been, subsequent to their uplift,

CONFERENCES CONTINUED ON NEXT PAGE

UPCOMING CONFERENCES (CON'T)

inundated by a tsunami generated by the same event and yet remain, to all intents and purposes, intact. It is important to examine the tsunami generating mechanisms and wave characteristics for such cases. What can this tell us about the record of what has happened to a coast? Equally, how does this compare with the nature of modification to coastal zones that are down-thrown by fault movement and affected by similar events? How may numerical modelling help to identify areas of resonance and amplification of waves for the determination of hazard zones?

Papers are sought, which address these issues, from historical, sedimentary and modelling studies. In particular we're interested in papers addressing the problem of separating the effects of tsunami, storm surge and sea level variations as preserved in the sedimentary record. This Special Session is linked with IGCP 437.

14-15 August, The 5th New Zealand Natural Hazards Management Conference 2002 Te Papa, Wellington, New Zealand. The Institute of Geological and Nuclear Sciences (GNS), the National Institute of Water and Atmospheric Research (NIWA), Ministry of Civil Defence and Emergency Management, Wellington City Emergency Management Office, Wellington Regional Council, and the Earthquake Commission (EQC) invite you and your colleagues to participate in the 5th New Zealand Natural Hazards Management Conference in August 2002.

The focus of the conference is to provide a forum to discuss the integration of hazard information into effective risk management, including:

- +Applying hazard information to best practice planning
- + Exploring new technologies - advances in science application
- +Natural hazard mitigation for industry
- +Creating resilient communities through integrating science and practice

Several pre conference short courses are planned. A one-day optional field trip is planned for Friday 16 August 2002. Registration & programme details will be sent out late May 2002. For further information please contact: Diane Tilyard, Wairakei Research Centre, Institute of Geological & Nuclear Sciences, Private Bag 2000, TAUPU New Zealand. Phone: (07) 374 8211 Fax: (07) 374 8199 or Email: d.tilyard@gns.cri.nz. This information is taken from <http://www.gns.cri.nz/news/conferences/hazconf2002.htm>.

Sept 10-15, Local Tsunami Warning and Mitigation. International Workshop organized by IUGG Tsunami Commission (IUGG/TC) and the

International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) Petropavlovsk-Kamchatskiy, Russia. Co-conveners are Dr. Joanne (Jody) Bourgeois (j.bourgeo@u.washington.edu) and Dr. Mikhail Nosov (psiwc47@phys.msu.su). The purpose of the workshop is to consider the current status of the local tsunami problem and to discuss fundamental and applied studies directed toward reduction of local tsunami hazard. The result of the workshop will be recommendations on strategies for local tsunami warning and mitigation. The scope of the workshop will cover:

- *Historical Catalogues and Databases
- *Seismo-tectonics of tsunami
- *Numerical and analytical models of local tsunami behavior
- *Combination of local tsunamis with other dangerous oceanic phenomena
- *Mitigation and Counter-measures
- *Recent local tsunamis
- *Tsunami geology and paleotsunamis
- *Tsunami measurement and data analysis
- *Landslides and other sources

Participants who wish to give a presentation are required to complete a pre-registration form and submit an abstract by April 30, 2002. The homepage of the workshop is found at <http://oceanc47.phys.msu.su/>.

3-6 Oct, HAZARDS 2002 SYMPOSIUM

Ninth International Symposium on Natural and Human-made Hazards "**Disaster Mitigation in the Perspective of the New Millennium**", Antalya, Turkey. Natural Hazards Society Organizing Committee headed by Professor Dr. Nuray Karanci and Associate Professor Dr. Ahmet C Yalciner, Middle East Technical University, Turkey. HAZARDS 2002 is about geological, meteorological, hydrological, marine, and human-made hazards, in general, with the following topics being covered specifically at this symposium:

- Disaster prevention, mitigation and management,
- Economic, social and political aspects,
- Public education & preparedness, Lessons from past disasters,
- Community participation in disaster mitigation,
- Adaptation and risk assessment, -Insurance,
- Psychological and sociological aspects of disaster,
- Disaster information,
- Tele & local tsunamis (generation, propagation, modeling)
- Avalanches and snow hazards,
- The IDNDR and ISDR: Lessons learned & follow ups,
- NGO, NPO & volunteer contributions

To learn more about the conference see the Web site: <http://www.hazards2002.metu.edu.tr>

INTERNATIONAL TSUNAMI INFORMATION CENTER (ITIC)



Located in Honolulu, the **International Tsunami Information Center (ITIC)** was established on 12 November 1965 by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO). In 1968, IOC formed an International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU). The present 25 Member States are:

Australia, Canada, Chile, China, Colombia, Cook Islands, Costa Rica, Democratic People's Republic of Korea, Ecuador, Fiji, France, Guatemala, Indonesia, Japan, Mexico, New Zealand, Nicaragua, Peru, Philippines, Republic of Korea, Singapore, Thailand, Russian Federation, United States of America, and Western Samoa.

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[http://www.shoa.cl/oceano/itic/
frontpage.html](http://www.shoa.cl/oceano/itic/frontpage.html)

SUMMARY OF PACIFIC BASIN EARTHQUAKES

Occurring December 2001-January 31, 2002

*With surface wave or moment magnitudes greater than or equal to 6.5,
with a depth no greater than 100 km, or an event for which a TIB or RWW was issued.*

DATE	LOCATION	TIME (UTC)	LAT.	LONG.	DEPTH (km)	Ms	Mw	PTWC ACTION	AC- TION (UTC)	Tsunami
Dec 12	South of Australia	14:03	42.8 S	124.7 E	17	6.7	7.1	—	—	No
Dec 18	Taiwan Region	04:03	23.9	122.9 E	14	7.3	6.9	TIB	04:31	Yes
Dec 23	Solomon Islands	22:53	9.5 S	159.5 E	33	7.0	6.8	TIB	23:17	No
Jan 2	Vicinity of Vanuatu	17:23	17.7 S	168.0 E	21	7.5	7.3	TIB	17:55	Yes
Jan 3	Vicinity of Vanuatu	10:18	17.9 S	168.1 E	29	6.4	6.7	TIB	10:40	Yes (slight)
Jan 10	Near N Coast of Papua New Guinea	11:15	3.0 S	141.9 E	11	6.6	6.7	TIB	11:45	No

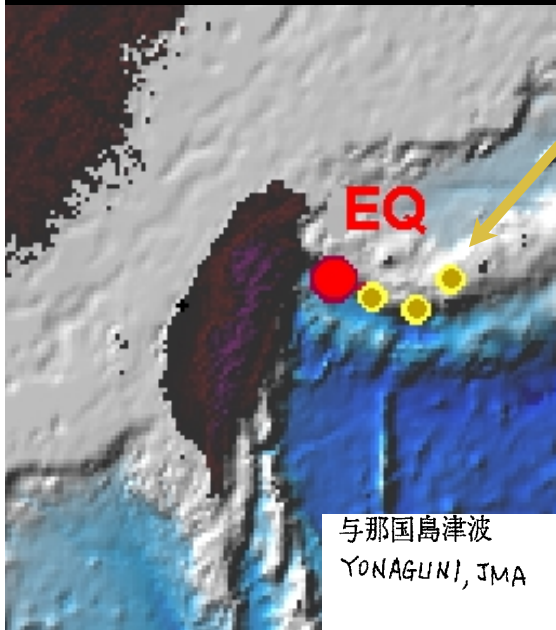
TIB=Tsunami Information Bulletin

18 Dec 2001 04:03 UTC TAIWAN Region 23.9N 122.9 E Ms=7.3 Mw=6.9

The earthquake was strongly felt in much of northern Taiwan, measuring a 4 in Ilan County, and a 3 in Taipei and Hualien, out of a maximum value of 7 on Taiwan's scale of tremor-intensity. It was the strongest earthquake in Taiwan since the July 16, 2001, M7.0 event. The earthquake occurred in the region where the Philippine Plate is subducting into the Ryukyu Oceanic Trench and colliding with the Eurasian Plate. Dozens of aftershocks were felt, including M5.0 and M4.9 earthquakes within the first hour after the event. As a precaution, Taipei shut down its mass rapid transit system immediately after the noontime event, but reopened it 16 minutes later after safety concerns had been addressed.

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18 Dec 2001 04:03 UTC TAIWAN Region —Continued



STATION (location)	ARRIVAL TIME (JST)	POLARITY	MAXIMUM HEIGHT (time)
YONAGUNI (24d 27' N, 122d 57' E)	13 h 13m	down	13 cm (13 h 18m JST)
IRIOMOTE (24d 23' N, 123d 45' E)	13 h 40 m	down	20 cm (13 h 46 m JST)
UEHARA (24d 25' N, 123 d 48'E)	—	—	11 cm (13 h 49 m JST)
ISHIGAKI (24 d 20' N, 124 d 09' E)	—	—	5 cm (14 h 00 m JST)

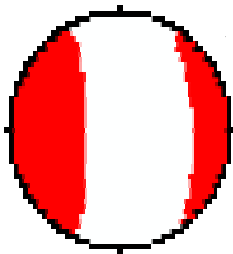
Thanks to Michio Takahashi of JMA for sending tide station data to ITIC.

与那国島津波
YONAGUNI, JMA



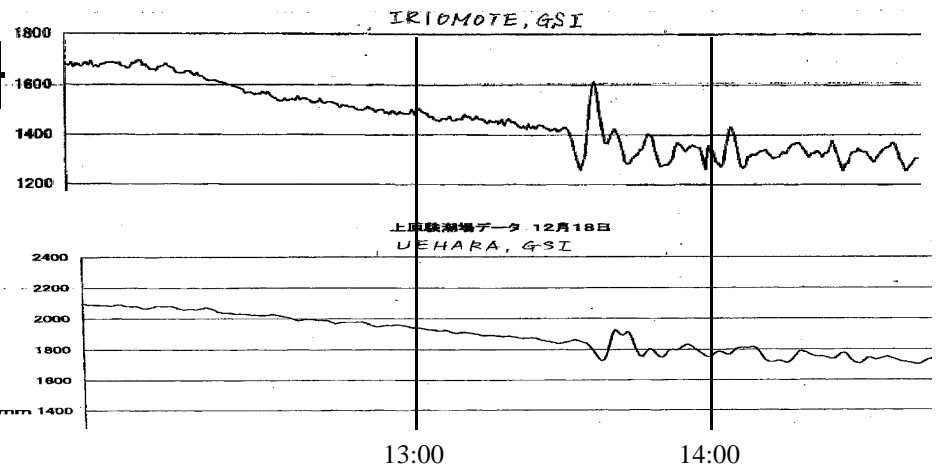
Harvard Centroid

Date: 2001/12/18
Centroid Time: 4: 3: 4.2
GMT Lat= 24.09 Lon=
122.78 Depth= 22.6



Half duration= 6.9

Centroid time minus hypocenter time: 4.2
Moment Tensor: Expo=26 -1.590 -0.660
2.250 0.040 0.990 -0.120
Mw = 6.8 mb = 6.7 Ms = 6.7 Scalar
Moment = 2.16e+26
Fault plane: strike=353 dip=32 slip=-
97



2 Jan 2002 17:23 UTC VANUATU 17.7 S 168.0 E Ms=7.5 Mw=7.3

A summary of damage caused by this earthquake and a description of the tsunami are included as a supplement to this newsletter as provided by Graham Shorten of SOPAC. The full report can be obtained online at:
<http://www.sopac.org.fj/Data/virlib/reportsindex.html>



HARVARD CENTROID MOMENT TENSOR:

Date: 2002/ 1/ 2 Centroid Time: 17:23: 5.8 GMT Lat= -
17.80 Lon= 167.81 Depth= 36.9 Half duration=10.4
Centroid time minus hypocenter time: 15.8
Moment Tensor: Expo=26 2.060 -0.740 -1.320 -1.900 -
8.160 2.000 Mw = 7.2 mb = 7.3 Ms = 7.3 Scalar Moment =
8.71e+26 Fault plane: strike=298 dip=14 slip=20 Fault

