



Contents

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Special features

Role of catastrophe modeling for estimating risk 1
 Australian Tsunami Warning System 4
 WSSPC Awards in Excellence 2005 5
 Governor Gregoire’s press releases 6, 24
 Investigations of historical earthquake theories 14
 Historical tsunami databases 15
 Earth Science Week CD 4
 Earthquake Tsunami Connection 16
 Tsunami glossary, part 3 13
 NOAA Weather Radio 22
 Personal Workplace Disaster Supplies Kit 23

Departments

Hazard Mitigation News 7
 Publications 7
 Websites/Listservs 9
 Conferences/symposia/meetings 10
 Material added to NTHMP Library 17
 IAQ 18
 Video Reservations 21
 State Emergency Management Offices 19
 NTHMP Steering Group Directory 20
 Grants/Contracts 12

THE ROLE OF CATASTROPHE MODELING FOR ESTIMATING RISKS

By Howard Kunreuther, The Wharton School, University of Pennsylvania

From: Natural Hazards Observer, v. 30, no. 1, p. 9-10.

<http://www.colorado.edu/hazards/o/sept05/sept05d.html>

Before Hurricane Hugo swept through Georgia and North and South Carolina in 1989, the insurance industry in the United States had never suffered a loss of more than \$1 billion from a single disaster. Since then, numerous catastrophes have exceeded that figure. Hurricane Andrew in 1992 caused \$15.5 billion in insured losses in southern Florida and Louisiana. Damage from the Northridge earthquake in California in January 1994 amounted to \$12.5 billion. Residential and commercial development along coastlines and areas that are earthquake- and hurricane-prone suggest that future disaster losses will only grow—a trend that emphasizes, as never before, the need to assess and manage risk on both a national and a global scale. People are now asking the question, “How do we scientifically evaluate catastrophic risk?”

Who Needs Catastrophe Modeling and Why?

Businesses are clearly interested in evaluating risk because they need to know more about the nature of the risks they face, their likelihood of occurrence, and the damage that may well result. Insurers are interested because they need to know what premiums to set for different types of risk in the context of their overall risk portfolio. And the government is interested because it needs to know what regulations and standards would be appropriate to lessen risk and reduce losses.

Catastrophe models play a key role in addressing these issues with respect to natural disasters by

identifying and quantifying the likelihood of specific events occurring in different parts of the country and estimating the extent of losses likely to be incurred. Such estimates can be based on past data (e.g., loss history in a specific region) coupled with data on what experts know about a particular risk through the use of catastrophe models.

The Structure of Catastrophe Models

The four basic components of a catastrophe model are hazard, inventory, vulnerability, and loss as depicted in Figure 1 and which will be illustrated using a hurricane as an example. First, the model characterizes the risk of the hazard phenomenon, which in the case of a hurricane is characterized by its projected path and wind speed. Next, the model characterizes the inventory (or portfolio) of properties at risk as accurately as possible by first assigning geographic coordinates, such as latitude and longitude, to properties based on street addresses, zip codes, or other location descriptors and determining how many structures in the insurer’s portfolio are at risk from hurricanes of different wind speeds and projected paths. In addition to each property’s spatial location, other factors that characterize the inventory at risk are the construction type, the number of stories in the structure, and its age.

(continued on page 3)

TsuInfo Alert

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Participants in the TsuInfo program can request copies of reports listed in this issue from:

Washington Geology Library
Washington Department of Natural Resources
Division of Geology and Earth Resources
1111 Washington Street SE, MS 47007
Olympia, WA 98504-7007
360/902-1473
fax: 360/902-1785
e-mail: lee.walkling@wadnr.gov

The views expressed herein are those of the authors and not necessarily those of
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WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands



(continued from page 1)

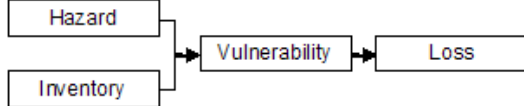


Figure 1: Structure of Catastrophe Models

The hazard and inventory modules enable the calculation of the vulnerability or susceptibility to damage of the structures at risk. In essence, this step in the catastrophe model quantifies the physical impact of the natural hazard phenomenon on the property at risk. How this vulnerability is quantified differs from model to model. Based on this measure of vulnerability, the loss to the property inventory is evaluated. In a catastrophe model, loss is characterized as direct or indirect in nature. Direct losses include the cost to repair and/or replace a structure. Indirect losses include business interruption impacts and relocation costs of residents forced to evacuate their homes.

Exceedance Probability

Catastrophe models were introduced in the mid-1980s but did not gain widespread attention until after Hurricane Andrew hit southern Florida in August 1992. Nine insurers became insolvent as a result of the losses they incurred from Andrew. Insurers and reinsurers realized that in order to reduce the likelihood of a very severe loss relative to their surplus (capital) they needed to estimate and manage their natural hazards risk more precisely. Many companies turned to the modelers of catastrophe risk for decision support.

Based on the outputs of a catastrophe model, one can construct an exceedance probability (EP) curve that specifies the probabilities that a certain level of losses will be exceeded. The losses can be measured in terms of dollars of damage, fatalities, illness, or some other unit of analysis. To illustrate with a specific example, suppose one were interested in constructing an EP curve for an insurer with a given portfolio of insurance policies covering wind damage from hurricanes in a southeastern U.S. coastal community. Using probabilistic risk assessment, one would combine the set of events that could produce a given dollar loss and then determine the resulting probabilities of exceeding losses of different magnitudes. Based on these estimates, one can construct a mean EP curve, such as the one depicted in Figure 2. The x-axis measures the loss to the insurer in dollars and the y-axis depicts the probability that losses will exceed a particular level. Suppose the insurer focuses on a specific

loss L_i . One can see from the figure below that the likelihood that insured losses exceed L_i is given by p_i .

An insurer utilizes its EP curve to determine how many structures to include in its portfolio given that there is some chance that there will be hurricanes causing damage to some subset of its policies during a given year. More specifically, if the insurer wanted to reduce the probability of a loss from hurricanes that exceeds L_i to be less than p_i it will have to determine what strategy to follow. The insurer could reduce the number of policies in force for these hazards, decide not to offer this type of coverage at all (if permitted to do so by law), or increase the capital available for dealing with future catastrophic events.

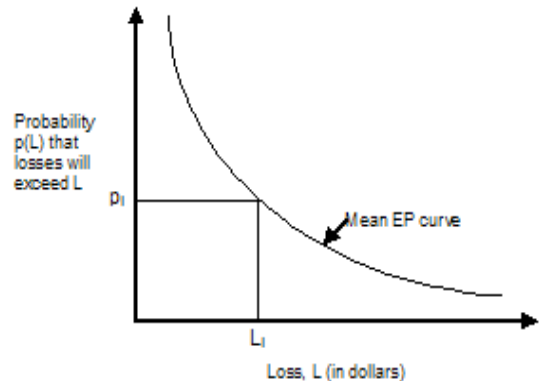


Figure 2: Sample Mean Exceedance Probability (EP) Curve

In developing an EP curve it is important to also indicate the uncertainties in estimates of the probability of an event occurring and the magnitude of dollar losses. This uncertainty can be reflected in curves surrounding the mean EP curve. These confidence intervals (e.g., 5 percent and 95 percent) depict the ranges of values that probabilities can take for a specified loss (L_i) and that losses can take for a specified probability (p_i). To construct these EP curves experts are forced to make explicit the assumptions on which they are basing their estimates of the likelihood of certain events occurring and the resulting consequences. This approach thus provides an important link between risk assessment by scientists and engineers and risk management by policy analysts and key decision makers.

Federal and state agencies may want to use EP curves for estimating the likelihood that losses to specific communities or regions of the country from natural disasters in the coming year will exceed certain levels in order to determine

the chances that it will have to provide disaster assistance. At the start of the 2004 hurricane season, Florida could have used EP curves to estimate the likelihood of damage exceeding \$21 billion that year. This probability would have been extremely low even though we now know that a confluence of events (i.e., Charley, Frances, Ivan, and Jeanne) was able to produce an outcome that exceeded this dollar value.

Recognizing that disasters can wreak enormous havoc, catastrophe modeling has already gained widespread acceptance and is being relied upon to support a wide range of risk management strategies involving both the public and private sectors. The extent of future disaster losses can go either way. Wider use of catastrophe modeling could help steer the course away from the escalating losses that we are experiencing today.

Note: The use of catastrophe modeling for estimating the risks from natural hazards is described in a new book edited by Kunreuther and Patricia Grossi titled *Catastrophe Modeling: A New Approach to Managing Risk* (**Springer 2005**). The book was written jointly with the three leading modeling firms (AIR Worldwide, EQECAT, and Risk Management Solutions) and researchers from the Wharton School, University of Pennsylvania. ♦

The Australian Tsunami Warning System

Joint media release by the Minister for Foreign Affairs, Alexander Downer, and the Attorney-General, Philip Ruddock: National Tsunami Warning System. 11 May 2005
<http://www.ga.gov.au/urban/geohazardupdates/tsunami/#tews>

In the 2005-2006 Federal Budget handed down on 10 May 2005, the Government announced an important new initiative that will have a significant impact on Geoscience Australia.

The initiative is the Australian Tsunami Warning System. It will contribute to an Indian Ocean Tsunami Warning System (IOTWS) and integrate with the existing Pacific Tsunami Warning Centre to facilitate warnings to the South West Pacific region.

The Government has allocated \$68.9 million for the system over a four year period. Geoscience Australia and the Bureau of Meteorology will jointly operate the system around-the-clock, and Emergency Management Australia will

handle the public awareness and disaster response aspects of the system.

Geoscience Australia's share of the \$68.9 million is \$21.2 million, the Bureau of Meteorology's share is \$40.3 million, and Emergency Management Australia's share is \$7.2 million. AusAid will also be providing \$2 million each to Geoscience Australia and the Bureau of Meteorology for overseas technical assistance and training to build in-country capacity.



Geoscience Australia's \$21.2 million is for the updating of Australia's seismic monitoring capability, and the development

of an around-the-clock operations and analysis centre. The Bureau of Meteorology's \$40.3 million is for new and upgraded sea-level gauges and Deep-Ocean Assessment and Reporting of Tsunamis (DART) buoys, and for the enhancement of their around-the-clock operations and analysis centre. Emergency Management Australia's \$7.2 million is for public and institutional awareness education and training.

The purpose of the Australian Tsunami Warning System is to:

- *reduce loss of life in the event of a tsunami affecting the Australian coast;
- *mitigate tsunami risks for operations at sea and in coastal waters, and;
- *reduce the impact of tsunamis on essential infrastructure in our coastal regions. ♦

EARTH SCIENCE WEEK

Every year during the second week of October, the American Geological Institute (AGI) sponsors Earth Science Week to promote geoscience education and awareness of the importance of earth sciences.

This year the ESW kit contains *TsunamiReady Education CD* by the National Oceanic and Atmospheric Administration's National Weather Service Office of Education and Sustainable Development. The material is for grade levels K-12, and includes textbooks and teachers' guides in both doc and pdf files. A copy, with the complete ESW kit, can be purchased for \$4.95 from <http://www.earthsciweek.org/materials/index.html>; or you can borrow the NTHMP copy for a 1-week loan. See contact information on page 2.

WSSPC Awards in Excellence 2005 Award Recipients

Awards Presented at the WSSPC
Annual Conference, September 14,
2005

Award Category: Overall Excellence in Mitigation and Educational Outreach to Schools

Administering Agency:
**Washington State
Military Department,
Emergency
Management Division**
Program Name:
[Earthquake Program
Video: "Run to High
Ground!"](#)

Award Category: Educational Outreach to Schools (2 Winners)

Administering Agency:
**Los Angeles County
Office of Emergency
Management**
Program Name: [ESP
Activity Book for Kids](#)

Administering Agency:
**Utah Seismic Safety
Commission and Utah
Division of Emergency
Services**
Program Name: [Student
Research Grant Program](#)

Award Category: Educational Outreach to General Public (2 Winners)

Administering Agency:
**Alaska Division of
Homeland Security
and Emergency
Management**

Earthquake Program
Name: [Program Booklet:
"Are You Prepared for
the Next Big Earthquake
in Alaska?"](#)

Administering Agency:
**City of Seaside,
Oregon**
Program Name: [Seaside
Tsunami Outreach
Project](#)

Award Category: Mitigation

Administering Agency:
**Nez Perce County,
State of Idaho**
Program Name: [Nez
Perce County Local
Hazard Mitigation Plan](#)

Award Category: Research

Administering Agency:
**Utah Geological
Survey**
Program Name: [Utah
Quaternary Fault
Parameters Working
Group](#)

Award Category: Response Plans/Materials

Administering Agency: **Utah Seismic
Safety Commission,
Geoscience Standing Committee**
Program Name: [Booklet: "Utah
Earthquake Ground-Shaking Maps:
Which One Do I Use?"](#)

From:
<http://www.wsspc.org/Awards/2005/index.htm> ♦

WASHINGTON STATE

OFFICE OF GOVERNOR CHRISTINE GREGOIRE

FOR IMMEDIATE RELEASE - August 8, 2005

Contact: Governor's Communications Office,
360-902-4136

Governor Gregoire announces steps to improve state's tsunami preparedness
Governor calls on local, state, federal and tribal governments to work together to increase preparedness

OLYMPIA – Aug. 8, 2005 – Gov. Christine Gregoire today announced plans designed to improve the state's tsunami preparedness and mitigate the effects of a large tsunami wave on public health and safety. The governor, along with Maj. Gen. Tim Lowenberg, director of the state's military department, and Grays Harbor County Commissioner Al Carter, made the announcement at a press conference at Ocean Shores, Wash.

"Our state has long been a leader in tsunami preparedness, but we must do more," said Gregoire. "The time between an offshore earthquake and the potential arrival of large tsunami waves could be very short. We need every possible minute to warn the public so they can move to safe ground."

On June 14, an earthquake off the coast of California caused a tsunami warning to be issued for the West Coast, including the coastal areas of Washington state. The quake did not cause a damaging tsunami wave, so the warning was canceled a little over an hour later.

"This warning was a sharp reminder that ocean buoys located near Hawaii may not provide enough time for people to move to safety when an earthquake near the West Coast triggers a tsunami," said Gregoire.

Washington is ranked second behind California in terms of potential economic loss due to earthquakes and tsunamis. The governor's plan includes six key points critical to tsunami preparedness in the state. Those steps include:

--- Improving our detection network. The governor pledged to work with the state's Congressional delegation to support a significant new tsunami detection and warning program. The governor will seek assurances that the necessary buoys and detection equipment are

adequately funded and properly located to warn of the tsunami risks along our coast.

--- Asking the Legislature for funding to accelerate the construction and installation of local tsunami warning systems, and asking federal agencies to match or exceed the state's contribution. Funding requests will also include all weather radios for schools and public facilities along the coast. This local broadcast network will supplement the federal system by ensuring that the word of an oncoming tsunami gets out quickly.

--- Ensuring that all levels of government come together in a unified response. The governor has asked the state's Emergency Management Division to secure agreements between local, state, federal and tribal governments to provide a consistent tsunami warning and response.

--- Improving public education and awareness through the Emergency Management Division by developing a sustained education campaign that will significantly increase the readiness of both children and adults to respond properly in the event of a tsunami warning. The governor will also ask that public education be a significant feature of the new federal tsunami program.

--- Improving tsunami evacuation routes by establishing a complete geological map of the roads to determine what road improvements must be made in order that the public will be able to move quickly and safely to higher ground. While the state currently has "Tsunami Evacuation Route" signs posted along highways in vulnerable areas, the governor asked the Emergency Management Division to improve the public's ability to evacuate safely along these roads by working with local jurisdictions, public land managers and owners of private roads to encourage agreements that allow for emergency access to safe, higher ground. The governor pledged to ask for legislation during the 2006 legislative session to provide access while protecting landowners if necessary.

--- Improving building standards in high risk, low-elevation areas. In some coastal areas, the roads may be damaged by the quake before the waves arrive, requiring people to take refuge in or on buildings that can withstand both the quake and the tsunami waves. ♦

From:

<http://www.governor.wa.gov/news/news-view.asp?pressRelease=122&newsType=1>

NEWS

Congratulations PAHO!

The newsletter *Disasters—Preparedness and Mitigation in the Americas* just released its 100th issue.

The Pan American Health Organization began publication in 1979, with a hand-typed quarterly newsletter. Then, as now, its mission is to “showcase the initiatives and steps taken by countries in Latin America and the Caribbean (and beyond) to prepare for and respond to the health consequences of disasters.” The entire issue is online at <http://www.paho.org/English/DD/PED/NL100e.pdf>.

Washington’s governor asks for additional tsunami funding for warning system

Aug. 8, 2005. Major General Timothy Lowenberg, director of Washington’s Emergency Management Division, and Governor Christine Gregoire held a press conference in Ocean Shores addressing the issue of an improved tsunami warning system for the coast.

The governor will seek federal funds and federal cooperation, in addition to state funding, to install more All-Hazard Alert Broadcasting systems in coastal communities. Maj. Gen. Lowenberg stated that 90 more units would be needed to protect the entire Washington coast.

According to the AP report, Governor Gregoire also asked for more tsunami monitoring buoys, a coordinated response among all levels of government, improved public education, improved evacuation routes, and better building standards.

September Is [Was] National Preparedness Month

September 2005 marks the second annual National Preparedness Month, the nationwide effort to encourage Americans to prepare for emergencies in their homes, businesses, and schools. Throughout the month, the U.S. Department of Homeland Security and the American Red Cross (cosponsors) will work with a National Preparedness Month Coalition, which consists of a wide variety of public and private sector organizations, to educate the public about the importance of emergency preparedness.

These organizations will provide information, host events, and sponsor activities that disseminate emergency preparedness messages to, and encourage action in, their customers, members, employees, stakeholders, and

communities across the country. Specifically, these activities will urge Americans to get emergency kits, make emergency plans, educate themselves about the threats to their communities, and get involved with their communities’ preparedness efforts (e.g., the American Red Cross, Citizen Corps).

For more information about National Preparedness Month, including a calendar of events and a list of coalition members, visit <http://www.ready.gov/npm/>.

From: *Natural Hazards Observer*, v. 30, no. 1, p. 6

First East Coast TsunamiReady Community Recognized

In early July, the National Weather Service recognized central Florida’s Indian Harbour Beach as the first community on the east coast of the United States to become TsunamiReady. TsunamiReady is a voluntary, community-based program that stems from the National Weather Service’s StormReady initiative. Both programs foster a well-designed emergency response plan on a community-by-community basis. As of August 1, there were 22 TsunamiReady communities across six states. For more information about the TsunamiReady program, see the November 2004 (pp. 11-12) and July 2005 (pp. 5-6) issues of the [*Natural Hazards*] *Observer* or visit <http://www.tsunamiready.noaa.gov/>.

PUBLICATIONS

What is a Disaster? New Answers to Old Questions

What is a Disaster? New Answers to Old Questions is the title of a new volume, edited by R. W. Perry and E. L. Quarantelli, which addresses this most basic questions: that of defining the phenomenon. It is important that researchers begin to develop a consensus about the meaning of disasters and related phenomena and this book brings together 12 social scientists to share their definition and vision of disasters. In the process, a wide range of views are expressed and issues raised regarding the relationship of academic vs. practical definitions and the impact of grouping types of disasters in different ways. The editors close the volume with discussions of an agenda for disaster research in the twenty-first century.

The book, published in 2005 and available in English only, can be purchased from Xlibris

Publishers, (www.Xlibris.com;
Orders@Xlibris.com) for US\$25.

From: Disasters-Preparedness and
Mitigation in the Americas, Bulletin 100, p. 6.

Disaster Research (DR)

Every other Friday, the Natural Hazards Center distributes an e-newsletter, Disaster Research (DR), which features timely announcements about new policies and programs, funding opportunities, calls for papers and presentations, upcoming conferences, Internet resources, job openings, and other information useful to researchers, practitioners, policy makers, and students in the field of hazards and disasters. The DR complements the Observer and while there is some information overlap between the two publications the DR often contains time sensitive information that the Observer cannot. The Center welcomes and encourages the submission of news, announcements, and questions for DR readers (a readily available network of experts). All contributions and queries for the DR should be indicated as such and e-mailed to hazctr@colorado.edu.

From: Natural Hazards Observer, v. 30, no. 1, p. 3.

The Social Contours of Risk.

Jeanne X. Kasperson and Roger E. Kasperson. Volume 1: Public, Risk Communication & the Social Amplification of Risk. ISBN 1-84407-073-5. 2005. 376 pp. £24.95. Volume 2: Risk Analysis, Corporations and the Globalization of Risk. ISBN 1-84407-175-8. 344 pp. £24.95. Published by Earth-scan. Available from Macmillan Distribution, Direct Customer Services, Brunel Road, Houndmills, Basingstoke, Hampshire RG21 6XS, UK; +44 (0) 1256 302699; e-mail: orders@earthscan.co.uk; <http://www.earthscan.co.uk/>.

Volume 1 of this two-book examination of the social dimensions of risk collects the authors' fundamental work on how risks are communicated among different publics and stakeholders, including local communities, corporations, and the larger society. It analyzes the problems of lack of transparency and trust and explores how even minor effects can be amplified and distorted through media and social responses, preventing effective management. Additionally, it investigates the ethical issues raised by the unequal distribution of risk depending on factors such as wealth, location, and genetic inheritance.

Volume 2 focuses on the analysis and management of risk in society, in international

business and multinationals, and globally. It reviews the structures and processes for managing risks in the private sector and the factors that produce or impede effective decisions. The authors also discuss the transfer of corporate risk management systems from Industrial to developing countries, how globalization is spreading and creating new kinds of risk, and the new priorities and capacities needed to deal with these enhanced vulnerabilities around the globe.

From: Natural Hazards Observer, v. 30, no. 1, p. 19

The Bridge

Vol. 35, No. 2, Summer 2005. 52 pp. Available free online from the National Academy of Engineering of the National Academies, 500 Fifth Street NW, Washington, DC 20001; (202) 334-3200; <http://www.nae.edu/NAE/bridgecom.nsf/weblink/s/MKEZ-6DJKL9?OpenDocument>.

This issue of *The Bridge* focuses on various aspects of the recent tsunami disaster. The featured articles are "Lessons in Engineering from the Tsunami in Thailand," "Tsunami Simulations and Numerical Models," "Tsunami Warning Systems," and "The Megatsunami of December 26, 2004."

From: Natural Hazards Observer, v. 30, no. 1, p. 20

After the Tsunami: Rapid Environmental Assessment

United Nations Environment Programme (UNEP) Asian Tsunami Task Force. ISBN 92-807-2565-3. 2005. 140 pp. \$20.00. Available free online from UNEP, PO Box 30552, Nairobi, Kenya; ++254 (0) 20 62 1234; e-mail: cpinfo@unep.org; <http://www.unep.org/>.

This report is the product of close cooperation between UNEP and national environmental authorities and experts. It provides a preliminary ground-level look at the tsunami's impact on various sectors of the region's environment. Problems in need of immediate attention are highlighted in a manner that underscores the strong link between environment and sustainable livelihood and the need for improved early warning and disaster preparedness systems. Looking forward, the report examines how the affected regions are rebuilding and how future tragedy can be avoided through adequate planning.

From: Natural Hazards Observer, v. 30, no. 1, p. 20-21

The Raging Sea: The Powerful Account of the Worst Tsunami in U.S. History

Dennis M. Powers. ISBN 0-8065-2682-3. 2005. 288 pp. \$15.95. Available from Kensington Publishing Corp., 850 Third Avenue, New York, NY 10022; (877) 422-3665; <http://www.kensingtonbooks.com/>.

On Good Friday in 1964, the town of Crescent City, California, was caught unawares by a tsunami generated by an earthquake thousands of miles away. This book tells the tale of this natural disaster, which killed eleven people, ravaged thirty city blocks, and damaged or destroyed 289 homes and businesses, by weaving historical research together with survivor accounts.

From: *Natural Hazards Observer*, v. 30, no. 1, p. 21

Scenario for a Magnitude 6.7 Earthquake on the Seattle Fault

The Scenario for a Magnitude 6.7 Earthquake on the Seattle Fault is the culmination of a three-year study led by a 12-member multi-disciplinary project team of scientists, engineers, planners, emergency managers, and social scientists. Staff from the [Washington] Military Department's Emergency Management Division participated on the project team and managed completion of the project during the past year.

Copies of the scenario publication are available at the Washington State Department of Printing Fulfillment Center website <https://fortress.wa.gov/prt/printwa/wsprt/default.asp> for the cost of shipping and handling. Cost per copy varies by the number of copies ordered.

The Disaster Mitigation Act of 2000 (Public Law 106-390 (Full-text))

The Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390) provides an opportunity for States, Tribes, and local governments to take a new and revitalized approach to mitigation planning. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Act) by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of requirements (Section 322). This new section emphasizes the need for State, Tribal, and local entities to closely coordinate mitigation planning and implementation efforts.

Section 322 continues the requirement for a State mitigation plan as a condition of disaster assistance, adding incentives for increased coordination and integration of mitigation activities at the State level through the establishment of

requirements for two different levels of State plans: "Standard" and "Enhanced." States that demonstrate an increased commitment to comprehensive mitigation planning and implementation through the development of an approved Enhanced State Plan can increase the amount of funding available through the Hazard Mitigation Grant Program (HMGP). Section 322 also established a new requirement for local mitigation plans and authorized up to 7% of HMGP funds available to a State to be used for development of State, Tribal, and local mitigation plans.

Download the *Disaster Mitigation Act of 2000* (158KB PDF, 1KB TXT) [link]. This file is provided in Adobe Acrobat Portable Document Format; to use it, you must have Adobe Acrobat Reader installed on your computer. If you have accessibility-related problems viewing the file, use Adobe's Online Converter to obtain the document in text format. Webpage last updated: Thursday, 10-Feb-2005 19:20:00 EST

From: <http://www.fema.gov/fima/dma2k.shtm>

WEBSITES

<http://www.ostp.gov/html/Tsunamiplanrelease.pdf>

U.S. Plan for an Improved Tsunami Detection and Warning System Fact Sheet. This is the text of the January 14, 2005 press release from the Office of Science and Technology Policy, Executive Office of the President.

<http://commerce.senate.gov/hearings/witnesslist.cfm?id=1591>

On July 27, the U.S. Senate Commerce Committee's Disaster Prevention and Prediction Subcommittee held a hearing to examine the need for a national all-hazards alert and public warning system. Prepared panelist testimonies and an audio transcript of the hearing are available here.

From: *Natural Hazards Observer*, v. 30, no. 1, p. 14

<http://www.englishlink.usace.army.mil/igp/>

The U.S. Army Corps of Engineers' Intergovernmental Plans Web site provides state, federal, and local governments with planning and execution guides for commodities distribution, emergency temporary power, debris removal, and more.

From: *Natural Hazards Observer*, v. 30, no. 1, p. 15

<http://dels.nas.edu/dr/f14.shtml>

Presentations from the June 21, 2005, Disasters Roundtable of the National Academies, The Indian Ocean Tsunami Disaster: Implications for U.S. and Global Disaster Reduction and Preparedness, are available here.

From: Natural Hazards Observer, v. 30, no. 1, p. 16

<http://walrus.wr.usgs.gov/tsunami/sumatra05/>

This new U.S. Geological Survey Web site, "The 26 December 2004 Indian Ocean Tsunami: Initial Findings from Sumatra," contains information gathered during an international survey conducted January 20-29, 2005, as well as more than 500 photographs.

From: Natural Hazards Observer, v. 30, no. 1, p. 16

<http://www.who.int/bulletin/volumes/83/1/71.pdf>

The January 2005 issue of the *Bulletin of the World Health Organization* featured this article, "Mental and Social Health During and After Acute Emergencies: Emerging Consensus."

From: Natural Hazards Observer, v. 30, no. 1, p. 17

<http://www.tsunamistories.net/Stories.aspx>

Personal, first-person accounts of the Sumatra earthquake/tsunami, by survivors, ages 8 and up.

CONFERENCES - SYMPOSIA

September 4-8, 2005

Asian and Pacific Coasts (APAC) 2005 Third International Conference on Asian and Pacific Coasts, Seogwipo, Korea, , 2005.
<http://wave.skku.ac.kr/APAC2005>

Indian Ocean Tsunami session to be coordinated by F. Imamura.

September – December 2005

Emergency evacuation workshop.

Organizer: National Fire Protection Association. Various dates and locations. This one-day workshop is designed for professionals concerned with preparedness and protection of facilities, such as property managers, facility managers, engineering managers, safety directors, fire service personnel, loss prevention personnel, risk managers, security managers, safety team members, and other interested individuals. For more information, visit <http://www.nfpa.org/catalog/product.asp?pid=eew>.

From: Natural Hazards Observer, v. 30, no. 1, p. 11

September 29-30, 2005

The International Workshop "Large Recent Tsunamis in the Indian Ocean and Other Regions", Santiago, Chile, in conjunction with ITSU-XX. Convened by Emilio Lorca (Chile), Viacheslav Gusiakov (Russia), Francois Schindele (France).

Following the long-term practice of having joint IUGG/TC – ICG/ITSU technical workshops in association with ICG/ITSU sessions and in response to ITSU-XIX recommendation, the International Workshop "Large Recent Tsunamis in the Indian Ocean and Other Regions" will be held in Santiago, Chile on September 29 to 30, 2005, on a week before the XX Session of the ICG/ITSU to be held in Valparaiso, Chile on October 3 to 7, 2005. The main purpose of the Workshop will be to consider the present situation with providing the safety from tsunami hazards resulted from large destructive tsunamis occurred recently and in the past., to review the existing methods of tsunami prediction and mapping of tsunami hazard, to identify the gaps in theory and practice of tsunami warning and hazard mitigation, and to consider the ways for improvements of early warning reliability.

Thanks to Wayne Johnston for this information.

October 3-7, 2005

ITSU-XX, the twentieth session of the International Coordination Group for the Tsunami Warning System in the Pacific, will be held in Valparaiso, Chile. For more information: <http://ioc3.unesco.org/itic/contents.php?id=280>.

Thanks to Wayne Johnston for this information.

October 4-7, 2005

18th Emergency Preparedness Conference—Community Resilience, a future for all. Vancouver, BC. Contact: (604) 665-6097; e-mail: info@epconference.ca; <http://www.epconference.ca/>

From: The Australian Journal of Emergency Management, v. 20, no. 3, p. 56.

October 9-12, 2005

ASBPA (American Shore and Beach Preservation Association) Fall Technical Conference. San Francisco, CA
<http://wave.skku.ac.kr/APAC2005>
Tsunami session or presentation being organized.

October 12, 2005

This year, the United Nations International Strategy for Disaster Reduction (ISDR) will celebrate the ISDR International Day for Disaster Reduction on October 12, 2005. Using microfinance and safety nets to increase disaster resilience is the primary theme of 2005's campaign. The objective is twofold: to sensitize the social and financial communities and institutions on their potential role in reducing disaster risk and to raise awareness in the disaster and risk management community of the utility of existing financial tools and safety nets to reduce the vulnerability of hazard-prone populations. Find out more from the ISDR Web site at http://www.unisdr.org/eng/public_aware/world_camp/2005/2005-press-kit.htm.

October 16-19

Geological Society of America Annual Meeting 2005, Salt Lake City, Utah
<http://www.geosociety.org/meetings/>
Special Tsunami Sessions:
Pardee Keynote Symposium:
"2004 South Asian Tsunami"
Convened by B. Atwater and J. Bourgeois
Technical Session (posters):
"Waves of Destruction: Historical and Geological Records of Tsunamis and Their Effects"
Convened by J. Bourgeois and H. MacDonald

October 20-21, 2005

North Pacific Tsunami Awareness Workshop. Palau. Contact: SOPAC, ITIC, NOAA/NWS.

October 25, 2005

Asia Earthquake and Tsunami Symposium and Reception. Los Angeles, California. Sponsored in part by the Port of Los Angeles and Psomas.
[Http://www.coprinstitute.org/events/tsunamiquake.cfm](http://www.coprinstitute.org/events/tsunamiquake.cfm)

October 26-27, 2005

Extreme Natural Hazards. London, UK. This meeting will focus on extreme geophysical and astrophysical hazards, including earthquakes, supervolcanic eruptions, tsunamis, near Earth objects, and giant landslides.
Phone: +44 (0) 207 451 2575; e-mail: discussion.meeting@royalsoc.ac.uk/;
<http://www.royalsoc.ac.us/event.asp?id=3177&month=10,2005>

From: The Australian Journal of Emergency Management, v. 20, no. 3, p. 58.

November 1-4, 2005

250th anniversary of the 1755 Lisbon Earthquake [and Tsunami]. Lisbon, Portugal. Phone: +351 21 364 94 98; e-mail: info@mundiconvenius.pt;
<http://www.mundiconvenius.pt/2005/lisbon1755/>
From: The Australian Journal of Emergency Management, v. 20, no. 3, p. 58.

November 2-3, 2005

Accessible Emergency Notification and Communication: State of the Science Conference. Presenter: The RERC on Telecommunications Access, Washington, DC.
The objectives of this conference are to identify needs and gather possible solutions for accessible emergency notification and communication; encourage interaction among industry, government, and consumer experts so that accessibility considerations are more likely to be built into notification and communication products and procedures; and create literature on the state of the science in this area. The conference is designed for accessibility experts, government representatives with responsibility for emergency communications, standards group representatives, academicians and consultants with research and technical background in emergency communications, and industry representatives. For more information, e-mail EmergencyConf@tap.gallaudet.edu;
<http://tap.gallaudet.edu/emergnecycommconf.htm>.
From: Natural Hazards Observer, v. 30, no. 1, p. 12

November 7-19, 2005

International Training Workshop on Numerical Modeling of Tsunami for Developing Countries in Southeast Asia, the Pacific, and the Indian Ocean. Quezon City, Philippines. Organized by WGSZLDC-IASPEI/IAVCEI, IOC ITIC, and PHIVOLCS.
http://ioc.unesco.org/indotsunami/capacitybuilding/modeling0511/modelin0511_intro.htm

November 12-16, 2005

IAEM 2005 Annual Conference and EMEX. Phoenix, Arizona. The purpose of this annual conference is to provide a forum to discuss current trends, topics and the latest tools and technology in emergency management and homeland security, and to advance IAEM committee work.

Phone: (703) 538-1795; e-mail:
info@iaem.com/events/
http://www.iaem.com/events/annual/intro.htm
From: The Australian Journal of Emergency
Management, v. 20, no. 3, p. 59.

November 16-18, 2005

World Conference on Disaster Reduction.
Mumbai, India. This is probably the first-ever
international conference on disaster reduction
that focuses on corporate sector's role & respon-
sibility. It will be held in India with an objective
to connect government agencies, relief organi-
zations, corporate world, and communities. The
Conference emphasizes the crucial role the cor-
porate sector could play in mitigating human
suffering wrought by disasters. Contact:
http://www.wcdr.gfdr.org/

From: The Australian Journal of Emergency
Management, v. 20, no. 3, p. 59.

November 17-19, 2005

2nd Annual Canadian Risk and Hazard
Network Symposium. Toronto, Canada.
Keynote speakers will be internationally
respected scholars, practitioners and activists
who will share leading edge knowledge and
practices in the risk and hazard fields. Contact:
http://www.crhnet2005.yorku.ca.

From: The Australian Journal of Emergency
Management, v. 20, no. 3, p. 59.

December 5-9, 2005

American Geophysical Union Fall Meeting
San Francisco, CA
http://www.agu.org/meetings/fm05/
Phone: 1-800-966-2481

Session U03: Interdisciplinary approaches to
reconstructing the 26 December 2004 Great
Sumatra-Andaman earthquake induced tsunami.

December 7-9, 2005

42nd Annual Convention and Meeting on
Earth System Processes Related to Earthquakes,
Tsunamis, and Volcanic Eruptions. Organizer:
Indian Geophysical Union. Bhopal, India. In
addition to earth system processes, other topics
will include solid earth geophysics; atmospheric,
space, and planetary sciences; marine geo-
sciences; environmental geophysics; and more.
Abstracts are due October 1, 2005. For more
information, contact P.R. Ready, Indian Geo-
physical Union, NGR. Campus, Pupal Road,
Hyderabad 500 007, India; 040-23434662; e-
mail: igu123@rediffmail.com;
http://www.igu.in/schedule.htm.

From: Natural Hazards Observer, v. 30, no.
1, p. 13

March 2-4, 2006

First international tsunami field symposium.
Bonaire, Netherlands Antilles. Symposium is
organized as a contribution to the efforts of
IGCP 495 (International Geoscience Programme
495: Quaternary Land-Ocean Interactions: Driv-
ing Mechanisms and Coastal Responses), of the
Commission on Coastal Systems of the Inter-
national Geographical Union and other scientific
bodies including the Sea Grant Program of
Puerto Rico.

May 24-25, 2006

Tsunami Symposium in Hawaii

CONTRACTS AND GRANTS

Affect, Risk, and the Tsunami Disaster.

Funding Institution: National Science
Foundation, one year. Principal Investigators:
Daniel Vastfjall (Paul Slovic, Ellen Peters),
Decision Science Research Institute, 1201 Oak
Street, Eugene, OR 97401; (541) 485-2400;
daniel.vastfjall@psy.gu.se.

How do big events like natural disasters
impact everyday behavior? By examining the
shift in the national mood of Sweden, a country
that experienced its largest national tragedy in
the last 100 years when more than 1,200 Swedes
were killed or went missing following Decem-
ber's Indian Ocean tsunami, this project studies
how individual and societal judgment and de-
cision behavior is influenced by feelings and
emotion in the aftermath of a major natural
disaster. The aim of this project is to test re-
search hypotheses about how affect experienced
by a whole nation can influence risk perceptions,
evaluative judgments, judgments about the
future, and the decision strategies people use to
mitigate their negative feelings.

From: Natural Hazards Observer, v. 30, no.
1, p. 18

Stalking Cascadia Episodic Tremor and Slip with Enhanced GPS and Seismic Arrays.

Funding Institution: National Science
Foundation, one year. Principal Investigator:
Kenneth C. Creager, University of Washington,
Earth and Space Sciences, Box 351310, Seattle,
WA 98195-1310; (206) 685-2803; e-mail:
kcc@ess.washington.edu.

Megathrust earthquakes, with similarities to
the December 2004 earthquake in Sumatra, are

thought to occur along the Cascadia subduction zone with average repeat intervals of roughly 500 years. These earthquakes accommodate the relative motion between the Juan de Fuca and North American plates along a fault that is mostly off shore but may extend onshore in places such as the Olympic Peninsula. It has been recently discovered that much, if not all, of the slip along the portion of the plate boundary just east of the megathrust earthquake zone is accommodated by episodic tremor and slip (ETS) events that occur every 14 months in the regions from the Olympic Peninsula north into Vancouver Island. This project proposes deployment of arrays of seismometers and global positioning system instrumentation in order to record and better characterize the next ETS event, which is expected to occur in August, September, or October 2005.

From: Natural Hazards Observer, v. 30, no. 1, p. 18. ♦

Tsunami Glossary, Part 3 (ITIC-UNESCO, 2003)

C

Cotidal.....indicating equality with the tides or a coincidence with the time of high or low tide.

Crest length.....the length of a wave along its crest. Sometimes called crest width.

D

Drop.....the downward change or depression in sea level associated with a tsunami, a tide, or some long term climatic effect.

E

Eddy.....by analogy with a molecule, a “glob” of fluid within the fluid mass that has a certain integrity and life history of its own; the activities of the bulk fluid being the net result of the motion of the eddies.

Elapsed time.....time between the maximum level arrival time and the arrival time of the first wave.

Estimated time of arrival (ETA).....time of tsunami arrival at some fixed location, as

estimated from modeling the speed and refraction of the tsunami waves as they travel from the source. ETA is estimated with very good precision if the bathymetry and source are well known (less than a couple of minutes).

Evacuation map.....a drawing or representation that outlines danger zones and designates limits beyond which people must be evacuated to avoid harm from tsunami waves.

H

Historical tsunami data.....Historical data are available in many forms and at many locations. The forms include published and manuscript catalogs of tsunami occurrences, marigraphs, tsunami amplitude, run-up and inundation zone measurements, field investigation reports, newspaper accounts, film or video records.

Horizontal inundation.....Distance between the inundation line and the shore, generally measured perpendicularly to the shore.

Hydraulic model.....A physical scale model of a basin or a harbor used to simulate effects of wave action or flooding caused by hurricane surge or tsunami wave activity.

Hydraulic modeling.....Mathematical formulations used in connection with a hydraulic model to simulate natural hydrologic phenomena which are considered as processes or as systems. ♦

<http://www.icecontact.com/>

The ICE (in case of emergency) campaign, which gained widespread coverage in the wake of the London bombings in July, encourages cell phone users to type the acronym ICE followed by an emergency contact name and number into the address book of their phones. This information can aid emergency responders in quickly notifying an individual's ICE contact should the need arise. The background and details of ICE can be found at this Web site. From: Natural Hazards Observer, v. 30, no. 1, p. 14

Editor's note:

Since the editor will be idling away the month of November in Sydney, Australia, the December 2005 issue of *TsuInfo Alert* might be arriving a little late. No worry, mate.

The investigation of historical earthquake theories

This is a very interesting website! It traces the evolution of earthquake theories from classical antiquity to date. It puts the historical earthquake reports in context of their times and helps modern scientists make more accurate assessments of those reports.

<http://www.univie.ac.at/Wissenschaftstheorie/heat/heat-1/heat000f.htm>

Author of the system: Erhard Oeser

Hypermedia version: Johann Stockinger

English version and terminological aspects:

Gerhard Budin

“The investigation of historical earthquake theories was started on the occasion of the first workshop of the ESC Working Group on Historical Earthquake Data (HEAT) that was held in Vienna on 24 to 27 of June 1987, where the author of the hypermedia system presented the historical earthquake theories from Aristotle to Kant. The aim of this paper (Oeser 1992) was to explain the theoretical and scientific back-ground of the contemporary authors who reported about the historical earthquakes in this period. The further development of earthquake theories after Kant was presented in the work-shops of the ESC Working Group "Historical Seismology" in Macerata (Italy) 1999 and in Vienna 2001. The historical development of the Terminology of Earthquake theories was presented in Beijing 2001.

The historical descriptions of earthquakes of the past are determined by contemporary theories that were used to interpret empirical data. This means that the analysis and reconstruction of historical earthquake theories are an integral part of today's earthquake research.

But since the different explanations come from various disciplines such as physics (mechanics, thermodynamics, theory of electricity), chemistry or astronomy or are linked to other fields such as meteorology, mineralogy, geography, etc., it is necessary to present all those fields of knowledge with their differing terminologies and explanatory claims in a context of dynamic development, that finally resulted in today's state of the art, as it was systematically founded at the beginning of the 20th century.”

[General Introduction](#)

[Earthquake Theories in Comparison](#)

[Aims, Methods, Sources of Theories](#)

[Contribution of Philosophy of Science](#)

Table of Historical Earthquakes and Volcanic Eruptions

From Aristotle to Kant

[Classical Antiquity](#)

[Middle Ages](#)

[Early Modern Times](#)

[Evolutionary Theories](#)

[Electricity](#)

[Kant](#)

18th and 19th Century

[Implications of the Lisbon Earthquake](#)

[Mechanical Theories: Mayer](#)

[Chemical Theories: Lemery, Krüger](#)

[Steam Pressure Theory: Jacobi](#)

[Hollow Sphere Theories](#)

[Pneumatic Theory: Franklin](#)

[Chemical Theory, Volcanism: Davy](#)

[Volcanism and Neptunism in the 18th Century](#)

[Neptunism: Werner](#)

[Volcanism: Michell](#)

[Combined Theories: Buffon, Pallas](#)

[Subsidence Theories](#)

[Neptunist Subsidence Theories: Mohr, Bischof](#)

[Hollow Strata Hypothesis: Volger](#)

[Non-neptunist Subsidence Theories:](#)

[Boussingault, Marenzi](#)

[Elevation Theory](#)

[Theory of Elevation Craters: von Buch](#)

[Generalized Theories: de Beaumont, Humboldt](#)

[Criticism and Rejection: Poulett-Scrope, Lyell](#)

[Actualistic Theory: Lyell](#)

[The Calabria Earthquake](#)

[Actualistic Boiler Theory](#)

[Explanation of Geysers and Refutation: Bunsen](#)

[Plutonistic Theory: Darwin](#)

[The Chile Earthquake](#)

[Lava Hypothesis](#)

[Subsidence and Elevation Earthquakes](#)

[Compensation of Stress and Dislocation](#)

[Humboldt's Volcanism](#)

[Cumana and Caracas Earthquakes](#)

[Mechanism of Volcanoes](#)

[Humboldt's Physics of the Earth](#)

[Thermal State of the Earth's Interior](#)

[Size of the Earth and Shape of the Crust](#)

[Humboldt's Volcanistic Theory](#)

[Extreme Volcanism: Tides of the Liquid Core](#)

[Relevance for Earthquake Prognosis](#)

Nature and Mechanism

[Introduction: The Paradigm Shift in the Theory of Earthquakes](#)

[Development of the Wave Theory and its Application to Earthquakes](#)
[Theory of Sound Waves](#)
[Theory of Water Waves](#)
[Predecessors of MALLET](#)
[HOPKINS' Foundations of a Mathematical Theory of the Wave Motions of Earthquakes](#)
[MALLET's Theory of Wave Motions and Propagation of Earthquakes](#)
[Dynamics of Earthquakes \(1846\)](#)
[The Experimentum Crucis: MALLET's Explosion Experiments for the Determination of the Transit Velocity in Earthquake Waves](#)
[The Great Neapolitan Earthquake](#)
[MALLET's Method](#)
[Determination of the Point on the Surface Vertically Above the Focus](#)
[Determination of the Depth of the Focus](#)
[Application of Wave Theory to the Form of Isoleisms of Earthquakes](#)
[HUMBOLDT's Theory of the Wave Propagation of Earthquakes](#)
[MALLET's Criticism of HUMBOLDT](#)
[Extension of Volcanistic Earthquake Theory to a Theory of Wave Propagation of Earthquakes](#)
[Independence of Volcanic Eruptions and of Earthquakes in HUMBOLDT](#)
[VOLGER's Neptunistic Theory of Fall Waves \(1858\)](#)
[The Wallis Earthquake on 25th July, 1855](#)
[VOLGER's Criticism of the Plutonistic Elevation](#)

[Link between the Hollow Layer Hypothesis with the Theory of "Fall Waves"](#)
[Seismic Geometry and Mechanics: Karl von SEEBACH](#)
[K. v. SEEBACH's Criticism of MALLET](#)
[The Method Based on Exact Time Measurements](#)
[Determination of the "Surface Centre" \(Epicentre\)](#)
[Determination of the Actual Propagation Speed, the Time of the First Shock and the Depth of the Actual Earthquake Centre](#)
[Criticism and Modification of Seismic Geometry by v. SEEBACH's Successors](#)
[Final Evaluation of Seismic Geometry and its Results](#)
[A Theory of Tectonic Earthquakes](#)
[Geotectonic Hypothesis about Volcanic Phenomena: Robert MALLET](#)
[Contraction Theory: DANA, HEIM and SUESS](#)
[Isostasy: EVEREST, PRATT and AIRY](#)
[Abyssodynamics: G. PILAR](#)
[Influence of Instruments: From Descriptive Earthquake Studies to Seismology as an Exact science](#)
[Pre-history of Earthquake Instruments](#)
[The Origin of Instrumental Observation in the Context of the Wave Theory of Earthquakes](#)
[Observation of Local Earthquakes with Self-recording Seismometers](#)
[Registration of Remote Earthquakes](#)
[Influence of Instrumental Observation on the Theory of Types of Vibrations and the Path of Earthquake Waves ♦ © HEAT Editors](#)

Historical Tsunami Databases

http://ioc3.unesco.org/itic/categories.php?category_no=72

Historical Tsunami Database for the Mediterranean
Updated: 23/3/05

Historical Tsunami Database for the Atlantic
Updated: 23/3/05

Historical Tsunami Database for the Pacific
Updated: 23/3/05

NOAA/NGDC Tsunami Database
An interactive site from the National Geophysical Data Center, allows the searcher to find tsunami events fitting any number of qualifications. The database is one of two concerned with tsunami that have occurred anywhere on Earth.
Updated: 23/3/05

and

Tsunami Event Database Search
http://www.ngdc.noaa.gov/seg/hazard/tsevsrch_idb.shtml
The NGDC Tsunami Database consists of two files:
The Event database contains information on the source of the tsunami.
The Runup database contains information on locations where tsunami effects occurred.

The Earthquake Tsunami Connection

a matter of life and death

***A workshop to prepare ...
For Oregon community residents, business owners, boaters,
builders, students, and educators***

Saturday, October 8
9:30 a.m.–4:30 p.m.
Southwestern Oregon Community College
Performing Arts Center

Questions You Need To Ask:

Will your home or business survive a 9.0 magnitude earthquake?
How will your family cope with a natural disaster similar to the December Sumatra tsunami?
How long will you have to wait for emergency help?
What can you do to prepare for the inevitable natural disaster?
Did you know that most experts agree that educating the public is the best form of preparation?

Learn From State Experts:

Dr. George Priest, Geologist, Oregon Department of Geology and Mineral Industries
Dr. Harvey Kelsey, Geologist, Humboldt State University
Jim Wheeler, Redwood National and State Parks
Darcy Connor, Former Tsunami Outreach Coordinator of Seaside, Oregon
A panel of local agencies
Educational material from local emergency preparedness organizations

Thanks to generous contributions from organizations and members of the business community, there is no fee for the workshop or the handouts, and there is a free lunch for those who register by September 28. Call the Community Educational Services at SWOCC (541) 888-7415

Planners and Sponsors:

Bay Area Hospital	Methane Energy Corporation
Bureau of Land Management	National Weather Service - NOAA
City of Bandon	Oregon Institute of Marine Biology
City of Coos Bay	Oregon International Port of Coos Bay, Charleston Marina
City of North Bend	Oregon Department of Parks
Charleston Fire District	Oregon Pacific Chapter -American Red Cross
Coast to Crest Interpretive League	Shoreline Education for Awareness (SEA)
Coos County ARES/RACES	South Slough National Estuarine Research Reserve
Coos County Citizens Corps	Southwestern Oregon Community College
Coos County Emergency Management	Southwestern Oregon Community College Education Dept.
Coos County Sheriff's Office	Southwestern Oregon Community College Geology Dept.
Coquille Indian Tribe	Southwestern Oregon Geology Club
Fred Meyer – Coos Bay	Southwestern Oregon Public Safety Association
KCBY -TV	United States Coast Guard

Southwestern Oregon Community College is an equal opportunity/affirmative action institution. If you need disability accommodations in order to attend or participate in this event, please contact the Disability Services Department at Southwestern Oregon Community College. To register contact the Southwestern Oregon Community College Community Education Department at (541) 888-7415 by September 28. ♦

Added to the NTHMP Library

September - October 2005

Note: These, and all our tsunami materials, are included in the online (searchable) catalog at <http://www.dnr.wa.gov/geology/washbib.htm>.
Type 'tsunamis' in the Subject field to get a full listing of all the tsunami reports and maps in the collection.

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INFREQUENTLY ASKED QUESTIONS

Compiled by Lee Walking

What is scientific modeling?

It is a working hypothesis or precise simulation by means of description, statistical data, or analogy, usually done on computers.

“Models are important in science. Many times the system or object of a scientist’s interest are either too small to be observed directly, like parts of atoms. Other objects may be inaccessible for direct visual study, like the center of the Earth or the surface of a distant galactic object. Other topics of study, such as gravity, magnetism, or energy, can be studied through their effects on matter. Because gravity, magnetism, and energy cannot be seen directly, they are also modeled. So a scientific model can be a scaled-down version or a scaled-up version of a natural object or system. New scientific discoveries and understanding frequently depend upon scientists developing scientific models and interacting with them.

Scientists develop models in many different forms. Models may be actual physical constructions of mental images. They can also be mathematical models.

Models are developed in an effort to explain how things work in nature. Because models are not the “real thing”, they can never correctly represent the system or object in all respects. The amount of detail that they contain depends upon how the model will be used as well as the sophistication and skill of the scientist doing the modeling.

To overcome this difficulty, different models are often used to describe the same system or object. Scientists must then choose which model most closely fits the scientific investigation being carried out, which findings

are being described, and, in some cases, which one is compatible with the sophistication of the investigation itself.”

Excerpted from:

http://www.mcrel.org/epo/resources/sci_modeling.asp (Sept. 27, 2005).

Why is modeling important to tsunami research?

“Tsunami inundation models, defining the extent of coastal flooding, are an integral aspect of tsunami hazard and preparedness planning. Using worst-case inundation scenarios, these models are critical to defining evacuation zones and routes so that coastal communities can be evacuated quickly when a tsunami warning is issued.”

From: U.S. National Oceanographic and Atmospheric Administration; and others, 2005, *Tsunami--The great waves: U.S. National Oceanographic and Atmospheric Administration*, p. 9.

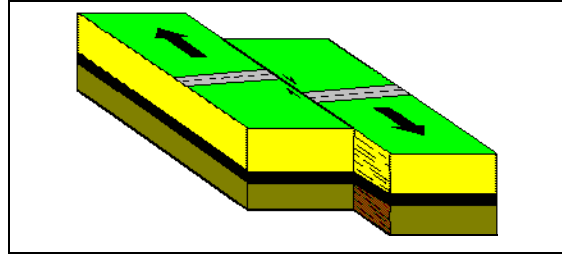
Speaking of worst-case scenarios, what has been done on the Cascadia subduction zone?

The Cascadia Region Earthquake Workgroup (crew) has issued **CASCADIA SUBDUCTION ZONE EARTHQUAKES: A MAGNITUDE 9.0 EARTHQUAKE SCENARIO**, a 21-page document “based on computer modeling funded by CREW and on other research about earthquakes in the region. ...” The document is also available online at <http://www.crew.org/papers/CREWCascadiaFinal.pdf>.

This report was also published as O-05-05 by the Oregon Department of Geology and Mineral Industries. ♦



Recipients of *TsuInfo Alert* are encouraged to submit information concerning tsunamis or emergency management programs and issues in their city, county, nation, or state. If you've found a great public information brochure or article (or you want to brag about one you've just produced), send the information along for *TsuInfo Alert* to share with other readers. Write or email Lee Walking at the contact addresses given on page 2



Transform fault

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updated 2-15-2005

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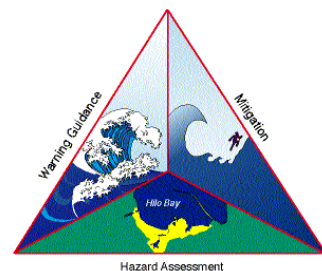
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From: <http://www.pmel.noaa.gov/tsunami-hazard/tsuhaz.htm>

Updated July 29, 2005♦



VIDEO RESERVATIONS

To reserve tsunami videos, contact *TsuInfo Alert* Video Reservations, Lee Walkling, Division of Geology and Earth Resources Library, 1111 Washington St. SE, MS 47007, Olympia, WA 98504-7007; or e-mail lee.walkling@wadnr.gov

Adventures of Disaster Dudes (14 min.). Preparedness for preteens. American Red Cross.

The Alaska Earthquake, 1964 (20 min.) Includes data on the tsunamis generated by that event.

Business Survival Kit for Earthquakes & Other Disasters; What every business should know before disaster strikes (27 min.). Global Net Productions for the Cascadia Regional Earthquake Workgroup, 2003. With CD disaster planning toolkit & other data.

Cannon Beach Fire District Community Warning System (COWS) (21 min.) Explains why Cannon Beach chose their particular warning system.

Cascadia: The Hidden Fire—An Earthquake Survival Guide (10 min.). Global Net Productions, 2001. A promo for a documentary about the Cascadia subduction zone and the preparedness its existence demands of Alaska, Oregon and Washington states. Includes mention of tsunamis.

Disasters are Preventable (22 min.) Ways to reduce losses from various kinds of disasters through preparedness and prevention.

Disaster Mitigation Campaign (15 min.). American Red Cross; 2000 TV spots. Hurricanes, high winds, floods, earthquakes.

Earthquake...Drop, Cover & Hold (5 min.). Washington Emergency Management Division. 1998.

Forum: Earthquakes & Tsunamis (2 hrs.). CVTV-23, Vancouver, WA (January 24, 2000). 2 lectures: Brian Atwater describes the detective work and sources of information about the Jan. 1700 Cascadia earthquake and tsunami; Walter C. Dudley talks about Hawaiian tsunamis and warning systems.

International Tsunami Information Centre, 2004, Tsunami warning evacuation news clips and video footage, UNESCO/IOC International Tsunami Information Centre, 1 **DVD**, 12 min.

Killer Wave: Power of the Tsunami (60 min.). National Geographic video.

Mitigation: Making Families and Communities Safer (13 min.) American Red Cross.

Not Business as Usual: Emergency Planning for Small Businesses, sponsored by CREW (Cascadia Regional Earthquake Workgroup) (10 min.), 2001. Discusses disaster preparedness and business continuity. Although it was made for Utah, the multi-hazard issues remain valid for everyone. Websites are included at the end of the video for further information and for the source of a manual for emergency preparedness for businesses.

Numerical Model Aonae Tsunami—7-12-93 (animation by Dr. Vasily Titov) and Tsunami Early Warning by Glenn Farley, KING 5 News (The Glenn Farley portion cannot be rebroadcast.)

Ocean Fury--Tsunamis in Alaska (25 min.) VHS and **DVD**. Produced by Moving Images for NOAA Sea Grant College Program, 2004.

The Prediction Problem (58 min.) Episode 3 of the PBS series "Fire on the Rim." Explores earthquakes and tsunamis around the Pacific Rim

Protecting Our Kids from Disasters (15 min.) Gives good instructions to help parents and volunteers make effective but low-cost, non-structural changes to child care facilities, in preparation for natural

disasters. Accompanying booklet. Does NOT address problems specifically caused by tsunamis.

The Quake Hunters (45 min.) A good mystery story, explaining how a 300-year old Cascadia earthquake was finally dated by finding records in Japan about a rogue tsunami in January 1700

Raging Planet; Tidal Wave (50 min.) Produced for the Discovery Channel in 1997, this video shows a Japanese city that builds walls against tsunamis, talks with scientists about tsunami prediction, and has incredible survival stories.

Raging Sea: KGMB-TV Tsunami Special. (23.5 min.) Aired 4-17-99, tsunami preparedness in Hawaii.

The Restless Planet (60 min.) An episode of "Savage Earth" series. About earthquakes, with examples from Japan, Mexico, and the 1989 Loma Prieta earthquake.

Run to High Ground (14 min.). Produced by Global Net Productions for Washington Emergency Management Division and Provincial Emergency Program of British Columbia, 2004. Features storyteller Viola Riebe, Hoh Tribe. For K-6 grade levels. Have video and **DVD** versions.

Tsunami and Earthquake Video (60 min.) "Tsunami: How Occur, How Protect," "Learning from Earthquakes," "Computer modeling of alternative source scenarios."

Tsunami: Killer Wave, Born of Fire (10 min.). NOAA/ PMEL. Features tsunami destruction and fires on Okushiri Island, Japan; good graphics, explanations, and safety information. Narrated by Dr. Eddie Bernard, (with Japanese subtitles).

Tsunami: Surviving the Killer Waves (13 min.). 2 versions, one with breaks inserted for discussion time.

Tsunami Chasers (52 min.). Costas Synolakis leads a research team to Papua New Guinea to study submarine landslide-induced tsunamis. Beyond Productions for the Discovery Channel.

Tsunami Evacuation PSA (30 sec.). DIS Interactive Technologies for WA Emergency Management Division. 2000.

Understanding Volcanic Hazards (25 min.). Includes information about volcano-induced tsunamis and landslides.

UNESCO/IOC International Tsunami Information Centre, 2005, U.S. National Tsunami Hazard Mitigation Program public information products—B-roll footage, tsunami science, warnings, and preparedness: UNESCO/IOC International Tsunami Information Centre, 1 **DVD**, 57 min.

The Wave: a Japanese Folktale (9 min.) Animated film to start discussions of tsunami preparedness for children.

Waves of Destruction (60 min.) An episode of the "Savage Earth" series. Tsunamis around the Pacific Rim.

Who Wants to be Disaster Smart? (9 min.). Washington Military Department/Emergency Management Division. 2000. A game show format, along the lines of *Who Wants to be a Millionaire?*, for teens. Questions cover a range of different hazards.

The Wild Sea: Enjoy It...Safely (7 min.) Produced by the Ocean Shores Wash. Interpretive Center, this video deals with beach safety, including tsunamis. ♦

NOTE: The TsunamiReady Education CD included in the 2005 Earth Science Week kit is available for borrowing, too. See note on page 4.

Updated Sept. 27, 2005

NOAA WEATHER RADIO

NOAA Weather Radio (NWR) is a nationwide network of radio stations broadcasting continuous weather information direct from a nearby [National Weather Service office](#). NWR broadcasts National Weather Service warnings, watches, forecasts and other hazard information 24 hours a day.

Working with the [Federal Communication Commission's](#) (FCC) [Emergency Alert System](#), NWR is an "all hazards" radio network, making it your single source for comprehensive weather and emergency information. NWR also broadcasts warning and post-event information for all types of hazards--both natural (such as earthquakes and volcano activity) and environmental (such as chemical releases or oil spills).

Known as the "Voice of NOAA's National Weather Service," NWR is provided as a public service by the [National Oceanic & Atmospheric Administration](#) (NOAA), part of the Department of Commerce. NWR includes more than [930 transmitters](#), covering all 50 states, adjacent coastal waters, Puerto Rico, the U.S. Virgin Islands, and the U.S. Pacific Territories. NWR requires a [special radio receiver](#) or scanner capable of picking up the signal. Broadcasts are found in the public service band at these seven frequencies (MHz):

162.400	162.425	162.450	162.475	162.500	162.525	162.550
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From: <http://www.weather.gov/nwr/>

How a NOAA Weather Radio Warning is Disseminated (NOAA Weather Radio is an "all hazards" radio network)

Your local National Weather Service (NWS) Office uses available data sources such as Doppler Radar, Satellite Imagery, Surface Observations, and Spotter Reports to monitor hazardous weather threats.

If the threat of a tornado, severe thunderstorm, or flash flood is sufficiently high, then a warning is issued. [Editor's note: NOAA Weather Radio also issues tsunami warnings].

The first method of dissemination, normally, is to broadcast live on the NOAA Weather Radio (NWR). If the warning is within the "official" NWR broadcast range (about 40 miles), a 1050 hertz alarm tone precedes the warning. This 1050 hertz alarm tone automatically activates NWR receivers equipped with the tone alert feature.

The alarm tone lasts about 9 seconds, and allows people to deactivate their alarm and listen

to the warning broadcast. The NWR is also able to integrate into the Emergency Alert System (EAS), using the Specific Area Message Encoder (SAME). The EAS is activated for life threatening weather events in specific areas, and incorporates all radio, TV, and cable stations. The weather threat is quickly disseminated on these commercial stations, reaching a wide audience in the affected area(s).

As the warning is being disseminated on the NWR and EAS, a "hardcopy" of the warning is being generated using computer software. Menu driven software allows the Meteorologists to quickly select the type of warning needed, the valid time of the warning, and the counties that must be warned. Information such as affected areas or communities, timing of severe weather, and a safety message is included in this warning.

Once this "hardcopy" warning is generated, it is broadcast on the NWR, providing additional warning detail to NWR listeners. The warning is also sent, via satellite uplink, to a wide variety of customers, including the NOAA Weather Wire Service, Internet, The Weather Channel, and to major news wire services, such as AP, UPI, etc. These services distribute the warning to their customers, which include many local TV and radio stations. The local radio and TV stations then disseminate the warning to their listening and viewing audience.

Emergency Managers enact their local severe weather plans, such as activating local dissemination systems, positioning storm spotters, or activating outdoor sirens, as needed.

Updated information on the storm position and spotter reports is provided in follow-up Severe Weather Statements and broadcast on the NWR as it becomes available.

From:

http://www.crh.noaa.gov/dtx/?page=nwr_wrng

NOAA Weather Radio broadcasts warning and post-event information for all types of hazards--both natural and technological. Working with other Federal agencies and the Federal Communications Commission's Emergency Alert System, NOAA Weather Radio is an "all hazards" radio, networking making it the single source for the most comprehensive weather and emergency information available to the public.

From:

<http://www.michiganweather.org/noaa.htm>

American Red Cross



"Together We Can Save A Life!"

Personal Workplace Disaster Supplies Kit

<http://www.redcross.org/services/disaster/beprepared/workkitfinal.doc>

For the workplace, where you might be confined for several hours, or perhaps overnight, the following supplies are recommended. More information is at: <http://www.redcross.org/services/disaster/beprepared/>

Flashlight with extra batteries

Use the flashlight to find your way if the power is out. Do not use candles or any other open flame for emergency lighting.

Battery-powered radio

News about the emergency may change rapidly as events unfold. You also will be concerned about family and friends in the area. Radio reports will give information about the areas most affected.

Food

Enough non-perishable food to sustain you for at least one day (three meals), is suggested. Select foods that require no refrigeration, preparation or cooking, and little or no water. The following items are suggested:

- Ready-to-eat canned meals, meats, fruits, and vegetables.
- Canned juices.
- High-energy foods (granola bars, energy bars, etc.).

Water

Keep at least one gallon of water available, or more if you are on medications that require water or that increase thirst. Store water in plastic containers such as soft drink bottles. Avoid using containers that will decompose or break, such as milk cartons or glass bottles.

Medications

Include usual non-prescription medications that you take, including pain relievers, stomach remedies, etc. If you use prescription medications, keep at least three-day's supply of these medications at your workplace. Consult with your physician or pharmacist how these medications should be stored, and your employer about storage concerns.

First Aid Supplies

If your employer does not provide first aid supplies, have the following essentials:

- (20) adhesive bandages, various sizes.
- (1) 5" x 9" sterile dressing.
- (1) conforming roller gauze bandage.
- (2) triangular bandages.
- (2) 3 x 3 sterile gauze pads.
- (2) 4 x 4 sterile gauze pads.
- (1) roll 3" cohesive bandage.
- (2) germicidal hand wipes or waterless alcohol-based hand sanitizer.
- (6) antiseptic wipes.
- (2) pair large medical grade non-latex gloves
- Adhesive tape, 2" width.
- Anti-bacterial ointment.
- Cold pack.
- Scissors (small, personal).
- Tweezers.
- CPR breathing barrier, such as a face shield

Tools and Supplies

- Emergency "space" blanket (mylar).
- Paper plates and cups, plastic utensils
- Non-electric can opener.
- Personal hygiene items, including a toothbrush, toothpaste, comb, brush, soap, contact lens supplies, and feminine supplies.
- Plastic garbage bags, ties (for personal sanitation uses) .
- Include at least one complete change of clothing and footwear, including a long sleeved shirt and long pants, as well as closed-toed shoes or boots.
- If you wear glasses, keep an extra pair with your workplace disaster supplies.

General Information

- Your kit should be adjusted based on your own personal needs.
- Do not include candles, weapons, toxic chemicals, or controlled drugs unless prescribed by a physician. ♦

Gov. Gregoire Calls for Hearings to Address Emergency Preparedness, High Fuel Prices, Alternative Energy

Olympia - Sept. 15, 2005 - Gov. Christine Gregoire today called for joint legislative hearings in October to study Washington's preparedness in case of disaster, the high price of gas and diesel fuels, and alternative energy options.

"I'm asking our House and Senate leaders to initiate joint legislative hearings in October to see what we can do based on key lessons in the wake of Hurricane Katrina," Gov. Gregoire said. "I am asking them to give careful thought and thorough considerations to two key areas, emergency preparedness and the high price of gas, short term and long term."

Gov. Gregoire said Hurricane Katrina and emergencies in Washington State left valuable lessons that need study for the future.

"This is a perfect opportunity to test out our own processes. Like fire, earthquake and tsunami drills, we'll be better prepared for when a natural disaster comes to our state," she said. "We learned some important lessons about what to do if and when disaster strikes our state, but we can do better."

"If the Nisqually earthquake had lasted a mere 15 seconds longer, the Alaskan Way Viaduct in Seattle and SR 520 would have crumbled, and bridges all up and down the I-5 corridor would have been highly vulnerable. The loss of life could have been devastating, and the long-term economic impact crippling," said Gov. Gregoire.

"Because we have neglected infrastructure projects like the Viaduct and SR 520, they are vulnerable. These are our levees, and the earthquake is our hurricane. We are not going to be given a warning. You can't see an earthquake coming."

Gov. Gregoire asked legislators to thoroughly consider the high price of gas for the long-term, "Our refineries here have continued to function at full capacity, so there is no apparent reason that Washington gas prices increased in response to Katrina. I have asked the U.S. Attorney General to look into oil company profits on the short-term, but we as a state can study the big picture."

The Governor called for leaders to study alternative energy sources for long-term solutions to a dependence on oil. She recently charged Agriculture Director Valoria Loveland to play a leading role in leading a multi-agency effort on bio-energy.

"Bioenergy reduces our dependence on petroleum fuels, especially imported fuels. It improves our energy independence and keeps our petro-dollars in Washington. It creates new jobs in the state, reduces pollution and reduces other environmental problems and risks, and it helps farmers maintain the profitability of their farms," she said.

Dependence on oil is crippling Washington's farmers, she said. "Our farmers are paying out more for a gallon of diesel fuel than they earn for a bushel of wheat. We may have the opportunity to plug our farmers right into the fuels they need. They could be producing the crops to make the fuel."

The Governor made her remarks during a 12:30 p.m. Capitol press conference where she was joined by House Speaker Frank Chopp, D-Seattle, and Sen. Marilyn Rasmussen, D-Eatonville, who represented Majority Leader Lisa Brown, D-Spokane, as well as Agriculture Director Valoria Loveland, Chief John Batiste, Washington State Patrol, General Administration Director Linda Bremer and Jim Mullen of Emergency Management Director. ♦

From: <http://www.governor.wa.gov/news/news-view.asp?pressRelease=144&newsType=1>