



Volume 1, Number 2, February, 1999

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**February Update on the TsuInfo Program**  
 by  
 Connie J. Manson  
 Washington Department of Natural Resources  
 Division of Geology and Earth Resources

*We're Listening!* A questionnaire was included in the introductory materials we mailed to the local emergency managers in the Pacific States. Of 102 sent out, we've received 38 replies (a 37% return rate)-- and they're still coming in! Here are the questions and the replies:

- Do you want the newsletter in print or by e-mail?
- 12 In print
  - 16 By e-mail
  - 10 Both
- 

In response, we'll be e-mailing *TsuInfo Alert* to those who want it electronically

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- Do you have access to the Internet?
- 35 Yes
  - 3 No
- 

Responding to this, Lee Walkling has compiled a list of **Tsunami and Hazard Mitigation Web Pages** (page 3).

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- Do you need specific materials?
- 25 Videos
  - 30 Inundation maps
  - 27 Examples of flyers
- 

We're tracking down **tsunami videos** (page 13), and this issue includes the first of many **flyers**.

The **inundation mapping** is being coordinated by the states, and is in various stages of completion. Call your state contact (listed on page 16) for the status of mapping in your area.

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- Do you need specific information about--?
- 19 General information about tsunamis
  - 21 The history of tsunamis in their areas
  - 27 Current research on the Jan. 26, 1700 event
- 

The January issue of *TsuInfo Alert* included bibliographies about tsunami hazards and mitigation and about the 1700 event. We're continuing to add reports on these and related subjects to the collection; the list of the new items are on pages 12 and 14.

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**Remember: Copies of all the reports listed in *TsuInfo Alert* are available FREE to participants in the TsuInfo Program. See page 2 for ordering information.**

***TsuInfo Alert* is published monthly by the Washington Department of Natural Resources, Division of Geology and Earth Resources. This publication is free upon request and is available in print (by surface mail) and electronically (by e-mail).**

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

**Library  
Washington Department of Natural Resources  
Division of Geology and Earth Resources  
P.O. Box 47007  
Olympia, WA 98504-7007  
ph: 360/902-1472 or 360/902-1473  
fax: 360/902-1785  
e-mail: [connie.manson@wadnr.gov](mailto:connie.manson@wadnr.gov) or [lee.walkling@wadnr.gov](mailto:lee.walkling@wadnr.gov)**

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and  
Lee Walkling, Library Information Specialist**



**WASHINGTON STATE DEPARTMENT OF  
Natural Resources**  
Jennifer M. Belcher - Commissioner of Public Lands

## TSUNAMI and HAZARD MITIGATION WEB PAGES

(URL's checked 1-21-99)

compiled by Lee Walkling

**Notes:** If you don't have Internet access you have two other options. First, we could send you prints from the sites-- just let us know which sites you'd would like to see and we'll print them out and mail them to you. (It won't have the color, the animation, or the links, of course.) Secondly, most public libraries have Internet access, so you could use their machines. Those computers are in high demand, though, so you may need to make a reservation.

The items marked \*\* are particularly recommended. Website titles are underlined.

This list will be added to the Washington Division of Geology and Earth Resources tsunami webpage soon, with links to each site. <http://www.wadnr.gov/ger/hazards.htm>

Please contact us to correct, add or remove websites (see page 2).

### CENTER FOR COASTAL AND LAND-MARGIN RESEARCH (CCALMR)

<http://www.ccalmr.org.edu/projects/tsunamis/>

#### Tsunami research

Includes photographs and animation for Cascadia subduction zone generated tsunami

<http://www.ccalmr.org.edu/projects/oregonian/>

#### Impact of tsunamis on Oregon coastal communities

### \*\* COMMUNITY PREPAREDNESS WEBSITE PROJECT

<http://www.preparenow.org>

“Supporting special needs and vulnerable populations in disaster”

Multiple languages: Portuguese, Chinese, Spanish, Japanese, Korean, Vietnamese,

Tagalog, Punjabi, and English

Based in California

### DISASTER! FINDER

<http://ltpwww.gsfc.nasa.gov/ndrd/disaster/links/>

Information about disaster management, organizations, and searchable index of disaster-related websites, including tsunami sites

### DISASTER RELIEF

<http://www.DisasterRelief.org/Library/>

Disaster preparedness materials, photographs, disaster dictionary, disaster IQ test, and state-by-state report on relief operations

### FEDERAL EMERGENCY MANAGEMENT AGENCY

<http://www.fema.gov/mit/ntmstrat.htm>

#### National Mitigation Strategy

<http://www.fema.gov/library/tsunamif.htm>

#### Fact Sheet - Tsunamis

Links to American Red Cross, mitigation definition, and preparedness information

### GEOLOGIC HAZARD PHOTOS

<http://www.lib.virginia.edu/sdc/HAZARD/hazard2.html#tsu>

Before and after tsunami photographs

### \*\* GLOBAL EMERGENCY MANAGEMENT SYSTEM (GEMS)

[http://www.fema.gov/cgi-shl/dbml.exe?action=query&template=/gems/g\\_index.dbm](http://www.fema.gov/cgi-shl/dbml.exe?action=query&template=/gems/g_index.dbm)

FEMA website, with links to hundreds of emergency information sites

GOVERNOR'S OFFICE OF EMERGENCY SERVICES (CALIFORNIA)

<http://www.oes.ca.gov/>

GREAT TSUNAMIS OF 1992-1996 AND THE USC EXPEDITIONS

<http://www.usc.edu/dept/tsunamis/home.html>

Includes maps, publications, photographs, videos (field survey movies and simulations), and other links.

HAZARDS CENTER

<http://www.colorado.edu/hazards/sites/earthquakes.html>

Mostly seismic sites

INTERNATIONAL CENTER FOR DISASTER-MITIGATION ENGINEERING (INCEDE)

<http://incede.iis.u-tokyo.ac.jp/default.html>

INTERNATIONAL TSUNAMI INFORMATION CENTER (ITIC)

<http://www.shoa.cl/oceano/itic/itic.html>

LIVING ON SHAKY GROUND

<http://glinda.cnrs.humboldt.edu/earthquakes/shaky2.html>

Fact sheet, *How to Survive Earthquakes and Tsunamis on the North Coast*, by Humboldt Earthquake Education Center

MARION COUNTY EMERGENCY MANAGEMENT

<http://www.open.org/memanager/>

Current emergency information (weather, emergency preparedness, other links)

MEXICAN TSUNAMI

<http://www.agu.org/scisoc/eisborerro.html>

Mexican earthquake generates tsunami, new data, and unusual photos. Includes glossary, photos, and personal accounts by tsunami survivors of October 9, 1995 event

MULTIDISCIPLINARY CENTER FOR EARTHQUAKE ENGINEERING RESEARCH  
(formerly National Center for Earthquake Engineering Research)

<http://nceer.eng.buffalo.edu>

Natural hazards mitigation information

NATIONAL GEOPHYSICAL DATA CENTER

<http://www.ngdc.noaa.gov/seg/hazard/resource/hazdir.html>

Natural Hazards Data Resources Directory

Table of Contents: Introduction

Geological Hazards (Tsunami page links to NGDC, ITIC, and PMEL)

Meteorological Hazards

Societal Response

Appendices

<http://www.ngdc.noaa.gov/seg/hazard/resource/tsudir.html>

Tsunami Data and Information

Links to: International Tsunami Information Center; National Geophysical Data Center, and Pacific Marine Environmental Laboratory

<http://www.ngdc.noaa.gov/seg/hazard/tsu.html>

Tsunami Data at NGDC

Links to: Tsunami Database

Tsunami Slide Sets

Tsunami Publications

<http://www.ngdc.noaa.gov/seg/hazard/tsevsrch.html>

[Tsunami Event Database Search](#)

Earthquake Parameters

Tsunami Source Parameters

Tsunami Event Parameters

<http://www.ngdc.noaa.gov/seg/hazard/tsupub.html>

[Tsunami Publications at NGDC](#)

#### NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM

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

<http://www.pmel.noaa.gov/~bernard/senatec.html>

<http://www.pmel.noaa.gov/tsunami/>

<http://www.pmel.noaa.gov/annual-reports/fy94/>

#### NATURAL HAZARDS CENTER, University of Colorado, Boulder

<http://pongo.colorado.edu/hazards/index.html>

Includes searchable HazLit - NHC online database, publications, conferences, and schools offering emergency management courses

<http://www.colorado.edu/hazards/o/o.html> (They are o's, not zeros)

Natural Hazards Observer newsletter

#### 1964 ALASKAN EARTHQUAKE/TSUNAMI personal account (British Columbia)

<http://hoshi.cic.sfu.ca/~pep/Zeballos64/tidalwave.html>

Personal account by Charles Ford, B.C. airlines pilot of tsunami and earthquake damage in B.C. due to 1964

Alaskan earthquake, with photographs

#### OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

<http://sarvis.dogami.state.or.us/homepage/>

#### OREGON GRADUATE INSTITUTE

<http://www.ccalmr.ogi.edu/projects/oregonian/>

Tsunami research

#### OREGON SEA GRANT

<http://seagrant.orst.edu/research/hazards.html>

#### PACIFIC DISASTER CENTER

[http://www.pdc.org/pdc/WEB\\_PAGE/frmain06.htm](http://www.pdc.org/pdc/WEB_PAGE/frmain06.htm)

Information about Hawaiian tsunamis, evacuation maps and shelter lists, as well as general tsunami fact sheets.

#### PACIFIC MARINE ENVIRONMENTAL LABORATORY (PMEL)

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

National Tsunami Mitigation Program Steering Group oversees the National Tsunami Hazard Mitigation Program (Alaska, California, Hawaii, Oregon, Washington, NOAA, USGS, FEMA, and NSF)

<http://www.pmel.noaa.gov/~bernard/senatec.html>

Report to the Senate Appropriations Committee by NOAA and PMEL about the threat of tsunamis originating along the Cascadia subduction zone

<http://www.pmel.noaa.gov/tsunami/>

Current research projects, tsunami data, field observations, inundation mapping, modeling & forecasting, National Tsunami Hazard Mitigation Program, and real-time tsunami reports

#### PACIFIC NORTHWEST SEISMOGRAPHIC NETWORK

<http://www.geophys.washington.edu/SEIS/>

#### PACIFIC TSUNAMI MUSEUM

<http://planet-hawaii.com/tsunami/>  
Includes tsunami photographs

#### PROVINCIAL EMERGENCY PROGRAM

<http://hoshi.cic.sfu.ca/pep/toc.html>  
<http://hoshi.cic.sfu.ca/~pep/tsunami.html>

#### SCIENCE OF TSUNAMI HAZARDS (JOURNAL)

<http://www.ccalmr.ogi.edu/STH/>

#### TSUNAMI!

[http://glinda.cnrs.humboldt.edu/earthquakes/tsunami!/Tsunami!\\_TOC](http://glinda.cnrs.humboldt.edu/earthquakes/tsunami!/Tsunami!_TOC)

#### TSUNAMI!

<http://www.geophys.washington.edu/tsunami/intro.html>  
Tsunami hazard mitigation safety rules, physics of tsunamis, research, warning systems, and other links

#### TSUNAMI DIRECTORY

[http://vishnu.glg.nau.edu/wsspc/tsunami/WA/biblio\\_2.html](http://vishnu.glg.nau.edu/wsspc/tsunami/WA/biblio_2.html)  
Tsunami directory of individuals and organizations involved with tsunami hazards on the Pacific Coast of Washington (Superceded by *Tsunamis on the Pacific Coast of Washington State and adjacent areas--A selected, annotated bibliography and directory, 1998* [Call (360) 902-1473 for a paper copy])

#### TSUNAMI HAZARD MITIGATION AND INFORMATION

<http://www.disastercenter.com/tsunami.htm>  
Many tsunami links, including Tsunami for Kids and Survey of Great Tsunamis  
Have local disaster information, state government, weather, NOAA Weather Radio broadcast stations, and other data for all 50 states. Under Washington, some links were Washington Disaster Message Board, Tsunami, NOAA Weather Radio, Emergency Management News, and Washington Emergency Management

#### TSUNAMI PAGE OF DR. GEORGE P.C.

<http://www.geocities.com/CapeCanaveral/Lab/1029/>  
Many links to tsunami data and warning systems  
Includes tsunami glossary and FAQ's about tsunamis and tsunami warning systems in French, English, and Spanish

#### TSUNAMI PUZZLE

[http://observe.ivv.nasa.gov/nasa/fun/wordsearch/tsunami\\_search/tsunami\\_search.html](http://observe.ivv.nasa.gov/nasa/fun/wordsearch/tsunami_search/tsunami_search.html)  
Word search puzzle for use in public awareness/education materials

#### TSUNAMI QUIZ

[http://observe.ivv.nasa.gov/nasa/exhibits/tsunami/tsunami\\_quiz.html](http://observe.ivv.nasa.gov/nasa/exhibits/tsunami/tsunami_quiz.html)  
Quiz for use in public awareness/education materials

#### TSUNAMI RESEARCH

<http://www.geo.lsa.umich.edu/SeismoObs/tsunamiStudies.html>  
University of Michigan  
List of Tsunami research papers; list of "earthquakes" (year/region) that have  
Tsunami studies (1-21-99 some of the links generated a 404 Not Found message)

#### TSUNAMI WARNING CENTERS

<http://www.alaska.net/~atwc/index.html>  
West Coast and Alaska Tsunami Warning Center  
Links to other warning centers, recent press releases and warnings  
<http://lumahai.soest.hawaii.edu/tsunami.html>

Hawaii Meteorology, University of Hawaii

Links to other Forecast Offices

<http://hoshi.cic.sfu.ca/~pep/tsunam2.html>

Tsunami Warning System in the Pacific

Information about Pacific Tsunami Warning Center (PTWC), Ewa Beach, Hawaii and Alaska Tsunami Warning Center (ATWC), Palmer, Alaska

<http://www.geocities.com/CapeCanaveral/Lab/1029/>

Links to warning centers

TSUNAMIS IN MEXICO

<http://www.cicese.mx/~loyasa/tsunami/>

In Spanish

U.S. ARMY ENGINEERS WATERWAYS EXPERIMENT STATION

<http://bigfoot.cerc.west.army.mil/tsu0000.htm>

U.S. GEOLOGICAL SURVEY

<http://walrus.wr.usgs.gov/docs/projects/cascadia/tsunami/tsunami.html>

Links to Tsunami Field Survey Photographs, NGDC tsunami database, Local Tsunamis and Earthquakes along the Cascadia Subduction Zone, PMEL Tsunami project, Tsunami research at CERC, Science of Tsunami Hazards journal, tsunami research at Oregon Graduate Institute, Pacific Tsunami Museum and Tsunamis in Mexico

<http://walrus.wr.usgs.gov/docs/projects/cascadia/tsunami/research.html>

Good explanation of what tsunamis are, their mechanics, and dangers

<http://www.usgs.gov/themes/coast.html>

Coastal storms and tsunamis

Includes article on Spirit Lake Tsunami, May 18, 1980 and USGS studies of earthquake faults and tsunami potential in the Pacific NW

UNIVERSITY OF COLORADO

Natural Hazards Research and Applications Information Center

<http://www.colorado.edu/hazards>

UNIVERSITY OF WASHINGTON GEOPHYSICS PROGRAM

<http://www.geophys.washington.edu/tsunami/welcome.html>

<http://www.geophys.washington.edu/tsunami/>

<http://www.geophys.washington.edu/tsunami/intro.html>

WASHINGTON DEPARTMENT OF ECOLOGY

<http://www.wa.gov/ecology>

WASHINGTON (STATE) MILITARY DEPARTMENT, Emergency Management Division

<http://www.wa.gov/mil/wsem/>

Links to Emergency Management resources

WEST COAST TSUNAMI WARNING CENTER

<http://www.alaska.net/~atwc/index.html>

West Coast and Alaska Tsunami Warning Center homepage

Links to tsunami catalogs, safety rules, physics of tsunamis and current reports

WESTERN STATES SEISMIC POLICY COUNCIL

<http://vishnu.glg.nau.edu/wsspc/tsunami/TsunamiHMC.html>

Tsunami Hazard Mitigation Committee's site

Members: Hawaii, Alaska, British Columbia, Washington, Oregon, Guam, and California

Lists tsunami publications of member states

## Tsunami Terminology

(reprinted from <http://www.pmel.noaa.gov/tsunami-hazard/terms.html>, downloaded 2-2-99)

- amplitude:** The rise above or drop below the ambient water level as read on a tide gage.
- arrival time:** Time of arrival, usually of the first wave, of the first wave of the tsunami at a particular location.
- bore:** Traveling wave with an abrupt vertical front or wall of water. Under certain conditions, the leading edge of a tsunami wave may form a bore as it approaches and runs onshore. A bore may also be formed when a tsunami wave enters a river channel, and may travel upstream penetrating to a greater distance inland than the general inundation.
- CREST:** Consolidated Reporting of EarthquakeS and Tsunamis, a project funded through the Tsunami Hazard Mitigation Federal/State Working Group to upgrade regional seismic networks in AK, WA, OR, CA, and HI and provide real-time seismic information from these networks and the USNSN to the tsunami warning centers.
- ETA:** Estimated Time of Arrival. Computed arrival time of the first tsunami wave at coastal communities after a specific earthquake has occurred.
- first motion:** Initial motion of the first wave, a rise in the water level is denoted by R, a fall by F.
- free field offshore profile:** A profile of the wave measured far enough offshore so that it is unaffected by interference from harbor and shoreline effects.
- harbor resonance:** The continued reflection and interference of waves from the edge of a harbor or narrow bay which can cause amplification of the wave heights, and extend the duration of wave activity from a tsunami.
- horizontal inundation distance:** The distance that a tsunami wave penetrates onto the shore, measured horizontally from the mean sea level position of the water's edge. Usually measured as the maximum distance for a particular segment of the coast.
- ICG/ITSU:** The International Coordination Group for the Tsunami Warning System in the Pacific, a United Nations organization under UNESCO responsible for international tsunami cooperation.
- IDNDR:** International Decade for Natural Disaster Reduction, a United Nations sponsored program for the 1990's.
- inundation:** The depth, relative to a stated reference level, to which a particular location is covered by water.
- inundation area:** An area that is flooded with water.
- inundation line (limit):** The inland limit of wetting measured horizontally from the edge of the coast defined by mean sea level.
- ITIC:** International Tsunami Information Center established in 1965. Monitors international activities of the Pacific Tsunami Warning Center and assists with many of the activities of ICG/ITSU.
- leading-depression wave:** Initial tsunami wave is a trough, causing a draw down of water level.
- leading-positive wave:** Initial tsunami wave is a crest, causing a rise in water level. Also called a leading-elevation wave.
- local/regional tsunami:** Source of the tsunami within 1000 km of the area of interest. Local or near-field tsunami has a very short travel time (30 minutes or less), mid-field or regional tsunami waves have travel times on the order of 30 minutes to 2 hours. Note: "Local" tsunami is sometimes used to refer to a tsunami of landslide origin.
- maremoto:** Spanish term for tsunami.
- marigram:** Tide gage recording showing wave height as a function of time.
- marigraph:** The instrument which records wave height.
- Mean Lower Low Water (MLLW):** The average low tide water elevation often used as a reference to measure runup.
- Ms:** Surface Wave Magnitude. Magnitude of an earthquake as measured from the amplitude of seismic surface waves. Often referred to by the media as "Richter" magnitude.
- Mw:** Moment Magnitude. Magnitude based on the size and characteristics of the fault rupture, and determined from long-period seismic waves. It is a better measure of earthquake size than surface wave magnitude, especially for very large earthquakes. Calibrated to agree on average with surface wave magnitudes for earthquakes less than magnitude 7.5.
- NOAA:** National Oceanic and Atmospheric Administration, the federal agency responsible for tsunami warnings and monitoring. Part of the Department of Commerce.
- NWS:** National Weather Service, the branch of NOAA which operates the tsunami warning centers and disseminates warnings.
- normal earthquake:** An earthquake caused by slip along a sloping fault where the rock above the fault moves downwards relative to the rock below.
- Pacific Disaster Center (PDC):** An information processing center to support emergency managers in the Pacific region. Funded by the U.S. Department of Defense.
- PTWC:** Pacific Tsunami Warning Center. Originally established in 1948 as the SSWWS, located in Ewa Beach near Honolulu. Responsible for issuing warnings to Hawaii, to U.S. interests in the Pacific other than the west coast and Alaska, and to countries located throughout the Pacific.
- period:** The length of time between two successive peaks or troughs. May vary due to complex interference of waves. Tsunami periods generally range from 5 to 60 minutes.
- runup:** Maximum height of the water onshore observed above a reference sea level. Usually measured at the horizontal inundation limit.



**seiche:** A standing wave oscillating in a partially or fully enclosed body of water. May be initiated by long period seismic waves, wind and water waves, or a tsunami.

**strike-slip earthquake:** An earthquake caused by horizontal slip along a fault.

**SSWWS:** Seismic Sea Wave Warning System, the original tsunami warning center established in 1948 after the April 1, 1946 tsunami killed 159 in Hawaii.

**teletsunami:** Source of the tsunami more than 1000 km away from area of interest. Also called a distant-source or far-field tsunami.

**THRUST:** The project for Tsunami Hazard Reduction Using System Technology, sponsored by the Office for U.S. Foreign Disaster Assistance/Agency for International Development. A comprehensive program to mitigate tsunami hazards in developing countries.

**thrust earthquake:** An earthquake caused by slip along a gently sloping fault where the rock above the fault is pushed upwards relative to the rock below. The most common type of earthquake source of damaging tsunamis.

**tidal wave:** Common term for tsunami used in older literature, historical descriptions and popular accounts. Tides, caused by the gravitational attractions of the sun and moon, may increase or decrease the impact of a tsunami, but have nothing to do with their generation or propagation. However, most tsunamis (initially) give the appearance of a fast-rising tide or fast-ebbing as they approach shore and only rarely as a near-vertical wall of water.

**TIME:** The Center for the Tsunami Inundation Mapping Effort, to assist the Pacific states in developing tsunami inundation maps.

**travel time:** Time (usually measured in hours and tenths of hours) that it took the tsunami to travel from the source to a particular location.

**tsunami:** A Japanese term derived from the characters "tsu" meaning harbor and "nami" meaning wave. Now

generally accepted by the international scientific community to describe a series of travelling waves in water produced by the displacement of the sea floor associated with submarine earthquakes, volcanic eruptions, or landslides.

**tsunami earthquake:** A tsunamigenic earthquake which produces a much larger tsunami than expected for its magnitude.

**tsunamigenic earthquake:** Any earthquake which produces a measureable tsunami.

**tsunami magnitude:** A number which characterizes the strength of a tsunami based on the tsunami wave amplitudes. Several different tsunami magnitude determination methods have been proposed.

**TWS:** Tsunami Warning System, organization of 26 Pacific Member States which coordinates international monitoring and warning dissemination. Operates through ICG/ITSU

**USNSN:** United States National Seismic Network, operated by the USGS. Monitors, in real-time, magnitude (M)>5 earthquake activity worldwide and M>3 in conterminousUS.UTCUniversal Coordinated Time, international common time system, formerly GMT (Greenwich Mean Time).

**UTC:** Universal Coordinated Time, international common time system (formerly GMT, Greenwich Mean Time).

**WC/ATWC:** West Coast/ Alaska Tsunami Warning Center, established in 1967 originally to issue warnings to Alaska of local tsunami events. WC/ATWC is now responsible for issuing warnings for any event likely to impact either Alaska, the west coast of the US, or the Pacificcoast of Canada.

**WCM:** Warning Coordination Meteorologist, regional weather service person responsible for providing information on the tsunami warning system to local agencies.

## NOAA WEATHER RADIO

from: NOAA/National Weather Service

(downloaded from <http://www.nws.noaa.gov/nwr/nwrtrans.htm>)

Some coastal communities have installed warning sirens to alert their citizens and visitors to tsunami threats. Not only Emergency Managers, but the coastal citizenry should also be aware of NOAA's Weather Radio, which, in addition to broadcasting local weather information 24 hours a day, provides warnings about natural disasters. Regular radios do not receive NOAA Weather Radio signals; you must have a radio capable of receiving VHF between 162.400 and 162.550 MHz.

You can also get radios which detect a special signal and notify listeners when an alert has been issued. NOAA Weather Radios will issue the all-clear notification after a tsunami to tell residents when it is safe to return to their homes, making a Weather Radio an important part of anyone's disaster preparedness kit.

### ALASKA

NWR TRANSMITTER...	AK CALL	FREQ MHZ	WATTS	NWS PROGRAMMING OFFICE
ANCHORAGE	AK KEC43	162.550	125	ANCHORAGE, AK
CORDOVA	AK WXJ79	162.400	500	VALDEZ, AK
CRAIG	AK WXJ26A	162.475	125	ANNETTE, AK
FAIRBANKS	AK WXJ81	162.550	500	FAIRBANKS, AK
HAINES	AK WXM97	162.400	100	JUNEAU, AK
HOMER	AK WXJ24	162.400	800	ANCHORAGE, AK
JUNEAU	AK WXJ25	162.550	500	JUNEAU, AK
KETCHIKAN	AK WXJ26	162.550	500	ANNETTE, AK
KODIAK	AK WXJ78	162.550	100	KODIAK, AK
NOME	AK WXJ62	162.550	500	NOME, AK
SEWARD	AK KEC81	162.550	330	ANCHORAGE, AK
SITKA	AK WXJ80	162.550	200	JUNEAU, AK
SOLDOTNA	AK WWG39	162.475	300	ANCHORAGE, AK
VALDEZ	AK WXJ63	162.550	500	VALDEZ, AK
WRANGELL	AK WXJ83	162.400	750	JUNEAU, AK
YAKUTAT	AK W XK69	162.400	1000	YAKUTAT, AK

### CALIFORNIA

NWR TRANSMITTER.....	CA CALL	FREQ MHZ	WATTS	NWS PROGRAMMING OFFICE
BAKERSFIELD	CA WXL89	162.550	100	SAN JOAQUIN
COACHELLA	CA KIG78	162.400	100	SAN DIEGO, CA
EUREKA	CA KEC82	162.400	330	EUREKA, CA
FRESNO	CA KIH62	162.400	30	SAN JOAQUIN
GRASS VALLEY	CA WWF67	162.400	100	SACRAMENTO, CA
LOS ANGELES	CA KWO37	162.550	500	LOS ANGELES, CA
MONTEREY	CA KEC49	162.550	100	SAN FRANCISCO
MONTEREY MARINE	CA WWF64	162.450	100	SAN FRANCISCO
PT. ARENA/UKIAH	CA KIH30	162.550	500	EUREKA, CA
REDDING	CA WXL88	162.550	100	SACRAMENTO, CA
SACRAMENTO	CA KEC57	162.550	330	SACRAMENTO, CA
SAN DIEGO	CA KEC62	162.400	330	SAN DIEGO, CA
SAN FRANCISCO	CA KHB49	162.400	500	SAN FRANCISCO
SAN LUIS OBISPO	CA KIH31	162.550	330	LOS ANGELES, CA
SANTA ANA	CA WWG21	162.450	100	SAN DIEGO, CA
S. BARBARA MARINE	CA WWF62	162.475	100	LOS ANGELES, CA
SANTA BARBARA	CA KIH34	162.400	330	LOS ANGELES, CA

### GUAM

NWR TRANSMITTER.....	GU CALL	FREQ MHZ	WATTS	NWS PROGRAMMING OFFICE
GUAM (Nimitz Hill)	GU WXM85	162.400	375	GUAM, GU

## HAWAII

NWR TRANSMITTER...	HI CALL	FREQ MHZ	WATTS	NWS PROGRAMMING OFFICE
HAWAII (KULANI CONE)	HI KBA99	162.550	1000	HONOLULU, HI
HAWAII (SOUTH POINT)	HI WWG27	162.550	150	HONOLULU, HI
KANEOHE	HI WWH21	162.400	1000	HONOLULU, HI
KAUAI (KOKEE)	HI KBA99	162.400	1000	HONOLULU, HI
MAUI (MT. HALEAKALA)	HI KBA99	162.400	1000	HONOLULU, HI
OAHU (MT. KAALA)	HI KBA99	162.550	1000	HONOLULU, HI
OAHU KAI (HAWAII KAI)	HI WWF39	162.400	10	HONOLULU, HI

## OREGON

NWR TRANSMITTER...	OR CALL	FREQ MHZ	WATTS	NWS PROGRAMMING OFFICE
ASTORIA	OR KEC91	162.400	100	PORTLAND, OR
BEND/REDMOND	OR WWF80	162.500	120	PENDLETON, OR
BROOKINGS	OR KIH37	162.550	500	EUREKA, CA
COOS BAY	OR KIH32	162.400	330	MEDFORD, OR
EUGENE	OR KEC42	162.400	100	PORTLAND, OR
KLAMATH FALLS	OR WXL97	162.550	100	MEDFORD, OR
MEDFORD	OR WXL85	162.400	330	MEDFORD, OR
MT. ASHLAND	OR WWF97	162.475	100	MEDFORD, OR
NEHALEM	OR WWF94	162.425	25	PORTLAND, OR
NEWPORT	OR KIH33	162.550	100	PORTLAND, OR
PENDLETON	OR WXL95	162.400	330	PENDLETON, OR
PORTLAND	OR KIG98	162.550	330	PORTLAND, OR
ROSEBURG	OR WXL98	162.550	100	MEDFORD, OR
SALEM	OR WXL96	162.475	100	PORTLAND, OR
TILLAMOOK	OR WWF95	162.475	25	PORTLAND, OR
UMATILLA	OR WWF57	162.500	100	PENDLETON, OR

## WASHINGTON

NWR TRANSMITTER...	WA CALL	FREQ MHZ	WATTS	NWS PROGRAMMING OFFICE
NEAH BAY	WA KIH36	162.550	330	SEATTLE/TACOMA, WA
OKANAGAN (Tunk Mt.)	WA WWF49	162.525	50	SPOKANE, WA
OLYMPIA	WA WXM62	162.475	100	SEATTLE/TACOMA, WA
PORT ANGELES marine	WA WWG24	162.425	90	SEATTLE/TACOMA, WA
RICHLAND	WA WWF56	162.450	100	PENDLETON, OR
SEATTLE	WA KHB60	162.550	330	SEATTLE/TACOMA, WA
SPOKANE	WA WXL86	162.400	100	SPOKANE, WA
WENATCHEE	WA WXM48	162.475	100	SPOKANE, WA
YAKIMA	WA KIG75	162.550	300	PENDLETON, OR

GLOSSARY TERMS: (NOAA Weather Radio tells its listeners when weather Watches and Warnings have been issued.)

WATCH---conditions are such that a weather event or natural disaster is possible.

WARNING---issued when a weather condition or natural disaster is imminent or occurring.

Another source of information about emergency communications is found online (<http://hoshi.cic.sfu.ca/~anderson/topics/emcom/emcoms.html>). This webpage offers many links to international, Canadian, British, and American organizations concerned with secure and reliable emergency communications to aid with disaster mitigation, warning, and recovery. The website also gives information about emergency information networks, emergency notification systems, online discussion groups, reference materials, and amateur radio.

In addition to NOAA's Weather Radio, there is also EMWIN, Emergency Managers Weather Information Network, headquartered in West Palm Beach, Florida, operated by the National Weather Service. EMWIN data comes from Weather Service Offices, National Meteorological Center, and GOES satellites. The service also includes tsunami warnings. WeatherNode software is needed to receive this weather reporting.

## NEW REPORTS ON TSUNAMI MITIGATION

January 1 through January 31, 1999

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(See page 2 or ordering information)

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## TSUNAMI INUNDATION MAPPING

The tsunami inundation mapping is in progress. Contact these members of the National Tsunami Hazard Mitigation Program Steering Group for the status of the mapping in your state.

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# Infrequently Asked Questions

compiled by  
Lee Walkling

## **“Do tsunamis only happen in the Pacific Ocean?”**

No. There have been three tsunamis in Norway this century, probably caused by rock slides. There is geologic evidence of a tsunami generated by the Storegga Slide west of Norway about 8000 years ago. Currently the Genesis and Impact of Tsunamis on European Coasts (GITEC) is studying tsunamis in European waters.

Puerto Rico and the Virgin Islands have experienced tsunamis, most recently in 1918.

The 8.6 earthquake at Gorrige Bank off the coast of Portugal caused tsunamis that reached as far north as Ireland. Lisbon, coastal areas of North Africa, the Azores, Madiera and the Canary Islands received major damage.

In 1929 a landslide at Georges Bank by the St. Lawrence River caused a tsunami that killed 26 people along the Burin Peninsula of Newfoundland.

The Intergovernmental Oceanographic Commission (IOC), an agency of UNESCO, includes the regional Subcommission for the Caribbean and Adjacent Regions (IOCARIBE). George A. Maul is the chairman of its Tsunami Steering Group of Experts which was founded in 1996, because the Caribbean is seismically active and has a history of tsunamis.

## **“Can lakes have tsunamis?”**

On 18 May 1980 the upper 1500 ft (460 m) including the former summit of Mount St. Helens suddenly detached as a gigantic landslide (debris avalanche). The great avalanche slipped off the volcano and slammed into Spirit Lake, raising the lake surface by 63 m (207 ft) and sending a cataclysmic tsunami surging around the lake basin as high as 250 m (820 ft) above the old lake level.

Hummocky debris avalanche deposit at the head of the west arm of Spirit Lake arrived by plowing through the lake. Displaced water ran up the valley head more than 200 m above the preruption surface of Spirit Lake. This displaced, momentarily elevated water then swept back to the lake, rinsing the valley sides clean of timber and sediment, jamming logs and boulders against the debris avalanche hummocks.

The tsunami also swept up the east arm of the lake. Its upper limit along the north side of Harmony Falls basin lies an amazing 225 m (738 ft) above the old level of Spirit Lake. Above the limit trees lie where felled by a cataclysmic hot pyroclastic surge (see previous summary); below the limit the downed trees and the surge deposit were removed by the tsunami as it swept up the basin. This amazing area can be visited by hiking Harmony Falls trail in Mount St. Helens National Volcanic Monument.

## **“Is the official tsunami hazard symbol cool or hot?”**

If referring to the official tsunami hazard symbol on the side of the very cool tsunami mug, the logo only appears when hot liquids are poured into the mug. When cold, the mug shows a placid beach scene, with a person enjoying the surf, and the word “Tsunami?” Hot liquid activates the mug and changes the scene to the tsunami sign with the word ‘TSUNAMI!’ This heat sensitive mug was designed to give important hazard information to the public in an amusing, non-threatening way.

The other side of the mug has a permanent list of steps to take to escape a tsunami and the PMEL website for the National Tsunami Hazard Mitigation Program (<http://www.pmel.noaa.gov/tsunami-hazard/>), for additional information about tsunamis and natural hazards.

The mugs are available for sale: Oregon Department of Geology and Mineral Industries, (503) 731-4100 or fax (503) 731-4066; or Nature of the Northwest Information Center (503) 872-2750. Organizations can sell the mugs as fundraisers. Price: \$216.00 for a case of 36 mugs; \$96.00 for 12 mugs, or individually for \$10.00.

## **“The Lost Continent of Atlantis is fiction, right? Why are you writing about it in a tsunami newsletter?”**

In 1956 a Greek seismologist Angelos Galanopoulos raised the idea that Atlantis might have been the island of Santorini (Thera in 1650 B.C.). His theory is that a volcanic eruption destroyed the civilization on Thera. There are early Egyptian records to which Plato referred when describing a wonderful civilization that disappeared due to a natural disaster. He called it Atlantis. Unfortunately, his calculations about the size of the lost continent made it ten times the size it actually was, and he dated the catastrophe about ten times earlier than it could have occurred.

According to (<http://volcano.und.nodak.edu/vwdocs.vwlessons/lessons/Ch2CM/Content5NewAt.html>), “A volcano named Santorini exploded with such fury that it not only blew most of the island into the heavens but also caused a huge tsunami that wiped out many of the neighboring civilizations...This tsunami was reported to have reached the height of over 300 feet...Historians believe these giant sea waves were what caused the mysterious end of the great Minoan civilization in the Mediterranean.”



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