TsuInfo Alert

prepared on behalf of the

National Tsunami Hazard Mitigation Program

by the Washington State Department of Natural Resources

Contents

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TSUNAMI PROGRAM NEWS

Seward is Alaska's First "TsunamiReady" Community

On January 16, 2002, Seward became the first community in Alaska to be designated "TsunamiReady" by NOAA's National Weather Service. Weather Service officials from Alaska announced the "TsunamiReady" designation at the Seward Polar Bear Festival 2002.

"We are making history today by honoring Seward for establishing specific means to protect citizens from tsunamis," said NOAA's Weather Service Alaska Region Director Richard Przywarty. "This community has demonstrated a strong commitment to save lives and protect property in the event of these damaging and hazardous events."

The TsunamiReady program is a voluntary preparedness program that establishes guidelines for communities to be ready for tsunamis. Seward is the third community in the nation to receive this designation. TsunamiReady communities have met the specific requirements set by NOAA's Weather Service in the areas of communications, warning reception and dissemination, public outreach and awareness, and administrative planning.

To receive the TsunamiReady designation, Seward successfully met these readiness criteria and was approved by an advisory board made up of local emergency managers, representatives from the Alaska Division of Emergency Services and NOAA's Weather Service. Official signs recognizing the community as TsunamiReady will be posted on roadsides entering the community.

"Preparation and advance warning are vital factors in tsunami readiness," Przywarty said. "Seaside residents, especially in areas prone to earthquakes like Seward, must understand the importance of moving to high ground or inland immediately when a tsunami warning is given."

Seward is located above the confluence of the North American and Pacific tectonic plates. Earthquakes are common in this region, with approximately one quake per day over magnitude 3.0. Seward experienced tremendous damage as a result of the 1964 Alaskan earthquake and tsunami. The wave inundated up to 27 feet in parts of town. Twelve residents were killed by the tsunami and over 200 injured. Damage was estimated at $14 million.

More information on the TsunamiReady program is available at: http://wcatwc.gov/tsunamiready/tready.htm.

More TsunamiReady Communities!

Ocean Shores and Long Beach, WA and now Seward, AK are TsunamiReady Communities. They'll soon be joined by the Quinault Tribal Nation, WA, Cannon Beach, OR, Kodiak, Homer/Seldovia, Sitka, and Whittier, AK who are awaiting their TsunamiReady designation. Congrats to all!

MIC Steve Todd (above, right), WFO Portland, OR, presenting the TsunamiReady and StormReady signs to Long Beach Mayor Dale Jacobson, and Pacific County Emergency Manager Stephanie Fritts.

from: http://205.156.54.206/stormready/

(Tsunami Program News is continued on p. 3)

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(Tsunami Program News, continued from p. 1)

New Director at Oregon Emergency Management

Myra Thompson Lee, Director of Oregon Emergency Management for the last 14 years, recently retired. On December 21, 2001, Oregon Governor John Kitzhaber appointed Beverlee Venell as the new director of the agency.

NOAA Tsunami Information Center Gets New Director

NOAA's National Weather Service has selected Dr. Laura Kong as the new director of the International Tsunami Information Center (ITIC), replacing Michael Blackford who retired on February 1. "Dr. Kong's appointment recognizes a unique combination of scientific and communication skills," said Jim Weyman, acting director of the National Weather Service Pacific Region. "Her extensive research in marine geophysics and seismology and her experience as an expert tsunami advisor for Hawaii State Civil Defense will enhance the operations of the ITIC."

Kong held previous positions with the University of Tokyo Earthquake Research Institute, the USGS Hawaii Volcano Observatory, the University of Hawaii Institute of Geophysics, and the Richard H. Hagemeyer Pacific Tsunami Warning Center (PTWC). She played a key role in modernizing operations at PTWC, assisting in developing the capability for the warning center to move from manual processes to computer automation. Her most recent position was with the Federal Highway Administration where she oversaw federal and state government environmental streamlining procedures. For the past two years, Kong served as a Hawaii State Tsunami Advisor and as a Hawaii co-representative of the National Tsunami Hazard Mitigation Program Steering Committee.

Kong is a graduate of Punahou School and Brown University. She received her Ph.D in marine seismology from Massachusetts Institute of Technology/Woods Hole Oceanographic Institution.

The ITIC was formed under the auspices of the UNESCO Intergovernmental Oceanographic Commission after a 1960 earthquake in Chile caused a tsunami that swept across the Pacific bringing death and destruction to many points, especially Hawaii and Japan. Its purpose is to help extend the services of the U.S. tsunami warning system to the international community in the Pacific Basin and beyond. Based in Honolulu, ITIC is operated by NOAA's Weather Service. In addition to monitoring and coordinating tsunami warning activities, the Center fosters research and applications and assists with tsunami investigations and procedures.

"I look forward to actively engaging the 26 member states of the Pacific Tsunami Warning System to help im-prove their warning capabilities by offering the resources of the ITIC," said Kong. "Advanced technologies have helped make many inroads into real-time earthquake source charac-terization, tsunami propagation, run-up modeling

and deployment of instrumentation in remote locations once deemed impossible. Our challenge is to ensure that all member states, as well as other nations, have access to these capabilities and products."

Glen L. Woodbury Is Announced as New President of NEMA

Glen Woodbury, Director of Emergency Management Division, Washington Military Department, has been elected the new President of the National Emergency Managers Association. NEMA is the professional association of state, Pacific and Caribbean insular state emergency management directors committed to providing national leadership and expertise in comprehensive emergency management; serv-

ing as a vital information and assistance resource for state and territorial directors and their governors; and forging strategic partnerships to advance continuous improvements in emergency management.

CNN Article on Kilauea and Tsunamis, from Brian Yanagi, February 27, 2002 (printed with permission)

On Feb. 27, 2002, CNN Headline News aired "Portion of Volcano Slips Toward Ocean," a story about a 72-square mile section of the south slope of Kilauea Volcano that slipped 3.5 inches towards the sea in November 2000. The broadcast discussed two items in the Feb. 28, 2002 issue of *Nature* about whether such a submarine landslide could generate a tsunami that could strike coastlines in California, Chile, or Australia. The primary article is "Sudden aseismic fault slip on the south flank of Kilauea volcano" by Peter Cervelli, Paul Segall, and others, p. 1014-1018. The issue also included a comment on that article, "Slip-sliding away," by Steven N. Ward.

The CNN article has generated concerned public calls to Civil Defense offices.

There is NO IMMINENT THREAT of a massive landslide of Kilauea Volcano causing a 100 foot tsunami.

On the island of Hawaii, there has been a continual geological process of seaward slips of the flanks of active volcanoes along nearly horizontal fault planes near the bases of the volcanoes. Large earthquakes are caused by such seaward slips.

Check out CNN Sci-Tech web site: http:www.cnn.com /2002/TECH/science/02/27/tsunami/index.html.

Response to CNN Article, from Gerard Fryer, Hawaii Institute of Geophysics & Planetology, University of Hawaii at Manoa, Feb. 27, 2002 (printed with permission)

The CNN stories (and everyone else's stories now--I shudder to think what will be on the evening news) were inspired by a couple of articles coming out in tomorrow's issue of *Nature* (on the web at www.nature.com).

The main *Nature* article is about GPS monitoring of the motion of Kilauea's South Flank. In "Sudden aseismic fault slip on the South Flank of Kilauea volcano" Peter Cervelli and colleagues at Stanford and HVO describe a fine piece of work showing rapid oceanward movement of the South Flank over a period of 36 hours. The motion was equivalent to an earthquake with moment magnitude of 5.7. This is the first "silent earthquake" ever identified in a volcano. It may have been triggered by an intense rain storm some days before.

The problem is with an associated article in the section "News & Views" (in News & Views other scientists are invited to comment on the more important articles appearing in that issue). The News & Views piece about the GPS work is titled "Slip-sliding away," and it's by Steven Ward of UC Santa Cruz. Ward has gained some notoriety for modeling tsunamis from volcano collapses and he had a couple of papers published recently. Unfortunately, he tries too hard to steer discussion of the GPS work towards his own tsunami modeling efforts.

Ward says of the GPS data "What else can they indicate but some early stage of one of those flank collapses that litter the geological record? [...] The offset was a silent earthquake, if you will, on the fault that may eventually detach the whole flank." He follows with one of his tsunami simulations, showing the consequences of a catastrophic flank failure: waves as high as 30 m along the west coast of North America, waves 20 m high in the southwest Pacific, etc.

There are at least two major problems with Ward's titillating article.

First, Cervelli's paper talks of a relatively shallow failure well up in the flank rather than at the base of the volcano. This is not a whole-flank motion at all (indeed, Phil Watts and I are currently working with Simon Day to show that a catastrophic failure of Kilauea will *not* occur; that instead it will fail in a succession of lurches like the earthquakes of 1868 and 1975). Ward's implication that this failure might one day evolve to a full-blown flank collapse is misleading, to say the least.

Second, Ward's tsunami simulations suffer severe problems. His slide moves at a specified constant velocity rather than starting from rest. The efficiency with which waves are generated depends on how close the slide speed is to the tsunami speed. Ward's slide moves at 70 m/s, which is already the speed of a tsunami in 50 m of water. His method thus generates far too much slide-to-water coupling. The problem is exacerbated by the manner of his computation. He is using depth averaging, a well accepted way to simplify tsunami generation by earthquakes. Unfortunately, it doesn't work for landslides. As a slide moves downslope, water flows around it in the opposite direction. But depth averaging assumes that slide and water move together (which is like assuming that when you put your hand out of a speeding car you'll feel no wind). The combined effects of these errors is to produce outgoing tsunami waves that are far too high. You end up with erroneous predictions of ocean-wide calamity. Predictions of ocean-wide calamity, however, are just the sort of thing that the news media people lust after. Hence our problems today.

Announcing the Partnership for Public Warning

Effective public warnings of emergency situations require coordinated operations between public officials and privately owned mass communications technologies. Not only must technology function properly, but information must be effective in telling the public how to respond to threats and potential disasters. In November, experts in disaster warning and disaster information met in McLean, Virginia, to form a public/private partnership aimed at improving the coordination, operation, and effectiveness of disaster warning systems. The new organization was dubbed Partnership for Public Warning (PPW).

The organization believes that disaster warnings, responses, and losses have primarily local impacts, but a properly functioning national infrastructure to enable the generation and delivery of timely warnings and critical information is a national responsibility. To be effective, a public warning system must combine the efforts of federal, state, and local governments; businesses, including equipment manufacturers and service providers; and the media. The PPW seeks to foster better coordination and cooperation through consensus on how to approach warnings, how existing warning systems can be used more effectively, and which standards should apply to a national warning system.

The group has identified several basic issues that must be addressed, including the need for an all-hazards integrated warning system, current difficulties in warning systems, issues of special interest to emergency managers, effective warnings, information needs, message properties, hardware properties, potential services, sociological concerns, and a range of economic, legislative, legal, business, and international issues.

Membership in the PPW is open to all organizations and individuals interested in improving public warning. For more information about the organization, including how to become a member, contact the Partnership for Public Warning, Mail Stop NO22, 7515 Colshire Drive, McLean, VA 22102-7508; (703) 883-2745; email: cpage@ partnership forpublicwarning.org; WWW: http://www. partnershipfor publicwarning.org.

from: *Natural Hazards Observer* (online)
http://www.Colorado.EDU/hazards/o/maro02/toc.htm,
Volume XXVI, No. 4, March 2002

Tsunami Publications are Online

U.S. Geological Survey Circular 1187*, Surviving a tsunami--Lessons from Chile, Hawaii, and Japan*, compiled by Brian F. Atwater, Marco Cisternas, V, Joanne Bourgeois, Walter C. Dudley, James W. Hendley, II, and P. H. Stauffer, is now available online at http://geopubs.wr.usgs.gov/circular/c1187/.

Tsunami Warning Systems and Procedures--Guidance for Local Officials, was prepared for the National Tsunami Hazard Mitigation Program. by Oregon Emergency Management and the Oregon Department of Geology and Mineral Industries (DOGAMI). It has been released as DOGAMI Special Paper 35 and is available online at http://www.wa.gov/dnr/htdocs/ger/tsunami.htm

APRIL-MAY-JUNE CALENDAR OF EARTHQUAKE AND/OR TSUNAMI EVENTS AND ANNIVERSARIES

Events

April 2002

California will celebrate its 19th Annual California Earthquake Preparedness Month and hold a statewide Drop, Cover, and Hold Drill.

Hawaii designates this month as Tsunami Awareness Month

Washington proclaims April Disaster Preparedness Month and will hold a Drop, Cover and Hold Drill on April 18th.

April 7-13, 2002

International Building Safety Week--National Conference of States on Building Codes and Standards Campaign Kits available starting in mid-March from:

BOCA 708-799-2300
ICBO 1-800-284-4406
SBCCI 205-591-1853

May 6-12, 2002

Emergency Preparedness Week in British Columbia will promote all-hazards awareness.

Anniversaries

April 1, 1946

The Aleutian Island, Alaska 7.8 earthquake and Hilo tsunami (http://www.geophys.washington.edu/tsunami/general/historic/aleutian46.html and http://www.geocities.com/CapeCanaveral/Lab/1029/Tsunami1946.html)

April 18, 1906

The San Francisco 7.8 earthquake and fire (http://americahurrah.com/USGS/Intro.htm) Jack London's account of the earthquake is at http://sunsite.berkeley.edu/London/Writings/Journalism/sfearthquake.html

May 22, 1960

Chilean 9.6 earthquake and Hilo tsunami (http://www.geophys.washington.edu/tsunami/general/historic/chilean60.html and http://www.extremescience.com/GreatestEarthquake.htm)

June 7, 1692

Port Royal, Jamaica earthquake and tsunami (http://www.nerc-bas.ac.uk/tsunami-risks/html/HJamaica.htm)

CASCADIA MEGATHRUST EARTHQUAKES IN PACIFIC NORTHWEST INDIAN MYTHS AND LEGENDS

by
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12/29/99 draft; modified 3/26/02 (reprinted with permission)

This unpublished article was developed under USGS Grant #1434-HQ-97-GR-03166; "A database catalog of Cascadia earthquakes" Disclaimer: The views and conclusions contained in this document are those of the authors, and should not be interpreted as necessarily representing the official policies, either express or implied, of the U.S. Government.

Abstract

Megathrust earthquakes in Cascadia were first known through geologic evidence (Atwater and others, 1995). Study of historic records of tsunamis in Japan suggests that the most recent Cascadia megathrust earthquake was on January 26, 1700 (Satake and others, 1996, Tsuji and others, 1998). This date agrees with tree ring evidence showing that trees killed as a result of the earthquake perished between August 1699 and May 1700 (Yamaguchi and others, 1997). The 1700 Cascadia earthquake occurred about 90 years before Europeans arrived in the area, but would have been witnessed by the Native population. We searched for Pacific Northwest Indian tales and legends related to subduction zone earthquakes, and located a series of stories that suggest that strong shaking has been felt over a wide area and accompanied by tsunami flooding.

Introduction

Although the Native cultures of the Pacific Northwest possessed a rich oral tradition, only fragmentary remnants of their stories are available today. European diseases spread across the continent much faster than settlement, and Pacific Northwest Native populations were substantially diminished long before the actual arrival of Europeans on the Northwest coast (Dobyns, 1983), and continued to decline rapidly until after 1900 (Arima and others, 1991, p. 2). Stories were likely lost as the population declined. Sudden epidemics and their attendant disruptions may have had an especially damaging effect; stories were individually owned in some tribes, and may have perished with their owners.

It is estimated that perhaps 95% of the native oral literature of Oregon has been lost (Jacobs, 1962). Stories from Washington likely also suffered great losses. Published stories collected by ethnographers, anthropologists and others reflect to some extent the interests and biases of the Europeans who recorded them. The available representations of Native oral literature may not be a representative sampling of the original material.

From our perspective at the beginning of the 21st century, accustomed to the persuasive explanations of plate tectonics and to the printed word, it is difficult to imagine how Natives thought of and remembered great earthquakes. We are seeking clear and unambiguous descriptions of earthquakes and/or tsunamis, but Native myths and legends are not newspaper reporting, but stories deeply rooted in Northwest Native culture, and in an ancient oral tradition.

Native accounts of a once-in-many-generations event like a great earthquake may be incorporated into preexisting myths and explanations of phenomena in a way that makes that event difficult to separate from the intertwined background. Native stories served many purposes, and were deeply embedded in the overarching tribal cultures. Understanding the story motifs and characters that are most likely to be linked with earthquake stories requires careful study and insightful interrogation of the material.

Review of Previously Cited Material

We began our investigation with a review of the material cited in geophysical literature or listed in the "Bibliography and Index of Indian Tales in Special Collections University of Washington Libraries" (Edwards, 1993), an index of Indian myth story motifs and characters. Under the motif or character name of "earthquake", most of the entries in Edwards (1993) are from the Yurok (northern California) and Haida (northern Vancouver Island and the Queen Charlotte Islands).

All of the earthquake-related Yurok stories are contained in "Yurok Myths" (Kroeber, 1976). These include the relatively unambiguous story of co-seismic subsidence and tsunami "How the Prairie Became Ocean" (Kroeber, 1976; BB3) (previously discovered by D. Carver and G. Carver). The Yurok stories include a character called "Earthquake" (Kroeber, 1976; stories B5, C1, C5, F1, L1, P1, P6, W1, X1, and BB3).

Haida earthquake stories appear in several volumes (Tora, 1976; Barbeau, 1953; Swanton, 1905), and feature an Atlas-like and/or hero-figure who causes earthquakes by moving his hands and feet, or by stomping on the ground, or by boiling over duck grease. This figure is variously known as "Stone Ribs", "Strong Man Who holds up the World", and "Sacred One Both Still and Moving". The Haida and Yurok areas are located at the north and south ends of Cascadia, where earthquake activity is more frequent than on the Washington and Oregon coastal margin.

Within Cascadia, from Vancouver Island, several stories are clearly set in historical (not mythic) time, and are possibly related to great Cascadia earthquakes. One such story is of the destruction of a village on Vancouver Island's Pachena Bay, "The tsunami at !ANAQTL'A or 'Pachena Bay'" related during 1964 by Louis Clamhouse, published in Arima and others (1991, p. 231), and cited in Hutchinson and McMillan (1997).

"They had practically no way or time to try to save themselves. I think it was at nighttime that the land shook.... I think a big wave smashed into the beach. The Pachena Bay people were lost.... But they who lived at Ma:lts'a:s,:House-Up-Against-Hill, the wave did not reach because they were on high ground... Because of that they came out alive. They did not drift out to sea with the others."

Another story describes a great ebb and flow of the sea in Barkley Sound (Sproat, 1987; cited by Clague, 1995). Hutchinson and McMillan (1997) note that the story of a flood is widespread throughout the tribes of the Pacific Northwest.

Hill-Tout (1978) records a Cowichan tradition of strong shaking. The Cowichan Valley is located on southeastern Vancouver Island.

"In the days before the white man there was a great earthquake. It began about the middle of one night .... threw down ... houses and brought great masses of rock down from the mountains. One village was completely buried beneath a landslide."

Few Native American stories have been found of earthquakes in Washington and Oregon. Heaton and Snavely (1985) have cited the story of a flood at Neah Bay that James Swan recorded in his diary in 1864, and published in 1870 (Swan, 1870).

A search of Washington and Oregon Indian earthquake and flood folklore

The University of Washington (UW)'s Pacific Northwest Collection Indian Myth Index (Edwards, 1993) contained a few other references to earthquake shaking, but nothing that could be definitively linked with a tsunami or tidal disturbance in coastal Washington or Oregon. We also reviewed a number of the flood myths listed in the Indian Myth Index, and found that very few had any elements that seem even remotely associated with an earthquake tsunami. Because it is difficult to imagine that a great subduction earthquake 300 years ago involving all of Cascadia would not leave some trace in the native oral literatures of Washington and Oregon, we began to scan other stories in the books that contained flood stories. Incomplete as the preserved oral history of Cascadia is, many stories are repeated in multiple versions, with some "mixing and matching" of story elements, and some of the stories are geographically wide-spread.

We discovered a group of stories with common thematic elements which, if they can be taken together, show that great subduction zone earthquakes may indeed be represented in the oral literature of Pacific Northwest Indians. These stories suggest a widely felt event with strong shaking, severe tidal disturbances, incursion of salt water into estuaries, and death and dislocation of Indians along the northern Washington coast and Strait of Juan de Fuca. An important feature of these stories is that the description of physical phenomena in the distant but historical past is intertwined with the story of a mythic battle between supernatural beings. This representation may reflect typical Native American storytelling techniques and a traditional (i.e. pre-scientific) world view, and helps to explain why Native American stories of Cascadia earthquakes and tsunamis have been difficult to find.

Table 1 lists thematic elements contained in the stories. Some stories share as many as 8 or 9 thematic elements, while others have essentially no overlap, but are joined by other stories.

Discussion of Selected Native American earthquake and flood stories from Washington State

James Swan Diary Entry

The first story was recorded by James Swan (1818-1900), a prolific diarist and early resident of Washington (1852) who served as the first school teacher at the Makah Reservation at Neah Bay (1862-1866). This story has been cited by Heaton and Snavely (1985) and Hutchinson and McMillan (1997). The version given here comes directly from Swan's original journal (1864).

The story is a seemingly straightforward description of sea level changes, with water flowing from Neah Bay through Waatch Prairie, making Cape Flattery an island. This story is set at some time in the indefinite, but not-distant past. It describes relatively rapid sea level changes that might conceivably be associated with an tsunami, but without any report of shaking, It includes canoes in the trees, many dead, and population disruptions. Heaton and Snavely (1985) point out that some elements of the story, such as the water being warm, and the very slow rise and fall of the water, seem inconsistent with a tsunami.

Albert B. Reagan "A story of the flood"

Albert B. Reagan (1871-1936) worked for the U.S. Indian Field Service. He was initially trained as a geologist, then became interested in ethnology and received his PhD from Stanford in 1925. From 1905 to 1909, Reagan was the government official in charge of the Indian villages of Quileute (now called La Push) and Hoh.

"A story of the flood" (Reagan, 1934) is a Hoh/Quileute tale strikingly similar to the Swan account. In fact, all the story elements from the Swan account are present. However, this version of the story is clearly set in mythic time, not the historical past of the Swan account, and includes many story elements not present in Swan. "A story of the flood" attributes the tidal phenomena to a battle between two supernatural figures; Kwatee and the Thunderbird. After multiple episodes of battle, Kwatee kills the Thunderbird. This story also adds a unique physical detail--it describes sea animals stranded on dry land when the water recedes.

Kwatee, who figures in this story is also known as the Transformer or the trickster; he is a central figure in many northwest mythologies. Stories about the Transformer deal

with how he improves the imperfect world, through "the theft of fire, the destruction of monsters, the making of waterfalls, and the teaching of useful arts to the Indians" (Judson, 1916, p. vii). The Transformer is most widely known as Coyote. This character is called Speelyai in the Columbia River Basin, and appears as Yehl, the Raven, in Alaska.

George Benson Kuykendall "Speelyai fights Eenumtla"

G. B. Kuykendall, M.D. (1843-?) was an early resident of the Pacific Northwest (1852?). He graduated from Willamette University and was appointed to the post of government physician at Fort Simcoe on the Yakima Indian Reservation. He became interested in ethnology of the natives of the North Pacific Coast, and published a number of popular articles. For the story "Speelyai fights Eenumtla", neither the tribe nor the informant is named. From other stories about Speelyai, we know that this tale is from the Yakama Tribe of the Columbia River Basin, "Speelyai fights Eenumtla" (Kuykendall, 1889; reprinted in Bagley, 1930) like the previous story, details the lengthy epic battle in mythic time between the Transformer and the Thunder god. This inland version of the story clearly mentions shaking, but not water-level disturbances. "Speelyai fights Eenumtla" shares many story elements with "A story of the flood" but none with Swan's account. In this version of the story the culminating battle "shook the whole world". The battle is accompanied with thunder, lightning, and heavy rain while storm clouds darkened the sky. The Thunder god is finally vanquished, and is forbidden to thunder except on hot sultry days.

In general, the Yakama transformer myths in Kuykendall (1889) have different themes from the Hoh and Quileute transformer myths given by Reagan (1934). The similarities between the previous story and this one suggest a single widely experienced event. It is interesting to consider how widely traveled the various tribes might have been in 1700, how frequently they were in contact, and how stories might have been disseminated, shared, and compared between inland and coastal groups.

Albert B. Reagan "A Hoh version of the Thunderbird myth"

The fourth story, from the Hoh tribe, is "A Hoh version of the Thunderbird myth", found in Reagan (1934). A slightly different version is available in Reagan and Walters (1933). "A Hoh version of the Thunderbird myth" is another supernatural-being battle story in mythic time, also featuring the Thunderbird. It is worth noting that in Yurok myth Earthquake and Thunder are strongly associated; Kroeber (1976, p. 279 and story BB3). In "Myths and Legends of the Pacific Northwest", Judson (1910, p. v) speaks of "Tatoosh the Thunder Bird who ... shook the mountains with the flapping of his wings".

Like "Speelyai fights Eenumtla", this story shares many story elements of "A story of the Flood", but has few similarities to Swan's account.

In "A Hoh version of the Thunderbird myth" the Thunderbird struggles with two bad whales. There are many battles, a whale is carried over the land and dropped to the prairie below. Ultimately, the Thunderbird prevails, tearing apart the bad whales and strewing them around the country where they turn into landmark rocks and landforms. This story contains an epilogue, where the informant adds some details related to him by his father:

"There was a great storm and hail and flashes of lightning in the darkened, blackened sky and a great and crashing "thunder-noise" everywhere ... There were also a great shaking, jumping up and trembling of the earth beneath, and a rolling up of the great waters".

This is the most clear and unambiguous description of an earthquake and tsunami yet found in the native literature of Washington or Oregon. It is interesting to note how this information is set aside from the main myth. The specific mention of the informant's father suggests that this information, passed from person to person, is not really part of the myth. The manner in which this epilogue is tacked onto the main story may indicate that a historical event has been overlain on, and associated with, an older myth.

Erna Gunther "The Flood"

Erna Gunther (1896-1982), was a UW Professor of Anthropology, Chairman of the UW Anthropology Department, 1930-1955, and Director of the Burke Museum for thirty years. She wrote numerous books on Northwest Coast Indian Ethnography.

Our last story, "The Flood", recorded by Gunther (1925), is a Klallam folk tale which recounts a version of the flood story. Flood stories are extremely widespread in Pacific Northwest Indian lore, although most versions have no story elements suggestive of either shaking or tsunami. Floods are the most frequently occurring natural disasters, and are certainly common throughout western Washington. Flood myths are known world-wide (Vitaliano, 1973). The story of Noah's ark is very popular, was very likely told by missionaries and early settlers. Native Americans may have incorporated some European stories in their repertoire (Marriott, 1952), and some of the Pacific Northwest flood myths may reflect outside influences. The story given by Gunther (1925) mentions heavy rain over many days and the death of children due to cold weather following the flood. This story does not mention shaking, but has one element that suggests a tsunami; the rivers become salty during the flood. The canoe-in-the-tree and "many dead" elements are very similar to those in the Swan and Reagan accounts. We have included this story because it includes both typical and distinct story elements, when compared with other Pacific Northwest Indian flood stories, and illustrates the difficulty of placing these stories into the context of an earthquake and tsunami. Typical story elements include foresight of the flood and preparation of canoes, rain, tying the canoe to the mountain and the death of many people. Distinct elements

include the salt water, extreme cold, and the canoes striking the trees. These distinct and specific details give an impression of the recall of a real event.

Since this article was written in 1999, two additional Clallam (Klallam) sources were poin-ted out by Jacilee Wray, Olympic National Park Anthropol-ogist. The account in Clark (1953) suggests that the flood was accompanied by strong shaking. The Eells (1985) com-ment was recorded in the 1870s, and suggests that the time frame of the flood could possibly be consistent with 1700.

Discussion and Conclusions

Oral literature disperses information through multiple versions of a story, with story elements added and subtracted according to the occasion and to the knowledge, recall, and inclination of the storyteller. The loss of stories and the loss of multiple versions of known stories blurs the information contained in the stories. Taken as a group, these stories suggest how a historic event ten generations ago might be incorporated into a pre-existing mythic world-view. To extract the full information content, the stories need to be viewed in their wider cultural context, with an appreciation for the way that oral literature mixes and matches story elements.

The depiction of a great earthquake as a battle between supernatural beings seems eminently rational, as does the mythic association of earthquake and thunder. Weather and earthquakes are both ephemeral phenomena and in our own culture, they were traditionally grouped together. Early weather observers were responsible for noting earthquake occurrence, and "earthquake weather" was often discussed in 19th century newspaper articles.

We believe that the stories discussed here are evidence of a large earthquake accompanied by a tsunami. Using similar thematic techniques in a more comprehensive review of Pacific Northwest Native American stories may reveal additional details of the effects of the 1700 earthquake, and of prior megathrust earthquakes.

Table 1: Shared story elements, and mentions of motifs possibly related to earthquakes and tsunamis. Reagan1 refers to "A story of the flood"; Reagan2 indicates "A Hoh version of the Thunderbird myth".

	Swan	Reagan1	Kuykendall	Reagan2	Gunther
Not-too-long-ago time frame	X			X	
Mythic time frame		X	X	X	X
Cape Flattery Island	X	X			
Relocation of Chimacums and Quillehutes	X	X			
Flooding	X	X			X
Multiple water receding/rising	X	X			
Canoes in the trees/many dead	X	X			X
"no waves"	X	X			
Waves				X	
Stranded marine life		X			
Whales		X		X	
Battle of supernatural beings		X	X	X	
Lengthy multi-episode battle		X	X	X	
Creator God		X	X		
Thunder God		X	X	X	
Death/Loss of Supernatural Power		X	X	X	
Darkened Skies			X	X	
Dropping on land surface			X	X	
Lightning			X	X	
Rain			X	X	
Thunder-noise			X	X	
Shaking			X	X	
Hail				X	
Landslides				X	
Salt Water in rivers					X

Afterword

This preliminary article was written in late 1999, when I was just discovering the Thunderbird and Whale theme. Since then, by pursuing the Thunderbird, the Whale, and other earthquake-related story motifs, I have located earthquake and tsunami stories for many more Native groups up and down the coast of Cascadia. Some of these contain time and/or environmental (e.g. night, winter) elements that appear to be consistent with the 1700 earthquake. An expanded article is being prepared for publication in summer 2002.

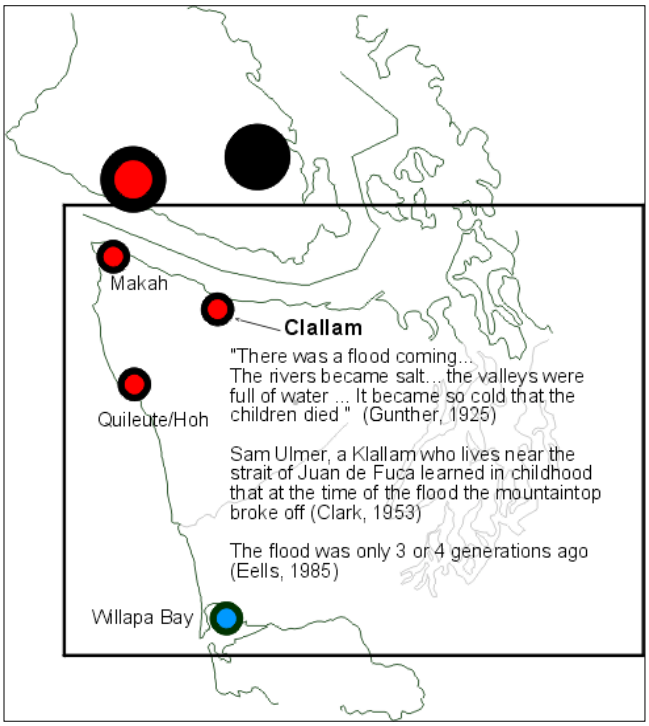

Figure 1. Approximate source locations of Makah, Quileute, and Clallam stories.

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More Native Oral Histories about Earthquakes and Tsunamis,

compiled by
Lee Walkling

For a telling article about the value and validity of oral traditions, read "At Least Noah Had Some Warning," in the July 10, 2001 issue of *Eos (American Geophysical Union Transactions)*, v. 82, no. 28. Contact *TsuInfo Alert* for a copy (see p. 2).

Alaska

"A Tlingit Indian story tells of a huge flood between 1850 and 1860 in which eight canoes filled with people were lost at Lituya Bay. This probably was the result of the 1853-54 tsunami, but cannot be proven.

from: Lander, Ja. F.; Lockridge, P.A., 1989, United States tsunamis (including United States possessions), 1690-1988: U.S. National Oceanic and Atmospheric Administration Publication 41-2, p. 87.

"…in 1786, the French navigator La Perouse discovered Lituya Bay and was told a Tlingit legend of a monster who dwelt in the bay. It was said that the monster destroyed all who entered the bay by grasping the surface of the water and shaking it like a sheet."

from: Dudley, W. C.; Lee, Min, 1998, Tsunami!; 2nd. ed.: University of Hawai'i Press, p. 79.

California: Gabrielino Indians, Southern California:

Long ago, when most of the world was water, Great Spirit decided to make a beautiful land with lakes and rivers, that turtles carried on their backs. One day the turtles began to argue and three of the turtles began to swim east, while the other three swam west. The earth shook! It cracked with a loud noise. The turtles could not swim far, because the land on their backs was heavy. When they saw that they could not swim far away they stopped arguing and made up. But every once in a while, the turtles that hold up California argue again, and each time they do, the earth shakes. *from:* http://www.ceri.memphis.edu/public/myths.shtml

Hawaii

"Archaeological findings on the Islands of Nihoa and Necker indicate that the people who lived there arrived earliest in the islands. During the 14th and 15th centuries, Tahitian Polynesians 'rediscovered' the islands, and most of their immigration to Hawaii occurred during this interval. For the next 300 to 400 years, until the arrival of Captain Cook in 1778, the Hawaiians lived in almost complete isolation from the rest of the world. With the exception of a few surviving chants from the era before discovery by Europeans, the record of tsunamis begins with European discovery and settlement."

from: Lander, J. F.; Lockridge, P. A., 1989, United States tsunamis (including United States possessions), 1690-1988: U.S. National Oceanic and Atmospheric Administration Publication 41-2, p. 17-18.

"1500-1600. The earliest reference to a tsunami came from the following chant attributed to Huluamana and composed in the 16th century: 'The sun shines brightly at Kalaeloa which sank into the sea. A huge wave came and killed its inhabitants, scattering them and leaving only Papala'au; their cries are all about.' It describes a tsunami-like event on the west coast of Molokai. (Cox, 1987)."

from: Lander, J. F.; Lockridge, P. A., 1989, United States tsunamis (including United States possessions), 1690-1988: U.S. National Oceanic and Atmospheric Administration Publication 41-2, p. 23.

Oregon

"The following account comes to us from a 1929 interview with Agnes Mattz, a full-blooded Tolowa woman, forty-five years old.

This happened in Oregon in a place called Brookings now, but Chetko is the Indian name. It is a very pretty place on the bank of the river. There was an old woman who was so old that she was blind. She had two grandchildren, a boy and a girl.

All of a sudden, the grandmother told the children to go right away, to go as fast as they could and not to wait for anybody. She would stay. She was old and ready to die anyway.

The two children ran as fast as they could, upstream, away from the harbor toward Mount Emilie as their grandmother had told them. Halfway there they looked back. They could hear people cry. They could hear the cries rise and sink out. They could see the water come.

When the sun came up it (the water) had all gone away. Everything was gone. They went back to where their house had been. There wasn't anything there, no dead people. Everything was swept clean. The ocean was nice and smooth. The boy went down to the beach to fish. He saw far away someone slowly coming toward him. It was a girl. He went to meet her. They got married and people started again."

from: Dudley, W. C.; Lee, Min,1998, Tsunami!; 2nd. ed.: University of Hawai'i Press, p. 309-310.

Washington

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S*ee TsuInfo Alert*, v. 3, no. 6, December 2001, page 13-14 for a Snohomish account of a landslide and tsunami at Camano Head and Hat Island, Washington.

General Earthquake Legends:

Earthquake legends are found in different cultures. Here are a few examples:

The world rests between the divine pillars of Faith, Hope, and Charity. When the deeds of humans weakens any of the pillars, the Earth shakes. (Romania)

The Earth is held up by four elephants standing on the back of a turtle. The turtle stands on a cobra. If any of these animals moves, the Earth trembles and shakes. (India)

A giant catfish, or namazu, lies curled up in the mud under the sea, with the islands of Japan resting on his back. The catfish likes to play pranks and can only be restrained by Kashima, a god (daimyojin) who protects the Japanese people from earthquakes. So long as Kashima keeps a mighty rock with magical powers over the catfish, the earth is still. But when he relaxes his guard, the catfish thrashes about, causing earthquakes. (Japan).

The devil makes giant rips in the Earth. He and his friends use the cracks when they want to come up and stir up some trouble on Earth. (Mexico)

The Earth rests on a sled driven by the god Tuli. The dogs who pull the sled have fleas. When the dogs stop to scratch, the Earth shakes. (Siberia)

Mother Earth has a child within her womb called the god Ru. When he kicks and stretches inside the womb, he causes earthquakes. (New Zealand)

The Earth is a living creature, much like humans. Sometimes the Earth gets sick, with fever and chills. When that happens we can feel it shaking. (Mozambique)

Powerful winds are trapped and held in caverns in the Earth. They struggle to escape. Earthquakes are the result of their struggle. (Greece)

from: http://www.sasked.gov.sk.ca/docs/midlsci/gr6ubmsc.html

New Zealand

(New Zealand legends provided by Dr. James Goff)

The earth began to rock, the great plain presenting the appearance of undulating sea waves. Then Ruapehu, Ngauruhoe, Tongariro and perhaps Waikaremoana belched forth what is commonly called fire and smoke, but in reality steam from superheated rock hurled out. Lighning flashed over a wide extent of the heavens, and the thunder seemed to rival the roaringof the volcanoes. The great black clouds, charged with pestilential vapours, spread far and wide, and driven by a fierce gale they soon quite obscured the sun. All this time the earth continued to rock laterally, and then a tremendous upward explosion occurred, as though the final cataclysm had come. The land was heaved up several feet and then suddenly went down fathoms deep beneath the sea, engulfing every living thing from the coast line back to Scinde Island, Mohaka and Te Wairoa, and Scinde Island, Parke Island and a few other small islets near Petane alone remained. The sea rolled over all the drowned plains and valleys, and when the mighty volcanoes had spent their force, and the skies cleared, there was nothing to be seen but broken canoes, parts of dwellings, and some of the bodies of the ill-fated inhabitants. The outer fringe of the coast went down the farthest, and the inner edge but a few feet. But the face of Nature was completely changed by the gigantic forces which had wrought such terrible destruction in a single day. Pihanga and the rival lovers had indeed wrought a terrible destruction.

from: Lambert, T., 1925, Story of Old Wairoa and the East Coast, New Zealand: Reed Publishers, Auckland.

<u>The Mahuhu Canoe (Maori)</u>

The Mahuhu canoe (finally) landed at the mouth of Kaipara, and the warriors who came in her settled down on the mainland at the entrance to Kaipara, at the place named Taporapora. But that part has become sea in these later days; it was a mainland (papa-tupu) originally, near the mouth of the Oruawharo. Here stood the Whare-kura, or

temple, of that people, at Taporapora. The people dwelt there for very many years, reciting their karakias (prayers,or incantations), and their ancient sacred history (karakia whakapapa o mua). That place (Taporapora) was shaved off (taraia noatia) by the sea, and the land disappeared together with the Whare-kura, the atuas (gods) and the tikis (images)---all were carried away by the sea. It was Ngati-whatua who killed the survivors of that people, but the women were taken as wives by Ngati-whatua, and one of their descendants is Te Otene-Kikokiko, who knows all the sacred things of old, together with the atuas and karakias and all the genealogies. The people who dwelt at Te Au-pouri (the North Cape) and the descendants of those who migrated (subsequently) to Waiapu descend from Whatu-tahae, the daughter of Po, who came here in the Mahuhu canoe, which first landed at Whangaroa.

from: Smith, S. P., 1896-97, The peopling of the North--Notes on the ancient Maori history of the Northern Peninsula and sketches of the history of the Ngati-whatua tribe of Kaipara, New Zealand: "Heru-Hapainga:" [Wellington, N.Z.], 22 p.

Cornell Tsunami Sleuths Explain the Power Behind the Wave That Caused a Major Disaster

(from: Cornell Theory Center press release, March 21, 2002; reprinted with permission from http://www.tc.cornell.edu/)

Editor's note: the website, at http://www.tc.cornell.edu/ includes wonderful illustrations and graphics that we were not able to reproduce here.

Ithaca, NY - With a death toll of more than 2000, the tsunami that struck Papua New Guinea on July 17, 1998 was one of the most devastating on record. Many of the victims drowned in the Sissano Lagoon behind the seaside Arop villages. While researchers were able to show the public a general picture of the event shortly after it occurred, time and powerful computing resources were needed to explain the unique power of this devastating event. Cornell civil and environmental engineers in the lab of Professor Philip Liu used the Dell/Intel/Windows Velocity high-performance cluster at the Cornell Theory Center (CTC) to show that the collapse of the sea floor caused by the associated earthquake intensified the wave's destructive power.

Papua New Guinea is a seismically active region, where many tectonic plates converge and slide past each other. The earthquake that caused the giant 1998 wave shocked the Sandaun province of northwestern New Guinea, about 65 km northwest of the port city of Aitape. Its magnitude was estimated at 7.0 on the Richter scale. Approximately 20 minutes after the first shock, Warapo and Arop villages were totally destroyed by tsunamis, which produced waves of 7 to 10 meters in height at the coast.

Working with Liu, graduate student Patrick Lynett simulated the track and size of the wave and its runup, based on details provided by an international team of tsunami researchers. This information included the bathymetry (undersea landscape) of the region, in addition to the forces generated by the shaking and dynamics of the quake and records of the runup gathered in New Guinea. The greatest wave height reported was more than 30 feet and can be explained by the unusual nature of the event. A huge underwater landslide, of a magnitude rarely seen, occurred near the shore. The ground movement disturbed the ocean above it and created the devastating tsunami. Lynett's simulation captures this complexity and shows the path of the wave as it surges through the lagoon where it destroyed the coastal villages.

Shortly after the event, Liu said, "In order to design the coastal structure properly and to reduce the damages which might be caused by a future tsunami, it is essential to be able to estimate the impact force acting on the structure." His team's simulations serve this purpose by going to great lengths to recreate the event in detail.

Such simulations make an important contribution to risk assessment for regional planners and contribute to our basic understanding of the behavior of these devastating waves, no longer thought to be limited to remote regions of the Pacific. Planners like Liu recommend construction of sea walls and implementation of zoning policies that ban building in high-risk areas as ways to minimize the destruction caused by such natural disasters. However, Liu is quoted by CNN to say, "It is questionable that in a country like Papua New Guinea such policies could be implemented."

In a country with limited resources, a flat coastal landscape, and sub-standard construction, planners have to make realistic recommendations. For example, instead of a storm shelter, families are encouraged to pick a sturdy Casuarina tree for quick climbing and to fit their tree out as a temporary refuge. Tsunami destruction is caused both by the water and the debris that is picked up by the wave and hurled at buildings. Thus tsunami experts recently recommended such straightforward, but important, plans as preventing relocation to vulnerable backwater regions, placing simple memorials to remind inhabitants of the danger and discourage resettlement of high risk locales, and planting sturdy trees instead of fragile palms along the coast.

CTC's Windows-based Velocity cluster consists of 64 Dell PowerEdge 6250 Quad Servers with Intel Pentium III Xeon 500 Mhz processors. CTC is a high-performance computing and interdisciplinary computational research center located at Cornell University. CTC receives funding from Cornell University, New York State, a number of federal agencies, and Corporate Program members. More ir information is available at http://www.tc.cornell.edu.

For more information, contact: Margaret Corbit, CTC, 533 Rhodes Hall, Cornell Univ., Ithaca, NY 14853-3801 ph: 607.254-8716; fax: 607.254.8888; e-mail: corbitm@tc.cornell.edu

Editor's note: Although this article is about a fire, the lessons learned apply to multi-hazard planning]

OPINION--Next Disaster: Where IT's At

by Craig Bicknell

originally printed in *Wired News*, May 23, 2000

Steen Rasmussen has long planned for disaster. As a government scientist, Rasmussen helps design Internet-based tools that would connect government, citizens, and relief agencies during such natural calamities as a major California quake. Then last week, quite unforeseen disaster. The giant fire that swept through Los Alamos drove Rasmussen from his Los Alamos Labs office into a real-life, chaotic calamity.

"The most difficult thing to understand was the lack of information--nobody knew anything," he said. "The different disaster agencies couldn't talk to each other. People were ringing the shelter's phones off the hook. And the television didn't give you anything. You'd have some reporter saying, 'Oh, isn't this terrible,' and then they'd show pictures of how terrible it was. But they didn't tell you anything you needed to know."

Rasmussen's response: Call in the information technology cavalry. Rasmussen put out calls to his friends in the local Net industry-such as owners of small ISPs and wireless communications companies--many of whom were already organizing their own volunteer efforts.

Rasmussen and a group of about 40 volunteers then hauled computers to the myriad shelters and relief centers and wired them together. Los Alamos residents displaced by the fire entered their contact information into searchable databases that were then posted online at several websites put together by volunteers.

Those sites became clearinghouses for any and all information about the fire, replete with news updates, current maps of fire damage, contact information for relief agencies and shelters, plus databases to locate loved ones--and even missing pets.

"You couldn't call any central area to find out what was going on," Rasmussen said. "But you could go online."

As the smoke settles, Rasmussen is now drafting up a lessons-learned memo that he plans to send to the Federal Emergency Management Agency (FEMA). First lesson: IT volunteer units work wonders.

"I was so impressed by the Internet providers' response, particularly the New Mexico Internet Providers Association," said Rasmussen. "Even though they'd never worked with a disaster before, they had all the right instincts.

"In the future, I think it would be a natural thing for wireless providers and Net providers to create volunteer organizations modeled on the Red Cross."

The Red Cross already has a Disaster Computer Operations unit, but it's limited in scope. When the Red Cross goes out to a major disaster area, it deploys teams of computer pros--along with up to 240 computers-from a central staging area in Austin, Texas.

Staffers in the field use the computers to help deal with the enormous administration burdens of relief work. The problem is, those machines aren't networked, and they're not connected to the Web. The Red Cross would like to hook everyone together, but the vast scope of its operations, plus concerns about clients' confidentiality, makes execution difficult. "The connectivity issues have yet to be worked out," said Greg Tune, a geographic information specialist with the Red Cross. "The question is, what does this thing look like that all of this information goes into?" It's critical that disaster response organizations find a way to answer that question, Rasmussen said.

"The problem with some of these big organizations it that they are, by necessity, bureaucracies--they have rigid, standardized ways of doing things," he said. "But once you're in a disaster, you need to rely 99 percent on people's ingenuity. You need to have a structure that will allow people to self-organize."

Rino Aldrighetti, executive secretary for the National Voluntary Organizations Active in Disaster, agrees. By coordinating their efforts online, disaster agencies could greatly increase the efficiency of relief efforts, he said.

When a disaster strikes, donations of food, clothing, and medicine often pour in from around the world--but it's frequently the wrong food, clothing, and medicine, he said. [*Editor's note:* see the PAHO flyer sent with the December 2001 issue about proper donations.]

By posting a combined inventory of what's needed and what's been received online, donors and agencies could help eliminate misguided giving. "You don't want to turn people away, but you need to deliver a better message about what's needed," he said.

To Rasmussen, long a student of Net-based disaster preparation, it's suddenly crystal clear that flexible, coordinated computer networks, already at the center of the business world, will soon be at the center of future relief efforts.

Or as he said, "It didn't really occur to me before that all the stuff I've been doing with pre-disaster preparation could be used during a disaster."

NEW TSUNAMI MITIGATION MATERIALS, February-March, 2002

(see page 2 for ordering instructions)

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Oregon

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Mitigation Resources for Success

This CD was developed by FEMA's Federal Insurance and Mitigation Administration to assist anyone concerned with building a safer future. The CD contains a wealth of mitigation information, publications, technical fact sheets, photographs, case studies, and federal and state mitigation program information and contacts. Case studies have been written and designed to be used as part of a presentation. It also describes federal mitigation programs and provides points of contact for each. It contains complete documents from the Mitigation Success publication series, the publications from FEMA's "How To" series on protecting homes and businesses, and other FEMA mitigation publications.

Copies are available **free** from the Federal Emergency Management Agency, Publications Distribution; (800) 480-2520.

Two Documents Explore Holistic Disaster Recovery

The period after a disaster can be a chaotic and discouraging one, especially for small- and medium-sized communities who are faced with innumerable difficult decisions, public pressure to act quickly, a confusing array of federal and state assistance programs, and a good deal of uncertainty. But it can also be an opportunity to improve the community for the long run, simply by adopting a broader perspective on the situation and by carrying out postdisaster decision-making and activities in a slightly different way. Two publications recently released by the Natural Hazards Center explain just such a new approach, termed "holistic disaster recovery," which integrates what is known about the process of recovering and reconstruction after a disaster with the principles of sustainability.

"Holistic Disaster Recovery: Ideas for Building Local Sustainability after a Natural Disaster" is an all-purpose handbook that contains background information, practical descriptions, and ideas about what sustainability is, why it is good for a community, and how it can be applied during disaster recovery. The book is intended for local officials and staff, activists, and the disaster recovery experts who help a community during disaster recovery, including state planners, emergency management professionals, mitigation specialists, and others.

"Holistic Disaster Recovery" (2001, 234 pp.) was produced under a 20-month project funded by the Public Entity Risk Institute (PERI). Printed copies can be obtained **free** from the PERI, 11350 Random Hills Road, Fairfax, VA 22030; (703) 352-1846; fax: (703) 352-6339; e-mail: dkouba@riskinstitute.org; WWW: http://www.riskinstitute.org. The handbook is also available in PDF format on the Hazards Center Web site at http://www.colorado.edu/hazards/holistic_recovery.

Another product of that project is a synthesis of the holistic recovery concept just released as Issue #3 of the "Natural Hazards Informer." "Building Back Better: Creating a Sustainable Community after Disaster," by Jacquelyn L. Monday, summarizes the importance of sustainability in the context of disaster recovery, presents the holistic recovery decisionmaking framework, and suggests how communities can incorporate sustainability ideals into each step of their recovery process. This issue of the Informer is intended for the same audience as the longer handbook but is also appropriate for distribution to citizens, elected officials, and others who would benefit from a synopsis of the concept.

"Building Back Better" was distributed to all "Natural Hazards Observer" subscribers. It is also available on the Center's Web site in PDF format at http://www.colorado.edu/hazards/informer. Readers are encouraged to print, copy, and widely distribute the Informer.

from: Disaster Research 362, March 6,2002.

2000 NEHRP Provisions Now Available

The 2000 *NEHRP Recommended Provisions for Seismic Regulation of New Buildings and Other Structures* (FEMA 368) and the Commentary (FEMA 369) are now available both online at the Building Seismic Safety Council site (www.bssconline.org) and through the FEMA Publications Warehouse (1-800-480-2520).

National Science Foundation-sponsored Volume

Facing the Unexpected: Disaster Preparedness and Response in the United States, by Kathleen J. Tierney, Michael K. Lindell and Ronald W. Perry, 2001, 300 pp. Free. Order from the National Academy Press, 2101 Constitution Avenue NW, Lockbox 285, Washington DC 20055; (888) 624-7645 or (202) 334-3313; fax (202) 334-2451;www.nap.edu. The volume can be read in its entirety online at www.books.nap.edu/catalog/9834.html.

This is one of the last volumes resulting from the National Science Foundation-sponsored Second U.S. Assessment of Research and Applications for Natural Hazards (see Natural Hazards Observer, v. XXVI, no. 1, p. 4). It presents knowledge garnered from disasters around the world over thepast 25 years and explores how disaster programs can be improved via these finds, identifies remaining research needs, and discusses disasters in the context of sustainable development. Combining theory, research, and practical guidance,the authors explain what makes communities and societies vulnerable to disasters and how that vulnerability can be minimized.

from: Natural Hazards Observer, v. XXVI, no. 4, p. 21. March 2002

Effective Emergency Management Organizations

Characteristics of Effective Emergency Management Organizational Structures is available from the Public Entity Risk Institute, 11350 Random Hills Road, Suite 210,

Fairfax, VA 22020;(703) 352-1846; fax (703) 352-6339; www.riskinstitute.org. Free.

Revised and updated version of the original 1970's work done by the International City/County Management Association (ICMA). The Association conducted research to identify 20 key characteristics contributing to an effective local government emergency management organizational structure. A self-assessment exercize was also developed and tested in more than 60 workshops. This new edition includes the self-assessment. Community leaders can work through the exercizes in the manual, examine the checklists, answer the questions, compare their own communities' situation to the standards, and learn from the experiences included throughout the book.

from: Natural Hazards Observer, v. XXVI, no. 4, p. 21-22. March 2002

CONFERENCES

May 6-8, 2002
Disaster Resistant California 2002: Sounding the Wake Up Call. Hosts: Emergency Preparedness Commission for the County and Cities of Los Angeles, Governor's Office of Emergency Services, City of Industry, CA. Contact: 323-980-2260

May 19-22, 2002
Coastal Society's 2002 Annual Meeting.
The conference will explore interrelationships among the physical, ecological, cultural, and political currents along U.S. coasts using three themes: Coastal Watersheds and Estuaries, Ecosystem Perspectives at the Regional Scale, and National Treasures and the International Commons. Galveston, Texas: May 19-22, 2002. Contact: Judy Tucker, The Coastal Society, P.O. Box 25408, Alexandria, VA 22313-5408; (703) 768-1599; fax: (703) 768-1598; e-mail: coastalsoc@aol.com; WWW: http://www.thecoastalsociety.org/conference.html.

May 28-29, 2002
Second Tsunami Symposium, Honolulu, HI

June 24-25, 2002
Emergency Operations Centers: Developand Maintain Command Structures that Save Lives, Prevent Damage, and Ensure Continuity of Operation. San Jose, CA Sponsors: National Institute for Government Innovation (NIGI), International Terrorism Response Association, Memorial Institute for the Prevention of Terrorism, National Terrorism Preparedness Institute, and the International Association of Emergency Managers. Theme: How to develop an emergency operation center and enhance understanding of the management process in terms of mitigation, preparedness, response, and recovery planning. Contact: NIGI, 708 Third Avenue, 4th Floor, New York, NY 10017-4103; (888) 670-8200; fax (941) 951-7885; e-mail: registration@nigi.org; www.nigi.org. (also: July 15-16, 2002, New York City)

July 9-12, 2002
Tsunami, Storm Surge, Relative Sea-level, and Coastal Change. Ocean Sciences Special Session #10 at the Western Pacific Geophysics Meeting 2002. Wellington, New Zealand. Contact: A. C. Hinton, Department of Earth Sciences, University of Waikato, Private Bag 3105, Hamilton, New Zealand; e-mail: a.c.hinton@leeds.ac.uk; WWW: http://www.agu.org/meetings/wp02top.html.

August 19-22, 2002
2002 Oregon Emergency Management Association Workshop. Valley River Inn, Eugene, OR http://www.oregonemergency.com/workshop.htm

September 10 - 15, 2002
"Local Tsunami Warning And Mitigation" Kamchatka Workshop 2002. Petropavlovsk-Kamchatskiy, Russia, Contact: Joanne Bourgeois, Dept. of Earth and Space Sciences, Box 351310, University of Washington, Seattle, WA 98195-1310; 206 685-2443; fax 206 543-0489; email: jbourgeo@u.washington.edu; http://oceanc47.phys.msu.su/Info.htm Organized jointly by the IUGG Tsunami Commission (IUGG/TC) and the International Co-ordination Group for the Tsunami Warning System in the Pacific (UNESCO/IOC/ICG/ITSU), with local organizers: P.P. Shirshov Institute of Oceanology of the Russian Academy of Sciences and the Kamchatka Seismological Department of Geophysical Service of the Russian Academy of Sciences

September 15-18, 2002
2002 American Shore and Beach Preservation Association Annual Conference. Portland, OR http://www.asbpa.org/2002conf.html

November 1-4, 2002
Annual Meeting of the International Association of Emergency Managers (IAEM). Orlando, Florida: November 1-4, 2003. Contact: IAEM, 111 Park Place, Falls Church, VA 22046; (703) 538-1795; fax: (703) 241-5603; e-mail: info@iaem.com; WWW: http://www.iaem.com.

November 13-15, 2002
2002 IBHS Annual Congress for Natural Hazard Loss Reduction. New Orleans, LA Sponsor: Institute for Business and Home Safety Contact: IBHS, 1408 North Westshore Blvd., Suite 208, Tampa, FL 33607; (813) 286-3400; fax (813) 286-9960; e-mail: info@ibhs.org; www.ibhs.org/congress/

WEBSITES

http://www.bghrc.com

At this site the Benfield Greig Hazard Research Centre at the University College London has posted two more in its series of Disaster Management Working Papers, intended to make new evidence, analysis, and ideas available to disaster researchers and practitioners worldwide. Click on "Disaster Studies." Working Paper No. 3, Rapid Environmental Impact Assessment: A Framework for Best Practice in Emergency Response, by Charles Kelly (2001, 16 pp.), starts with the premise that ignoring environmental issues during predisaster planning or during response and recovery clearly conflicts with comprehensive disaster management goals of "doing no harm" and "using best practices." The author suggests a way of incorporating a quick assessment of environmental damage and risks in the immediate aftermath of a disaster. Working Paper No. 4, 'Vulnerability': A Matter of Perception, by Annelies Heijmans (2001. 17 pp.), analyzes the role that local and individual perception of risk plays in how disaster-prone communities interpret their circumstances. She argues that relief efforts often ignore local capacity to assess and cope with threats, and that giving the community a voice and role in exploring strategies for long-term, secure livelihoods is crucial to successful disaster response. http://208.184.24.125/ http://208.184.24.125/ presspass/

The Emergency Email Network provides emergency notifications from local/regional/national governments, Red Cross, civil defense, and other public service agencies to subscribers via the Internet and e-mail (computer, cell phone, digital pager, and FAX). Users receive the emergency information alerts by filling out an on-line form and choosing one or more U.S. counties of interest. Messages contain alerts about severe weather, evacuations, health emergencies, natural disasters, utility outage information, locating emergency supplies, organ donations, daily weather forecasts, routine blood drives organized by the Red Cross, and other Internet services (third party solicitation). Government and public agencies can join the network and distribute their alerts and notices to professional and citizen subscribers.

from: Disaster Research 362, March 6, 2002

http://www.csc.noaa.gov/cmfp/admin/welcome.htm

US government's National Ocean Service's Office of Ocean and Coastal Resource Management (OCRM) and Coastal Services Center (CRC), in conjunction with coastal managers, have been working on a web-based learning and reference tool called "Coastal Management for Practitioners." The first module, "Coastal Management Framework," has just been brought online.

from: icoast newsletter, version 4.2, March 3, 2002

http://walrus.wr.usgs.gov/peru2/

"Preliminary Analysis of Sedimentary Deposits from the June 23, 2001 Peru Tsunami" This page covers preliminary results and conclusions from a cooperative field study conducted from September 4-18, 2001 by the United States Geological Survey, la Direccion de Hidrograffa y Navegacion (DHN) (Peru), Instituto Geoffsico del Peru (IGP) (Peru), Instituto Geologico, Minero y Metalurgico (INGEMMET) (Peru), University of California, Santa Cruz, University of Southern California, and University of San Agustin (Peru). The goal of the field work was to document sediment deposits from the tsunami and to collect information for developing numerical models to interpret deposits to extract information about tsunami flow velocity and height. We hope that this work will improve the understanding of tsunami hazards in Peru and other places in the world. The page includes information on tsunami sediment deposits, runup, topographic profiles, and damage from the tsunami.

from: Bruce Jaffe, US Geological Survey, Guy Gelfenbaum, US Geological Survey, and Robert Peters, US Geological Survey
3-8-02 email

Editor's Delight!!

The *entire* TsuInfo bibliography-- including **ALL** the tsunami materials we've been gathering for the last 7 years-- is now searchable online! It's all included in our library database at, **http://www2.wadnr.gov/dbtw-wpd/washbib.htm**

Assistance Needed

The Cascadia Region Earthquake Workgroup (CREW) has just completed a *Business and Homeowners Forum* in The Dalles, Oregon. It was in support of the Burke Museum's *The Big One* traveling exhibits (www.washington.edu/ burkemuseum/earthquakes/index.html). CREW plans to hold several additional 4-6 hour forums this year and is looking for assistance. They are especially in need of contingency and business resumption planners. For more information, contact: Bob Freitag: bfreitag@mindspring.com

VIDEO RESERVATIONS

Place a check mark (T) beside the video(s) you want to reserve; write the date of the program behind the title. Mail to TsuInfo Alert Video Reservations, Lee Walkling, Division of Geology and Earth Resources Library, PO Box 47007, Olympia, WA 98504-7007; or email lee.walkling@wadnr.gov

___ **Cascadia: The Hidden Fire - An Earthquake Survival Guide;** Global Net Productions, 2001. 9.5 minutes. 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. (The full documentary is scheduled for broadcasting on a PBS station in April 2002.)

___**Not Business as Usual: Emergency Planning for Small Businesses,** sponsored by CREW (Cascadia Regional Earthquake Workgroup), 2001. 10 min. Discusses disaster preparedness and business continuity. Web-sites are included at the end of the video for further information and for the source of a manual for emergency preparedness for businesses.

___**Adventures of Disaster Dudes** (14 min.)
Preparedness for pre-teens

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

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

___**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

___**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 the development of warning systems.

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

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

___**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.)

___**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. The Institute provides a booklet to use with the video. Does NOT address problems specifically caused by tsunamis.

___**The Quake Hunters** (45 min.)
A good mystery story: how a 300-year old Cascadia earthquake was finally dated by finding tsunami records in Japan

___**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, discussing 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 in California.

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

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

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

___**Tsunami Warning** (17 min.)
San Mateo (California) Operational Area Office of Emergency Services. This is a good public service program, specifically made for San Mateo County. Citizens are told what to do in cases of tsunami watches or tsunami warnings, with specific inundation zones identified for the expected 20-foot tall tsuna-mi. An evacuation checklist is provided, as well as locations of safe evacuation sites.

___**USGS Earthquake Videotapes "Pacific Northwest"**
USGS Open-File Report 94-179-E

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

___**The Wave: a Japanese Folktale** (9 min.) Animated film to help 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 (Washington) Interpretive Center, this video deals with beach safety, including tsunamis.

Check the title(s) you would like and indicate the date of your program. The video(s) will be mailed one week before the program date. You will be responsible for return postage.

Name:
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STATE EMERGENCY MANAGEMENT OFFICES

For general emergency management information, contact:

Alaska Division of Emergency Services
Department of Military & Veterans Affairs
P.O. Box 5750
Fort Richardson, Alaska 99505-5750
(907) 428-7039; Fax (907) 428-7009
http://www.ak-prepared.com/

California Office of Emergency Services
2800 Meadowview Road
Sacramento, California 95832
(916) 262-1816, Fax (916) 262-1677
http://www.oes.ca.gov/

Hawaii State Civil Defense
Department of Defense
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495
(808) 734-2161; Fax (808)733-4287
E-Mail: rprice@pdc.org http://iao.pdc.org

Oregon Division of Emergency Management
595 Cottage Street, NE
Salem, Oregon 97310
(503) 378-2911 ext 225, Fax (503) 588-1378
http://www.osp.state.or.us/oem/oem.htm

Washington State Military Department
Emergency Management Division
Camp Murray, WA 98430-5122
(253) 512-7067, Fax (253) 512-7207
http://www.wa.gov/mil/wsem/

Provincial Emergency Program
455 Boleskin Road
Victoria, BC V8Z 1E7
British Columbia, Canada
(250) 952-4913
Fax (250) 952-4888 http://www.pep.bc.ca

Infrequently Asked Questions

compiled by Lee Walkling

How do the children of Assam (located between Bangladesh and China) provide earthquake and tsunami mitigation?

According to local myth, there is a race of people living inside the Earth. From time to time they shake the ground to find out if anyone is still living on the surface. When children feel a quake, they shout, "Alive, alive!" so the people inside the earth will know they are there and stop the shaking.

from: http://www.sasked.gov.sk.ca/docs/midlsci/gr6ubmsc.html

According to J. H. Latter (1981), how many mechanisms are there for the generation of tsunamis during volcanic eruptions?

A) 3 B) 5002 C) 8

Eight is the answer given by J. H. Latter in the article "Tsunamis of volcanic origin--Summary of causes, with particular reference to Krakatoa, 1883": Bulletin Volcanologique, v. 44, p. 468-490. They are:

1. earthquakes accompanying eruptions
2. submarine explosions
3. pyroclastic flows entering the sea
4. caldera collapse or subsidence
5. landslides and avalanches of hot or cold rock or lahars entering the sea
6. lava entering the sea
7. base surges and associated shock waves
8. phase coupling with atmospheric shock waves (The topic of "Volcano-meteorological tsunamis, the c. AD 200 Taupo eruption (New Zealand) and the possibility of a global tsunami," by David J. Lowe and Willem P. de Lange: Holocene, v. 10, no. 3, p. 401-407.)

What *is* phase coupling with atmospheric shock waves?

A) abiki B) yota C) rissaga D) Seebär
E) meteorological tsunami

The article cited above (in answer #8) says there is a "special type of tsunami known as the 'meteorological tsunami' which results from the generation of waves by phase coupling with atmospheric compressional gravity or shock waves. Known by various local names (e.g., abiki, yota, rissaga, Seebär), these waves are not true tsunamis *sensu stricto* but are identical to 'normal' tsunamis in having long-period (c. 6-40 minutes) waves with speeds determined by water depths. They originate mainly through disturbances in the atmosphere, hence water surfaces, via the passage of strong cyclones (typhoons) or frontal squalls, or by atmospheric pressure jumps and trains of atmospheric gravity waves. Such large long waves, like their seismogenic or volcanogenic counterparts, have caused loss of life and catastrophic destruction in coastal areas and thus represent a significant but previously underestimated natural hazard."

The same article's abstract states: "Meteorological tsunamis are long-period waves that result from meteorologically driven disturbances. They are also generated by phase coupling with atmospheric gravity waves arising through powerful volcanic activity."

In the *Glossary of Geology*, the definition of coupled wave is a type of surface wave that is continuously generated by another wave which has the same phase velocity.

According to the website http://stommel.tamu.edu/~baum/paleo/ocean/node24.html, meteorological tsunami is defined as the excitation of short period (on the order of minutes) sea level oscillations near a coast by the passage of atmospheric pressure gravity waves.

Meteorological tsunami references

Monserrat, S.; Rabinovich, A. B.; Casas, B., 1998, On the reconstruction of the transfer function for atmospherically generated seiches: Geophysical Research Letters, v. 12, p. 2197-2200.

Rabinovich, A. B.; Monserrat, S., 1998, Generation of meteorological tsunamis (large amplitude seiches) near the Balearic and Kuril Islands: Natural Hazards, v. 18, p. 27-55.

What is the difference between a tsunami and a rogue wave?

According to Dr. Frank Gonzalez, "A tsunami is caused by a sudden displacement of water. The most frequent cause is an underwater earthquake but, less frequently, tsunamis can be generated by volcanic eruptions, landslides, or even oceanic meteor impact. The length of these waves, from one crest to the next, can be up to 200 km long, and they travel in the deep ocean at speeds around 700 km/hr. Their height in the open ocean is very small, a couple of meters at most, so they pass under ships and boats undetected.

So called "rogue waves" are a bit more mysterious, and not very well understood. They are very high waves, tens of meters, perhaps. They are very short compared to tsunamis, less than a 2000 m, perhaps. They arise unexpectedly in the open ocean, and the generating mechanism is a source of controversy and active research. Some theories:

-- Strong currents interact with existing swell to make them much higher

-- They are just a statistical aberration that occurs when a bunch of waves just happen to be in the right spot at the right time, so that they add together to make one big wave

-- If a storm "prepares" the ocean, by making it very rough, and this is followed by a sudden intensification of the storm, then the wind can get a "better grip" on the ocean surface (i.e., wind energy is much more efficiently transferred to the water), and the monster waves can thus be created."

from: http://www.pmel.noaa.gov/tsunami/Faq/x012_rogue

Why might April 3 be a day of celebration in the surfing community?

According to the Guinness Book of Records, a 15-metre-high tsunami (on April 3, 1869) was probably the highest wave ever ridden on a surfboard. The lucky surfie was a Hawaiian called Holua. [He was *lucky* to have survived.]

from: http://www.abc.net.au/science/k2/trek/4wd/tsunami.htm

Why were 1946 tsunami warnings ignored by many people in Hawaii?

The April 1, 1946 Aleutian Island, Alaska earthquake (7.8) generated a devastating tsunami that hit the Hawaiian Islands, inflicting much damage on Hilo. Many assumed the warnings were April Fool's Day jokes and ignored them.

> "The large number of deaths from this event brought the realization that a warning system was necessary to ensure the safety of the populace. On August 12, 1948, a plan was approved and the Seismic Sea Wave Warning System was established. Later its name would be changed to the Pacific Tsunami Warning System."

from: http://www.geophys.washington.edu/tsunami/general/historic/aleutian46.html

To celebrate the May 22 anniversary of the world's largest earthquake, make a large pot of

Chili Chile

Warning! Chipotle Hazard! If you like mild chili, beware, because when it comes to chipotles, you have to be prepared to take responsiblity for your own pain.

Ingredients:

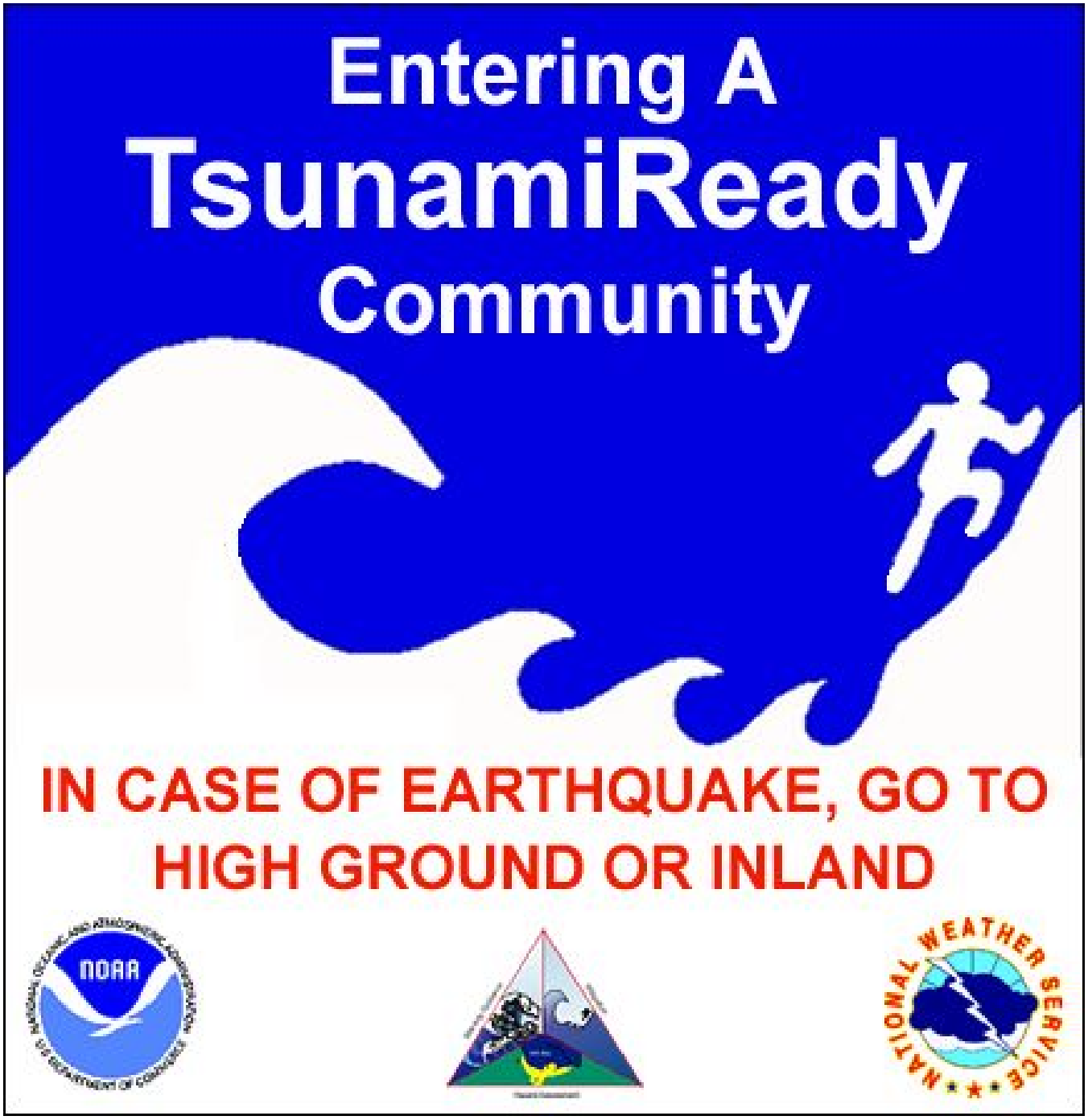
- 3 lbs ground or whole sirloin
- 3 medium onions
- 12 dried chipotle peppers
- 1 Tbsp ground comino (cumin seed)
- 3 cloves garlic
- 2 Tbsp fresh chopped oregano
- 9 fresh poblano peppers
- 4 10-oz cans Rotel diced tomatoes
- 2 Tbsp New Mexico chili powder
- 1 Tbsp paprika
- 5 fresh chopped sage leaves

Cut the chipotles in half and cover with hot water, steeping for 30 minutes. After they soften, add the water and chipotles to blender with garlic; blend till smooth. Resist the temptation to smell this up close; it generates a tsunami of pain.

If using whole sirloin, slice it thin across the grain. Saute the meat until grey. Add chopped onion and brown on high heat until the onion is dark and carmelized (best done in non-stick pan). Add meat, chipotle sauce, tomatoes and spices to pot and bring to boil. Reduce heat to simmer till meat is tender (about an hour and a half.)

Blister poblanos in a broiler (burn skin till black, both sides), and then put in a plastic bag for a few minutes. Dig this aroma! Remove skins and chop. Add to pot for last 20 minutes.

Wash it down with one of the Chilean beers: Cristal (a universal beer -drink it any time, any place, whoever you are), Escudo (stronger and more bitter than Cristal -a young people's beer), Royal Guard (an up-market beer; popular with women), Paulaner (a German beer, drunk mostly by the over-forties), Austral (a connoisseur's beer -foreigners like it), or Imperial (a beer drinker's beer -strong and bitter). Beer evaluations from : http://www.chileinfo.com/opportunities/opp_beer.html


Entering A
TsunamiReady
Community
IN CASE OF EARTHQUAKE, GO TO
HIGH GROUND OR INLAND
NOAA
NATIONAL WEATHER SERVICE

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands