TsuInfo Alert

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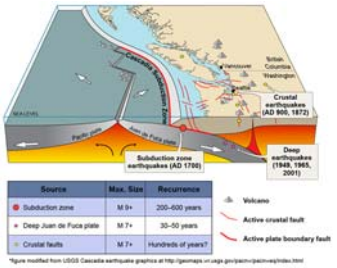
THE CASCADIA EARTHQUAKE AND TSUNAMI – WHAT ARE WE TO DO?
A response to the New Yorker articles

By Chuck Wallace, Deputy Director Emergency Management, Grays Harbor County, WA

The articles recently presented in The New Yorker Magazine by Kathryn Schulz, The Really Big One, (July 20, 2015) and How to Stay Safe When the Big One Comes, (July 28, 2015), have caused a tremendous amount of discussion throughout the nation. For the most part, her information is right on the mark as to what could occur during a Cascadia Subduction Zone earthquake and resulting tsunami. However, while understanding her wish to channel her article's "emotion into action," it is apparent Ms. Schulz neglected to report on specific types of mitigation, prevention, and safety plans which are in place in all coastal communities, to provide residents and visitors the best chance of surviving an earthquake and possible tsunami.



Credit: Washington Division of Geology and Earth Resources

In the City of Aberdeen, a coastal city in Grays Harbor County, Washington (WA), Police Chief Bob Torgerson implemented a "Yellow Brick Road" signage program to help lead the citizens to higher ground and safety during an earthquake and tsunami event. The Quinault Indian Nation has initiated the same type of program, as has the Shoalwater Bay Tribe in Tokeland, WA. This type of program will save many lives by getting the affected to high ground prior to the impact of tsunami.

Our schools take the possibility of disaster seriously. Twice each year they practice Drop, Cover, and Hold On drills to teach students what they should do during an earthquake. During The Great Shakeout Exercise in October, (modeled after the California Great Shakeout Earthquake exercise), every school in our county practices Drop, Cover, and Hold On, then students, faculty and staff evacuate the school to their assigned assembly areas which are in tsunami-safe areas.

The Ocosta School District just outside of Westport, WA is currently building the first Vertical Evacuation, Tsunami Safe Haven building in North America. This was driven by a community desire to keep their children and the school's teachers and employees safe should a Cascadia event occur. This was modeled from Project Safe Haven which was initiated by Washington State Emergency Management Division, The Washington Department of Natural Resources, the University of Washington, and the Federal Emergency Management Agency* (FEMA). The new elementary school, with engineering to withstand multiple earthquakes and the impact from numerous tsunamis, is based upon Japanese tsunami safe haven buildings, all of which endured the Tohoku Earthquake and Tsunami.

*Editorial footnote: Project Safe Haven made possible through significant NTHMP grant funding provided by NOAA.

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WASHINGTON STATE DEPARTMENT OF Natural Resources
Peter Goldmark - Commissioner of Public Lands
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NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM LIBRARY CATALOG:
http://d92019.eos-intl.net/D92019/OPAC/Index.aspx

The U.S. Tsunami Program: A brief overview – Tsunami Program reflections

By Rocky Lopes, NTHMP Administrator,
NOAA/National Weather Service Tsunami Program

In the June 2015 edition of TsuInfo Alert, there was an article about a 12-page report issued by the Congressional Research Service (CRS) on the U.S. Tsunami Program. The non-partisan CRS is often asked to provide reports about Federal Government activities that are impacted by legislation pending before Congress.

The report author did not consult with NOAA's National Weather Service Tsunami Program staff before issuing the report. Doing so could have prevented some unfortunate errors.

For clarification—

- The report erroneously states that $27M was appropriated as "full funding" for the NTHMP. For FY15, Congress appropriated $27M in funding for the NOAA Tsunami Program, and of that, $6M was for NTHMP grants. This information was reflected accurately on the last page of the report, but not in the introductory summary.
- The report implied that the NTHMP was responsible for DART buoy maintenance. The National Weather Service's National Data Buoy Center has that responsibility.
- The flow chart of the Tsunami Warning System lifted from NOAA's website was modified by CRS and in that process, the new chart became inaccurate. The correct chart is here: http://www.tsunami.noaa.gov/images/warning-system-smaller.jpg
- The article stated that as a result of P.L. 109-424 (TWEA), "the NTHMP assumed responsibility for planning and executing NOAA's tsunami activities..." That is not true—the NTHMP as a collaborative multistate group does not direct any Federal agency on how to execute its mission activities. Credit for the language reported by the CRS was given to the "About the NTHMP" section on the NTHMP website of February, 2015, which was updated in March.

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NTHMP Summer Subcommittee Meetings

By Rocky Lopes, NTHMP Administrator,
NOAA/National Weather Service Tsunami Program

The National Tsunami Hazard Mitigation Program's (NTHMP) Mitigation & Education (MES) and Mapping & Modeling (MMS) subcommittees met in San Diego for three days each in mid-July. Each subcommittee met separately for 2-1/4 days, and met together in a joint meeting for 3/4 of a day. The NTHMP Coordinating Committee also met in person as well.

Some highlights from these meetings include:

Mitigation & Education Subcommittee

- The TsunamiReady Fundamental and Tier II Guidelines were approved. See the revised Guidelines here: http://nws.weather.gov/nthmp/tr/index.html
- Kevin Richards and Ann Gravier were appointed to serve on the National TsunamiReady Board.
- The updated final version of the NTHMP Fact Sheet was approved. This document is on the NTHMP website here: http://nws.weather.gov/nthmp/about_program.html
- The updated Investment Activities report was discussed. Minor edits and a data call on the number of residents in tsunami inundation areas were requested. The report is being finalized for publication in August or September, 2015.
- The MMS proposes to hold a workshop with the USGS to facilitate more collaboration and consider holding it at the same time as the annual meeting. A workshop planning group involving Stephanie Ross, Kara Gately, Rick Wilson, and Rocky Lopes was appointed.
- The NTHMP Rules of Procedure were updated to allow for appointment of designated alternates for members of the Coordinating Committee if the official member cannot attend a meeting.

Mapping & Modeling Subcommittee

- The weeks of January 25–29 or February 1–5, 2016, were selected as the top choices for meeting dates for the NTHMP Annual Meeting and related NTHMP/USGS workshop & subcommittees. A number of locations were suggested. Rocky is working on it, and will provide site selection recommendations to Aimee Devaris in time for her to make a selection and announcement at the September 22 meeting of the Coordinating Committee. The announcement will also be available on the NTHMP website soon after that date, so stay tuned!

Each of these meetings provided ample opportunity for the subcommittees to accomplish a great deal including refining objectives and collaboration. Presentations and notes from these meetings are on the NTHMP website:

http://nws.weather.gov/nthmp/2015mesmms/index.html

THE CASCADIA EARTHQUAKE AND TSUNAMI – WHAT ARE WE TO DO?
A response to the New Yorker articles

By Chuck Wallace, Deputy Director Emergency Management, Grays Harbor County, WA

(Continued from Page 1)

The mitigation practices for earthquakes and tsunamis in Washington State are based upon our worst case scenario. We have a deliberate tactic towards community preparedness education, which we base upon an all-hazards approach to disaster. Each person, home, business and government building has a site specific risk to specific hazards. Understanding those hazards and their associated risk is where we learn how best to reduce the impact of any particular disaster event upon our families and community, creating the foundation for resilience.

According to some researchers and scientists, the odds for the next Cascadia earthquake are 1 in 3 in the next 50 years. Could it occur? Absolutely! Will it occur within that time frame? Let's all hope it doesn't. Does that mean everyone should flee their communities or not visit west coast beaches because of a prediction? I think not. Where would we go? If we decided to move to Missouri, Arkansas, Illinois, or Kentucky we are at risk from the New Madrid Earthquake which is predicted to have 87,000 casualties and billions of dollars in losses. California is out…San Andreas Fault. Perhaps Oklahoma...no, that's tornado alley. How about Florida and the Gulf States? No way, we've all heard about Katrina. How about the Mid-Atlantic States? No, they had an earthquake a few years ago. I remember reading that they just finished repairing the damage to the Washington Monument. As you can see, every place has issues when it comes to disaster.

Tsunami evacuation map for Westport. Credit: Washington Division of Geology and Earth Resources

There isn't a community in the world that can state they meet the threshold to be considered truly "resilient". Even New York City, the most funded, trained, and prepared city in the U.S. was not able to handle the issues presented by Superstorm Sandy. Japan, considered to be the most disaster-prepared country in the world, suffered severely from the Tohoku earthquake and resulting tsunami in 2011, because of a belief that they were "prepared enough".

The occurrence of the Cascadia earthquake and resulting tsunami will be devastating to all. If we recognize the need for continued work to help reduce the impacts of emergencies and disaster, we can begin to move forward to reduce their impact upon ourselves, our community, business and industry, and upon government. Preparedness saves lives. The cost of personal preparedness begins with a desire to become better educated about your risk and the potential impact of disaster to you and your family at home, work, and during your daily routine.

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IN THE NEWS

University of New South Wales TV—Catastrophic Science: Tsunamis
How the Japan tsunami changed science

Featuring: James Goff and Catherine Chague-Goff

When UNSW scientists James Goff and Catherine Chague-Goff studied the effects of the 2011 Japan tsunami, they made a discovery that will save lives in future disasters. And it all came down to a handful of soil.

This is the first episode of Catastrophic Science, the series that uncovers the life-saving work that has resulted from natural and man-made disasters.

View video on YouTube: https://www.youtube.com/watch?v=-Go9cA4LtBs

The U.S. Tsunami Program: A brief overview – Tsunami Program reflections

By Rocky Lopes, NTHMP Administrator,
NOAA/National Weather Service Tsunami Program
(Continued from Page 2)

Lessons learned:

- Congress and its research arm (the CRS) reads the NTHMP website, so we must ensure that the NTHMP's website is accurate. For example, we updated the "About the NTHMP" web page in March. The CRS accessed the information they reported in February.
- The relationship between NOAA's tsunami activities and the NTHMP is complex and hard to describe accurately by people unfamiliar with the details.
- CRS reports are issued on request when legislation is pending. As committees of Congress revise language in legislation, what is reported may be rendered outdated.

IN THE NEWS

ACS and the government of Chile convene workshop on seismic, tsunami and volcanic risk

By Association of Caribbean States (ACS)

Port of Spain, Trinidad and Tobago, July 8th, 2015 "Our region remains one of the most at risk to seismic and the attendant tsunami events. In fact vulnerability and exposure have increased in the last decade in all the Caribbean territories due to a number of physical, social and economic factors," delivered Dr Stephen Ramroop, Chief Executive Officer, Office of Disaster Preparedness and Management of Trinidad and Tobago on behalf of Mr Ronald Jackson, Executive Director, Caribbean Disaster Emergency Management Agency (CDEMA) during the Opening Ceremony of a two day workshop convened at the Secretariat of the Association of Caribbean States (ACS).

Credit: Association of Caribbean States

The Training Workshop on Seismic, Tsunami and Volcanic Risk is a collaborative event between the ACS and the Government of Chile which is aimed at comprehensively analysing and explaining the kind of emergency management needed when faced with a volcanic eruption, with seismic and tsunami signs affecting the Caribbean; giving details on demarcating areas of impact and actions for prevention, preparedness and warning associated with these natural processes.

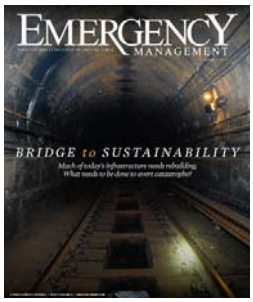
Access full article: http://goo.gl/KHpjow

A window of opportunity: Rebuilding the right way

By Jim McKay

From: Emergency Management Magazine, Summer 2015

America's GPA with regard to the state of critical infrastructure — roads, bridges, dams, drinking water, hazardous waste — is about a 1.3, equivalent to a grade of D+, according to the American Society of Civil Engineers (ASCE). It will take trillions of investment dollars to rebuild. Those costs are magnified if you acknowledge the trend of more intense natural disasters and the promise of more damage, largely from wind and water.



The solution isn't neat and tidy or easy, but with forward thinking, it presents opportunity. The Smarter- Safer coalition, composed of more than 30 groups, including major insurance companies, addressed the problem in an April 2015 report that says the U.S. must spend more money on infrastructure protection pre-disaster instead of wasting so much money rebuilding after an emergency happens.

It's a concept that's beginning to resonate, especially after events like Hurricane Sandy. Many experts agree that investments in more resilient infrastructure and an acknowledgment of infrastructure as a system are critical to viable long-term recovery.

Access full article: http://www.emergencymgmt.com/disaster/A-Window-of-Opportunity-EM.html

A contribution to the selection of tsunami human vulnerability indicators: conclusions from tsunami impacts in Sri Lanka and Thailand (2004), Samoa (2009), Chile (2010) and Japan (2011)

By P. González-Riancho, B. Aliaga, S. Hettiarachchi, M. González, and R. Medina

From: Natural Hazards and Earth System Sciences, July 2015

Abstract: After several tsunami events with disastrous consequences around the world, coastal countries have realized the need to be prepared to minimize human mortality and damage to coastal infrastructures, livelihoods and resources. The international scientific community is striving to develop and validate methodologies for tsunami hazard and vulnerability and risk assessments. The vulnerability of coastal communities is usually assessed through the definition of sets of indicators based on previous literature and/or post-tsunami reports, as well as on the available data for the study site. The aim of this work is to validate, in light of past tsunami events, the indicators currently proposed by the scientific community to measure human vulnerability, to improve their definition and selection as well as to analyse their validity for different country development profiles. The events analysed are the 2011 Great Tohoku tsunami, the 2010 Chilean tsunami, the 2009 Samoan tsunami and the 2004 Indian Ocean tsunami. The results obtained highlight the need for considering both permanent and temporal human exposure, the former requiring some hazard numerical modelling, while the latter is related to site-specific livelihoods, cultural traditions and gender roles. The most vulnerable age groups are the elderly and children, the former having much higher mortality rates. Female mortality is not always higher than male mortality and not always related to dependency issues. Higher numbers of disabled people do not always translate into higher numbers of victims. Besides, it is clear that mortality is not only related to the characteristics of the population but also of the buildings. A high correlation has been found between the affected buildings and the number of victims, being very high for completely damaged buildings. Distance to the sea, building materials and expected water depths are important determining factors regarding the type of damage to buildings.

Access full article: http://www.nat-hazards-earth-syst-sci.net/15/1493/2015/nhess-15-1493-2015.html

Source location impact on relative tsunami strength along the U.S. West Coast

By L. Rasmussen, P. D. Bromirski, A. J. Miller, D. Arcas, R. E. Flick, M. C. Hendershott

From: Journal of Geophysical Research—Oceans, v. 120, no. 7, p. 4945-4961.

Abstract: Tsunami propagation simulations are used to identify which tsunami source locations would produce the highest amplitude waves on approach to key population centers along the U.S. West Coast. The reasons for preferential influence of certain remote excitation sites are explored by examining model time sequences of tsunami wave patterns emanating from the source. Distant bathymetric features in the West and Central Pacific can redirect tsunami energy into narrow paths with anomalously large wave height that have disproportionate impact on small areas of coastline. The source region generating the waves can be as little as 100 km along a subduction zone, resulting in distinct source-target pairs with sharply amplified wave energy at the target. Tsunami spectral ratios examined for transects near the source, after crossing the West Pacific, and on approach to the coast illustrate how prominent bathymetric features alter wave spectral distributions, and relate to both the timing and magnitude of waves approaching shore. To contextualize the potential impact of tsunamis from high-amplitude source-target pairs, the source characteristics of major historical earthquakes and tsunamis in 1960, 1964, and 2011 are used to generate comparable events originating at the highest-amplitude source locations for each coastal target. This creates a type of "worst-case scenario," a replicate of each region's historically largest earthquake positioned at the fault segment that would produce the most incoming tsunami energy at each target port. An amplification factor provides a measure of how the incoming wave height from the worst-case source compares to the historical event.

Access full article: http://onlinelibrary.wiley.com/doi/10.1002/2015JC010718/full

Erosion of a paleo-tsunami record by the 2011 Tohoku-oki tsunami along the southern Sendai Plain

By Tetsuya Shinozakia, Kazuhisa Gotob, Shigehiro Fujinoc, Daisuke Sugawarab, Takashi Chibac

From: Marine Geology, August 2015

Abstract: Erosion of sediment beneath a coastal lake by the 2011 Tohoku-oki tsunami largely removed up to 1100 years of the geologic record of tsunami and tephra deposition. That lost geologic record included the 1611 Keicho tsunami deposit and the 915 To-a tephra, amounting to ca. 1.4 m of lake-bottom sediment, as judged from comparison of stratigraphy at four locations examined before and after the 2011 tsunami. The tsunami replaced the eroded sediment with a 7–15-cm-thick sand sheet and an overlying 20–60-cm-thick layer of black mud. Both 2011 deposit components were likely derived from sediment eroded along the tsunami flow path, including granite rock fragments downstream of the lake basin and mainly reworked lake-floor sediment. Erosion and redeposition of lake floor sediment by tsunami inundation can introduce uncertainty to sandy tsunami deposit age estimation. The 2011 tsunami sand might be dated a few hundred years older than the actual age if one overlooks the reworked muddy tsunami deposit. In its facies, the mud closely resembles mud deposited from the usual environment but is mixed with sediments of various ages. Therefore, it is important to identify the reworked muddy tsunami deposit based on geochemistry and micropaleontology, to avoid misinterpretation of the depositional age of tsunami deposits. Erosion of deposits beneath the lake floor also erases evidence, leaving an incomplete paleo-tsunami history. Reconstructing geological records of tsunamis in coastal lakes requires careful evaluation of the possible effects of tsunami erosion. Identifying sediment sources, mapping stratigraphic unconformities, and constructing detailed age-depth models to test for gaps in sedimentation can produce important insights.

Access full article: http://www.sciencedirect.com/science/article/pii/S0025322715300141

Tsunami waveform inversion for sea surface displacement following the 2011 Tohoku Earthquake: Importance of dispersion and source kinematics

By M. Jakir Hossen, Phil R. Cummins, Jan Dettmer, Toshitaka Baba

From: Journal of Geophysical Research—Solid Earth, August 2015

Abstract: This paper considers the importance of model parametrization, including dispersion, source kinematics and source discretization, in tsunami source inversion. We implement single and multiple time window methods for dispersive and non-dispersive wave propagation to estimate source models for the tsunami generated by the 2011 Tohoku-Oki earthquake. Our source model is described by sea surface displacement instead of fault slip, since sea surface displacement accounts for various tsunami generation mechanisms in addition to fault slip. The results show that tsunami source models can strongly depend on such model choices, particularly when high-quality, open-ocean tsunami waveform data are available. We carry out several synthetic inversion tests to validate the method and assess the impact of parametrization including dispersion and variable rupture velocity in data predictions on the inversion results. Although each of these effects have been considered separately in previous studies, we show that it is important to consider them together in order to obtain more meaningful inversion results. Our results suggest that the discretization of the source, the use of dispersive waves, and accounting for source kinematics are all important factors in tsunami source inversion of large events such as the Tohoku-Oki earthquake, particularly when an extensive set of high quality tsunami waveform recordings are available. For the Tohoku event, a dispersive model with variable rupture velocity results in a profound improvement in waveform fits that justify the higher source complexity and provide a more realistic source model.

Access full article: http://onlinelibrary.wiley.com/doi/10.1002/2015JB011942/full