

Formation of New NOAA Tsunami Science and Technology Advisory Panel (TSTAP)

By Rick Wilson, California Geological Survey

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The Weather Research and Forecasting Innovation Act of 2017 (the Weather Act) directed the NOAA Administrator to designate an expert working group within the NOAA Science Advisory Board (SAB) to serve as the Tsunami Science and Technology Advisory Panel (TSTAP). The purpose of the TSTAP is to provide advice to



the NOAA Administrator on matters regarding tsunami science, technology and regional preparedness. In order to accomplish this, the TSTAP will review and report on the activities of the Administration and other Federal activities as appropriate, relating to tsunami research, detection, forecasting, warning, mitigation, resiliency and preparation at least once every four years beginning in 2021. In its report, the TSTAP will make recommendations for legislative or administrative action to improve Federal tsunami planning in the areas discussed above and address other matters as the NOAA Administrator and/or SAB members may request.

The membership of the TSTAP is composed of non-Federal employees with academic or practical expertise in tsunami science, coastal civil/ocean engineering, geophysics, hydrology/flooding, emergency/disaster management and information/communications services, social sciences, information technology, and/or public education. The seven members of the 2020 TSTAP include: Corina Allen, Carrie Garrison-Laney, Rocky Lopes (Co-Chair), Diego Melgar, Aurelio Mercado, Mark Merrifield, and Rick Wilson (Co-Chair). These members will serve a three year term which can be renewed for an additional three years. Liaisons from the NOAA, the USGS, and related NOAA SAB groups also participate to provide feedback to questions from the TSTAP.

The TSTAP has met several times over the past two months hosting presentations from experts on specific topics and assessing the progress made by the NOAA Tsunami Program and its partners over the past decade. The TSTAP members will continue their evaluation over the next six to eight months and will summarize these activities and compile a list of recommendations in its first report due in 2021. The hope is that this work will result in improvements to end-to-end tsunami science, warning, and preparedness planning nationwide.

TsuInfo Alert

Prepared and published bimonthly by the Washington State Department of Natural Resources, Washington Geological Survey, on behalf of the National Tsunami Hazard Mitigation Program (NTHMP), a state/federal partnership led by the National Oceanic and Atmospheric Administration (NOAA).

This publication is free upon request and is available in print by mail and online at:

<http://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/tsunamis/tsuinfo-alert>

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NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM LIBRARY CATALOG:

<http://d92019.eos-intl.net/D92019/OPAC/Index.aspx>

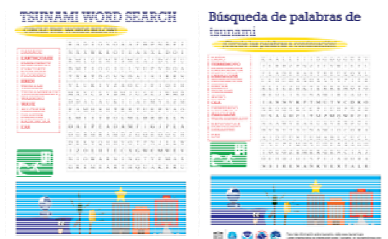
The views expressed herein are those of the authors and not necessarily those of NOAA, the Washington Department of Natural Resources, or other sponsors of TsuInfo Alert.

Vertical Evacuation Best Practices for the International Community

By Dane Sobol and Laura Kong, International Tsunami Information Center (ITIC)

Vertical evacuation may be a life-saving solution where natural high ground does not exist, or a local tsunami does not allow sufficient advance warning time to enable evacuation to high ground. Strong vertical evacuation buildings should provide a safe refuge for people to escape a tsunami. By simple definition, a vertical evacuation building is a structure with sufficient height and strength to resist tsunami wave effects. The 2018 International Building Code for structures references the ASCE/SEI 7-16 standard, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, Chapter 6, "Tsunami Loads and Effects," to design structures for tsunamis.

In response to a request from the UNESCO Intergovernmental Oceanic Commission Working Group on Tsunamis and Other Hazards related to Sea Level Warning and Mitigation Systems (IOC TOWS) Task Team on Disaster Management and Preparedness, ITIC has compiled international best practices in tsunami vertical evacuation. Highlights have been posted to the ITIC Vertical Evacuation web site http://itic.ioc-unesco.org/index.php?option=com_content&view=article&id=2070&Itemid=2927. Best practices were categorized by country and the following keywords: engineering assessment, building code, mitigation, and response. Each reference contains a brief summary for rapid comprehension. A total of 117 references were found. USA, Japan, and Indonesia had the most references. Tsunami awareness activities were also created for children to reinforce vertical evacuation guidance.



ITIC welcomes additional contributions to this compilation (please send to itic.tsunami@noaa.gov).

TSUNAMI RESEARCH

Tsunami Social Science Findings and Application-Part 2

By Elyssa Tappero, Washington Emergency Management Division

In 2018 the Washington State Tsunami Program teamed up with Dr. Michael Lindell’s team at the Environmental Hazards Research Institute (EHRI) to conduct a social science research study of tsunami evacuation products¹. EHRI conducted a survey of 221 residents in three Pacific coast communities that are vulnerable to a Cascadia Subduction Zone (CSZ) earthquake and tsunami—Discovery Bay, Washington; Lincoln City, Oregon; and Eureka, California. While the study areas were limited to the western coast of the United States, we believe the takeaways from this research are worth sharing with the wider tsunami community, along with the ways Washington is working to better emphasize them in our program. The findings were broken down into three major categories, two of which were covered in Part 1 of this article series (https://www.dnr.wa.gov/publications/ger_tsuinfo_2020_v22_no4.pdf), and the third which is covered here in Part 2.

Response to Ground Shaking and Evacuation Time

When asked how they expected to respond during “long violent earthquake shaking” (phrased in this manner to imply a tsunami would be likely to follow), the majority of participants chose the Drop/Cover/Hold On protective action. However, many still chose either outdated response methods like standing in doorways or the Triangle of Life, or options like “freeze” which seem to indicate they were unsure of what to do (see Figure 7, taken from the final report).

Figure 7. Mean ratings of expected response actions during earthquake shaking.

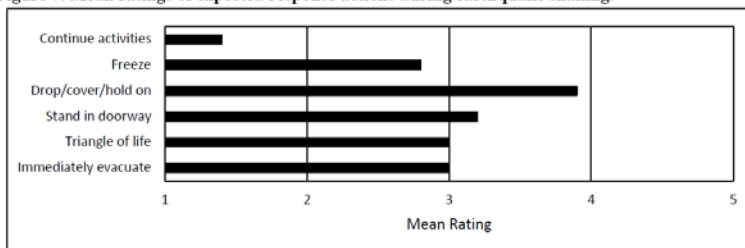


Figure 8. Mean ratings of expected response actions after earthquake shaking.



In addition, when asked to estimate their immediate actions following the end of ground shaking, most participants did NOT choose evacuation. Instead, they indicated they planned to seek additional information through news media, social media, or friends and family before taking further action (see Figure 8, taken from the final report). Many would also need to take time to pack emergency bags

before they could evacuate; less than half of respondents indicated they already had go-bags.

Finally, participants were asked to estimate the time they thought it would take them from the end of ground shaking to prepare for evacuation and reach high ground. The study found that participants across the board fell prey to the planning fallacy, a phenomenon in which predictions about how much time will be needed to complete a future task display an optimism bias and underestimate the time needed. Though participants felt confident they could evacuate to

¹Social Science Evaluation of Tsunami Evacuation Products, Part 2: Survey Results; Michael K. Lindell, Carla S. Prater, and Donald H. House; Environmental Hazards Research Institute, Seattle Washington; 31 November, 2019

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TSUNAMI RESEARCH & NTHMP UPDATES

Tsunami Social Science Findings and Application-Part 2

By Elyssa Tappero, Washington Emergency Management Division

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high ground safely, their combined estimated preparation time and estimated travel time were actually greater than the arrival time of the first waves. Even those participants who were prepared to evacuate immediately still underestimated how long the entire process would take.

According to the EHRI study, this is in keeping with decades of tsunami evacuation research which has repeatedly found people use valuable evacuation time to confirm warning information, pack supplies, or communicate with neighbors and loved ones. These findings also make sense given that less than half of the participants in the EHRI study had walked their evacuation routes and thus had nothing to realistically base their time estimate on. Fortunately, the majority of those who had not walked their routes indicated they were willing to do so.

This is a good reminder that both the need and the interest are there if we can provide the tools and opportunities to local jurisdictions. For that reason, our team is working on an evacuation drill guide with guidance for planning “small”, “medium”, and “large” walkout drills. These sizes are based on factors such as the drill’s location, complexity, and participant population, as well as the planning team’s experience, timeline, and funding. The guide is intended for people who have either never planned an evacuation drill before or who are looking to take their yearly drill to the next level but aren’t sure how to do so. We hope breaking evacuation drill planning down into easy, manageable steps encourages more groups to organize them and makes drills a more common part of community preparedness.

Walk Your Evacuation Routes

Evacuating will take longer than you think!

- Have your go-bag already packed and stored in an easily accessible place
- Don't waste time confirming alerts with secondary sources or social media
- Have a plan and *practice, practice, practice!*

Washington laws

- [House Bill 1279](#) requires public schools to practice 1 earthquake drill per year
- [House Bill 1216](#) requires public schools in mapped tsunami inundation zones to practice 1 tsunami drill per year



Community-wide Yellow Brick Road event where residents walk their tsunami evacuation routes.

Mitigation and Education Subcommittee of the NTHMP

Discusses Diversity and Inclusion, COVID-19 and Other Actions

By Kevin Miller and Dominique Degrate-Word (California Governor’s Office of Emergency Services), Christa von Hillebrandt-Andrade (US NWS Caribbean Tsunami Warning Program) and Tamra Biasco (FEMA Region 10)

The Mitigation and Education Subcommittee (MES) of the NTHMP held a virtual meeting on September 29, 2020. The meeting included a keynote speaker on diversity and inclusion, Ana-Marie Jones. Her presentation was followed by a discussion on the impact of COVID-19 and other MES actions.

Ana-Marie Jones is the former Executive Director of the non-profit Collaborating Agencies Responding to Disasters, a facilitator and convener of communities, a shameless purveyor of positive preparedness, and an author. She provided an engaging presentation about motivating preparedness and inclusiveness. She recommended shifting from the terms *special needs, at-risk, and marginalized, to disabilities, access, and functional needs*, which are more inclusive terms. Based on her experience, she emphasized that when engaging with vulnerable sectors of the population, it is critical to make

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NTHMP UPDATES

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preparedness conversations shamelessly positive, and to provide preparedness messaging to communities in an understandable and culturally sensitive format. She shared the Law of Diffusion of Innovation Curve which explains how new ideas or products are accepted by society, and the types of people that play a role in that process, from the early and eager acceptors to the "CAVE dwellers" (Consistently, Against, Virtually, Everything). She also strongly recommended using social science research for the development of outreach materials, as they can help identify the value people may place on those materials.

Christa von Hillebrandt-Andrade led a discussion on actions and readjustments that may be required in the light of COVID-19 pandemic. In her opening remarks, she raised the observation that health issues are not considered in the NTHMP Strategic Plan.

Laura Kong indicated that as COVID-19 expanded it was important to remind people that although COVID-19 is a factor, evacuation is still necessary if a tsunami arrives. This drove the UNESCO/IOC regional tsunami warning systems to develop guidance to be adapted at the national and local level. It recommends looking at reevaluating plans in order to provide clear guidance to the populations. She highlighted that there have been no significant reports of degradation of tsunami warning services due to COVID-19.

Wildaomaris Gonzalez of Puerto Rico indicated that the IOC document for the Caribbean was updated and available, and that it encouraged additional planning for shelters and even a COVID Quake M 8.5 exercise. Emergency managers have been tasked with detailing their plans and resource needs, including improvement to communication and equipment. Wildaomaris is currently working with six agencies to become TsunamiReady Supporters and was eager to implement Ana Marie's recommendations as she works with constituents directly. During COVID-19, Puerto Rico has experienced 11,000 earthquakes opposed to approximately 3,000 earthquakes last year, so they are stressing the importance of being ready.

Christa mentioned that during previous evacuations, Puerto Rico has had an issue with over-evacuation, so they are stressing the message to potential evacuees to consider the size of the evacuation zones during COVID-19.

Kevin Miller indicated that California has provided examples of alternatives to congregate shelters such as closed universities providing dorm rooms as evacuation points to families. In addition, California set up evacuation points and then placed people into hotels; California fairgrounds are open if people prefer to camp/shelter outside; and it is important to perform temperature checks, separate cohorts, deep clean facilities, serve individual instead buffet style meals, and have enhanced medical staffing/nursing available during evacuation orders.

Brad Baker, Santa Rosa County, Florida Emergency Manager, shared his experience with hurricane Sally and related evacuations considering COVID-19. They pooled people to a rally point and then moved people to hotels; provided non-congregate shelters for families and congregate shelters for special needs populations. Instead of 50 square feet per



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NTHMP UPDATES

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person, they increased to 100 square feet per person, provided masks, hand sanitizer, and per day snack pack boxes for families. They expanded the cleaning regimen during evacuations and performed extensive deep cleaning upon completion. All of these precautions helped prevent the spread of COVID-19. Persons in the congregate shelters were tested before they left the shelter – all persons tested negative. There was specific messaging related to the storm surge for persons concerned with evacuating: **“the storm surge kills, so if you are concerned about COVID, the surge can kill as well; evacuation takes precedence over COVID-19 concerns”**.

The MES will be following up on both of these new topics for MES: Inclusion and Health considerations.

The rest of the meeting was focused on three major MES projects: [TsunamiZone.org](https://www.tsunami-zone.org), Social Science Report, and the Maritime Guidance Website.

[TsunamiZone.Org](https://www.tsunami-zone.org) is the centralized source for tsunami preparedness information. It provides regional information in English, Spanish, and French languages, and provides capability to register for large exercises, such as Tsunami Preparedness Week. All stakeholders are encouraged to look at the website and provide feedback for further enhancement.

Elyssa Tappero and Maximillian Dixon of Washington Emergency Management highlighted the following lessons and deliverables from the Social Science Project which was recently completed.

1. Stress the message: **“Don't wait for the siren, ground shaking is your warning”**. They have also designed posters and pull-up banners to emphasize the aforementioned message and local vs distant tsunamis.
2. Advertise/push the NOAA radio and consider disseminating the NOAA radios at presentations as raffle items. The 2-Weeks Ready App is coming soon and will include tsunami info, local vs distant tsunamis definitions, webpages about the various alerts and alert definitions, and a tracking page of site views in response to the many views during wildfire season.
3. Myths still persists. Some of the post survey results shared were: almost all participants learned that it will take more time to prepare than it would for the tsunami to arrive; less than half of the participants walked their evacuation routes; of the participants that had kits, less than half of the kits had all of the essential items such as water and warm clothing.
4. Details related to the Social Science Project were featured in a two-part series in TsuInfo Alert

Kevin Miller and Todd Becker noted that they received feedback from the West Coast, Alaska, and Caribbean partners and incorporated the feedback into Tsunami Maritime Guidance Website. The website is designed with users in mind, has information for the boating community, incorporates outreach materials from NTHMP members, and has information geared towards Emergency Managers, Harbor Managers, and Port Masters. Steps for mitigation planning in the context of meeting TsunamiReady® criteria, and project listings for individual harbors are also included. The site has a feedback form so users can provide issues, links, or any materials or documents that should be included on the site. Discussions are underway on the final hosting of the website.

NTHMP UPDATES

California Tsunami Program

By Yvette LaDuke, California Governor's Office of Emergency Services

The California Tsunami Program (CTP) is a partnership of the California Governor's Office of Emergency Services (Cal OES), California Geological Survey (CGS), University of Southern California-Southern California Earthquake Center (SCEC), and Humboldt State University (HSU)/Redwood Coast Tsunami Work Group.

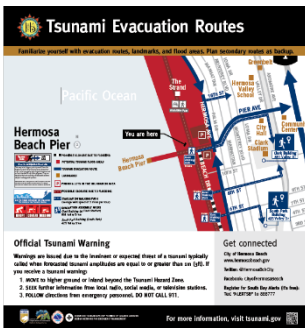
The CTP is in the process of updating the tsunami inundation maps for the entire California coast. As the CTP delineates this area community by community, we meet with each local jurisdiction to discuss the updates and collectively confer with experts in law enforcement, transportation, fire response, emergency management, and public works to identify and implement changes to evacuation areas and routes. Once this process is complete, the CTP publishes the finalized tsunami zone and evacuation maps on the public website: tsunami.ca.gov.



California Tsunami Hazard Update
Video: Tsunami Inundation Map Update Process - tsunami.ca.gov

Updating the tsunami inundation maps enhances opportunity for the CTP to expand the TsunamiReady® program. As inundation maps are completed and evacuation areas identified, California encourages communities to become TsunamiReady® or renew their TsunamiReady® status. The CTP coordinates with our local NWS Weather Field Office

Warning Coordination Meteorologists to: 1) obtain services to design and develop evacuation maps specific to locations within the tsunami zone; and, 2) procure kiosks containing tsunami warning and evacuation information installed at these locations by the local jurisdiction.



Tsunami Evacuation Map (TsunamiClear Map) at Hermosa Beach Pier in California developed by Jaenichen Design.

California maintains a robust arsenal of resources used by all CTP Partners (federal, state, local) to inform planning efforts and response operations and ensure that emergency managers and other local decision-makers in California have the same data to inform decisions during a tsunami event. The partnership between the NWS and the CTP ensures resources used by local decision-makers in developing emergency plans that inform response operations during tsunami events reflect the updates made to the inundation maps.

The CTP is conducting community hazard risk assessments (Hazardus) throughout coastal California and will develop maps and report outputs to identify opportunities for targeted outreach efforts; and, incorporate the information into local planning, mitigation, and response documents, and conduct workshops to coordinate these efforts with local tsunami program partners.

The CTP is working with its Tsunami Technical Advisory Panel to develop Tsunami Regulatory Zones to help local jurisdictions address requirements within the California Seismic Hazard Mapping Act. These zones may require that new residential, commercial, and industrial developers analyze and mitigate tsunami hazards through evacuation, land-use, and engineering strategies. The regulatory zones, and associated community and project-level guidance will be available in 2021.

California's Tsunami Program is the collective effort of many individuals and local programs working together to form one comprehensive Program. We continuously work together to plan, exercise, train, and educate the public on the most effective way to be informed and prepare for a tsunami event.

TSUNAMI PREPAREDNESS

Redwood Coast Tsunami Work Group's Annual Earthquake-Tsunami Fair Goes Virtual

By Lori Dengler for the RCTWG

The Redwood Coast Tsunami Work Group (RCTWG) was formed in 1996 to develop and coordinate preparedness materials in Mendocino, Humboldt and Del Norte Counties. It was created as a response to the 1995 California Division of Mines and Geology (now the California Geological Survey), Earthquake Planning Scenario for a magnitude 8.5 earthquake on the Cascadia Subduction zone (Toppozada et al., 1995*).

By 1998, the RCTWG had developed brochures and preparedness magazines and was looking for platforms to push information to the public. We participated in local preparedness fairs with limited success. Attendance was often sparse and the few who showed up were usually already aware of hazards. We had done a small county fair exhibit in 1992, sharing a room with the FEMA crew responding to the Cape Mendocino earthquakes and in 1999, approached the Humboldt County Fair Association about a larger repeat. They enthusiastically welcomed us, providing a large room in the Commercial exhibit center in the summer of 1999.

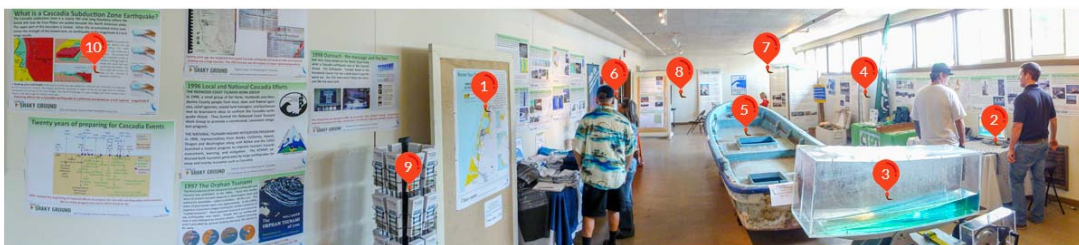
We had a lot of space to fill. We found a discarded wave tank in the Engineering Department. It had been built for a coastal engineering class but it didn't work well for their purposes. They didn't realize they had made a perfect tsunami wave tank, the two side-by-side chambers providing an excellent way to illustrate how tsunami wave speed depended on water depth. And best of all, it was kid proof. They could turn the crank as hard as they could and nothing would spill or tip.

We set up a Tsunami Theater with an old VHS projection system

and a mix of videotapes. We had a new edition of the Living on Shaky Ground magazine and Red Cross and California's Office of Emergency Services provided other materials to give away. We used an old rotap shaker from the Geology sediment lab to create an "earthquake in a pail" liquefaction display. The best decision was having RCTWG volunteers staff the room. It was a two-way learning street. Listening to people's concerns and answering questions changed our perspectives on what people knew and what worried them.

We returned in 2000, using the 300th anniversary of the 1700 Cascadia earthquake as our theme. The theater and wave tank came back and we added a smoked paper drum seismograph. This became the format for the next 18 years. We chose a theme – in 2005 it was the Indian Ocean tsunami and in 2006 the 100th anniversary of the San Francisco earthquake. For several years we also had smaller exhibits at the Del Norte and Mendocino County Fairs. When the

Photo Tour of the RCTWG Virtual Fair



1. Know your zone! | 2. Real-Time Earthquake Map | 3. About Tsunamis | 4. Preparing Your Family & Community | 5. Tsunami Debris | 6. Kids Corner | 7. Takeaways & Talking Points | 8. Movie Corner | 9. Resources | 10. Check out the Archive!

*Toppozada, T., Borhardt, G., Haydon, W., and Petersen, M., 1995, Planning Scenario in Humboldt and Del Norte Counties, California for a Great Earthquake on the Cascadia Subduction Zone, California Division of Conservation, Division of Mines and Geology Special Publication 115, 159 pp.

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TSUNAMI PREPAREDNESS & NTHMP EVENTS

Redwood Coast Tsunami Work Group's Annual Earthquake-Tsunami Fair Goes Virtual

By Lori Dengler for the RCTWG

(Continued from page 8)

California Office of Emergency Services began supporting RCTWG efforts, we were able to make nicer posters and hire student assistants, but the basic format remained the same. We always had a RCTWG volunteer in the room and we always emphasized making it a fun, positive experience. Attendance ranged between 3000 – 6000 people for each 11-day fair run.

And then came COVID. Our last in-person RCTWG meeting was the first week in March. We were still thinking Tsunami Week would happen and 2020 fair planning was moving forward. By the middle of the month it was clear we were in a brave new world and nothing would go on as usual. Tsunami Week was cancelled and a few months later, so was the Humboldt County Fair.

But not our fair. On October 12, a new era in RCTWG Earthquake-Tsunami Fairs debuted, virtually at <https://rctwg.humboldt.edu/virtual-fair>. Just like our former fairs, People can still enter our room and a RCTWG member is there to greet you. Ten balloons mark locations to explore further. Balloon #1 takes visitors to an interactive display of Humboldt County's new tsunami hazard maps and another click to real-time earthquake information. We added a Kid's Corner, featuring the heartwarming story of Kamome, the tsunami boat that connected children in Japan and Crescent City. Balloon#5 features tsunami debris and Humboldt's own tsunami boat, the Tai Shou Maru, that spent more than three years traveling across the Pacific after the 2011 tsunami before beaching at Dry Lagoon.

The Virtual Fair has provided a platform to organize much of our preparedness materials in one place. Balloon #4 has important tips including easy ways to sign up for emergency notification, ShakeOut and California Earthquake Alerts. Almost all of our print media is available for download at Balloon #9. And something that was impossible with the physical fair, an archive of posters and features of past fairs at balloon #10.

Please visit and give us feedback; there's a link to ask questions and make comments. And unlike the physical fair, the RCTWG Virtual Fair will be open indefinitely and updated as we acquire new materials and earthquakes and tsunamis make the news.



UPCOMING NTHMP & RELATED EVENTS

- ◆ November 5, 2020—World Tsunami Awareness Day <https://tsunamiday.undrr.org/>
- ◆ November 16-18, 2020—IAEM Annual Conference (Virtual) <https://www.iaem.org/usconf>
- ◆ November 17, 2020—NTHMP CC Meeting (Virtual) <https://nws.weather.gov/nthmp/>
- ◆ December 1-17, 2020—AGU Fall Meeting (Virtual) <https://www.agu.org/fall-meeting>



NEW TSUNAMI RESEARCH

Gallotti, G.; Passaro, S.; Armigliato, A.; Zaniboni, F.; Pagnoni, G.; Wang, L.; Sacchi, M.; Tinti, S.; Ligi, M.; Ventura, G., 2020, Journal of Volcanology and Geothermal Research, v. 404, no. 107025, <https://doi.org/10.1016/j.jvolgeores.2020.107025>.



Lobkovsky, Leopold; Mazova, Raissa; Remizov, Ilya; Baranova, Natalia, 2020, Local tsunami run-up depending on initial localization of the landslide body at submarine slope: Landslides, <https://doi.org/10.1007/s10346-020-01489-1>.



Rashidi, Amin; Dutykh, Denys; Shomali, Z. H.; Farajkhah, N. K.; Nouri, Mohammadsedegh, 2020, A Review of Tsunami Hazards in the Makran Subduction Zone: Geosciences, v. 10, no. 9, p. 372, <https://doi.org/10.3390/geosciences10090372>.



Tyatyushkina, Elena; Kozelkov, Andrey; Kurkin, Andrey; Pelinovsky, Efim; Kurulin, Vadim; Plygunova, Kseniya; Utkin, Dmitry, 2020, Verification of the LOGOS Software Package for Tsunami Simulations: Geosciences, v. 10, no. 10, <https://doi.org/10.3390/geosciences10100385>.



Williamson, A. L.; Melgar, Diego; Xu, Xiaohua; Milliner, Christopher, 2020, The 2018 Palu Tsunami: Coeval Landslide and Coseismic Sources: Seismological Research Letters, <https://doi.org/10.1785/0220200009>.



NTHMP Partners in the News

Small Tsunami Generated by Magnitude 7.5 Earthquake that Prompted Evacuation Orders—Steve Almasy, Dave Alsup and Andy Rose, CNN
<https://www.cnn.com/2020/10/19/us/alaska-earthquake/index.html>



More than 200 Coastal Communities in Costa Rica have Adequate Risk Management for a Potential Tsunami—TCRN Staff
<https://thecostaricanews.com/more-than-200-coastal-communities-in-costa-rica-have-adequate-risk-management-for-a-potential-tsunami/>



The Specter of a Mega-Tsunami in Alaska—NASA Earth Observatory
<https://earthobservatory.nasa.gov/images/147345/the-specter-of-a-mega-tsunami-in-alaska>