TsuInfo Alert

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Annual Tsunami Exercises Supported by National Weather Service

By James Waddell, National Tsunami Warning Center
Stan Goosby and Charles McCreery, Pacific Tsunami Warning Center
Christa von Hillebrandt-Andrade, Caribbean Tsunami Warning Program

In this issue:

NOAA's National Weather Service has supported tsunami exercises since 2008, to improve tsunami warning system effectiveness along the United States, Canada, and Caribbean coasts and adjacent regions. The exercises enable emergency management organizations and communities to exercise operational lines of communications, review tsunami response procedures, and promote tsunami preparedness. Regular exercising of response plans is critical to maintain readiness for emergencies. This is particularly true for tsunamis, which are infrequent but high impact events. The exercises are advertised well in advance and the handbooks are available to download from tsunami.gov, weather.gov or unesco.org (Exercises that include countries outside of the US). All emergency management organizations (EMO) are encouraged to participate.

The exercises can be customized to the participants' schedule in the form of an orientation exercise (seminar), a drill, a tabletop exercise, a functional exercise, or a full-scale exercise. A description of each exercise is provided in the handbook.

Three national/international exercises have been conducted thus far in 2018, CARIBE WAVE 2018, LANTEX18, and PACIFEX18. Each exercise had a handbook which described the scenario(s) and included the corresponding messages that would be disseminated from the servicing tsunami warning center had it been a real event.

CARIBE WAVE 2018: This exercise was conducted on March 15 as of 14h00 and was executed in support of the 48 countries and territories in the Caribbean and Adjacent regions (including Puerto Rico and USVI) which receive tsunami threat and warning services from the Pacific Tsunami Warning Center (PTWC). It was both a domestic and international exercise and consisted of three scenarios for each of the countries to choose from. These three scenarios were identified as the Barbados Scenario, the Colombia Scenario, and the Puerto Rico Scenario While the PTWC ran the tsunami simulations, the USGS provided earthquake shaking and impact information for the scenarios. According to TsunamiZone.org, almost 400,000 people participated in this exercise from Bermuda through Brazil. PTWC issued one "dummy" start-of-exercise message which was followed with the simulated products which were sent according to the scenario each country had selected. For more information on this exercise, see articles on pages 4-6.

- Barbados Scenario: This region lacks the large earthquake record of other regions. This scenario involved a magnitude 8.6 earthquake located at 12.20°N, 58.30°W along a 400 km by 100 km wide fault. With this scenario, the southern segment of the Lesser Antilles ruptured and while it created a tsunami that affected the Southeastern Caribbean, most of the energy was directed towards the southern Atlantic Ocean.

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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

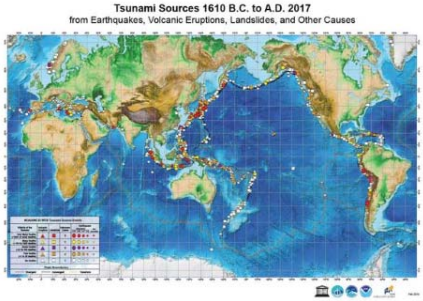
Visualizing Disasters: New Hazardous Event Posters Available

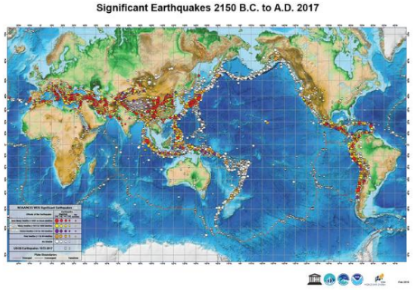
By National Centers for Environmental Information

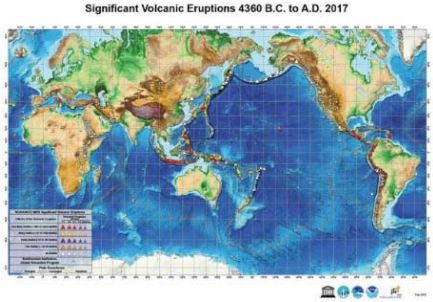
NCEI's Global Historical Tsunami, Significant Earthquake, and Significant Volcanic Eruption databases provide valuable information available to many agencies that issue alerts when potentially deadly or damaging natural phenomenon occur.

These databases play a critical role in informing the public about natural hazards. To reach a much wider audience, NCEI researchers began thinking outside the box due to a request to expand tsunami information beyond a database.

In 2008, at the request of the International Tsunami Information Center (ITIC), NCEI began the development of a historical Global Tsunami Sources poster. Since the initial request, three natural hazards posters have been developed and updated, most recently in February 2018.







View full article and access posters here:
https://www.ncei.noaa.gov/news/visualizing-disasters-new-hazardous-event-posters-available

Annual Tsunami Exercises Supported by National Weather Service

By James Waddell, National Tsunami Warning Center
Stan Goosby and Charles McCreery, Pacific Tsunami Warning Center
Christa von Hillebrandt-Andrade, Caribbean Tsunami Warning Program

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- Colombia Scenario: Colombia has a complex tectonic setting, due to its location at the convergence of three major plates: South America, Nazca, and Caribbean. For this exercise, a magnitude 8.1 earthquake located at 11.4°N, 74.8°W occurred along a 300 km long by 30 km wide fault segment at 19.39 km depth. The scenario produced localized wave amplitudes between one and more than five meters, and regional amplitudes less than one meter. Simulated shaking intensities reached up to VII on the Modified Mercalli Intensity Scale.
- Puerto Rico Scenario: Geological data, marine geophysical studies, seismicity, and geodesy have been used to define at least two microplates in this region; the Hispaniola and the Puerto Rico-Virgin Islands microplates. The Mona Passage, with a rate of motion of 5 ± 3 mm/yr in a North America Fixed Reference Frame (Jansma and Mattioli, 2005), is the active feature accommodating the separation between the two blocks. This relative movement explains the presence of extensional features in the Mona Passage seafloor and the seismic activity along the area, and may have been responsible for the occurrence of the October 11, 1918 earthquake and tsunami. However, which particular fault within the Mona Passage ruptured during that earthquake is still uncertain. Therefore, two models have been suggested to describe the source of the 1918 earthquake and tsunami. For this exercise, the second model, which yields a better source, was used as the tsunami source. The parameters of the source are based on a pure normal fault (rake = -90) with azimuth at 110 degrees, with a dip of 70 degrees towards the SW, that is 80 km in length and 20 km in width. With these values and an average slip of 6m, it yields a magnitude 7.6 event located at 18.3°N, 67.8°W. This was the scenario chosen by Puerto Rico and the US Virgin Islands (see article page 6).

LANTEX18: The exercise was coordinated by the National Tsunami Warning Center (NTWC) for its stakeholders in the Northwestern Atlantic. It started with a magnitude 7.5 earthquake located 90 miles south of Nantucket, MA. and 170 miles southeast of Boston, MA at 40.0°N, 70.0°W. The earthquake occurred at 1300UTC on March 21, 2018 and immediately triggered a 100 cubic km underwater slide of sediment that slid south from 40.0°N, 70.0°W at a maximum speed of 50 meters/second. The slide width was 30km and the block length was 20km. The earthquake uplift did not generate a significant tsunami, but the slide generated a destructive tsunami along some portions of the east coast and in Puerto Rico and the Virgin Islands (tsunami amplitudes over 1.5 m). A moderate, though damaging, tsunami was observed along other portions of the U.S. and Canadian Atlantic coast (tsunami amplitudes were 0.5 to 1.5 m). Most regions along the coast did not experience major inundations, though all areas at a minimum experienced strong currents which produced significant amounts of damage to boats, harbors, and docks as well as making swimming dangerous.

PACIFEX18: This exercise was also coordinated by the NTWC for its Pacific stakeholders and replicated a magnitude 8.2 earthquake located 100 miles southeast of Sand Point, AK and 565 miles southwest of Anchorage, AK at 54.4°N, 158.5°W. The earthquake occurred at 1600UTC on March 26, 2018. This location is in the area of the Shumigan Islands which is located off the tip of the Alaskan Peninsula. Earthquakes of magnitude 8.0 or more have occurred on average every 70 years within different segments of the Aleutian Arc. The Shumigan Islands area is unique in that it has inspired much debate over when its next strong earthquake is likely to occur, since the area's last great quake was in 1848.

NTWC also supported a mini-scenario for Washington State on April 5, which simulated a future major tsunami generating earthquake, similar in nature to Alaska's March 27, 1964 9.2 magnitude event, located 70 miles east of Kodiak City, AK. This event was located at 58.0°N, 150.5°W and its O-time was 0920UTC on July 08, 2018.

The NWS is dedicated to improving the knowledge and safety of those protected within its tsunami warning system. These exercises are aligned with the *2018-2023 NTHMP Strategic Plan* and its Goal 2.3 that exercises be effectively supported. States served by the NTWC should contact James Waddell, at 907-745-4212, if you are interested in having a customized mini-scenario developed for an exercise.

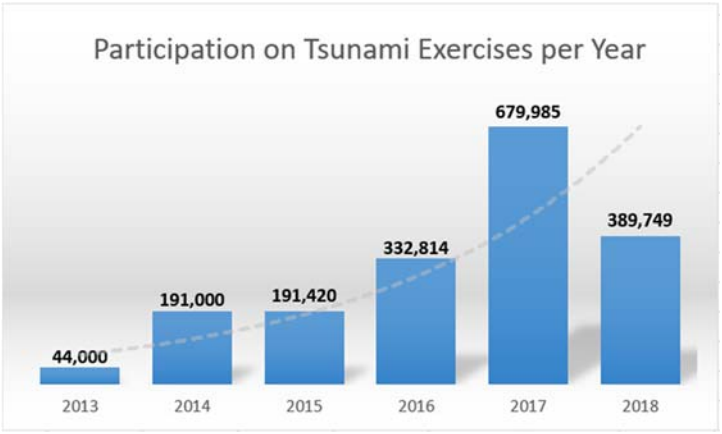
A Decade Promoting Tsunami Awareness and Readiness Thru Exercises in the Caribbean Region and Western Atlantic Ocean

By Carolina Hincapié and Christa von Hillebrandt-Andrade, NWS Caribbean Tsunami Warning Program

Tsunami exercises have been conducted in the Western Atlantic and the Caribbean since 2009. On March 15, 2018 over 389,000 people from Bermuda thru Brazil and across the entire Caribbean basin signed up to participate in the tenth edition of the collective regional tsunami exercise.

When the first exercise took place in 2009 it was called LANTEX (Large AtlaNtic Tsunami EXercise) and included the Eastern Coasts of the United States and Canada, Gulf of Mexico, Puerto Rico and the Virgin Islands. The focus was mainly communications, but several hundreds of people participated. LANTEX was also conducted in years 2010 and 2012, and Puerto Rico also took advantage of these practical opportunities to assess the implementation of the Tsunami Ready Program in its coastal communities.

In 2011, for the first time, per recommendation of the UNESCO Intergovernmental Coordination Group for Tsunamis and other Coastal Hazards (CARIBE EWS), LANTEX was extended to include all the Caribbean and Adjacent regions and the exercise was renamed CARIBE WAVE/LANTEX. At that early stage, the metric used to measure participation was noting the number of CARIBE EWS member states per se. Seventy five percent participation from the 48 total members was a good start. For four years (2011, 2013-2015), both NOAA/NWS Tsunami Warning Centers collaborated and tested the issuance of their tsunami products throughout the standard broadcast channels for dissemination.



Graphic showing the gradual increase of participation over the years with the record registered in 2017.

As of 2016, the tsunami exercise for the Caribbean and Adjacent regions is just called CARIBE WAVE because it involves exclusively the CARIBE Early Warning System Members States and Territories, including Puerto Rico and US Virgin Islands. The participation in 2017 hit the records with a total number of 679,938 participants, positioning this tsunami exercise as the largest simulation exercises of its kind in the world. The exercise involves large amounts of time, effort, and labor capacities before, during, and after the chosen date by the PTWC, the Caribbean Tsunami Warning Program (exercise coordinator), and most importantly the individual countries and territories and their stakeholders. As of 2017, as the sole tsunami service provider for the Caribbean, PTWC was the only US TWC that issues products for the exercise. For 2018, PTWC issued 40 simulated international and domestic products, including enhanced graphical and informational products. LANTEX is still supported annually by the NTWC for the Gulf and East Coasts of the U.S. and Canada.

For the 2018 exercise it is important to note that it was the first time Brazil participated as an official Member State (MS), and the CARIBE WAVE 18 was the first large scale exercise conducted since hurricanes Irma and María affected

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A Decade Promoting Tsunami Awareness and Readiness Thru Exercises in the Caribbean Region and Western Atlantic Ocean

By Carolina Hincapié and Christa von Hillebrandt-Andrade, NWS Caribbean Tsunami Warning Program

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the region. Almost 400,000 participants registered their interest and enthusiasm for the exercise including designated CARIBE EWS Tsunami Warning Focal Points (TWFPs) and respective MS tsunami warning centers, as well as emergency and preparedness organizations, K-12 schools, government agencies, colleges and universities, healthcare, businesses and hotels, senior facilities/communities, among others. Each country participated with one of the three CARIBE WAVE 18 proposed scenarios: Barbados, Colombia or Puerto Rico. Each MS and territory also decided its level of participation and whether or not to disseminate national and local products.

Like the initial 2009 LANTEX exercise, one of the main objectives was validating the communication systems to receive and disseminate the official information. Sirens, emails, emergency alert systems, text messages, media outlets, and social media were employed. In addition to the communication tests, exercises were conducted at various levels of magnitude and sophistication including seminars, tabletop exercises, and drills like the one in Puerto Rico which was organized as part of the centennial commemoration of the 1918 Earthquake and Tsunami. The CARIBE WAVE 18 was especially important for many countries who lost many of their communication assets because of Irma and María. During the exercise, they were able to test alternative communication systems and gauge progress of the recovery from the damage due to these extreme weather events.

Main objectives of the exercises during the past ten years: communication tests, review tsunami plans and evacuation drills.

Planning for the tsunami exercises takes over a year of preparation. Each year a CARIBE EWS Task Team is established to provide guidance, while the Caribbean Tsunami Warning Program serves as coordinator. TsunamiZone.org has been used for the past 3 years for registration to determine the number and type of participants, an important metric to evaluate the effectiveness of the exercise within the communities of the Caribbean and Adjacent Regions. The CARIBE WAVE is conducted under the framework of the National Tsunami Hazard Mitigation Program and the CARIBE EWS, which was established by UNESCO in 2006 after the devastating Indian Ocean Tsunami and the recognition of the high tsunami threat in the Caribbean.

Education and Outreach during the Caribe Wave 2018 Exercise: Practice Evacuation of two Communities in Puerto Rico

By Roy Ruiz, Glorymar Gomez, Elizabeth Vanacore, and Victor Huérfano, Puerto Rico Seismic Network

On March 15th 2018, the Puerto Rico TsunamiReady® program, funded by NOAA (NA17NWS4670014), organized a tsunami evacuation exercise called "Walk Your Evacuation Route for Caribe Wave 2018" in the city of Mayagüez, PR. Approximately 400 people participated in the practice of evacuating from their communities, to the established assembly point. At the assembly point, the organizing agencies (the Puerto Rico Seismic Network, the Bureau of Emergency Management and Disaster Administration, the local Emergency Management Office, the National Guard, and FEMA among others) provided educational activities and talks on tsunami and earthquake safety and preparedness. The evacuation consisted of two coastal communities (San Jose and Ramirez de Arellano), an elementary school, two pre-schools, various businesses, and private entities. The major objective was for emergency management stakeholders and communities at risk to test, validate, and update their tsunami response plans. This major collaborative effort included participation of various agencies including: Puerto Rico Emergency Management Agency (PREMA), Mayagüez Municipal Emergency Management (OMME), the Puerto Rico National Guard, State and Municipal Police Departments, State and Municipal Fire Departments, and the Medical Emergencies Office. The Secretary of the Puerto Rico Department of Public Safety, and the Commissioner of PREMA, participated during the exercise and congratulated the Tsunami program for the success[1]. Additionally, emergency management and military officers from the Emergency Management Office (COPECO) of Honduras, were visiting the Island and participated during the exercise as observers. Mr. Aguilera Quiroz of COPECO said[2]: "We are pleased with the experience we had while participating in the drill. It was possible to see the collaboration between the agencies and how the information was taken especially to the children."

Roy Ruiz, coordinator of the TsunamIReady program of the Puerto Rico Seismic Network (blue t-shirt) and Israel Martinez (grey hat) director of the OMME, providing safe and instructions before the tsunami drill.

Community practicing the evacuation route as part of the tsunami exercise "Walk Your Evacuation Route for Caribe Wave 2018".

The event was an ideal opportunity to test emergency systems after hurricane Maria where TsunamiReady infrastructures were severely damaged. Because of the damages to the infrastructure, one important lesson for the populace was that they learn to respond to a major local earthquake event immediately using natural signals and not to depend solely on alert systems or sirens. The Puerto Rico component of the NTHMP (National Tsunami Hazard and Mitigation Program) TsunamiReady used the event to encourage future engagement and participation of the public in tsunami and earthquake exercises.

1. https://www.elnuevodia.com/noticias/locales/nota/agenciasdegobiernorealizanunsimulacrodetsunamientodalaisla-2406710/
2. https://www.army.mil/article/202612/puerto_rico_guard_honduran_leaders_explore_tsunami_response

2018 Tsunami Preparedness Week/Month in California

By Kevin Miller, California Governor's Office of Emergency Services

Tsunami Preparedness Week was proclaimed[1] by Governor of California, Jerry Brown, March 26 – 30, 2018. This proclamation and others by county and city boards of supervisors during this week and month helped highlight an opportunity for learning more about how people may protect themselves from tsunamis. Whether from a variety of government agencies, an emergency management professional, or a person living or visiting the coast, people around the state were provided opportunities to learn easy, non-threatening steps to prepare themselves for tsunamis that could impact coastal areas. Leading up to and during Tsunami Preparedness Week in California, a number of educational outreach events, workshops, drills, exercises and other activities were conducted and coordinated with local, state, and federal partners throughout the state. The TsunamiZone.org website was promoted and used as an effective, centralized one-stop-shop for registering people and events. Registration in California increased to over 180,000 people! A news release[2] provided by the Earthquake Country Alliance promoted the effort. Select events are highlighted below.

- On March 1st Kevin Miller, Tsunami Program Officer for the California Office of Emergency Services, and Cindy Pridmore, Engineering Geologist for the California Geological Survey, provided a presentation to the Earthquake Country Alliance, Bay Area Chapter, at Cisco Systems in Sunnyvale. https://www.earthquakecountry.org/bayarea/

- On March 8th Kevin Miller, Rick Wilson, Tsunami Scientist for the California Geological Survey, and Reggie Harrison, Director the City of Long Beach Department of Disaster Preparedness, served on a panel at the Aquarium of the Pacific discussing such topics as what areas of Southern California are at risk for a tsunami, what individuals and business owners can do to prepare, and the science behind tsunamis. The event was moderated by Dr. Jerry Schubel, President/CEO of the Aquarium of the Pacific, and streamed live via the web and is free to view at http://www.aquariumofpacific.org/events/archive/tsunami_science_and_preparedness_panel_discussion.

- On March 9th Kevin Miller, and Cindy Pridmore provided a presentation to the Sierra Club in Berkeley, California titled *Understanding Tsunami Hazards in and around the Bay Area*. Topics covered included what a tsunami is and what causes them, natural warning signs and public notifications, recent effects of tsunamis on California, and an overview of the Bay Area's vulnerability and planning for potential future events. The presentation included information on preparedness efforts at regional, statewide, and national levels. Tsunami preparedness posters and pamphlets were provided.
https://www.meetup.com/sanfranciscobay/events/248450317/?_cookie-check=byxx7KeVYrjmuu9Q

1. http://www.oesnews.com/governor-brown-issues-proclamation-declaring-tsunami-preparedness-week-2/
2. https://www.prnewswire.com/news-releases/are-you-in-the-zone-its-tsunami-preparedness-week-in-california-300620444.html?tc=eml_cleartime

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2018 Tsunami Preparedness Week/Month in California

By Kevin Miller, California Governor's Office of Emergency Services

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- On March 16th Yvette LaDuke, Tsunami Program Coordinator for the California Office of Emergency Services provided a presentation to an Emergency Preparedness Workshop hosted by Senator Ben Hueso, 40th District, at the George L. Stevens Senior Center in San Diego. Cal OES and the Red Cross were on-hand to present information on how to protect yourself in the event of an earthquake and how to work with your family and community to prepare for disaster situations and answered questions regarding tsunami preparedness. Attendees received an emergency preparedness kit following the presentations.

- On March 17th Kevin Miller and Yvette LaDuke participated in a preparedness fair, tsunami walk, and presentation with audience Q & A. The Long Beach Tsunami Preparedness Walk and Resource Fair was held on March 17 at the Will Rogers Mini Park (Appian Way and Nieto Avenue, Long Beach, 90814). The resource fair began at 9:00 a.m. and the event program began at 10:30 a.m. with the walk taking place shortly thereafter. Residents living in the tsunami inundation/flood zone were encouraged to attend. Participants walked to a designated safe zone where Disaster Preparedness staff answered questions and provided additional information. The Walk and Fair concluded at 12:00 p.m.[3]

Engineering geologist Cindy Pridmore talks to students about what causes a tsunami. Credit: County News Center (https://www.countynewscenter.com/)

- On March 22nd, Yvette LaDuke and Cindy Pridmore provided a tsunami science and preparedness presentation at a workshop in the City of Newport Beach.[4]

- On March 23rd, Kevin Miller, Yvette LaDuke, and Cindy Pridmore participated in a Tsunami Walk with students from Cabrillo Elementary School in San Diego.[5]

3. http://www.longbeach.gov/disasterpreparedness/news/tsunami-awareness-walk-3-17-2018/
4. http://ktla.com/2018/03/26/newport-beach-officials-prepare-for-possibility-of-big-tsunami-that-could-flood-large-swaths-of-city/
5. https://www.countynewscenter.com/fourth-graders-learn-about-tsunami-hazard/

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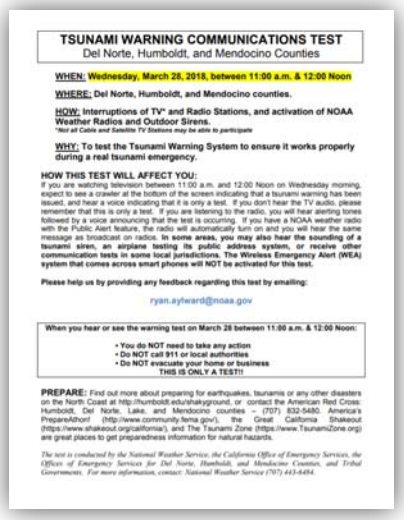
2018 Tsunami Preparedness Week/Month in California

By Kevin Miller, California Governor's Office of Emergency Services

(Continued from page 8)

- On March 24th, Kevin Miller and Yvette LaDuke participated in The Richmond District Community Earthquake & Tsunami Preparedness Workshop so residents could learn how to be prepared for an earthquake, tsunami, or other natural disasters in San Francisco. The event began with a one hour workshop on disaster scenarios and how to prepare for them, followed by interactive demonstrations to teach residents basic first aid skills, how to use a fire extinguisher, how to sign up for NERT, how to receive emergency alerts from Alert SF, and how to create their own emergency preparedness plan. Cantonese, Russian, and Spanish interpreters were present.
  http://www.ktsf.com/en/events/richmond-district-earthquake-and-tsunami-preparedness-workshop/

- On March 28th Kevin Miller, Yvette LaDuke, and Rick Wilson supported the 10th Annual Tsunami Warning Test from the Eureka NWS Office. This tested live tsunami notification triggering the Emergency Alert System to turn on coastal sirens and TV/Radio alerts. The counties of Humboldt and Del Norte tested their reverse calling systems and Mendocino participated as well. Elsewhere in the state a tsunami notification test using "test codes" was similarly conducted from Monterey, Oxnard, and San Diego NWS Offices. Additionally a statewide communications exercise drilling use of tsunami evacuation and maritime playbooks was conducted with coastal counties and agency partners.
  https://www.scpr.org/programs/take-two/2018/03/28/62369/are-you-prepared-for-a-tsunami/
  https://www.wrh.noaa.gov/eka/Poster_Tsunami_Warning_Test_2018.pdf
  https://www.tsunamizone.org/downloads/Tsunami_Alert_Test_Central_Coast_Southern_Coast_CA_2018.pdf



TSUNAMI WARNING COMMUNICATIONS TEST
Del Norte, Humboldt, and Mendocino Counties

WHEN: Wednesday, March 28, 2018, between 11:00 a.m. & 12:00 Noon

WHERE: Del Norte, Humboldt, and Mendocino counties.

HOW: Interruptions of TV* and Radio Stations, and activation of NOAA Weather Radios and Outdoor Sirens.
*Not all Cable and Satellite TV Stations may be able to participate

WHY: To test the Tsunami Warning System to ensure it works properly during a real tsunami emergency.

HOW THIS TEST WILL AFFECT YOU:
If you are watching television between 11:00 a.m. and 12:00 Noon on Wednesday morning, expect to see a crawler at the bottom of the screen indicating that a tsunami warning has been issued, and hear a voice indicating that it is only a test. If you don't hear the TV audio, please remember that this is only a test. If you are listening to the radio, you will hear alerting tones followed by a voice announcing that the test is occurring. If you have a NOAA weather radio with the Public Alert feature, the radio will automatically turn on and you will hear the same message as broadcast on radios. In some areas, you may also hear the sounding of a tsunami siren, an airplane testing its public address system, or receive other communication tests in some local jurisdictions. The Wireless Emergency Alert (WEA) system that comes across smart phones will NOT be activated for this test.

Please help us by providing any feedback regarding this test by emailing:

ryan.aylward@noaa.gov

When you hear or see the warning test on March 28 between 11:00 a.m. & 12:00 Noon:

- You do NOT need to take any action
- Do NOT call 911 or local authorities
- Do NOT evacuate your home or business

THIS IS ONLY A TEST!!

PREPARE: Find out more about preparing for earthquakes, tsunamis or any other disasters on the North Coast at http://humboldt.edu/shakyground, or contact the American Red Cross: Humboldt, Del Norte, Lake, and Mendocino counties – (707) 832-5480. America's PrepareAthon! (http://www.community.fema.gov), the Great California Shakeout (https://www.shakeout.org/california/), and The Tsunami Zone (https://www.TsunamiZone.org) are great places to get preparedness information for natural hazards.

The test is conducted by the National Weather Service, the California Office of Emergency Services, the Offices of Emergency Services for Del Norte, Humboldt, and Mendocino Counties, and Tribal Governments. For more information, contact: National Weather Service (707) 443-6484.

- On March 29th Kevin Miller, Yvette LaDuke, and Cindy Pridmore provided a panel presentation and workshop to the Long Beach Disaster Preparedness and Emergency Communications Department DPREP Community Partner Organizations who meet on a quarterly basis (LBUSD, CSULB, LB City College, Transit, hospitals, VA, et al) to provide informational workshops, review disaster plans and exchange information.

- On March 31st Yvette LaDuke and Cindy Pridmore provided a tsunami science and preparedness presentation to iPrepare Wilmington at the Tzu Chi Wilmington in the City of Los Angeles. The topic was "What would you do if you heard there was a Tsunami alert?" As part of California's Tsunami Week, iPrepare Wilmington in cooperation with Governor Brown's Office of Emergency Services and the Port of Los Angeles provided information on how your family and co-workers should respond. https://www.facebook.com/events/418378155270180/

Cascadia Presentations - Friends in High Places

By Virginia "Jenny" Demaris, Emergency Manager Lincoln County, OR

Saturday's presentation at the Waldport Community Center was standing room only; 71 local community members came out to hear the realistic review of the potential impacts of a Cascadia event and how best to prepare.

Lincoln County Emergency Manager Jenny Demaris noted "One of the best outcomes of today's presentation was connecting community members who might not ever cross paths in their daily routines but by the end of the presentation they had formed a bond...friends in high places."

Betsy Johnson and Linda Behnke both live near each other in South Lincoln County but one is in the local tsunami inundation area and the other is on high ground. After the presentation it became very clear to Betsy, who will need to evacuate on foot for a local tsunami, that she may not have a home to return to nor a place where could she store her critical supplies in advance and shelter after she evacuates. Linda on the other hand, was interested in helping those around her that will need to evacuate the inundation area.

Cascadia Presentation attendees. Credit: Lincoln County, OR Sheriff's Office Emergency Management

Jenny Demaris brokered an introduction to the two ladies and suggested they should become tsunami buddies. Introductions and conversation began between the two and within minutes they had formulated a plan to be there for one another at their most vulnerable time.

The term "friends in high places" was generated over the past few years among local public safety representatives and Community Emergency Response Team members who regularly outreach to communities on Cascadia impacts and preparedness.

"The value of friends in high places is to preposition needed supplies for those who will need to evacuate to a location on high ground; this may be with a friend, family, neighbor or in the case of Betsy and Linda complete strangers who have formed a bond and commitment to help each other. As a public safety official and emergency planner I couldn't begin to describe the level of pride I have when our local outreach efforts pay off in such a way. The most effective way for our message to be heard and action taken to prepare is through community members talking to each other and encouraging our aware and prepared vision."

The Saturday Waldport presentation was co-sponsored by Sylvia Pauly, Financial Associate of Thrivent Financial Services. Thrivent Financial Services regularly promotes local outreach and community benefit programs. Sylvia provided an overview of the Map Your Neighborhood program, originated from the State of Washington and promoted throughout Oregon. Sylvia can be reached at Office: 541-579-6612.

More information on the Map Your Neighborhood program can be found at: http://www.co.lincoln.or.us/emergencymanagement/page/plan-and-prepare-neighborhood-preparedness.

Five more presentations are scheduled over the next few weeks and more will be scheduled in the future. The events are open to the public and free; contact Lincoln County Emergency Manager Jenny Demaris for more information. Presentation announcements for these events can be found on our County website at: www.co.lincoln.or.us/emergencymanagement.

Oregon Prepared—Emergency Preparedness Workshop

Hosted by Oregon Emergency Management & Oregon Health Authority
April 2-6, 2018

The Oregon Office of Emergency Management and the Oregon Health Authority hosted the fifth annual Oregon Prepared Workshop on April 2-6, 2018, at Sunriver Resort. The theme was "Bridging the Gap from Response to Recovery." The workshop provided participants with training and information on programs, current issues, lessons learned, and best practices related to all phases of emergency management. Participants included tribal, county, city, special district, state and federal emergency management, public safety and health preparedness staff, DHS/FEMA preparedness grant recipients, non-profit and private sector partners with a role in preparedness, response, recovery, and resilience.

See video of event: https://www.facebook.com/OMDOEM/videos/1209069189237775/

Tsunami Preparedness Tour on the North Coast of British Columbia

By Elizabeth Predham, Public Education Officer at PreparedBC

In March, PreparedBC joined Royal Canadian Marine Search and Rescue (RCM-SAR) on a tour of the North Coast of British Columbia. Over two days, we traveled from Kitimat to Hartley Bay, Prince Rupert, and Lax Kw`alaams where we spoke with community members about tsunami preparedness and our High Ground Hike program. Hosting a High Ground Hike is an opportunity for communities to learn about tsunami preparedness, know their notification zone, and practice where to go if a tsunami warning is issued. We filmed some videos along the way; check them out on our Tsunami Preparedness playlist: https://www.youtube.com/playlist?list=PL3E2CB95DFC42670D

Elizabeth Predham, and Ian Foss, Regional Manager, on Vancouver Island. Credit: Emergency Management BC

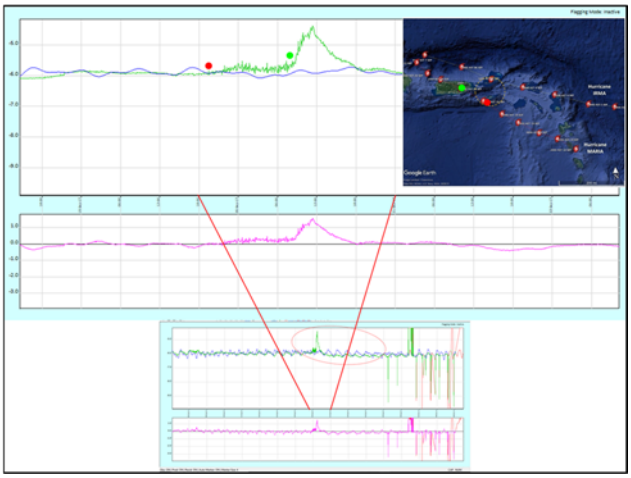
Additional videos from our Tsunami Preparedness Week (April 9-15, 2018) will be available for viewing. This annual event is a reminder of the rare but real threat of a tsunami along British Columbia's coast and can be a great opportunity to talk about tsunami risk in communities, update household plans and emergency kits, and host High Ground Hikes! Visit www.gov.bc.ca/PreparedBC and follow @PreparedBC on Twitter.

Sixth Short Course on Sea Level Data Quality Control, Analysis and Applications for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (CARIBE-EWS)

By Christa von Hillebrandt-Andrade and Carolina Hincapie, NWS Caribbean Tsunami Warning Program

Coastal sea level stations are a critical component of the Tsunami Warning System. Data from these stations are used to confirm and evaluate tsunami impact. The more stations that are available permit a faster assessment of the situation. On February 26-March 2, 2018, the Sixth Caribbean Sea Level course was held in Mexico City. It was organized within the framework of the UNESCO Intergovernmental Oceanographic Commission (IOC) Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS) by the IOC, the Commonwealth Marine Economies Programme (CME, UK), the National Oceanography Centre (NOC, UK), the National Autonomous University of Mexico, the University of Hawaii Sea Level Center (UHSLC), and the Caribbean Tsunami Warning Program (US NOAA/NWS). Over 25 trainees participated from Antigua and Barbuda, Aruba, Belize, Brazil, Cayman Islands, Costa Rica, Dominica, Dominican Republic, Haiti, Jamaica, Mexico, Nicaragua, Saint Lucia, and the United States of America. The focus of the training was on sea level data analysis and quality control using the UK TASK software and PTWC/ITIC's TideTool. Trainers included Dr. Angela Hibert and Dr. Simon Williams from NOC, and Christa von Hillebrandt-Andrade and Dr. Stuart Weinstein from NOAA/NWS. Additional lectures on topics such as tide gauges instrumentation, operation and levelling, experiences and best practices were covered by experts from the Cuban Marine Science Institute, University of Hawaii Sea Level Center, National Autonomous University of Mexico and the Puerto Rico Seismic Network at UPRM. Participants were able to analyze sea level records from the Honduras tsunami and several weather events. Many participants generated tide tables based on data from their local stations for the first time.

Short Course attendees. Credit: CTWP



Analysis results of the data from a survival station in Puerto Rico that recorded the pass of the Hurricane Maria. Credit: CTWP

Before the 2017 hurricane season there were 76 sea-level stations in the Caribbean and adjacent regions contributing to the CARIBE-EWS, and available to the Pacific Tsunami Warning Center and National Tsunami Warning Centers. These stations are critical for the monitoring and detection of tsunamis, and are used to extend or cancel tsunami warnings and advisories. Over a dozen stations were destroyed or damaged by Hurricanes Irma and Maria. But, many stations that survived recorded the associated storm surges highlighting the usefulness of these stations for monitoring other coastal hazards related to sea level. The increased capabilities gained by the operators during this training is expected to lead to improved sea level station operations for the benefit of all countries at risk from tsunamis.

Curating History for Education and Outreach: Exhibition of the 1918 Puerto Rico Earthquake and Tsunami

By Glorymar Gómez, Annie Plaza, Elizabeth Vanacore, Haniel Cordero, Víctor Huérfano
Puerto Rico Seismic Network

In Commemoration of the 1918 Earthquake and Tsunami in Puerto Rico, the Puerto Rico Seismic Network (PRSN) has curated a collection of 100 photographs and artifacts to display in museums across the island throughout the year. The goal of this initiative is to increase awareness of the importance of earthquake and tsunami preparedness in the region. Additionally, this exhibition will increase awareness that Puerto Rico is located in an active subduction zone and is vulnerable to tsunamigenic earthquakes. Critically, the museum exhibition not only shows pictures of the municipalities that were most impacted by the earthquake and tsunami, but also includes newspaper articles and other historical material highlighting that while most of the recorded damaged occurred in Western Puerto Rico, the entire island was impacted by the 1918 event.

The research process to develop the exhibition began approximately one year before the anticipated opening, by visiting historical archives in various municipalities, accessing historical documents and reports, and contacting known researchers of the 1918 Puerto Rico earthquake and tsunami. The PRSN team sorted through hundreds of photographs and selected 100 photographs to be professionally remastered and included in the exhibition. Where possible, historical records were used to provide the context of each photograph and included in the photograph description. In addition to the photographs, a digitized copy of the seismogram of the 1918 earthquake as well as a few historical artifacts are included in the museum exhibition. The seismogram was recorded in Vieques (one of the Islands from the Puerto Rico archipelago just East of the Main Island) on a Bosch-Omori seismograph in Fort El Conde. The digitized original trace was employed to create a replica displayed on a more modern drum instrument. Also included in the exhibition, we have the names of the deceased people related to this event and the aftershocks that occurred on October 24 and November 12, 2018. This exhibition began in the Art Museum of the University of Puerto Rico, Mayagüez, and will travel to other locations across Puerto Rico for the benefit of the community around the Island throughout the centennial year.

As part of the promotion we created a Facebook page (https://www.facebook.com/terremoto1918) for the public to trace the route about the island and advertise special events related to the exhibition. Special events include lectures from experts in the history of the 1918 earthquake, local scientific experts, and PRSN education and outreach personnel. Future plans include creating a digital version of the exhibition with virtual guided tours in English and Spanish to share the lessons learned from this historical event, not only with Puerto Rico, but also the greater global community.

Washington's 2nd Annual Tsunami Roadshow

By Daniel Eungard, Washington Geological Survey

The state of Washington conducted its 2nd annual Tsunami Roadshow organized by Washington Emergency Management Division. The roadshow made eight stops covering four different coastal counties and two tribal nations. An estimated 950 persons attended the roadshow which consisted of one hour 30 minutes of presentations, 30 minutes of question and answer, and a raffle of NOAA Weather Alert Radios. Invited speakers for the presentations included:

- Carrie Garrison-Laney — WA Sea Grant — When can we expect the next Cascadia tsunami?
- Daniel Eungard — WA Geological Survey — Science behind tsunamis: modeling and map production
- Tyree Wilde — National Weather Service (Portland) and also Keily Yemm — WA Emergency Management Division — NOAA's Tsunami Warning Program
- Maximilian Dixon — WA Emergency Management Division — You can Survive the Big One!

It was also attended by local emergency managers, elected officials, and community driven organizations such as CERT programs which also answered questions and guided the public to additional local resources to prepare and train for tsunami hazards. The roadshow generated significant media coverage with notable segments and interviews on local and statewide news stations. The Washington State Public Affairs Network recorded one of the stop's presentations which is archived at https://www.tvw.org/watch/?eventID=2018041007.

Improving Tsunami Awareness in Skagit and Whatcom Counties, Washington State

By Daniel Eungard, Washington Geological Survey

On April 3rd, 2018 representatives from Washington Emergency Management Division and the Washington Geological Survey met with local emergency managers from the City of Anacortes, City of Bellingham, Skagit County, Whatcom County, and Port of Bellingham. The emergency managers were informed of the hazards posed by tsunamis, given geologic background regarding Cascadia and other local crustal fault sourced tsunamis, presented preliminary models for tsunami inundation, current velocities, evacuation walk times for their areas of interest, and discussed preparedness and mitigation options for their communities. The meeting concluded with the local emergency managers better understanding their tsunami risk and created a list of action items to address in order to aid the state in producing evacuation maps for their communities.

NEW RESEARCH / REQUEST FOR RESEARCH

Pedestrian evacuation modeling to reduce vehicle use for distant tsunami evacuations in Hawai'i

By Nathan Wood, Jamie Jones, Jeff Peters, and Kevin Richards

ABSTRACT: Tsunami waves that arrive hours after generation elsewhere pose logistical challenges to emergency managers due to the perceived abundance of time and inclination of evacuees to use vehicles. We use coastal communities on the island of O'ahu (Hawai'i, USA) to demonstrate regional evacuation modeling that can identify where successful pedestrian-based evacuations are plausible and where vehicle use could be discouraged. The island of O'ahu has two tsunami-evacuation zones (standard and extreme), which provides the opportunity to examine if recommended travel modes vary based on zone. Geospatial path distance models are applied to estimate population exposure as a function of pedestrian travel time and speed out of evacuation zones. The use of the extreme zone triples the number of residents, employees, and facilities serving at-risk populations that would be encouraged to evacuate and slightly reduces the percentage of residents (98–76%) that could evacuate in less than 15 min at a plausible speed (with similar percentages for employees). Areas with lengthy evacuations are concentrated in the North Shore region for the standard zone but found all around the O'ahu coastline for the extreme zone. The use of the extreme zone results in a 26% increase in the number of hotel visitors that would be encouraged to evacuate, and a 76% increase in the number of them that may require more than 15 min. Modeling can identify where pedestrian evacuations are plausible; however, there are logistical and behavioral issues that warrant attention before localized evacuation procedures may be realistic.

CITATION: Wood, Nathan; Jones, Jamie; Peters, Jeff; Richards, Kevin, 2018, Pedestrian evacuation modeling to reduce vehicle use for distant tsunami evacuations in Hawai'i: International Journal of Disaster Risk Reduction, v. 28, p. 271-283, https://doi.org/10.1016/j.ijdrr.2018.03.009.

REQUEST FOR RESEARCH

TOPIC: Tsunami sediment transport modeling

The Washington Department of Natural Resources has been tasked with compiling a catalog of research and projects related to sediment transport modeling and impacts of debris on tsunami modeling. This catalog is a 2018 NTHMP MMS supported project in the 2018 annual workplan. The Mapping and Modeling Subcommittee will use this research as a guide for benchmark tests, and future benchmarking workshops. Links to articles or project websites that would be a good addition to this catalog can be sent to Stephanie Earls (stephanie.earls@dnr.wa.gov). Here are a few examples:

Apotsos, Alex; Gelfenbaum, Guy; Jaffe, Bruce, 2011, Process-based modeling of tsunami inundation and sediment transport: Journal of Geophysical Research, v. 116, no. F1, https://doi.org/10.1029/2010JF001797.

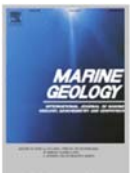
Jaffe, B. E.; Goto, Kazuhisa; Sugawara, Daisuke; Gelfenbaum, G. R., 2016, Uncertainty in Tsunami Sediment Transport Modeling: Journal of Disaster Research, v. 11, no. 4, p. 647-661, DOI:10.20965/jdr.2016.p0647.

Yeh, H.; Mason, H. B., 2014, Sediment response to tsunami loading: Mechanisms and estimates: Geotechnique, v. 64, no. 2, p. 131-143, https://doi.org/10.1680/geot.13.P.033.

RESEARCH & NTHMP EVENTS

CURRENT TSUNAMI RESEARCH

Chagué, C.; Sugawara, D.; Goto, K.; Goff, J.; Dudley, W.; Gadd, P., 2018, Geological evidence for the 1946 and 1960 tsunamis in Shinmachi, Hilo, Hawaii? Sedimentary Geology: v. 364, p. 319-333, https://doi.org/10.1016/j.sedgeo.2017.09.010.



Judd, K.; Chague-Goff, C.; Goff, J.; Gadd, P.; Zawadzki, A.; Fierro, D., 2017, Multi-proxy evidence for small historical tsunamis leaving little or no sedimentary record: Marine Geology, v. 385, p. 204-215, doi: 10.1016/j.margeo.2017.01.002.

Kain, C.L.; Wassmer, P.; Goff, J.; Chagué-Goff, C.; Gomez, C.; Hart, D.E.; Fierro, D.; Jacobsen, G.E.; Zawadzki, A., 2017, Determining flow patterns and emplacement dynamics from tsunami deposits with no visible sedimentary structure: Earth Surface Processes and Landforms, v. 42, p. 763-780, DOI: 10.1002/esp.4020.

Sardina, Victor; Koyanagi, Kanoa; Becker, Nathan; Walsh, David; McCreery, Charles; Weinstein, Stuart; von Hillebrandt-Andrade, Christa, 2018, Evaluation of the Pacific Tsunami Warning Center's performance for the Caribbean based on the compilation and analysis of tsunami messages issued between 2003 and July 2017: Seismological Research Letters, v. 89, no. 2A, p. 416-423, https://doi.org/10.1785/0220170178.

Takeda, Hiraku; Goto, Kazuhisa; Goff, James; Matsumoto, Hideaki; Sugawara, Daisuke, 2018, Could tsunami risk be underestimated using core-based reconstructions? Lessons from ground penetrating radar: Earth Surfaces Processes and Landforms, v. 43, no. 4, p. 808-816, |https://doi.org/10.1002/esp.4282.

UPCOMING NTHMP & RELATED EVENTS

- May 14-17, 2018—Joint Conference of the Latin American and Caribbean Seismological Commission and the Seismological Society of America (Miami, Florida) http://seismology2018.org/
- May 7-9, 2018—8th International Symposium on Submarine Mass Movements and Their Consequences (Victoria, British Columbia) http://igcp640.oceannetworks.ca/
- June 3-8, 2018—15th Annual Meeting Asia Oceania Geosciences Society (AOGS) (Honolulu, Hawaii) http://www.asiaoceania.org/aogs2018
- June 25-29, 2018—11th National Conference on Earthquake Engineering (NCEE) (Los Angeles, California) https://11ncee.org/
- July 24-26, 2018—MES/MMS Summer Meetings (Sacramento, California) https://nws.weather.gov/nthmp/2018mesmms/index.html
- September 15-23, 2018—AEG's 61st Annual Meeting & XIII IAEG Congress (San Francisco, California) https://www.aegannualmeeting.org/
- December 10-14, 2018—AGU Fall Meeting (Washington, D. C.) https://fallmeeting.agu.org/2017/future-meetings/