

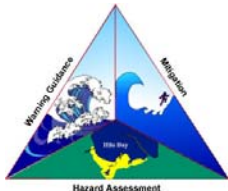


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CARIBE WAVE 2016 Regional Tsunami Exercise

By Christa von Hillebrandt-Andrade, NOAA Caribbean Tsunami Warning Program, and Elizabeth Vanacore, Puerto Rico Seismic Network

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Over 330,000 people from Bermuda through Brazil and across the entire Caribbean basin participated in the CARIBE WAVE 16 tsunami exercise held on March 17, 2016. This represents an increase of 73% from 2015 (191,000 participants). This level of participation makes the CARIBE WAVE 16 exercise the largest international tsunami drill in the world. The participants in the fifth annual regional tsunami exercise hailed from 32 nations and 15 territories*, and represented a participation rate of almost 100% of all the members of the UNESCO Intergovernmental Coordination Group for Tsunamis and other Coastal Hazards for the Caribbean and Adjacent Regions (CARIBE EWS).



Puerto Rico Communications Exercise, Puerto Rico Seismic Network.

Registered participants included designated CARIBE EWS Tsunami Warning Focal Points (TWFPs) and National Tsunami Warning Centers (NTWCs), as well as emergency and preparedness organizations, K-12 schools, government agencies, colleges and universities, healthcare, and hotels, among others. According to the registration system hosted by TsunamiZone.org and information provided by the Member States, Puerto Rico had the largest number of participants with 140,875 people, followed by Guadeloupe with 62,928 and Venezuela with 60,822. The British Virgin Islands activated 16% of its population with 4762 participants.



Panama Evacuation Drill, Miguel de la Borda Community.

CARIBE WAVE 2016 had two scenarios: Venezuela and Northern Hispaniola. The Venezuela scenario simulated a tsunami generated by a magnitude 8.4 earthquake located adjacent to the northern coast of Venezuela with waves of almost 12 meters. The Northern Hispaniola Scenario was based on a magnitude 8.7 earthquake with waves of almost 17 meters forecasted for the shores of Haiti and Dominican Republic. The simulated tsunami messages were disseminated by the U.S. Pacific Tsunami Warning Center (PTWC), and the CARIBE EWS Tsunami Service Provider.

These messages were disseminated mainly over the Global Telecommunication System and email. Many countries also generated and disseminated their own domestic tsunami warning products for their areas of responsibility.

(Continues on Page 3)



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

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TsunamiReady® Recognition Update: As of March 29, 2016, there were 194 TsunamiReady® Communities* in 16 U.S. states and territories, as well as 8 TsunamiReady® Supporters

We welcome five new TsunamiReady® Counties or Communities that received their TsunamiReady® recognition during the first two quarters of FY16 (September 1, 2015 – March 31, 2016):

AK Skagway
CA Carmel-By-The-Sea
CA Marina (City of)
CA Sonoma County
NC Hyde County

The following 23 TsunamiReady® Counties or Communities renewed their TsunamiReady® recognition during the first two quarters of FY16 (September 1, 2015 – March 31, 2016):

| | |
|-----------------------------------|-----------------------|
| CA Dana Point | PR Arroyo |
| CA Dillon Beach | PR Lajas |
| CA Marin County | PR Naguabo |
| CA Newport Beach | PR Patillas |
| CA Santa Monica | PR Ponce |
| HI Hau'ula | PR Santa Isabel |
| NC Camp Lejeune Marine Corps Base | SC Charleston County |
| NC Onslow County | SC Debordieu Colony |
| OR Coos Bay | SC North Myrtle Beach |
| OR Gold Beach | WA Aberdeen |
| OR North Bend | WA Long Beach |
| OR Port Orford | |



PROJECT UPDATES

CARIBE WAVE 2016 Regional Tsunami Exercise

By Christa von Hillebrandt-Andrade, NOAA Caribbean Tsunami Warning Program,
and Elizabeth Vanacore, Puerto Rico Seismic Network

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This exercise also tested communications between the PTWC, Puerto Rico, and the U.S. and British Virgin Islands in preparation for the upcoming transfer of tsunami domestic responsibility from the U.S. NTWC (Alaska) to PTWC (Hawaii).

Sirens, emails, emergency alert systems, SMS and text messages, media outlets, NOAA weather radio, and social media were used by many TWFPs to further disseminate the messages. In addition to the communication tests, exercises were conducted at various additional levels of magnitudes and sophistication and included seminars, table top exercises, video/web conferencing, and drills.



Haiti Communications Exercise, National Emergency Operation Center.

Through the exercise it has been possible to:

- ◆ Validate the **issuance** of tsunami products from the PTWC.
- ◆ Validate the **receipt and dissemination** of tsunami products by TWFPs and NTWCs.
- ◆ Continue with the **exposure to enhanced PTWC products**, which were fully implemented as of March 1, 2016.
- ◆ Validate **the readiness of the Caribbean and Adjacent Regions** to respond to a local/regional source tsunami.

Planning for CARIBE WAVE 16 has taken over a year. The exercise was coordinated by a task team led by Dr. Elizabeth Vanacore of the Puerto Rico Seismic Network, and facilitated by the U.S. NWS Caribbean Tsunami Warning Program (CTWC). For the first time TsunamiZone.org was used to handle the registration of the participants. Registration was available for all three major languages used in the Caribbean and adjacent regions: English, French, and Spanish. The Exercise Handbook and other information and supporting documents for the exercise will remain posted on different websites, including the CTWP (<http://caribewave.info>).

CARIBE WAVE 16 was conducted under the framework of the UNESCO Intergovernmental Oceanographic Commission (IOC) CARIBE EWS, which was established in 2006 after the devastating Indian Ocean Tsunami highlighted the high tsunami threat in the Caribbean. Each of the countries and territories will be providing feedback on the exercise, the Enhanced PTWC products, and their individual state of preparedness. The results of CARIBE WAVE 2016 will guide future work for this Intergovernmental Coordination Group, and will be presented at the 11th Session of the CARIBE EWS to take place in Cartagena, Colombia on April 5-7, 2016.

* Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Brazil, Colombia, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, France (Martinique, Guadeloupe, St. Barthelemy, St. Martin), Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Netherlands (Bonaire, Saba and Sint Eustatius), Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sint Maarten, Suriname, Trinidad and Tobago, United Kingdom (Anguilla, British Virgin Islands, Bermuda, Cayman Islands, Montserrat and Turks and Caicos), United States (Puerto Rico and the U.S. Virgin Islands), and Venezuela (Bolivarian Republic of).

PROJECT UPDATES

2016 Tsunami Preparedness Week Activities in California

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

In California, culminating months of planning and coordination, Tsunami Preparedness Week was observed from March 20 -26, 2016, by conducting outreach, exercises, and testing warning systems and response plans. The Governor issued an official proclamation, as did a number of coastal county and city boards of supervisors.

As part of the effort to prepare for tsunamis, the California Governor's Office of Emergency Services, California Geological Survey, state and federal agencies, local agencies, businesses, educational institutions, and community organizations contributed to emergency preparedness efforts. Tsunami Warning Communications Tests focused on a tsunami coming from far away, potentially activating the emergency alert system, and thereby triggering various methods of notification. Using a Chile Tsunami Scenario, government agencies practiced implementation of existing response and evacuation relief and assistance planning. These efforts concluded with a statewide communications drill to test coordination using multi-scenario planning products call "Tsunami Playbooks". Civil Air Patrol flights along the coast tested on-board audio systems.

Education and outreach efforts focused on the general public's understanding of how to prepare and protect themselves from a local tsunami threat with readily available information. The week set the preparedness tone for the year by providing an opportunity for emergency managers and community officials in general to promote tsunami safety and awareness and urge coastal residents and visitors to prepare themselves and their families for the next tsunami.

Individuals at local events in Del Norte, Monterey and elsewhere were encouraged to find out whether their area is at risk for tsunamis by reviewing local hazard maps online or via brochures. Finally, Tsunami Walks were conducted in a number of communities, as a good way to "know your zone" by walking from the coast, to safe, high ground with your family, friends, group, neighborhood or community. A number of communities that participated in California Tsunami Preparedness Week were already recognized as TsunamiReady by the National Weather Service. Participating in these events fulfills meeting TsunamiReady Guidelines as these communities come up for TsunamiReady recognition renewal.

(See www.TsunamiZone.org)



Eleventh Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions held in Colombia

By Christa von Hillebrandt-Andrade, NOAA Caribbean Tsunami Warning Program

The Eleventh Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS-XI) of UNESCO was held in Cartagena, Colombia, from April 5-7, 2016. The meeting was hosted by the Government of Colombia through the Colombian Oceanographic Commission and was attended by 70 participants from 18 Caribbean countries and territories and three observer organizations: Puerto Rico Seismic Network (PRSN), University-Governed Consortium for Geodesy (UNAVCO), and the World Meteorological Organization (WMO). The U.S. Delegation was led by Michael Angove, Tsunami Program Manager, and also included delegates from NWS International Activities, Pacific Tsunami Warning Center (PTWC), Caribbean Tsunami Warning Program, U.S. Geological Survey, National Aeronautics and Space Administration, and Puerto Rico Emergency Management Agency.



Participants of the Eleventh Session of the ICG CARIBE EWS.

(Continues on Page 5)

PROJECT UPDATES

Eleventh Session of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions Held in Colombia

By Christa von Hillebrandt-Andrade, NOAA Caribbean Tsunami Warning Program

(Continued from Page 4)

The participants reviewed the accomplishments in 2015-2016 including the successful transition to the PTWC Enhanced Products on March 1, the development of the requirements for the CARIBE EWS Tsunami Service Providers, and the very successful conduct of the largest tsunami exercise to date, CARIBE WAVE 16, which included over 330,000 participants from 47 Member States and Territories in the Caribbean and Adjacent Regions.

Some of the main recommendations for upcoming activities and policy matters include:

- ◆ The PTWC be henceforth referred to as a CARIBE EWS Tsunami Service Provider (TSP), removing the term “Interim”. This recommendation was based on PTWC meeting the criteria established in the CARIBE EWS Tsunami Service Model and successful operational performance in support of CARIBE EWS in a TSP role since 2005.
- ◆ A Task Team was established to consider procedures for addressing the threat of tsunamis from volcanic activity, which was in response to the Kick ‘em Jenny crisis of July 2015.
- ◆ The CARIBE EWS will also be looking towards strengthening the global navigation satellite system (GNSS) data and functionality for improving tsunami threat assessments.
- ◆ A group of experts is to be established to advise the ICG-CARIBE-EWS on the work and implementation plan for enhancing the warning system by including other coastal hazards.
- ◆ CARIBE WAVE 17 was scheduled for Tuesday March 21, 2017 at 1400h UTC with three scenarios for the Member States to choose from: Costa Rica, Cuba and Northern Lesser Antilles.
- ◆ Further implementation of the UNESCO CARIBE EWS Tsunami Ready recognition program which is modelled after the U.S. TsunamiReady® and was approved in 2016.



Officers elected at the Eleventh Session of the ICG CARIBE EWS for the 2016-2018 biennium. From the left to right: Milton Puentes (Colombia-Vice Chair), Gerard Metayer (Haiti -Vice Chair), Christa von Hillebrandt-Andrade (USA-Chair), and Paul Martens (Kingdom of the Netherlands-Vice Chair).

A major concern continues to be the financial sustainability of the system, especially as it relates to the Caribbean Tsunami Information Center (CTIC), which was established in 2014 as a partnership between Barbados and UNESCO. CTIC only has operational funding for eight months of 2016.

The following people were elected for the 2016-2018 biennium: Christa von Hillebrandt-Andrade (USA-Chair), Paul Martens (Kingdom of the Netherlands-Vice Chair), Gerard Metayer (Haiti-Vice Chair), and Milton Puentes (Colombia-Vice Chair). The Twelfth Session is planned for Costa Rica in April, 2017.

TSUNAMI NEWS

ODPEM Raising Awareness about Tsunamis

By Shari-Ann Palmer, Jamaica Information Service

The Office of Disaster Preparedness and Emergency Management (ODPEM) is undertaking measures to increase tsunami awareness and preparedness among Jamaicans.

A tsunami, also known as a seismic sea wave, is a series of waves in a water body caused by the displacement of a large volume of water. They are produced by earthquakes or underwater landslides.

Training Manager at ODPEM, Cheryl Nichols, said special attention is being placed on educating the public on what to do in the event of a tsunami hitting Jamaica.

"We have sought every opportunity, once we speak about an earthquake, to also speak to the likely event of an accompanying tsunami and this is something that the ODPEM stresses.

"We have... used a number of traditional and non-traditional media to get the message across," she informed.

See full article: <http://jis.gov.jm/odpem-raising-awareness-tsunamis/>



Indonesia's Early Tsunami Warning Buoys Down When Big Quake Hit

By Kanupriya Kapoor and Gayatri Suroyo, Reuters

All 22 of the early-warning buoys Indonesia deployed after the 2004 tsunami disaster were inoperable when a massive undersea earthquake struck off the coast on Wednesday, a National Disaster Mitigation Agency official said.

The 7.8 magnitude quake did not trigger a tsunami, and there were no deaths and no major damage, but it did expose gaps in the systems put in place to prevent a disaster similar to the Indian Ocean quake that killed more than 200,000 people 11 years ago.

In addition to the malfunctioning of buoys designed to warn of massive waves, authorities said there were not enough evacuation routes or shelters in Padang, a Sumatra island port city of around one million people that felt the quake.

"There was definitely panic last night, that cannot be denied," said Zulfiatno, the head of the disaster management agency in Padang who uses only one name, adding that shelters had the capacity to only hold around 200,000 people.



Credit: rnw.org

"But the situation has improved from previous years. People have started to understand how to evacuate safely."

The 9.15 magnitude quake of December 2004 opened a fault line deep beneath the ocean, triggering a wave as high as 17.4 meters (57 feet) that crashed ashore in more than a dozen countries to wipe some communities off the map in seconds.

See full article: <http://www.reuters.com/article/us-indonesia-quake-idUSKCN0W41J2>

TSUNAMI NEWS & RESEARCH

Nearly 6,000 Emergency, Military Personnel to Conduct PNW Megaquake Exercise

By Sandi Doughton, Seattle Times science reporter

The last damaging earthquake in Washington struck 15 years ago, on Feb. 28, 2001.

The next one is scheduled for June 7.

The ground isn't expected to actually shake this spring. But nearly 6,000 emergency and military personnel will pretend it is during a four-day exercise to test response to a seismic event that will dwarf the 2001 Nisqually quake: A Cascadia megaquake and tsunami.



Called "Cascadia Rising," the exercise will be the biggest ever conducted in the Pacific Northwest. Which is fitting, because a rupture on the offshore fault called the Cascadia Subduction Zone could be the biggest natural disaster in U.S. history.

See full article: <http://www.seattletimes.com/seattle-news/science/preparing-for-the-really-big-one-cascadia-earthquake-tsunami-drill/>

NEW TSUNAMI RESEARCH

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NTHMP NEWS & EVENTS

NOAA Tsunami Program Special Report—United States and Territories National Tsunami Hazard Assessment: Historical Record and Sources for Waves—Update

By Paula K. Dunbar, National Oceanic and Atmospheric Administration,
and Craig S. Weaver, U.S. Geological Survey

The first U.S. Tsunami Hazard Assessment (Dunbar and Weaver, 2008) was prepared at the request of the National Tsunami Hazard Mitigation Program (NTHMP). The NTHMP is a partnership formed between federal and state agencies to reduce the impact of tsunamis through hazard assessment, warning guidance, and mitigation. The assessment was conducted in response to a 2005 joint report by the Sub-Committee on Disaster Reduction and the U.S. Group on Earth Observations entitled Tsunami Risk Reduction for the United States: A Framework for Action. The first specific action called for in the Framework was to “develop standardized and coordinated tsunami hazard and risk assessments for all coastal regions of the United States and its territories.” Since the first assessment, there have been a number of very significant tsunamis, including the 2009 Samoa, 2010 Chile, and 2011 Japan tsunamis. As a result, the NTHMP requested an update of the U.S. tsunami hazard assessment.



The first step in a tsunami hazard assessment is to examine the past record since it provides clues to what might happen in the future. The National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information [NCEI, formerly the National Geophysical Data Center (NGDC)] catalogs information on global historical tsunamis. Earthquakes or earthquake-generated landslides caused more than 85% of the tsunamis listed in the NCEI Global Historical Tsunami Database, with the remainder due to volcanic eruptions, non-earthquake generated landslides, and other sources. The United States Geological Survey (USGS) conducts research on earthquake hazards facing all of the United States and its territories. Therefore, NOAA/NCEI and USGS collaborated on the first tsunami hazard assessment of the United States and its territories and have again partnered to conduct the updated assessment.

See full report: http://nws.weather.gov/nthmp/documents/Tsunami_Assessment_2016Update.pdf

UPCOMING NTHMP & RELATED EVENTS

- ◆ May 31-June 3, 2016—9th Biennial Workshop on Japan-Kamchatka-Alaska Subduction Processes (Fairbanks, Alaska) <http://gps.alaska.edu/JKASP/>
- ◆ June 2016—Cascadia Rising 2016/PACIFEX2016 Tsunami Exercise (West Coast U.S./ Pacific Ocean Region) <http://wcatwc.arh.noaa.gov/?page=exercises>
- ◆ June 8-11, 2016—Plinius Conference on Mediterranean Risks (Giardini Naxos, Italy)
- ◆ June 11, 2016 (11:00am)—Dedication of Tsunami Vertical Evacuation structure at Ocosta Elementary School (Westport, WA)
- ◆ June 20-22, 2016—IASPEI Regional Assembly Latin-American and Caribbean Seismological Commission (San José, Costa Rica) <http://lacsc2016.com/>
- ◆ July 26-28, 2016—2016 NTHMP Mitigation and Education Subcommittee Meeting (Lynnwood, WA) <http://nws.weather.gov/nthmp/2016messummer/index.html>
- ◆ July 31-August 5, 2016—Asia Oceania Geosciences Society Annual Meeting (Beijing, China) <http://www.asiaoceania.org/aogs2016>
- ◆ September 12-15, 2016—7th International Tsunami Symposium (Ispra, Italy)

