

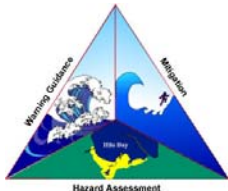


# TsuInfo Alert

prepared by the Washington State Department of Natural Resources on behalf of the

## National Tsunami Hazard Mitigation Program

a state/federal partnership funded through the National Oceanic and Atmospheric Administration (NOAA)



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### Washington Military Department Participates in Cascadia Rising Event

By Steven Friederich, Washington Military Department

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The Washington Military Department joined partners across the Northwest for Cascadia Rising in June, the largest earthquake exercise in state history simulating a 9.0 Cascadia Subduction Zone earthquake and tsunami along the Washington and Oregon coast.

Soldiers and Airmen from the Washington National Guard worked side-by-side with first responders to test response capabilities. The Washington Emergency Operations Center was activated with partner agencies from across the state and many counties, cities and tribes activated their own response plans.

With an estimated 20,000 participants across the Northwest, Cascadia Rising is one of the largest disaster preparedness exercises ever conducted.

“This is a massive undertaking nearly four years in the making,” said Major General Bret D. Daugherty, The Adjutant General.

Conducting successful life-saving and life-sustaining response operations in the aftermath of a Cascadia Subduction Zone disaster will hinge on the effective coordination and integration of governments at all levels.

During the exercise, Renton Municipal Airport experienced a mock liquefaction, where the integrity of the airfield was in question. Soldiers with the Guard were deployed to work with civilian authorities and determine the structural safety of the runway. During a real earthquake situation, local airfields will be one of the prime ways to get supplies in and out for the population.

Testing the potential of inoperable ferry terminals, the 181 Brigade Support Battalion transported to Vashon Island via Army landing craft and assisted in search and rescue and developing distribution points.



Washington Army National Guard Pfc. Dezeirai Lewis, a logistics specialist with the 56th Information Operations Group, and Sgt. Cassandra Callender, a flight medic with Detachment 2, Charlie Company, 1st Battalion, 168th Aviation Regiment, deliver simulated medical supplies out of a UH-60 Black Hawk helicopter to firefighters from Whatcom County Fire District 5 in Point Roberts on June 9 as part of Exercise Cascadia Rising. (Photo credit: Sgt. Matthew Sissel)

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## Authorities Tallying Lessons Learned From Cascadia Rising Exercises

By Bellamy Pailthorp, KPLU

Emergency Management offices around the state are analyzing the data collected during last month's Cascadia Rising earthquake and tsunami drill. They say the four-day exercise did just what it was supposed to: uncover strengths and weaknesses of preparedness plans for a massive earthquake off the West Coast.

The scenario was for a full-rip 9.0 earthquake along the subduction zone off the West Coast, followed by a devastating tsunami. The four-day drill tested the preparedness plans of agencies at every level of government in three states plus British Columbia.



Chuck Wallace is the deputy director of Emergency Management for Grays Harbor County, where the exercise included decontamination and search-and-rescue drills with the Washington National Guard. But Wallace says there's nothing like actually testing the software and equipment the state Military Department would use to get things like internet and cell phone service back up and running. They do that via ham radios.

"What we realized was that some of their connectivity to us didn't work. And my radio guys are very adept at what they do," Wallace said. "We were teaching each other, back and forth, which is – if you don't actually get to exercise it, you never find out where you need to upgrade, on both sides."

See full article: <http://www.kplu.org/post/authorities-tallying-lessons-learned-cascadia-rising-exercises>

# CASCADIA RISING & ASSOCIATED EXERCISES

## Washington Military Department Participates in Cascadia Rising Event

By Steven Friederich, Washington Military Department

*(Continued from Page 1)*

Elsewhere, members of the 792nd Chemical Company teamed up with Aberdeen and Hoquiam firefighters in response to a large hazardous materials response on the coast.

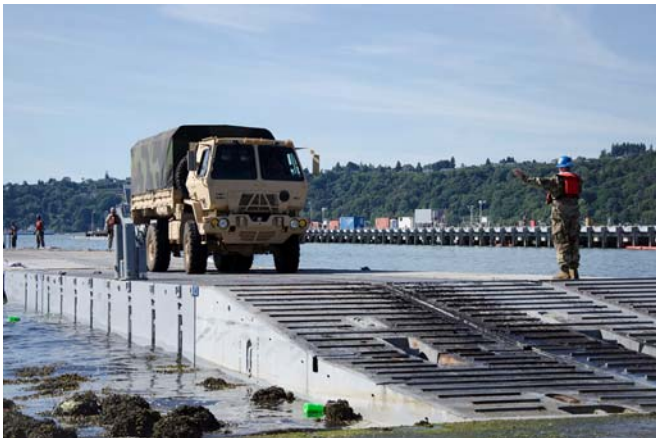
A water purifying system was established at St. Clare Hospital in Lakewood, one of several interactions between the agency and hospitals in the region. At Grays Harbor Community Hospital, for instance, hoist training was done with the 111th Air Support Operations Squadron, necessary training because during a real earthquake, patients might need to be evacuated via helicopter.

At North Beach High School in Ocean Shores, the Kentucky National Guard was deployed to conduct urban and wide area search and rescue. During a real disaster, the region will see help come in not just from local Guard units, but from across the country.



The state EOC is shown during the afternoon briefing on the first day of Cascadia Rising. (Photo credit: Steven Friederich)

For the state Emergency Operations Center (EOC), the exercise helped agency partners figure out ways to communicate with people when cell phones don't work and the Internet is dark. There was heavy reliance on amateur radio operators, for instance. The state EOC, itself, was built on rollers and is expected to survive when a 9.0 earthquake hits.



Soldiers from the Washington Army National Guard's 181st Brigade Support Battalion and U.S. Army's 7th Transportation Brigade load trucks during a Joint Logistics Over the Shore exercise at the Port of Tacoma in support of Cascadia Rising 2016 on June 5. (Photo credit: Sgt. Michael Tietjen)

Sue Bush, with the state Department of Social and Health Services, was in charge of the mass care unit, exploring ways to meet immediate needs as well as figure out where potential shelters could be set up in Eastern Washington as the focus from the disaster turned into recovery. The state of Idaho was participating in Cascadia Rising, in part, because state officials there figure there will be plenty of residents heading to Idaho following the disaster.

Bush said the exercise was "very realistic" when it came to help not arriving in some areas for the first few days following a major disaster.

"The further you are from other people, the less likely you are to receive services right away because the response, by necessity, will be to those areas where we can serve the greater good," she said.

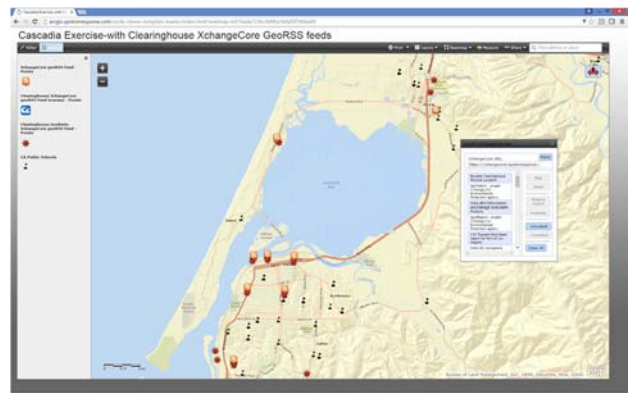
"And even before you have an emergency kit, have a plan, because family reunification is a huge thing because people will forgo shelter, water and food until they know their loved ones are safe," Bush said.

# CASCADIA RISING & ASSOCIATED EXERCISES

## California Earthquake Clearinghouse Participation in Cascadia Rising Exercise

By Anne Rosinski, California Geological Survey

A Cascadia Subduction Zone Earthquake and Tsunami are expected to generate damage from both earthquake shaking potentially extending as far south as the San Francisco Bay Area, and tsunami inundation along the entire coast of California. The California Earthquake Clearinghouse (Clearinghouse) is a temporary coordinating facility where, following a damaging earthquake, engineers, geologists, seismologists, sociologists, economists, and other professionals can congregate to exchange and review information about ground failure, structural damage, social or financial impacts of devastation, and can become part of a larger organization to facilitate and coordinate the gathering and dissemination of this information (<http://www.californiaeqclearinghouse.org/>). The California Public Resources Code § 2201 authorizes the California Geological Survey (CGS) to activate the Clearinghouse when conditions warrant. In addition, the National Earthquake Hazards Reduction Program authorizes establishing technical information clearinghouses within 24 hours following significant earthquakes in the United States. The CGS serves as the permanent, lead coordinating organization for the Clearinghouse in California, and manages the Clearinghouse in collaboration with the California Office of Emergency Services, U. S. Geological Survey, Earthquake Engineering Research Institute (EERI), and California Seismic Safety Commission. Clearinghouse activations traditionally have consisted of a physical outpost located near the earthquake-impacted area, but increasingly in both exercises and actual earthquakes, it employs advanced technologies to create a “Virtual Clearinghouse.” This Virtual Clearinghouse allows people and organizations anywhere in the world to contribute their time and expertise to earthquake response.



Clearinghouse Information Sharing – Arc GIS Online map updated in real time, with Clearinghouse Field Data, through XchangeCore GeoRSS feed, and XchangeCore connector.

Since 2011, the Clearinghouse has participated in both state and national earthquake-themed exercises, and two real California earthquakes, to refine its operations at a physical clearinghouse, develop the virtual Clearinghouse, and improve its information sharing capabilities. Most recently, the California Clearinghouse participated in the National FEMA Region X Cascadia Rising exercise, which offered the rare opportunity to coordinate with other states and FEMA regions.

Our goals for the exercise included the following:

- Identify who the Clearinghouse counterparts are in other states/regions, and conduct a calldown to exchange updates of ongoing activities and availability of resources at clearinghouses in different regions.
- Learn more about how other states/regions accomplish the federal clearinghouse mandate. The effects of a Cascadia Subduction earthquake will be felt throughout the Pacific Rim. The California Earthquake Clearinghouse recognizes that many of our partner organizations (USGS, NASA, EERI) respond to earthquakes on a global scale and Clearinghouse partners may be faced with the challenge of deploying their resources to different states/regions simultaneously.

*(Continues on Page 5)*



# CASCADIA RISING & ASSOCIATED EXERCISES

## FEMA Region X Cascadia Rising Exercise

By Patrick Massey, FEMA Region X Federal Preparedness Coordinator

**Overview:** The Cascadia Rising Exercise conducted June 7-10, 2016, was the largest disaster response exercise ever to occur in the Pacific Northwest, and one of the largest in U.S. history. Over 50 counties, numerous cities, three states, a number of tribal nations, federal agencies, and National Guard and active duty military forces participated in the exercise. All told, over 23,500 individuals directly participated in the exercise.



Over the course of 4 days, participants practiced their response to a magnitude 9.0 earthquake along the Cascadia Subduction Zone (CSZ), a tsunami, and subsequent aftershocks. Primarily, they focused on connecting Emergency Operations Centers (EOCs) at all levels of government to coordinate disaster operations as they would in a real-world wide-area catastrophic disaster like this CSZ scenario. While a number of overarching objectives and critical tasks were evaluated at all levels during the exercise, the two major processes tested amongst all EOCs were situational awareness and resource ordering and tracking. Essentially, participants sought to understand the impacts to people and built infrastructure with limited communications and access to the impacted areas; and refine the process to acquire and transport disaster relief supplies to survivors.

*(Continues on Page 7)*

## California Earthquake Clearinghouse Participation in Cascadia Rising Exercise

By Anne Rosinski, California Geological Survey

*(Continued from Page 4)*

- Information sharing and technology interoperability will continue to be tested and refined using the capabilities of XchangeCore; additional applications and partners will be identified for information sharing; understand Essential Elements of information.
- Enroll new members for the Clearinghouse, which now is a recognized Disaster Service Worker organization and is authorized to provide limited liability coverage for anyone participating in a Clearinghouse activation or exercise.

During the Cascadia Rising Exercise, the Clearinghouse successfully:

- Conducted a calldown among over 30 municipal, state, federal, research, public, and private response organizations, across six states, and two FEMA regions.
- Led a collaboration among partners to improve the process to request, collect, and distribute aerial and satellite imagery across multiple states and FEMA regions, employing the USGS Hazards Data Distribution System, and federal, state and military air reconnaissance assets.
- Worked with municipal, state, federal, and military environmental and public health partners to incorporate earth science and engineering earthquake data into their contamination plume modeling.
- Incorporated NASA damage and loss estimations, and regional deformation modeling, into response activities.



The Lessons Learned in the Cascadia Exercise will be used to develop Clearinghouse participation in the National Guard Vigilant Guard Exercise in Nevada and California, slated to occur in November of 2016.

# CASCADIA RISING & ASSOCIATED EXERCISES

## Navigating the Social Media Storm During Exercise Coastal Response

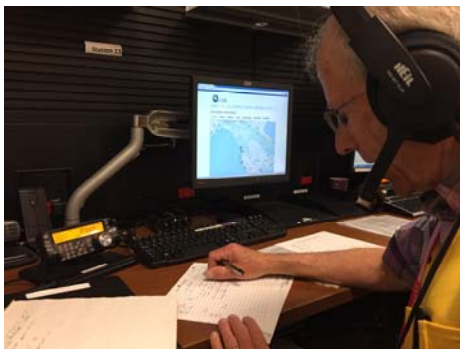
By Colleen Hildebrandt, Strategic Communications Chair, Exercise Coastal Response & Online Communications Officer, Emergency Management BC

Led by Emergency Management BC (EMBC), Exercise Coastal Response 2016 was BC's first ever large-scale, province-wide earthquake and tsunami response exercise. The exercise was a resounding success, involving more than 800 participants across 65 organizations including First Nations, Crown Corporations, non-governmental organizations and the private sector, as well as agencies and ministries from all levels of government.

During the exercise, EMBC tested elements of B.C's Immediate Response Plan, which lays the framework for the province's response to a catastrophic earthquake. As such, the EMBC Social Media Unit used a simulated social media platform to test its ability to share public information during the event's initial hours when power and telephone services were down. The unit used Twitter direct messages to reach a Kamloops-based BC Wildfire Service information officer, who in turn communicated critical first-steps to the public via EMBC's social media channels. From over 300 miles away, the information officer gathered



Heavy Urban Search and Rescue CAN Task Force 1 removes bus panel to save trapped children during Exercise Coastal Response. (Photo Credit: Province of British Columbia)



Volunteer amateur radio operators communicating with the local authorities to learn more about the mock earthquake, Port Alberni, BC. (Photo Credit: Province of British Columbia)

intelligence and pushed out key messages for a few hours when our normal operations were compromised. Our radio communications officers were able to collect initial situational awareness information, and share the information along to our unit for further distribution.

The exercise also helped strengthen the social media unit's Standard Operating Procedures by exposing the unit to new opportunities for sharing access to trusted government partners to ensure someone can effectively communicate on event, and also be used for backup capacity if required. In turn, the experience confirmed the importance of social media communications during catastrophic events and the need to have full time social media

representation dedicated to our Provincial Emergency Coordination Centre and Provincial Regional Emergency Operations Centres.

Overall, the exercise confirmed the need to get critical information out in a fast, effective way to communicate directly with the public. Building on our capabilities, increasing capacity, and expanding access to our tools with trusted agents are significant steps forward in increasing efficiency during an emergency.



Multi-agency coordination in the Provincial Regional Emergency Operations Centre, Victoria, BC. (Photo Credit: Province of British Columbia)

# CASCADIA RISING & ASSOCIATED EXERCISES

## New Modeling Integrated into Port Alberni's Exercise Coastal Response

By Ocean Networks Canada

Located in the heart of Vancouver Island, Port Alberni has a well-known history of tsunamis. The Tseshaht First Nation, as well as many of the Nuu-Chah-Nulth bands in this region, have a rich oral history that includes stories about past tsunamis. Some stories describe a battle between a thunderbird and a whale that resulted in earth shaking and tsunami-like effects. This story is compatible with the recently recognized great Cascadia tsunami in January, 1700.

Port Alberni, with a total population of approximately 20,000 people, lies beside the Somass River at the head of the Barkley Sound Inlet. The narrow canal connecting this town to the Pacific Ocean runs for more than 64 km between steep mountains providing an ideal setting for the amplification of tsunami waves. The effects of devastating tsunamis are still fresh in people's memories because of the impact of the 1964 Alaska tsunami that caused serious damage to the city.



In June 2016, Emergency Management BC ran Exercise Coastal Response in Port Alberni. During three days of non-stop exercises, the emergency teams in the City of Port Alberni practiced and learned from the experience of this mock earthquake and tsunami. The emergency response teams followed the established structure of the Incident Command System, dividing them by function: planning, logistics, operations, and finance.

A team of evaluators was also present, observing and providing guidance to the participants while challenging them with unexpected situations, such as landslides that blocked access to the city and food supplies to the area. During the initial developments, all communications were cut and the team was supported by the Port Alberni Arrowsmith amateur radio club as their main communication stream with other towns and the authorities.

*(Continues on Page 8)*

## FEMA Region X Cascadia Rising Exercise

By Patrick Massey, FEMA Region X Federal Preparedness Coordinator

*(Continued from Page 5)*

**Federal Participation:** During Cascadia Rising, the federal interagency tested its ability to support the impacted states of Oregon and Washington and secondary impacts to Idaho from its primary EOC locations: the FEMA Regional Response Coordination Center (RRCC) in Bothell, Washington, and the National Response Coordination Center (NRCC) in Washington D.C. At both the RRCC and NRCC, all federal agencies with Emergency Support Function (ESF) responsibilities under the National Response Framework participated in the exercise. In addition, two National FEMA Incident Management Assistance Teams (IMATs) and two Regional IMATs along with two Defense Coordinating Element components deployed to the Oregon and Washington state EOCs, respectively, to work with their state counterparts side-by-side during the exercise. Immediately after an earthquake such as this, the RRCC personnel (FEMA and other ESFs) immediately work to gain situational awareness and begin executing pre-identified tasks that support life-saving operations. Once onsite, the IMATs resume operations to work in lock-step with their State counterparts.

For the federal interagency most of the challenges uncovered during the exercise involved the establishment of disaster logistics staging areas and the movement of response teams and equipment into western Oregon and Washington to support the states, communities, and ultimately disaster survivors.

# CASCADIA RISING & ASSOCIATED EXERCISES

## New Modeling Integrated into Port Alberni's Exercise Coastal Response

By Ocean Networks Canada

(Continued from Page 7)

Ocean Networks Canada contributed to this exercise with the presentation of preliminary tsunami model results for the city. These models were based on Digital Elevation Models for Barkley Sound and Port Alberni that were developed by the National Oceanic and Atmospheric Administration's National Centers for Environmental Information (NCEI-NOAA) team and generated collaboratively among Emergency Management BC, Canadian Hydrographic Service, GeoBC, NCEI-NOAA, Alberni-Clayoquot Regional District and Ocean Networks Canada. The rupture model used for this simulation was developed by Dr. Kelin Wang's team from Natural Resources Canada and corresponded to a Cascadia buried rupture scenario. The hydrodynamic model FUNWAVE-TVD was run by Ocean Networks Canada in collaboration with University of Rhode Island, Compute Canada and Westgrid. The preliminary model results were presented to the Port Alberni Emergency Board, as part of Alberni-Clayoquot Regional District's evaluation of damage to the city.

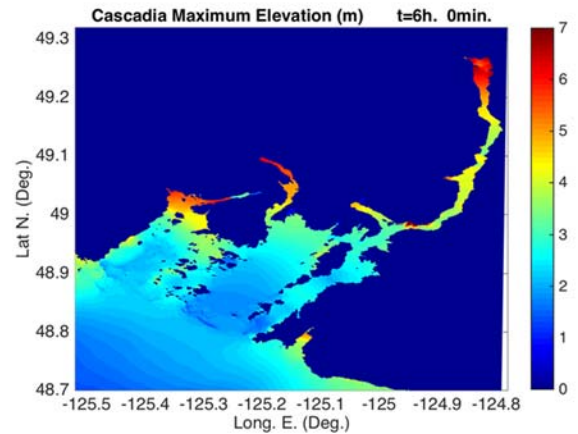


Figure 1. Preliminary results for maximum surface elevation for the Buried rupture modeled in Barkley Sound. (Photo credit: Ocean Networks Canada)

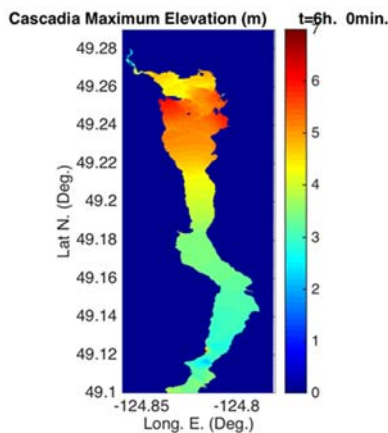


Figure 2. Preliminary results for maximum surface elevation for the Buried rupture modeled in Port Alberni. (Photo credit: Ocean Networks Canada)

Other source scenarios—including splay faulting and trench breaching—will soon be modeled for the City of Port Alberni as part of the Ocean Networks Canada Tsunami Program. This program is a collaborative effort among multiple academic, industry, and government agencies. Additional elements of this program include the development of new technology, as well as models and algorithms for tsunami detection and propagation applied to the Canadian coast.

Efforts like the Exercise Coastal Response are a key tool to communicate ocean science findings with managers, emergency responders, First Nations, and the public in general. This successful exercise has opened a floodgate of communications between major agencies and is helping to build resilience in British Columbia coastal communities.

More information and visuals from these preliminary models can be found on the Ocean Networks Canada website: <http://www.oceannetworks.ca/fly-wall-notes-port-albernis-exercise-coastal-response>.

Ocean Networks Canada would like to thank all the collaborators that made possible this effort.



# TSUNAMI NEWS & RESEARCH

## Grenada Holds Field Training Exercises for Emergency and Disaster Preparedness

By Kimberly Arsenault, Emergency and Disaster Management Digest

A Whole Society Approach—Grenada's Tradewinds 2016, a joint combined field training exercise with partner nations, was held June 4 – 14. The 10-day event included first responders, U.S. Army Reserve soldiers from Washington State, and participants from American Airlines. Private sector, non-governmental organizations (NGOs), chaplains, volunteers, and other humanitarian personnel also participated.



Seeking a whole society approach, the exercise was designed to teach law enforcement and other first responders enhanced capabilities for addressing human-caused threats and natural disasters, along with how to provide humanitarian relief in a coordinated and cooperative manner.

Hostile takeover & tsunami—The exercise began with a hostile takeover that included incendiary devices that resulted in multiple explosions and fires to test the nation's 911 system and its first responders. The focus was on real-world training to help responders understand what they might face when encountering such a threat.

See full article: <http://edmdigest.com/news/grenada-holds-field-training-exercises-for-emergency-and-disaster-preparedness/>

## Expedition to Understand Causes of 2004 Tsunami

By University of Southampton UK

The devastating earthquake that struck North Sumatra and the Andaman and Nicobar Islands on Boxing Day (26 December) in 2004 caused a tsunami that inundated coastal communities around the Indian Ocean, killing over 250,000 people in 14 countries.

That earthquake was caused by a slip on a subduction zone plate boundary fault beneath the eastern Indian Ocean.

Now, over the coming weeks, a team of international researchers are returning to offshore Sumatra to collect marine sediments, rocks and fluids from this particular zone for the first time to gain a better understanding of the materials and to collect data for predicting how they behave in fault zones to generate large earthquakes.



Throughout August and September the researchers, including experts from Ocean and Earth Science at the University of Southampton, will spend two months on board the drilling vessel JOIDES Resolution as part of the International Ocean Discovery Programme (IODP). The Expedition, number 362 of the IODP, involves 33 scientists and two educators from 13 countries including Professors Lisa McNeill and Tim Henstock from the University of Southampton. Professor McNeill is one of the Expedition leaders along with Associate Professor Brandon Dugan of the Colorado School of Mines and Dr Katerina Petronotis of the IODP.

See full article: <http://www.southampton.ac.uk/news/2016/08/sumatra-drilling-expedition.page>

# TSUNAMI RESEARCH & EVENTS

## CURRENT RESEARCH

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Goff, James; Ebina, Yuichi; Goto, Kazuhisa; Terry, James, 2016, Defining tsunamis: Yoda strikes back?: Earth-Science Reviews, v. 159, August 2016, p. 271-274, doi:10.1016/j.earscirev.2016.06.003.

Kawashima, Issei; Toh, Hiroaki, 2016, Tsunami-generated magnetic fields may constrain focal mechanisms of earthquakes: Nature, Scientific Reports 6, Article 28603, doi:10.1038/srep28603.

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Suleimani, E. N.; Nicolsky, D. J.; Koehler, R. D.; Freymueller, J. T.; Macpherson, A. E., 2016, Tsunami inundation maps for King Cove and Cold Bay communities, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2016-1, 73 p., 2 sheets, scale 1:63,360, doi:10.14509/29565.

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Yamamoto, Naotaka; Aoi, Shin; Hirata, Kenji; Suzuki, Wataru; Kunugi, Takashi; Nakamura, Hiromitsu, 2016, Multi-index method using offshore ocean-bottom pressure data for real-time tsunami forecast: Earth, Planets and Space, v. 68, no 128, 14 p., DOI 10.1186/s40623-016-0500-7.

## UPCOMING NTHMP & RELATED EVENTS

◆ November 5, 2016—United Nations Office for Disaster Risk Reduction (UNISDR) World Tsunami Awareness Day <https://www.unisdr.org/archive/48820>



◆ December 12-16, 2016—AGU Fall Meeting (San Francisco, California) <https://fallmeeting.agu.org/2016/>



◆ January 30-February 3, 2017—2017 NTHMP Annual Meeting (Portland, Oregon) <http://nws.weather.gov/nthmp/2017annualmeeting/>

