TsuInfo Alert

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NOAA National Weather Service Participates in the 2nd Global Tsunami Symposium in Banda Aceh, Indonesia

Dr. Laura Kong and Christa von Hillebrandt-Andrade (International Tsunami Information Center), and Dr. Charles McCreery and Dr. Stuart Weinstein (Pacific Tsunami Warning Center)

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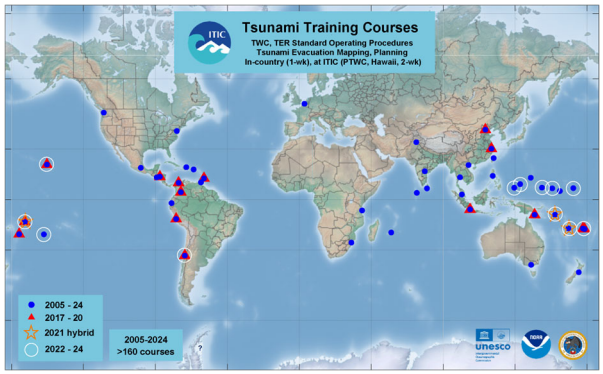
The 2nd UNESCO-IOC Global Tsunami Symposium, co-organized by the Meteorology, Climatology, and Geophysical Agency of Indonesia and UNESCO Intergovernmental Oceanographic Commission, was held in Banda Aceh on 11-14 November. The Symposium also included a Special Session on November 9th entitled "Tsunami Sciences After the 2004 Sumatra Earthquake" co organized with the IUGG Tsunami Commission. Dr. Laura Kong and Christa von Hillebrandt-Andrade, International Tsunami Information Center (ITIC), and Dr. Charles McCreery and Dr. Stuart Weinstein, Pacific Tsunami Warning Center (PTWC), were invited to partake in the reflection on two decades of progress in tsunami preparation, alerts and science since the 2004 Indian Ocean Tsunami, as well as witnessing the resilience of the people of Banda Aceh.

Invited Speakers, including Dr. Laura Kong, Dr. Charles McCreery, Stuart Weinstein and Christa von Hillebrandt-Andrade with the Director General of BMKG, Prof. Dwikorita Karnawati. (Photo credit: Indonesia BMKG)



Since 2005, ITIC has conducted more than 160 trainings on tsunami warning and emergency response standard operating procedures and evacuation planning.

Dr. Charles McCreery highlighted the role that the PTWC played in the development of the UNESCO-IOC Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (IOTWMS). Working together, the USA, Japan, Australia, India and Indonesia developed and implemented products for the Indian Ocean. In April 2005, the PTWC and Japan Meteorological Agency began interim services to Indian Ocean countries. These services lasted until March 2013 when centers in Australia, India and Indonesia assumed full operational responsibility. In addition, the PTWC staff also lent their expertise and experience in tsunami warning science, technology and procedures, and joined ITIC-led tsunami warning center trainings as trainers. In addition to his presentation, Dr. McCreery also moderated some of the sessions and participated as a panelist.

Dr. Stuart Weinstein was on shift at the PTWC the day of the 2004 tsunami and presented a

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timeline of events and actions. He highlighted that the biggest challenge was that at the time there was no Indian Ocean tsunami warning system, and little tsunami awareness. Those limitations contributed to significant loss of life. While the PTWC was able to estimate the magnitude and location of the earthquake, due to the lack of sea-level data and underestimating the true moment magnitude, the PTWC was not aware of how destructive the tsunami was. Another challenge was the lack of official contacts outside of Thailand and Indonesia. The PTWC kept track of the tsunami's propagation in the Pacific basin and its impacts there.

Dr. Laura Kong gave three talks, moderated and participated in panel discussions, and staffed the booth of the UNESCO -IOC Tsunami Information Centers. Dr. Kong, like Dr. Mc Creery and Dr. Weinstein, was instrumental in the development of the IOTWMS and the Caribbean and Northeastern Atlantic and Mediterranean Tsunami Warning Systems, including their corresponding Tsunami Information Centers. She talked about how to build resilient communities through awareness and preparedness, and the importance of providing understandable and actionable messages to everyone. She highlighted the United Nations goal to make 100% of at-risk communities UNESCO-IOC Tsunami Ready by 2030, the Tsunami Ready Coalition's facilitating role, and the synergies with the Weather Ready Pacific project and Early Warnings 4 All for implementing impact-based inundation forecasting and engaging the private sector as a partner in using risk knowledge. At the UNESCO-IOC booth, ITIC shared its awareness and education materials developed over decades. Key themes to address for saving lives are traditional knowledge and culture, locality

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(Continued from page 2)

and community focus, diversity and inclusion, and coordination, collaboration, and sustainability through public policy.

Christa von Hillebrandt-Andrade of the ITIC Caribbean Office spoke about the UNESCO-IOC Intergovernmental Coordination Group for the Tsunami and other Coastal Hazard Warning System for the Caribbean and Adjacent Regions (CARIBE EWS), which was established in 2005. Her first talk focused on the status of identifying the number of communities at risk from tsunami in the region. While there has been an advance in information on tsunami sources, there still is a significant gap in detailed topographic and bathymetric data and capacity. Therefore, in most areas in the Caribbean, the tsunami hazard has not been assessed. She presented the results of researchers from the University of Montpellier. They used theoretical tsunami evacuation zones based on land elevation, maximum inland distance, and OpenStreetMap, and estimated that there are 950 coastal jurisdictions with a tsunami threat. On a separate panel, she provided a history of the US TsunamiReady® implementation in the region since 2005, and the establishment of the UNESCO-IOC Tsunami Ready Recognition program in 2022. She also shared the documented benefits beyond tsunami awareness, preparedness, and response, like interaction between scientists, emergency managers, authorities and communities, and improved preparedness and response to other hazards. She also highlighted the challenges to scale up the program implementation to meet the UN Ocean Decade goal of 100% of tsunami at-risk communities prepared for and resilient to tsunamis by 2030 through efforts like Tsunami Ready.

Rahmaulloh Mosque in 2004 (left), and November 2024 (right). (Photo credit: Christa von Hillebrandt-Andrade)

Aceh Tsunami Museum (Photo credit: Christa von Hillebrandt-Andrade)

During one of the days there was a field trip which included several iconic moments. Delegates participated in a drill in Lamkruet, a village near Banda Aceh, which was also recently recognized as Tsunami Ready by UNESCO-IOC. They also had the opportunity to visit the Lampuuk Rahnatulloh Mosque, the only structure in the area that survived the 2004 tsunami, pictures of which circulated the globe. The day ended with a tour of the Aceh Tsunami Museum, which serves as a reminder of the 2004 Indian Ocean earthquake and tsunami disaster, as well as an educational center, and a tsunami vertical evacuation structure.

In addition to conversations and meetings with tsunami experts, there were opportunities to meet with young professionals, and university and high school students. PTWC and ITIC staff also met with the Director of the United States Agency for International Development (USAID) and his staff, as well as visited their booth and joined them for the inauguration of a special exhibit at the Tsunami Museum focusing on US contributions to relief and recovery efforts which are still ongoing.

NTHMP PARTNER UPDATES

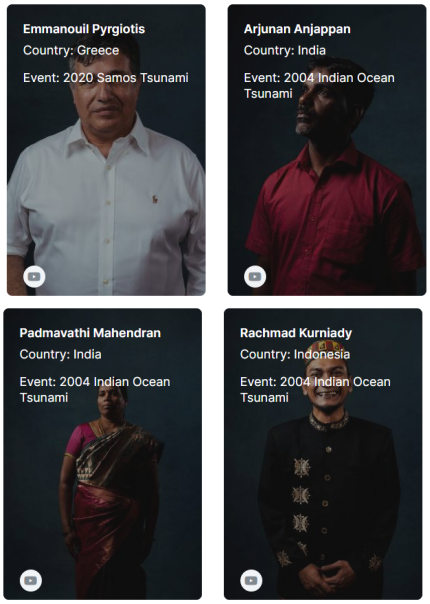
UNESCO-IOC Created the Tsunami Eyewitness & Survivors Project

The Project: Aiming to strengthen tsunami awareness for effective warning, mitigation, and preparedness, UNESCO-IOC created the Tsunami Eyewitness & Survivors Project.

Through portraits and interviews, the project shares the stories and experiences of tsunami survivors and eyewitnesses – not only those affected by the 2004 Indian Ocean Tsunami, but by some other infamous events like the 2011 Great East Japan and 1960 Chilean tsunamis as well.

The Survivors: 15 survivors were brought together for a portrait session and accompanying editorial feature profiles to be developed by UNESCO-IOC. Here you can meet all of them, their countries of origin, and the tsunami event that changed their lives. Follow the link in each card to hear their stories.

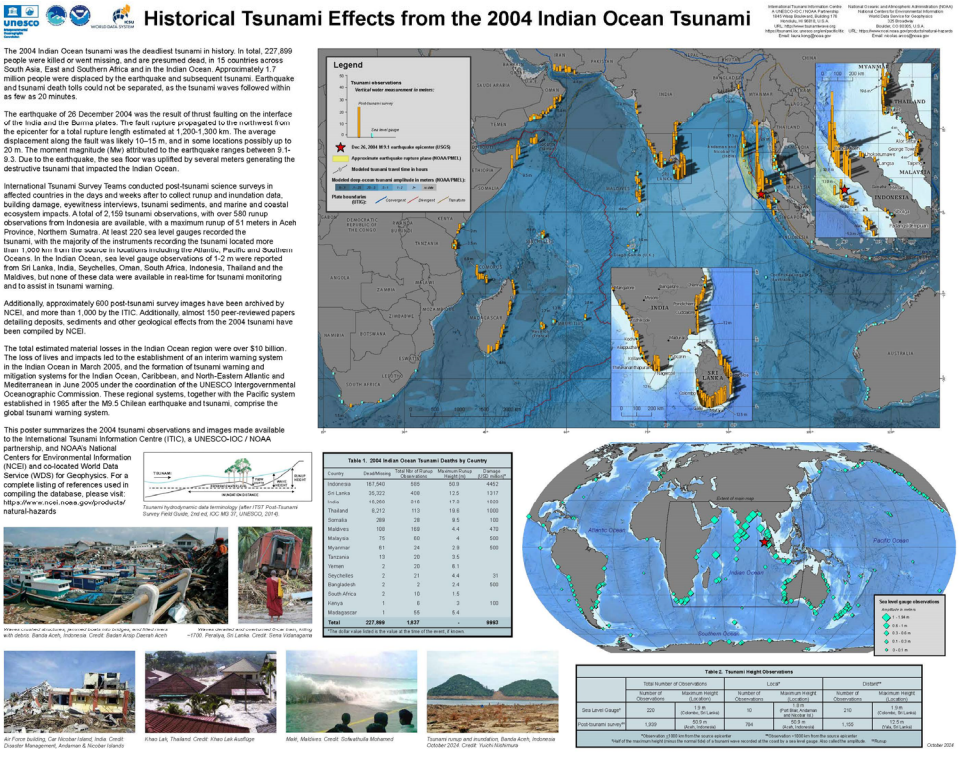
View project:
https://tsunami.ioc.unesco.org/en/impact/eyewitness-survivors-project



2004 Indian Ocean Tsunami Poster

By National Centers for Environmental Information (NCEI) and International Tsunami Information Center (ITIC)

The 2004 Indian Ocean tsunami was the deadliest tsunami in history. In total, 227,899 people were killed or went missing, and are presumed dead, in 15 countries across South Asia, East and Southern Africa and in the Indian Ocean. Approximately 1.7 million people were displaced by the earthquake and subsequent tsunami. The International Tsunami Information Center (ITIC) and National Centers for Environmental Information (NCEI) developed a poster to summarize the 2004 tsunami observations.



For hard copies of the poster contact ITIC at itic.tsunami@noaa.gov. Digital copies can be accessed via NCEI's website at:

https://www.ncei.noaa.gov/products/natural-hazards/tsunamis-earthquakes-volcanoes/tsunamis/posters

ITIC-CAR Participation in the United Nations Headquarters in New York Event, World Tsunami Awareness Day 2024: Youth Engagement, Education and Empowering the Next Generation

By Glorymar Gómez, International Tsunami Information Center Caribbean Office

November 5th is World Tsunami Awareness Day (WTAD). WTAD was established by the UN General Assembly to raise awareness of the danger of tsunamis and to promote comprehensive actions to mitigate their impacts. On November 5, 2024, the UN headquarters in New York hosted the World Tsunami Awareness Day 2024 event, under the theme "Youth Engagement, Education and Empowering the Next Generation". This event also commemorated two decades since the catastrophic Indian Ocean tsunami on December 26, 2004, that took more than 230,000 lives.

Glorymar Gómez, International Tsunami Information Center, Caribbean Office

Glorymar Gómez, contractor for International Tsunami Information Center Caribbean Office (ITIC-CAR) participated in the panel. Other participants included the Permanent Representatives and Ambassadors from Maldives and Thailand, Aishath Shamma, youth representative and 2004 tsunami survivor from the Maldives, Admiral Musa Julius, Disaster Management for National Security in Indonesia, and Dr. Stephan T. Grilli, Distinguished Professor and Chair, Ocean Engineering, Rhode Island University. They shared efforts in tsunami preparedness, lessons learned from past tsunamis, initiatives in creating tsunami awareness, and in the case of Aishath Shamma, her experience during the 2004 Indian Ocean tsunami. Dr. Grilli presented on the sources of tsunami, other than earthquakes.

Glorymar Gómez spoke about ITIC's efforts in mitigating tsunami hazards, with a focus on the visually impaired population. In the Caribbean and Latin America, more than 26 million individuals are visually impaired, of which 3.2 million are completely blind. Following this finding, IOC Tsunami Safety Rules flyer was adapted to Braille (English/Spanish), and hundreds of copies were sent to Caribbean countries, USA and other places around the world. She also highlighted the ongoing adaptation of the children's coloring book, "Tommy Tsunami & Ernie Earthquake" to Braille and audio guide. She highlighted that prioritizing tsunami safety for vulnerable populations is essential not only for immediate safety, but also for building long-term community resilience and recovery.

Admiral Musa Julius, DM for National Security, Indonesia, Glorymar Gómez, ITIC-CAR, Maldives Representative, Elaine Reyes, reporter for CGTN America, Thailand Ambassador, Dr. Stephan T. Grilli, professor at Rhode Island University, Aishath Shamma, Associate Accounts Officer, NDMA Maldives

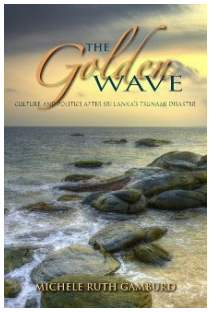
ITIC appreciated the UN for the invitation to participate in the panel, and hopes to have raised awareness around the need to protect and empower those most vulnerable to tsunamis around the world.

Honoring the Memory of the 2004 Indian Ocean Tsunami in Literature

By Elyssa Tappero, Tsunami Program Manager, Washington Emergency Management Division

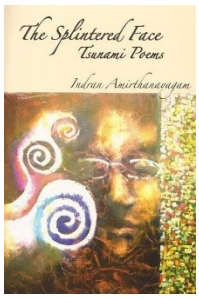
As we approach the 20th anniversary of the 2004 Indian Ocean tsunami, one way we can continue to honor the lives taken or irrevocably changed is by ensuring their experiences aren't lost to history as newer disasters claim our attention. I would therefore like to share some of my favorite written works about this particular disaster that remains the deadliest tsunami in recorded history. There can be no better way to honor those who lost their lives to this tragedy, nor to show our respect to the survivors who worked so hard rebuilding their communities, than to ensure their stories and lessons continue to inform the way we approach disaster resilience.*

The Golden Wave: Culture and Politics After Sri Lanka's Tsunami Disaster by Michele Ruth Gamburd



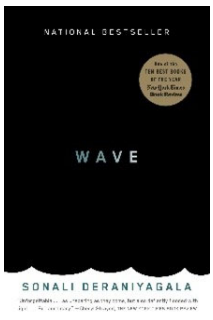
As a non-fiction political ethnography of the 2004 Indian Ocean tsunami, The Golden Wave may not be for everyone. However, for those interested in how disasters can change not just the physical landscape of a community and country, but also social identities, economic dynamics, and political structures, this book is a fascinating read. The Golden Wave reaches beyond the standard narrative of tsunami disasters to delve into the way low-frequency, high-impact events reverberate across sectors through the months, years, and decades to follow. Using years of data collected before and after the tsunami, Gamburd highlights the complexities of post-tsunami response and recovery in Sri Lanka while grounding the text in stories from those directly impacted.

The Splintered Face: Tsunami Poems by Indran Amirthanayagam



Poetry often captures emotion in a way prose cannot, and this collection of tsunami poems by Indran Amirthanayagam is no exception. A child of both Sri Lanka and the United States, Amirthanayagam wrote these poems as a way to process his complex mix of emotions and "overcome the natural and shocked silence that results from tragedy" in the days and weeks after the 2004 Indian Ocean tsunami. The Splintered Face is a short yet exceedingly eloquent meditation on the nature of disaster, chance, anger, grief, and community by a poet whose words easily bridge the thousands of miles between his two homes.

Wave by Sonali Deraniyagala



The New York Times dubbed Wave one of the ten best books of the year in 2013, and it is easy to understand why. Where the other books on this list cover the tsunami's impacts on a larger scale, Wave is an utterly unflinching autobiography of how the disaster forever changed one woman's life. Deraniyagala, a native of Sri Lanka living in London in 2004, lost her husband, two young sons, and both parents to the tsunami. She nearly lost her own life as well. What follows in the book is a wrenchingly honest accounting of her anger and grief as she struggles to make sense of a world without those she loves most. While Wave is by no means a light read, it is a powerful one which illuminates the very human need to carry the past with us in some way.

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Honoring the Memory of the 2004 Indian Ocean Tsunami in Literature

By Elyssa Tappero, Tsunami Program Manager, Washington Emergency Management Division

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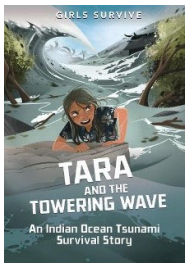
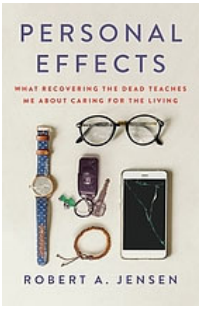
Tara and the Towering Wave: An Indian Ocean Tsunami Survival Story (Girls Survive) by Cristina Oxtra



The story of Tilly Smith attests to the importance of geohazard education for children. Tara and the Towering Wave, part of the Girls Survive series of historical fiction books, does a wonderful job presenting the 2004 tsunami disaster to young readers at a 4th-6th grade reading level. Alongside the fictional story of Tara, a 12-year-old girl exploring her Thai heritage with her mother while on vacation when the Indian Ocean tsunami hits, the book also includes a glossary of terms, facts about the disaster, and question prompts to get kids thinking about disaster preparedness. Kids can learn about the danger of tsunamis while taking inspiration from Tara's courage, strength, and determination.

Personal Effects: What Recovering the Dead Teaches Me About Caring for the Living by Robert A. Jensen



Personal Effects is not strictly a tsunami book, but it earns its place on this list for good reason. Part memoir and part disaster relief text, Personal Effects follows the life and career of mass fatality response expert Robert A. Jensen. His experience includes fatality management for major disasters like the Oklahoma City bombing, 9/11, and Hurricane Katrina, and he dedicates an entire chapter in his book to the 2004 Indian Ocean tsunami. Personal Effects is a captivating read for those interested in the details of fatality management and how responders ensure disaster victims are recovered, identified, and returned, along with their personal effects, to surviving family members with utmost dignity – no matter the size of the disaster.

*These are my personal views and do not represent those of my agency, nor should this list be considered any sort of official endorsement.

Congratulations to Jeff Lorens, NWS Western Region, on His Retirement!

By Megan Syner, NWS Western Region Headquarters, Integrated Services Division (ISD)Meteorology, Hydrology & Climate Services Branch Chief

Jeffrey Lorens has had a tremendous legacy of 47 years of service, with 28 years in the National Weather Service (NWS), 12 years in the U.S. Air Force, and 9 years in the U.S. Coast Guard. Jeff graduated with a Bachelor of Science in Meteorology from San Jose State University in 1985 and a Master of Science in Atmospheric Science from the University of Arizona in 1992. Jeff's passion for marine weather started when he joined the U.S. Coast Guard as a shipboard radar operator in July 1977. He served aboard two Coast Guard Cutters and was promoted to Radarman First Class in 1979. Jeff transferred to Active U.S. Coast Guard Reserve in 1981 while pursuing his undergraduate degree at San Jose State University. During his undergrad program, Jeff spent one summer at the Weather Service

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Congratulations to Jeff Lorens, NWS Western Region, on His Retirement!

By Megan Syner, NWS Western Region Headquarters, Integrated Services Division (ISD)Meteorology, Hydrology & Climate Services Branch Chief

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Office in Sacramento, CA and the next two summers at the Weather Service Forecast Office in Redwood City, CA as an NWS Student Trainee.

After nine years in the U.S. Coast Guard and graduation from San Jose State University, Jeff joined the U.S. Air Force as a Weather Officer. In addition to serving as a Weather Officer on the 30th Weather Squadron deployed to South Korea from 1988 -1990, he supported NASA space shuttle Atlas and Delta rocket launches, and served as Air Force Liaison to the media at the Kennedy Space Center on space shuttle launch days. In early 1998, Jeff was promoted to Major, a testament to his leadership, dedication, and service.

Jeff transitioned to permanent civilian service in 1998 at the NWS Austin/San Antonio, TX Weather Forecast Office (WFO), then went to the Aberdeen, SD WFO before the ocean called him to the Eureka, CA WFO. His passion for marine meteorology and program management led him to NWS Western Region Headquarters in 2003 where he has been the program manager for the Western Region Marine, Tsunami, and Tropical programs. Jeff also supports the Warning Coordination Meteorologist programs and the Western Region Regional Operations Center. He is a friend, mentor, colleague and peer to many in the NWS.

One of Jeff's favorite stories is how the Tsunami Program started in Western Region. Shortly after he arrived in Salt Lake City in 2003, the Regional Director at the time called Jeff and his supervisor to her office, opened a drawer and handed him a big stack of files and said "The Tsunami Program is yours!" Then the Indonesia Tsunami of 2004 happened and in 2009, he was a part of the Service Assessment Team for the 2009 Tsunami in American Samoa. Less than six months after the 2009 American Samoa Tsunami, a portion of the same team went to Honolulu for a follow up visit when a large earthquake in Chile triggered a tsunami. Imagine the experience of being in Hawaii for such a historical event!

Jeff also spearheaded the tropical program in Western Region and has been nationally recognized for his work in the marine and tsunami programs. In 2016, he received a NOAA Bronze Medal as part of a team for developing and implementing a Beach Hazards Statement. He also received a NOAA Administrator's Award in 2016 and 2017 for a Polygon Warning initiative and software to rapidly activate the Emergency Alert System for Tsunami Warnings. In 2022, Jeff received a Regional Isaac Cline Award for Program Management/Administration for his leadership and service in the national Tsunami Program. Jeff's legacy of exemplary leadership, service, and dedication will be remembered for many years to come. In retirement, Jeff is looking forward to spending quality time with family, traveling around the world, and volunteering at local animal shelters.

CRESCENT Workshop—From Hazard to Risk: The Science of Planning for Future Tsunamis

By Ignacio Sepulveda, San Diego State University;
Diego Melgar and Jill Elizabeth, University of Oregon and CRESCENT

On November 7 & 8, 2024, the Cascadia Region Earthquake Science Center (CRESCENT) hosted a topical workshop "From hazard to risk: The science of planning for future tsunamis" at University of Oregon. The workshop, organized by Ignacio Sepulveda (San Diego State University), Diego Melgar (University of Oregon), Dan Cox (Oregon State University) and Shubharoop Ghosh (ImageCat Inc), invited multi-sectoral organizations to participate in-person and remotely.

Speakers from Academia (Geology, Geophysics, Coastal Engineering, Structural engineering), Federal and State Agencies, and consulting and insurance companies shared their perspective and ideas on various topics ranging from tsunami hazard and risk assessment, planning, mitigation and preparedness, and tools and technologies for risk management.

Diego Melgar commented, "It was remarkable to see people working on every stage of the tsunami problem, from the science of how and why they happen, all the way through how we make our societies resilient to them, gathered in the same room and having spirited discussions. It's exactly the kind of interaction that CRESCENT was built for."

The workshop addressed four core themes:

1. Geophysics: Science of earthquakes and tsunamis
2. Probabilistic tsunami hazard assessment (PTHA): The methodology of how we quantify uncertain hazards
3. Fragility analysis: From hazard to risk
4. Implementation: How do our models/estimates make it into policy and industry applications?

Each core theme included the presentation of invited speakers addressing new advancements, examples of application, and technical challenges. These were followed by fruitful discussions during the several round tables.

Ignacio Sepulveda commented: "Participants were very engaged, providing their point of view on every topic discussed. Now, they know well about the several technical and non-technical challenges that experts face every day, from the modeling of tsunami hazards that will hit our coastal communities, to design models to predict structural damage and optimal evacuation plans. They will have a better idea of what happens in all other moving parts, while they contribute to the science of planning for future tsunamis."

This workshop was funded by the NSF and produced in collaboration with the NSF-funded Cascadia Coastlines and Peoples Hazards Research Hub (Cascadia Copes Hub).

Luis Muñoz Marin International Airport, Puerto Rico's New TsunamiReady Community

By Wildaomaris González Ruiz, Puerto Rico Emergency Management Bureau (PREMB)

Luis Muñoz Marin International Airport is an airport located inside the tsunami evacuation zone in Carolina, Puerto Rico. With more than 40,000 people including passengers that come to the island from numerous locations and more than 8,000 employees, having this airport inside the tsunami evacuation zone makes the airport a high-risk location in the event of a tsunami. As you can see in the Carolina Tsunami Evacuation Map (**Figure 1**), it's almost impossible for visitors and employees to get to higher ground in the event of a tsunami warning. For this reason, the airport strengthened its ways to disseminate tsunami messaging, and installed signs directing people to the multi-story parking lot.

Figure 1 Tsunami Evacuation Map Carolina, Puerto Rico

Figure 2 TsunamiReady Recognition for the Luis Muñoz Marin International Airport

The airport staff (Aerostar) completed the requirements established by the TsunamiReady Program on October 29, 2024, and obtained the TsunamiReady recognition (**Figure 2**). The process to be officially recognized took them approximately one year in which they managed to install the required signage, complete a tsunami evacuation plan, and train more than 8,000 employees. The success of the TsunamiReady program in Puerto Rico is due to the joint work of Puerto Rico Seismic Network, Puerto Rico Emergency Management Bureau, National Weather Service, International Tsunami Information Center- Caribbean Office, and agencies like Aerostar who walk the extra mile to be prepared to face a tsunami in Puerto Rico. We are so proud of our team!

Updates from the American Samoa NTHMP

By Aukusitino Steffany, Program Liaison, American Samoa Department of Homeland Security

American Samoa Finalizes Rehabilitation and Repairs for Early Alert Siren System

In October 2024, American Signal Corporation (ASC) Senior System Care Manager Robert Basil was in American Samoa to continue the rehabilitation and repairs of all 56 sirens on the Islands of Tutuila, Aunu'u and Manu'a. ASC is the sole service and maintenance provider for the American Samoa Early Alert Siren System. Basil has been working for ASC for the past 12 years, and was part of the crew that installed the first set of outdoor sirens in American Samoa. During Basil's visits in January 2024, and earlier in October 2024, he was able to provide a successful hands-on training for our very own Aukusitino Steffany. This opportunity has increased Steffany's knowledge, and allowed him to assist with the maintenance of all the sirens in American Samoa. Repairs for the Manu'a Island Chain sirens has been postponed due to no supply of fuel between the islands. All 49 sirens on the islands of Tutuila and Aunu'u were successfully repaired and fully operational. In the past, the NTHMP has been integral in American Samoa's overall ability to address the maintenance needs for its sirens. The end goal is to ensure that the system will be brought back to its optimal operating status.

Earthquake and Tsunami Evacuation Drill for Tafuna High School

In October 2024, the American Samoa Tsunami Team was invited to evaluate Tafuna High School (THS) Earthquake and Tsunami Evacuation Drill. THS is one of the biggest schools on island with an enrollment of over 600 students, located in the busiest area of the Tualauta District. The evaluation found that students had high levels of familiarity and knowledge about actions to take in the event of an earthquake or tsunami. Students practice the "Drop, Cover and Hold," and were attentive to instructions, and understood the school evacuation plan.

American Samoa Community College Annual Career Fair

On November 2024, the American Samoa Tsunami Team was invited to the American Samoa Community College (ASCC) Annual Career Fair Day. This event was well attended by over 100 students. ASCC is the only community college in American Samoa. Students who are studying Inclusive-Emergency Management expressed interest in learning about the NTHMP. This opportunity allowed our team to set up an informational booth, and network with students who come from different ethnic backgrounds.

Redwood Coast Tsunami Work Group –

Creative Opportunities for Promoting Tsunami Awareness and Preparedness

By Amanda Admire, RCTWG/Cal Poly Humboldt; Todd Becker, Cal OES

Community outreach and engagement play a big role in increasing awareness to local hazards and gaining participation for drills like The Great ShakeOut and World Tsunami Awareness Day. In Northern California, we utilize various community events to help promote these important drills and foster conversation around the topics they address. This October we participated in two great outreach opportunities.

Pastels on the Plaza

Annually, North Coast Children's Services holds a fundraiser called Pastels on the Plaza. This event is very unique and participants are provided with creative freedom to design a message for a sidewalk square. The unique part is that all the messages are drawn on the ground in sidewalk chalk and they remain on display for the community until the first fall rains wash them away. The Redwood Coast Tsunami Work Group has regularly participated in this event, and this year our message promoted participating in both ShakeOut and World Tsunami Awareness Day. Our design included visuals to remind the community what to do during an earthquake and tsunami, and it directed people to the Redwood Coast Tsunami Work Group website (https://rctwg.humboldt.edu/) where they could learn more about and register for ShakeOut and World Tsunami Awareness Day.

TOP: RCTWG members Megan Bryant (left) and Cheyenne Bailey (right) after completing the Pastels on the Plaza design. BOTTOM: RCTWG Pastels on the Plaza design. Message promoted participating in ShakeOut as well as World Tsunami Awareness Day.

Clarke Historical Museum Preparedness Display

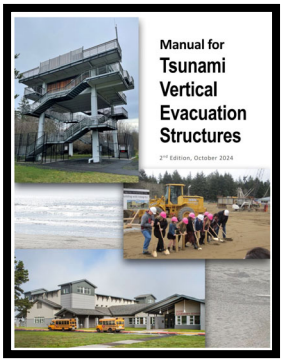
The second event placed us with Eureka's Clarke Historical Museum where we developed a display highlighting the importance of earthquake and tsunami preparedness on California's north coast. This display was on show for both October and November allowing museum visitors to learn about our local earthquake and tsunami hazards as well as think about what they need to do to prepare including participate in ShakeOut and World Tsunami Awareness Day.

RCTWG display at the Clarke Historical Museum. Contents promoted increasing awareness to north coast hazards as well as participation in ShakeOut and World Tsunami Awareness Day.

Advancing Tsunami Preparedness in WA: New VES Manual and Project Manager Position Strengthen Life Safety Efforts

By Danté DiSabatino, Washington State Emergency Management Division

The Washington Emergency Management Division (EMD) Tsunami Program recently published an updated edition of its **Manual for Tsunami Vertical Evacuation Structures**. This critical resource is designed to guide coastal communities through the complex process of planning, funding, and building Vertical Evacuation Structures (VES) to protect lives during a tsunami. With over 175,000 residents in Washington's tsunami inundation zones and more than 58 VES still needed, the Manual provides a clear roadmap for turning plans into lifesaving action.



The Manual breaks the process into eight manageable phases, helping communities take practical steps toward completing these critical structures. From early collaboration with emergency management partners to long-term maintenance and community training, the guide ensures that every phase is well-supported and achievable.

A Dedicated Role to Support Communities

To help coastal communities bring the Manual's guidance to life, I recently stepped into the role of **Tsunami Vertical Evacuation Structure Project Manager**. This position was created to provide hands-on support to jurisdictions throughout the VES process, ensuring they have the technical expertise, project management assistance, and outreach resources needed to succeed. My primary focus is on empowering communities to move forward with confidence by simplifying complex steps and connecting them to necessary resources.

With over four years of experience at Washington EMD, I bring a background in tsunami preparedness and mitigation to this role. I've had the opportunity to work on maritime response and mitigation strategies for coastal ports, lead Washington's first tribal tsunami exercise with the Makah Tribe, and coordinate with federal and state partners to strengthen coastal resilience. These experiences have shaped my collaborative approach, which emphasizes building partnerships and providing tailored support to meet community needs.

Supporting Lifesaving Action

The need for VES is urgent. A Cascadia Subduction Zone tsunami poses a significant risk to coastal communities, and these structures are essential for saving lives. As the Project Manager, my goal is to help jurisdictions turn planning into action by providing consistent guidance at every step—from organizing community meetings to managing long-term maintenance. Whether a community is just starting the process or encountering challenges along the way, I'm here to offer support and solutions.

This role is built on a commitment to collaboration. By working alongside local, tribal, state, and federal partners, the VES process can align with broader resilience strategies. Successful projects like the Shoalwater Bay Indian Tribe's Tokeland tower serve as a powerful reminder of what's possible when communities take action together. My role focuses on helping more jurisdictions achieve similar success, ensuring that lifesaving structures are not only built but also maintained and ready for use when needed.

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A Roadmap for Resilience

The updated Manual outlines a phased approach to developing VES, making the process more accessible and actionable for communities. As Project Manager, I'm here to help jurisdictions navigate these steps, from initial planning and funding applications to construction and long-term training. The goal is to ensure that every structure built is sustainable, functional, and familiar to the people it will protect.

By focusing on early collaboration, addressing barriers, and maintaining engagement, the VES process becomes less daunting and more achievable. My role is to bridge the gap between planning and implementation, ensuring communities have the tools they need to build safer futures.

Building Toward a Safer Future

The creation of the Tsunami Vertical Evacuation Structure Project Manager position and the release of the updated Manual mark significant progress in Washington's coastal resilience strategy. Together, these resources provide a clear path forward for addressing the critical need for lifesaving structures.

This role is an opportunity to translate Washington's commitment to resilience into action. By working side-by-side with communities, we can ensure that they are equipped to meet the challenges of a Cascadia Subduction Zone tsunami. My experience at Washington EMD has shown me the power of partnerships, and I'm excited to bring that perspective to this role to help protect lives and build a stronger, safer coast for everyone.

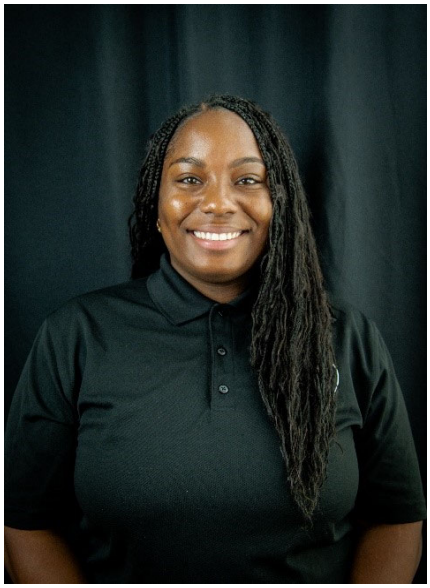
Additionally, we are currently collaborating with the City of Long Beach, WA, to address their Vertical Evacuation Structure (VES) needs. This partnership is an important step toward improving tsunami resilience in the area, and we're excited to share progress as the project develops! Attached is a photo from a site visit with Long Beach stakeholders, tsunami modelers, and members of our team as we evaluated a prospective location for the VES.

Staffing Changes to the WA EMD Tsunami Program

Elyssa Tappero, Washington Emergency Management Division

Washington State Emergency Management Division's (WA EMD) Tsunami Program is excited to announce that effective August 1st, **Danté DiSabatino has been promoted to Tsunami Vertical Evacuation Structure Project Manager!** This new BRIC-funded position under the Tsunami Program will work closely with communities on Washington's outer coast, the Office of the Superintendent of Public Instruction, and WA EMD's Mitigation Grants team to champion tsunami vertical evacuation structure (VES) efforts in Washington's highest-risk coastal areas. Danté's work will involve conducting community outreach and education about the need for VES, providing technical assistance for VES projects, and developing an overall VES strategy for Washington state. This is a vital step toward getting the 58 to 80+ more VES needed on our outer coast and will provide greater capacity for both the state and our local jurisdictions as they undertake lengthy, complex VES projects.

The WA EMD Tsunami Program is also pleased to announce that effective August 1st, **Ethan Weller will be transitioning from his project role in the Tsunami Program to the Inner Coast Tsunami Program Coordinator!** This NTHMP-funded position, previously filled by Danté, is responsible for tsunami risk reduction support to stakeholders along Washington's inner coast and the maritime community. This includes the creation of unique tsunami maritime response and mitigation strategies for our highest risk ports, harbors, and marinas, as well as close collaboration with the US Coast Guard and other maritime entities. The Washington Tsunami Program is currently working on two maritime strategies, one with Eagle Harbor on Bainbridge Island along Washington's inner coast and a second with the Port of Port Angeles along the Strait of Juan de Fuca.



Lastly, to continue Ethan's work supporting NTHMP partner states and territories with the Hazard Simplification Project Deep Dive, funded by NTHMP through August 2025, **the WA EMD Tsunami Program is thrilled to introduce the hiring of Tyisha (Ty) Brown El!** Ty joins WA EMD from Pierce County Department of Emergency Management, where she recently finished up an internship developing community profiles, overseeing cooling centers during EOC activations, delivering community outreach, and aiding in the K-12 school safety initiative. Previous to her emergency management experience, she worked in the public school system, through which she honed the kind of stakeholder-wrangling skills so valuable in this field as well. Ty brings a unique professional background and passion for helping underserved communities to the Deep Dive project which will serve it well, and WA EMD is excited to welcome her to the NTHMP family!

Building Tsunami Resilience: From Survey Insights to Public Outreach

By Regina Browne (VITEMA) and J'lisa Martinez (Consult Universal LLC)

The ongoing United States Virgin Islands (USVI) Tsunami Preparedness survey has revealed crucial insights into community awareness and readiness, paving the way for enhanced disaster preparedness initiatives. These findings are now being integrated into an innovative public education campaign that combines podcast outreach with practical insurance guidance.

Key Survey Findings and Impact

Our survey results demonstrated that while USVI residents recognize tsunami risks, there are significant gaps in understanding evacuation routes and emergency protocols. Notably, coastal communities showed higher awareness levels but lower preparedness in terms of emergency supplies and evacuation plans. As the survey continues, we are actively incorporating new findings into our program development, ensuring our outreach efforts remain responsive to community needs and evolving understanding.

Bridging Knowledge Gaps Through Podcasting

To address these findings, we're launching a 12-episode podcast series that uniquely combines earthquake insurance education with tsunami preparedness. This dual focus reflects the interconnected nature of these coastal hazards and provides practical solutions for community protection.

Podcast Series Overview

The series will strategically weave tsunami preparedness topics throughout its earthquake insurance focus, including:

- Understanding dual coverage needs for tsunami and earthquake events
- Real-world examples of insurance claims following tsunami events
- Early warning systems and their role in property protection
- Risk assessment for coastal properties
- Mitigation strategies that can reduce insurance premiums

Moving Forward

This integrated approach to disaster preparedness education represents a new model for public outreach. By combining insurance literacy with tsunami awareness, we're creating a more comprehensive framework for community resilience. The podcast format allows for in-depth exploration of these crucial topics while reaching a broader audience through an accessible medium.

The lessons learned from the USVI survey will continue to shape our outreach efforts, ensuring that future educational initiatives directly address identified community needs and knowledge gaps.

Guam Schools Conduct First Tsunami Evacuation Drill

By Stephen Cahill, Tsunami Program Manager, Guam Homeland Security

Guam Homeland Security and Civil Defense (GHSOCD) is pleased to announce that Mt. Carmel and Marcial Sablan Elementary Schools have conducted their first local tsunami evacuation drill on October 17, 2024, at 10:18 AM. This drill followed the Great Guam Shakeout, reinforcing our community's preparedness for natural disasters.

This collaborative effort involved coordination with the Offices of Guam Homeland Security and Civil Defense, Hagat Mayor's Office, Guam Department of Education, Mt. Carmel Charter School, and the Archdiocese of Guam, coordinated by Father Harold from Mt. Carmel Church. Together, these organizations aim to enhance awareness and readiness among students, staff, and families in the event of a local tsunami.

The drill simulated a local tsunami threat with a wave arrival time of 10 minutes based on recent NeoWave modeling, enabling participants to practice quick and efficient evacuation techniques. Families were encouraged to discuss the importance of preparedness at home, ensuring everyone knows what to do in case of an actual emergency.

"We are glad to have the support of NOAA and the National Tsunami Hazard Mitigation Grant Program to help us to ensure the safety and resilience of our community," said Esther Aguigui Guam Homeland Security. “Emergency preparedness drills are essential for transforming theoretical knowledge into practical skills, ensuring individuals and organizations can respond effectively and efficiently during crisis,” adds Charles Esteves, Civil Defense Administrator.

Event Review: 12/5/2024 Northern California Tsunami Warning

By Summer Ohlendorf and David Snider, U.S. National Tsunami Warning Center;
Corina Allen and Gregory Schoor, National Weather Service,Analyze, Forecast, and Support Office;
Stuart Weinstein, U.S. Pacific Tsunami Warning Center

In the late morning Pacific Time on Thursday, December 05, 2024, both of the National Weather Service's (NWS) U.S. Tsunami Warning Centers (TWCs) responded to a significant potentially tsunamigenic earthquake off the coast of Northern California. The earthquake began at 18:44 UTC (10:44 a.m. PST) and initial TWC analysis yielded a preliminary magnitude of 7.3. Within minutes of the earthquake, the centers began coordination and issuing products. As the authoritative center for this earthquake region, the National Tsunami Warning Center (NTWC) followed procedures based on earthquake magnitude and location to issue a Tsunami Warning for portions of the CA and OR coastline, with no alerts for the rest of their Pacific service area (Alaska, Canada, and U.S. West Coast). The Pacific Tsunami Warning Center (PTWC) followed with messaging for their Designated Service Areas, issuing Tsunami Information Statements for Hawaii, American Samoa, and Guam and the Northern Mariana Islands. PTWC issued a Threat Message to the member states of the Pacific Tsunami Warning System (PTWS). This message indicated that the threat would be confined to within 300 km of the epicenter.

A NWS National Data Buoy Center (NDBC) Deep Ocean Assessment and Reporting of Tsunamis (DART) sensor (46411) was triggered into event mode approximately 4 minutes after the earthquake occurred by the shaking of the seismic Rayleigh wave. A much smaller tsunami wave signal (less than 1 cm amplitude) was later observed on this DART.

The USGS National Earthquake Information Center (NEIC), released a reviewed, authoritative earthquake assessment with a revised magnitude of M7.0 at 18 minutes after the earthquake. They also determined the faulting mechanism to be strike-slip, which lowered the probability of tsunami generation and impacts. The TWCs adopted this official information and sent updates, with NTWC continuing the Warning for its alert areas in light of imminent estimated tsunami arrival times at the coast, and PTWC issuing a final threat message for international waters within the 300 km radius.

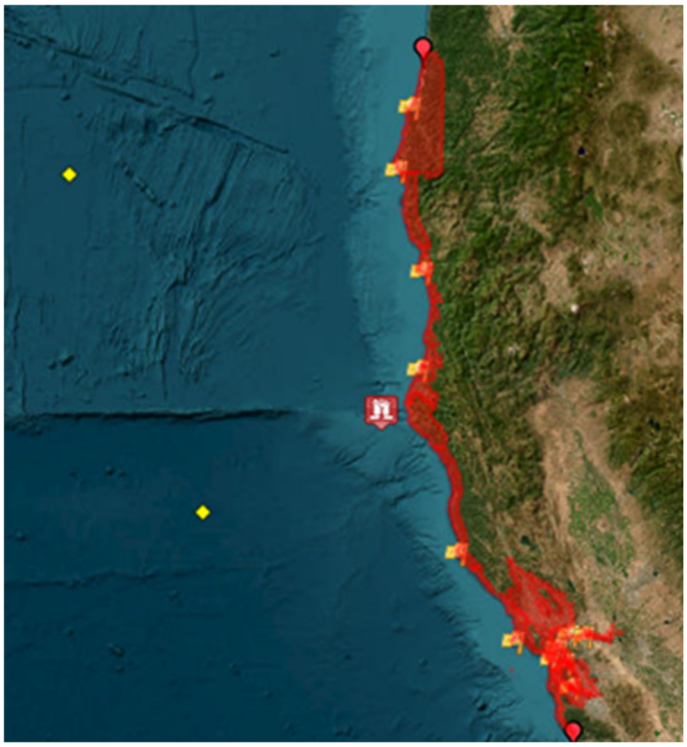


Figure 1: Red shaded areas show tsunami warning alert areas as displayed on Tsunami.gov. Yellow squares show locations of DART buoy systems.

Minutes after the earthquake, NTWC produced a low-resolution worst-case tectonic tsunami forecast suggesting Advisory-level impacts. PTWC supported NTWC with a forecast from the Real-time Inundation Forecasting of Tsunamis (RIFT) model, supporting that the tsunami was not expected to be impactful due to earthquake deformation alone. Due to uncertainties about local landslide tsunami generation at this magnitude range for cases of strong coastal shaking, NTWC maintains alerts until tsunami observations are obtained that support downgrade or cancellation, or confirmed not to be present.

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A tsunami was measured at Arena Cove, CA, with a maximum of 9 cm (about 3.5 inches) zero-to-peak above the tide at 19:46 UTC. An earlier crest had measured 5 cm, a reminder that the first tsunami wave is often not the largest or last. For reference, the threshold for a Tsunami Advisory is 30 cm and 100 cm is the threshold for a Tsunami Warning.

NTWC held one conference call for internal NOAA and external core operational partners about 20 minutes after the second message and an hour after the first message. During this call, the third and final NTWC message, which was the Tsunami Warning Cancellation message, was sent at 19:54 UTC (11:54 a.m. PST).

This event served as a reminder that drills and scenario-based exercises are critical for maintaining TWC and partner awareness and preparedness on operating procedures and decision-making during an actual event. In a forward-leaning sense, it will also help the TWCs to better review standard operating procedures, identify gaps in systems and procedures, and work toward improvements ahead of the next event.

Based on end-user feedback and system logs, alert messages were transmitted as intended and a Wireless Emergency Alert (WEA) was activated for the initial Tsunami Warning message. The Tsunami Warning and follow-up statements displayed on Tsunami.gov, and the site did not experience any outage despite a heavy user load.

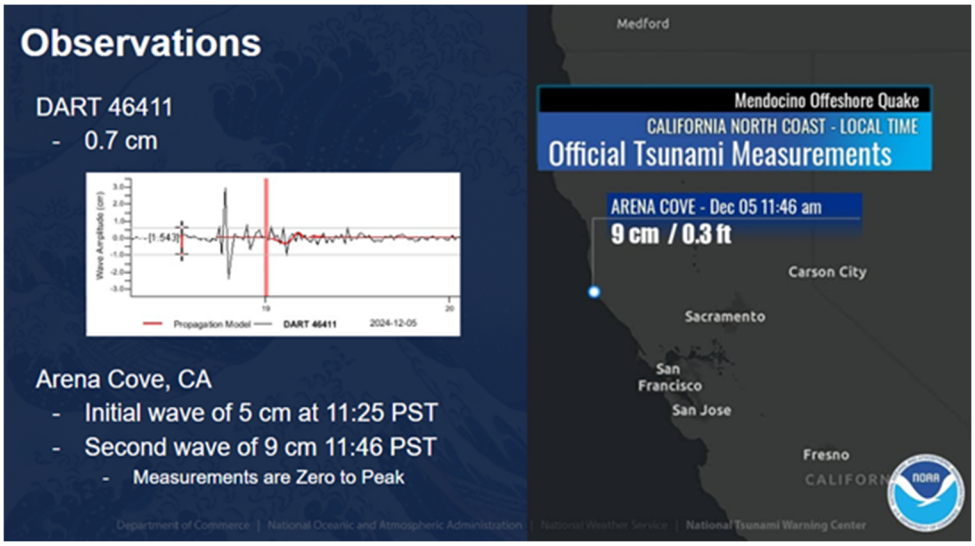

Figure 2: Observed tsunami measurements and location of measurement offshore at Arena Cove, CA. Credit: NTWC.

There was extensive media coverage of this event, particularly because the warning area coverage of the Northern California coastline included much of the San Francisco Bay Area. Following cancellation, interest turned to understanding tsunami hazard zones, WEA and its relationship to hazard zones, and TWC alerting procedures.

NTWC conducted formal internal and external partner event reviews in the week following the event, including with the NTHMP. Discussion centered around public understanding of hazard zones and alerting, how NTWC uses scientific information to inform decision making and alert strategies, and who is responsible for "all clear" messaging once NTWC sends a final cancellation message.

TSUNAMI RESEARCH & EVENTS

RESEARCH

Chua, C. T.; Otake, Takuro; Li, Tanghua; Cheng, An-Chi; Qiu, Qiang; Li, Linlin; Suppasri, Anawat; Imamura, Fumihiko; Switzer, A. D., 2024, An approach to assessing tsunami risk to the global port network under rising sea levels: NPJ Natural Hazards, v. 1, article 38. https://doi.org/10.1038/s44304-024-00039-2

Ferreira, M. A.; Oliveira, C. S.; Francisco, Rafael, 2024, Tsunami risk mitigation: the role of evacuation routes, preparedness and urban planning: Natural Hazards, 33 p. https://doi.org/10.1007/s11069-024-07061-7

Grezio, Anita; Anzidei, Marco; Baglione, Enrico; Brizuela, Beatriz; Di Manna, Pio; Selva, Jacopo; Taroni, Matteo; Tonino; Roberto; Vecchio, Antonio, 2024, Including sea-level rise and vertical land movements in probabilistic tsunami hazard assessment for the Mediterranean Sea: Scientific Reports, v. 14, article 28873. https://doi.org/10.1038/s41598-024-79770-9

Horiuchi, Takuro; Ichihara, Mie; Nishida, Kiwamu; Kaneko, Takayuki, 2024, A Seismic Precursor 15 min Before the Giant Eruption of Hunga Tonga-Hunga Ha'apai Volcano on 15 January 2022: Geophysical Research Letters, v. 51, no. 21, article e2024GL111144. https://doi.org/10.1029/2024GL111144

Johnson, C. Y., 2024, Tsunami researchers hunt for clues about next big Pacific Northwest quake: The Washington Post, Dec. 2nd, 2024. https://www.washingtonpost.com/science/2024/12/02/pacific-northwest-earthquake-tsunami-risk-research/

Sajan, M. K.; Chaudhary, Babloo; P K, Akarsh; Sah, Babita, 2024, Developing Tsunami-Resilient Rubble Mound Breakwater: Novel Gabion-Based Technique: Natural Hazards Review, v. 26, no. 1. https://doi.org/10.1061/NHREFO.NHENG-2183

UPCOMING NTHMP & RELATED EVENTS

- March 2025—CARIBE WAVE 25 Tsunami Exercise https://www.weather.gov/itic-car/caribewave
- April 14-18, 2025—Seismological Society of America Meeting (Baltimore, MD) https://meetings.seismosoc.org/
- April 15-17, 2024—2025 Partners in Emergency Preparedness Conference (Tacoma, WA) https://piepc.org/2024-conference