

## BIO: Jeff Lorens

Acting NTHMP Administrator

### IN THIS ISSUE:

Jeff Lorens, Acting NTHMP Administrator	1
Fleet Week at the Port of Los Angeles	2
Tsunami Science and Technology Advisory Panel Findings	3
April is Tsunami Awareness Month in Hawai'i	4
Alaska National Guard Conducts Earthquake, Tsunami Exercise	6
GAO Tsunami Alert Report	7
Strengthening Tsunami Maritime Response and Mitigation Through Inclusive Stakeholder Engagement in WA	8
Minutes-to-Hours: Arrival Times for Tsunami on BC Coast	10
Tsunami Research	13
NTHMP Related Events	14

Jeff's roots in weather (and later tsunamis) begin with a 4-year enlistment in the U.S. Coast Guard, serving aboard two Coast Guard cutters on the west coast (USCGC Rush and USCGC Resolute). It was spending time at sea watching the weather and waves where he developed his initial interest in meteorology. After four years on active duty, he went to San Jose State University and received his B.S. in Meteorology in 1985. Jeff moved back to the military in 1986, this time with the U.S. Air Force, serving in various roles and locations as a Weather Officer, including Yongsan, South Korea, and working with the Air Force Space program and NASA's Space Shuttle program at Patrick AFB and Cape Canaveral AFS. While in the Air Force, he earned an M.S. (Atmospheric Science) at the University of Arizona in 1992. In 1998, Jeff retired (early) from the Air Force and moved on to the National Weather Service.

Jeff's NWS career began at WFO New Braunfels, TX (Austin-San Antonio area), with stops at WFO Aberdeen, SD and Eureka, CA as a Lead Forecaster and Marine Focal Point. Jeff's role as the Marine Focal point introduced him to the tsunami hazard.



In 2003, Jeff became the Western Regional (WR) Marine, Tropical, and Tsunami Program Manager, beginning the longest assignment of his career (continuing up to the current time). Following the Indian Ocean Tsunami in late 2004, tsunamis steadily increased in importance in Western Region, with several significant events over the years since then. His roles as WR's Tsunami Program Manager include supporting the NTHMP, working with the west coast WFOs and the National Tsunami Warning Center on operational tsunami issues and projects, and supporting WR's Regional Operations Center (ROC) during tsunami events.

Jeff grew up in northern California (Sacramento and Red Bluff). He is married to Sue Lorens (37 years). They have two sons, Brad and Kenny. Jeff loves hiking, photography, and traveling to great places (like New Zealand)!

# TsuInfo Alert

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

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**NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM LIBRARY CATALOG:**

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

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

## Fleet Week at the Port of Los Angeles

By Matt Palmer – California Office of Emergency Services (Cal OES)

LA Fleet Week is an annual, multi-day celebration of our nation's Sea Services held on the LA Waterfront at the Port of Los Angeles over the extended Memorial Day Weekend. It includes military equipment demonstrations, educational activities, live entertainment, and more.

The Cal OES Tsunami program had the honor of participating in the Los Angeles Fleet Week in 2023, which took place from May 26 to May 29. An outreach booth was staffed by the Cal OES Tsunami program to inform Fleet Week attendees about tsunamis and the threat in California. Information also included how to



prepare, the appropriate response/protective actions, and information for maritime communities. We provided links to resources to learn more information about tsunamis.

California OES Tsunami Program provided information on understanding natural and official warnings and encouraging participation in World Tsunami Awareness Day (November 5, 2023). In addition to tsunami information, Cal OES also provided attendees with some earthquake hazard information since earthquakes produce most tsunamis. Earthquake messages include the importance of securing items to prevent damage or injury from falling objects and an "under-bed bag" containing basic items such as shoes, socks, flashlights, and a whistle. In the event of a tsunami at night, the bag is easy to find, and you can put your shoes on before stepping on the ground that could contain items that could injure your feet.

# TSUNAMI SCIENCE & TECHNOLOGY ADVISORY PANEL

## Report to the National Oceanic and Atmospheric Administration Science Advisory Board

in Response to

**The findings of the Tsunami Science and Technology Advisory Panel's report to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives as Requested in Weather Research and Forecasting Innovation Act of 2017**

April 2023

### EXECUTIVE SUMMARY

This report is prepared in response to findings presented to the National Oceanic and Atmospheric Administration (NOAA) Science Advisory Board by the Tsunami Science and Technology Advisory Panel (TSTAP). TSTAP is established as part of the Weather Research and Forecasting Innovation Act of 2017, which provides:

#### §3206a. Tsunami Science and Technology Advisory Panel

(a) *Designation.* The Administrator shall designate an existing working group within the Science Advisory Board of the Administration to serve as the Tsunami Science and Technology Advisory Panel to provide advice to the Administrator on matters regarding tsunami science, technology, and regional preparedness.



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...

(c) *Responsibilities.* Not less frequently than once every 4 years, the Panel shall— (1) review the activities of the Administration, and other Federal activities as appropriate, relating to tsunami research, detection, forecasting, warning, mitigation, resiliency, and preparation; and (2) submit to the Administrator and such others as the Administrator considers appropriate— (A) the findings of the working group with respect to the most recent review conducted under paragraph (1); and (B) such recommendations for legislative or administrative action as the working group considers appropriate to improve Federal tsunami research, detection, forecasting, warning, mitigation, resiliency, and preparation.

(d) *Reports to Congress.* Not less frequently than once every 4 years, the Administrator shall submit to the Committee on Commerce, Science, and Transportation of the Senate, and the Committee on Science, Space, and Technology of the House of Representatives a report on the findings and recommendations received by the Administrator under subsection (c)(2).

*Tsunami Warning, Education, and Research Act of 2017, part of the Weather Research and Forecasting Innovation Act of 2017 (Public Law 115-25 § 501, et seq., at § 508(a)(2); codified at 33 U.S.C. § 3206a)*

NOAA has received, reviewed and prepared responses to the report from TSTAP of December 8, 2021. This report is intended to support NOAA's response to the NOAA Science Advisory Board.

NOAA welcomes the input from the TSTAP and in general concurs with the characterization of the NOAA Tsunami Program and views the findings as both relevant and actionable. NOAA agrees with the panel in that the biggest risk related to national tsunami services is the independent operations of NOAA's two operational Tsunami Warning Centers (TWC). This leads to both lack of service consistency between TWCs and, most crucially, lack of service back-up, as directed in law. NOAA is pursuing an initiative to fully integrate TWC operations, and it is expected this will directly address many of the TSTAP findings.

Access full report: <https://sab.noaa.gov/wp-content/uploads/NOAA-Response-to-SAB-TSTAP-Report-FINAL.pdf>





# TSUNAMI PREPAREDNESS

## April is Tsunami Awareness Month in Hawai'i

By Pacific Tsunami Warning Center, International Tsunami Information Center,  
and NWS Pacific Region Regional Operations Center

*(Continued from page 4)*

During the County visits, stakeholders were briefed on their island's tsunami hazard and preparedness, including for evacuation of ports and harbors, and on PTWC's Hawai'i Operations. The information briefs were followed by in-depth



PTWC operations room (NOAA Tsunami Day)

discussions on both local and distant tsunami warning procedures and how coordination and information flow can be improved, including the roles of the PR-ROC and State and County Tsunami Advisors during events. Dr. Laura Kong, who serves as the State Tsunami Advisor to HI-EMA, emphasized that pre-event coordination and a plan is needed for post-tsunami science surveys to be able to support both emergency response and recovery and collect the perishable data required to improve tsunami forecast models and mitigation. The Hawai'i Tsunami Observer Plan from the early 2000s needs to be updated, and should be synched with the draft US National Plan for the Coordination of Post-Tsunami Investigations that NOAA/ITIC and the USGS are in the process of drafting.

Finally, as a conclusion to Hawai'i TAM, the ITIC and PTWC presented a summary of NOAA Tsunami Day State and County visit discussions and recommendations to the HI-EMA-sponsored Hawai'i Advisory Council for Emergency Management (HACEM) on April 25, 2023. Highlighted topics that will continue to be discussed and actioned include:

- Preparedness and mitigation activities such as the need for regular distant and local tsunami exercises
- Post-tsunami field survey planning
- Evacuation modeling
- Local tsunami scenario modeling
- Regular briefings to state and county elected officials
- Tsunami event operations actions to improve the clarity, content, and targets of Hawai'i alert products
- Sharing information during events between the PTWC, State, Counties
- The role the Tsunami Advisors can play
- Plans for future expected changes to the NWS tsunami advisory message.



Visit to the Kauai Emergency Management Agency (April 12)

# TSUNAMI PREPAREDNESS

## Alaska National Guard Conducts Earthquake, Tsunami Exercise

By Senior Master Sgt. Julie Avey, 168th Wing Public Affairs, National Guard News

EIELSON AIR FORCE BASE, Alaska - The 168th Wing and the Alaska National Guard Joint Force Headquarters conducted an earthquake continuity of operations (COOP) exercise, moving the joint operations center from Anchorage to Fairbanks May 1-5.

The exercise scenario required members to respond to a large earthquake and multiple tsunamis striking southern Alaska and coastal communities.

“The Arctic Eagle 23 exercise focused on testing our continuity of operations plan and training our service members north of the Alaskan Range,” said Col. Aaron Kelsey, Alaska National Guard deputy director of emergency operations. “Testing our emergency plans and training our service members is critical to ensuring we are prepared to serve our fellow Alaskans in their time of need.”



The 168th Wing Joint Operations Center and Crisis Action Management Team worked alongside counterparts from the Army National Guard and members of the Joint Operations Center at Alaska National Guard Joint Force Headquarters.

“This exercise was extremely important to help us develop and test a continuity of operations plan which will allow us to respond in the event of a significant event in the Anchorage area which reduces or disables the ability of our primary emergency operations command and control agencies to function,” said Col. Michael Griesbaum, 168th Wing commander. “The training we received ensures we will be able to effectively respond to help our fellow Alaskans in a crisis and to effectively interface with our local, state and federal interagency partners.”

The exercise focused on the immediate response to a 9.2 magnitude earthquake, including emergency communications to respond to the seismic zone and coordinate with local, state and federal agencies. In this scenario, the earthquake disrupted public utilities and caused widespread infrastructure damage in southern Alaska.

“We want to be able to respond rapidly and efficiently, and training together allows us to move toward that goal,” said Lt. Col. Joshua Sprague, 168th Wing.

Emergency managers from Washington state also participated in the exercise. Alaska has a mutual aid agreement with Washington for Emergency Management Assistance Compact capabilities. All 50 states, three territories, and the District of Columbia have EMAC agreements, enabling interstate aid in a disaster.

U.S. North American Aerospace Defense Command conducted academic training focusing on the Joint Operations Center to prepare for the emergency response tactical exercise.

“Arctic Eagle 23 brought a diverse group of Alaska National Guard members together, requiring them to form a team, assess the situation, and learn on the job,” said Kelsey. “Arctic Eagle showed once again that the Alaska National Guard is always ready and able to help the nation and the state regardless of the situation.”

During the exercise, Alaska Air and Army National Guard members worked together to coordinate the emergency response.

“We gained a tremendous amount of insight by having U.S. NORTHCOM, Washington state National Guard emergency operations members, and key members of the Alaska National Guard in one location for the exercise,” said Sprague.

“This is more than just an exercise,” said Griesbaum. “The relationships we formed with our Army Guard friends will be vital if an earthquake of this magnitude does occur. The goal is to be as ready as possible to respond.”

**Link to original article:**

<https://www.nationalguard.mil/News/Article/3392037/alaska-national-guard-conducts-earthquake-tsunami-exercise/>

# TSUNAMI PREPAREDNESS

## EMERGENCY ALERTS: NOAA Should Take Additional Actions to Help Ensure Tsunami Alerts Reach Those at Risk

By United States Government Accountability Office, Report GAO-23-105961

### What GAO Found

The National Oceanic and Atmospheric Administration (NOAA) primarily uses three methods to send tsunami alerts to the public (see figure):

- **NOAA Weather Radio** delivers alerts to listeners and to the Emergency Alert System, the nationwide system for broadcasting emergency messages over television, radio, and cable systems;
- **the Integrated Public Alert and Warning System (IPAWS)** delivers alerts through various pathways, including via Wireless Emergency Alerts—text-like messages on people's mobile devices; and
- **the internet** contains alerts on NOAA's website and social media posts.

The Federal Emergency Management Agency (FEMA) operates IPAWS and the Federal Communications Commission (FCC) sets rules and standards for wireless providers and broadcasters that participate in emergency alerting.

### National Oceanic and Atmospheric Administration's (NOAA) Primary Methods for Disseminating Tsunami Alerts to the Public



Source: GAO analysis of National Oceanic and Atmospheric Administration, Federal Communications Commission, and Federal Emergency Management Agency information. | GAO-23-105961

NOAA has taken steps to address some tsunami alerting challenges, but GAO found opportunities for improvement. For example, NOAA has efforts underway to improve its website to allow users to more easily access critical information during tsunamis and to better target tsunami alerts to at-risk populations. GAO found that NOAA could improve its tsunami alerting by taking the following actions:

- *Assessing the extent of NOAA Weather Radio's coverage of populated areas at risk of tsunamis.* NOAA Weather Radio is a critical tool to broadcast tsunami alerts, especially in tribal, remote, and rural areas, yet NOAA lacks assurance that tsunami alerts are reaching these areas. Assessing the extent of NOAA Weather Radio coverage would help NOAA and others understand whether at-risk communities have access to a key alerting method.
- *Enhancing collaborative efforts with FCC and FEMA to determine how to use IPAWS to deliver tsunami alerts to the Emergency Alert System.* Using IPAWS in this way would have many benefits, such as allowing tsunami alerts to be sent in multiple languages and to include additional information such as maps and video.

(Continues on page 8)

# TSUNAMI PREPAREDNESS & NTHMP PARTNER UPDATES

## EMERGENCY ALERTS: NOAA Should Take Additional Actions to Help Ensure Tsunami Alerts Reach Those at Risk

By United States Government Accountability Office, Report GAO-23-105961

*(Continued from page 7)*

### Why GAO Did This Study

Tsunamis are powerful, destructive, and capable of striking any U.S. coast, making it critical that the public is alerted to tsunami hazards. NOAA has primary responsibility for sending tsunami alerts to the public.

GAO was asked to review NOAA's tsunami alerting system. This report examines (1) NOAA's primary methods for sending tsunami alerts to the public, and (2) the extent to which NOAA has addressed related challenges and opportunities for improvement.

GAO reviewed NOAA and other federal documentation and interviewed NOAA, FCC, and FEMA officials. GAO identified challenges NOAA faces and opportunities for improvement by reviewing advisory reports and interviewing a non-generalizable selection of stakeholders including tribal representatives, state and local emergency managers, industry associations, and a consumer group. GAO compared NOAA's efforts to selected key collaboration practices and federal internal control standards.

### Recommendations

GAO is recommending that NOAA (1) assess NOAA Weather Radio's coverage of populated areas at risk of tsunamis and (2) collaborate with FCC and FEMA to determine how to use IPAWS to deliver tsunami alerts to the Emergency Alert System. NOAA concurred with GAO's recommendations.

Access full report: <https://www.gao.gov/products/gao-23-105961>

## Strengthening Tsunami Maritime Response and Mitigation Through Inclusive Stakeholder Engagement: Lessons Learned in Washington State

By Danté DiSabatino, Tsunami Program Coordinator, Washington Emergency Management Division

**Introduction**—The Washington Emergency Management Division's (WA EMD) tsunami program has developed several maritime response and mitigation strategies ([Port of Bellingham](#), [Westport Marina \(Port of Grays Harbor\)](#)), gathering valuable insights along the way. The success and versatility of these projects depend on engaging stakeholders, assigning dedicated project managers, securing funding, and simplifying the data collection process. Recently Elyssa Tappero (Tsunami Program Manager) and Danté DiSabatino (Tsunami Program Coordinator overseeing the Maritime work) were invited to publish their lessons learned in the upcoming issue of the Journal of Business Continuity & Emergency Planning. Below summarizes the key lessons learned that are featured in the article from these initiatives and emphasizes the importance of onsite champions, stakeholder engagement, early involvement, and streamlined data collection.

**Onsite Champions: Key to Success**—The engagement, passion, and expertise of onsite champions are crucial to project success. These individuals facilitate connections between the project team and subject matter experts, ensuring accurate and robust recommendations. An engaged champion brings the right people to the table from the beginning and ensures that port or marina leadership is involved. Conversely, a disengaged or passive champion can cause delays and result in an incomplete final product. By consulting engineering and financial teams, champions can accurately assess feasibility and funding options for mitigation actions.

*(Continues on page 9)*



# NTHMP PARTNER UPDATES

## Strengthening Tsunami Maritime Response and Mitigation Through Inclusive Stakeholder Engagement: Lessons Learned in Washington State

By Danté DiSabatino, Tsunami Program Coordinator, Washington Emergency Management Division

*(Continued from page 8)*

**Engaging the Right Stakeholders**—The involvement of the right stakeholders is vital for the success of any tsunami response and mitigation strategy. This includes government agencies, local emergency management, fire and police departments, U.S. Coast Guard, transportation departments, and private businesses operating in the area. Onsite champions play a crucial role in identifying and engaging these stakeholders at the right time. Their involvement ensures that perspectives from those "in the field" are considered, leading to more robust planning and better community response.

**Early and Ongoing Stakeholder Engagement**—Engaging stakeholders early and maintaining their involvement throughout the project is essential. Given stakeholders' demanding schedules, establishing clear expectations, and scheduling regular meetings are necessary for effective communication. Flexibility in communication platforms is crucial for engaging diverse stakeholder groups efficiently. Regular check-ins with the onsite champion help keep all stakeholders informed and maintain consistent communication, enabling the project manager to navigate unexpected changes effectively.



Over 30 stakeholders attended the Port of Neah Bay strategy project kick-off meeting in April 2023, including members of tribal council, tribal police, tribal and county emergency management, and federal agencies. (Photo credit WA EMD)

**Simplify Data Collection and Stakeholder Feedback**—The WA EMD tsunami program identified the need to streamline data collection and stakeholder feedback processes. In the past, check-ins with primary stakeholders were the primary avenue for discussion on feasibility. To overcome delays, the program introduced stakeholder response and mitigation workshops that allowed for more inclusive discussions on feasibility and risk assessment. Workshops involving representatives from local government, emergency management, and private businesses yielded more fruitful discussions, accelerated the data collection process, and provided a platform for collaborative problem-solving.

**Conclusion and Future Initiatives**—The completion of tsunami response and mitigation strategies empowers stakeholders with actionable next steps to prioritize mitigation efforts over time. Funding opportunities, such as grants from FEMA and NOAA, can support these initiatives. The recently passed Community Disaster Resilience Zones Act offers additional federal funding and support for high-risk coastal communities. By implementing detailed and site-specific strategies, maritime entities can enhance their resilience and contribute to a culture of nationwide resiliency. As the WA EMD tsunami program continues its initiatives, it aims to expand stakeholder engagement, refine workshop formats, and explore additional funding avenues. By incorporating the lessons learned from previous projects, the program seeks to improve the success and versatility of future strategies, ensuring the safety and resilience of maritime infrastructure and the communities they serve.

To see past Tsunami Maritime Response and Mitigation Strategies, [click here](#) to learn more.

# NTHMP PARTNER UPDATES

## Minutes-to-Hours: Arrival Times for Tsunami on BC Coast New Hazard Assessment Combines Ocean Science & Indigenous Knowledge

News Release from Ocean Networks Canada, May 8, 2023

Ocean Networks Canada (ONC) is developing a coastal hazard assessment framework that utilises a [two-eyed seeing approach](#), interweaving Indigenous knowledge with its tsunami and flood hazard modelling services. Results from these assessments—which include the estimated arrival times and flooding extent of earthquake-induced tsunamis on the British Columbia (BC) coast—are being used to support emergency planning for coastal communities.

BC communities are particularly vulnerable to tsunamis because of their proximity to the seismically active Alaska-Aleutian and the Cascadia subduction zones, which are capable of producing megathrust earthquakes.

In two articles (accessible [here](#), and [here](#)) published in *Oceanography Magazine* this year, ONC researchers discussed results from a series of collaborative tsunami hazard assessments ([see IEEE publication](#)) undertaken along the west coast of Canada.

### Tsunami hazard results

In the most recent study, ONC was engaged by the Strathcona Regional District (working in partnership with Ka:yu:k't'h'/Che:k'tles7et'h' First Nations and Nuchatlaht First Nation), to undertake the [Northwest Vancouver Island Tsunami Risk Assessment Project](#), alongside Northwest Hydraulic Consultants, and Northwest Seismic Consultants.

Through a combination of modelling, mapping, community engagement, and Indigenous knowledge, the researchers identified the expected height (amplitudes), current speed and direction (velocities), inundation extents, and arrival times of tsunami waves on the BC coast and the areas that would be hardest hit; findings that are backed up by historical records of past major events.

Tsunami waves generated by a magnitude 9.0 (M9) earthquake in the Cascadia subduction zone would reach the outer coast of northwest Vancouver Island in about 20 minutes. In this scenario, the tsunami would significantly impact local communities such as Kyuquot, with an estimated wave height of 5.9 metres reaching the shore in less than 30 minutes, followed by runup on the land that may exceed 12 metres of elevation.

A separate ONC study found that waves from a M9 Cascadia earthquake would travel into the Strait of Georgia and reach Boundary Bay (south of Vancouver) in three hours, with offshore waves of 1-2 metres tall.

The Alaska-Aleutian subduction zone is of interest due to the 1964 Alaska earthquake resulting in record tsunami waves hitting the BC coast. A tsunami triggered by a megathrust earthquake from this source would have significant impact in Prince Rupert and Haida Gwaii, with respective arrival times of 2.5 and 3.5 hours.

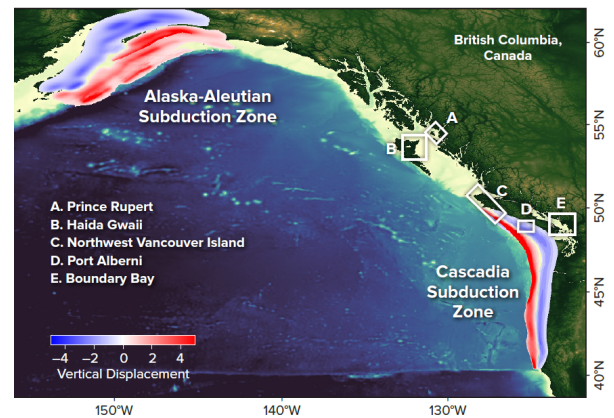


FIGURE 1. Several study areas along the coastlines of British Columbia, Canada, where tsunami hazard assessment was performed by ONC. Earthquake data are shown as seafloor vertical displacement (m) for the Alaska-Aleutian and Cascadia subduction zones. Blue indicates the topography subsidence and red indicates topography uplift.

(Continues on page 11)

# NTHMP PARTNER UPDATES

## Minutes-to-Hours: Arrival Times for Tsunami on BC Coast New Hazard Assessment Combines Ocean Science & Indigenous Knowledge

News Release from Ocean Networks Canada, May 8, 2023

(Continued from page 10)

The tsunami current speeds will exceed 1.5 metres per second in several regions, which will be hazardous for mariners and boaters, in particular in shallow water regions and narrow passages in the case of both Cascadia and Alaska tsunami.

### Impact of sea level rise

Current-day sea level and projected sea-level rise were modelled in the study to increase the accuracy of projected tsunami impacts. Results suggest that sea level rise would not significantly influence the amplitude of the waves but would intensify wave runup over land, leading to greater extents of flooding and damage.

Several overwater hazard graphics (Figure 2) and inundation maps (Figure 3) were created to represent the tsunami hazard information in each study area, including the tsunami wave amplitudes, current velocities, tsunami arrival times, and extent of flooding.

### The science and ocean knowledge behind hazard assessments

The researchers used layers of Digital Elevation Models (DEMs) - which are 3-D representations of Earth's surfaces - to identify areas that could be impacted by flooding under different scenarios. DEMs require large volumes of water depth and elevation data that are collected, checked for potential errors, merged, and converted for processing. As data can be sparse for remote communities, several additional Light Detection And Ranging (LiDAR) surveys were done to fill in the gaps.



FIGURE 3. (Left) Inundation extent map for a Cascadia tsunami in Tahsis, BC, produced by the Northwest Hydraulic Consultant Ltd. in collaboration with ONC. (Right) Satellite image of Tahsis, BC, showing existing shoreline without inundation extent.

and 1700 tsunamis in a series of interviews conducted by ONC Indigenous Engagement Research Associate, [Jaquelynn LaFlamme](#), and Indigenous Community Liaison, [Pieter Romer](#).

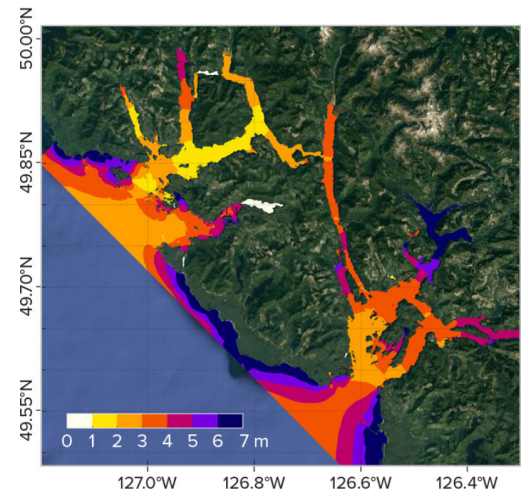


FIGURE 2. Maximum wave height for a Cascadia-generated tsunami in Esperanza Inlet and Nootka Sound as determined by the Northwest Vancouver Island Tsunami Risk Assessment Study. Colours show wave height from 0 metres (white) to 7 metres (blue).

(Continues on page 12)



# NTHMP PARTNER UPDATES

## Minutes-to-Hours: Arrival Times for Tsunami on BC Coast New Hazard Assessment Combines Ocean Science & Indigenous Knowledge

News Release from Ocean Networks Canada, May 8, 2023

(Continued from page 11)

“These ‘boots on the ground’ tsunami experiences provide insights into the location, extent of damage, and evacuation routes for past tsunamis, and the adaptation measures that exist today as a result,” says Romer.

[Soroush Kouhi](#), ONC Applied Science Specialist and co-author of the reports, says interweaving knowledge from coastal communities with scientific modelling offers significant insights for coastal safety and survival in the event of a megathrust earthquake.

“Knowing where coastal vulnerabilities lie and the predicted areas at risk strengthens hazard awareness, allowing decision-makers and communities to mitigate, prepare, respond, and recover from emergencies.”

### Building resiliency

ONC’s Learning and Engagement team has developed public education tools to raise tsunami risk awareness. To date, students in Kyuquot, Goldriver, Coal Harbour, Port Alice, Tahsis, and Zeballos have received tailored tsunami awareness programs delivered by the team.

This spring also saw the release of “Tsunami I lth Relative”, a documentary film produced and directed by Pieter Romer. The tour runs until June 2023.

Several tsunami signage illustrating evacuation routes, assembly locations, and inundation maps are under development, with installations planned for summer 2023. This collaborative research has also culminated into a report that authenticated and tailored emergency planning recommendations to fit the context of each affected community in Northwest Vancouver Island.

Access the Oceanography articles here:

- [Assessment of Tsunami Hazard Along British Columbia Coastlines from Coseismic Sources](#)
- [Integrating Topographic and Bathymetric Data for High-Resolution Digital Elevation Modeling to Support Tsunami Hazard Mapping](#)

Full model results can be found here: [Assessment of tsunami coastal hazard along the Northwest Vancouver Island from coseismic sources in Cascadia and Alaska subduction zones](#)

Full results from Phase 1 of the Northwest Vancouver Island Tsunami Risk Assessment Project can be accessed on [Strathcona Regional District’s website](#) and Phase 2 results will be released later this summer.

ONC’s coastal hazard assessment and mapping services are part of a suite of services for improving community safety, that include earthquake early warning and a [pioneering geodesy project](#) to monitor tectonic movement offshore along the boundary between the Juan de Fuca and North American plates.

Read more about ONC’s [earthquake early warning system](#).

For more information contact: Soroush Kouhi; [skouhi@uvic.ca](mailto:skouhi@uvic.ca) or ONC communications: [onc-comms@uvic.ca](mailto:onc-comms@uvic.ca)

*Link to original article:*

<https://www.oceannetworks.ca/news-and-stories/stories/minutes-to-hours-arrival-times-for-tsunami-on-bc-coast/>



FIGURE 4. ONC applied science specialist Soroush Kouhi on a visit to Tahsis, BC, Canada in September 2022 to learn about the study site geography and existing tsunami signs.



## RESEARCH

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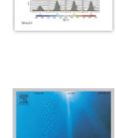
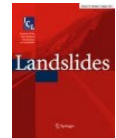
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# TSUNAMI RESEARCH & EVENTS

## USGS-led Team Discovers Pre-Columbian Tsunami Deposits in Puerto Rico

By Pacific Coastal and Marine Science Center

The deposits, found in a mangrove pond on the northwest corner of Puerto Rico by researchers from the USGS Pacific Coastal and Marine Science Center and the University of Puerto Rico, are believed to date back to between 1470 and 1530. They suggest that the tsunami was triggered by a massive megathrust earthquake that occurred at the Puerto Rico Trench. Similar age deposits at other Caribbean islands up to 400 km to the east, [as well as prior seismic modeling](#), suggest that the earthquake was of a magnitude 8.7 or larger. An earthquake of that magnitude in the Caribbean would generate tsunamis that cross the Atlantic Ocean.

“These Puerto Rican tsunami deposits provide valuable information for assessing the seismic and tsunami risks of the region,” said Bruce Jaffe, USGS Research Oceanographer, who led the research. “This work contributes to a better understanding of the frequency and magnitude of earthquakes and tsunamis in the area.”

These findings are significant because written records of tsunamis in the Caribbean extend back only 500 years, and evidence of earthquakes of magnitude 8.0 or larger on the Puerto Rico Trench is sparse. Understanding the likelihood of such events is crucial for developing effective disaster management strategies.

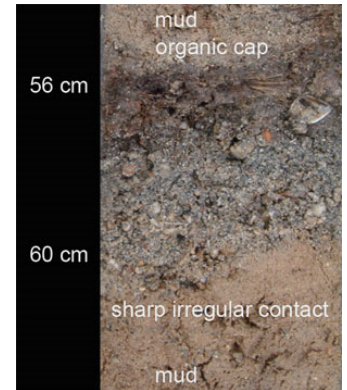
“When buildings are engineered to withstand earthquakes in areas where tsunamis occur, it is often the tsunami, rather than the earthquake, that results in greater loss of life and property,” said Jaffe. “The most striking example is the 2004 Indian Ocean tsunami, which killed nearly a quarter million people. A small fraction of these deaths was attributed to earthquake-related damage. The 2011 Great Tōhoku Earthquake in Japan was similar: the tsunami caused widespread destruction and the loss of nearly 20,000 lives, while earthquake damage to the buildings was much reduced thanks to their design.”

Jaffe and colleagues presented their findings at the Seismological Society of America's 2023 Annual Meeting.

[Read the related press release](#) from Seismological Society of America.

*Link to original article:*

<https://www.usgs.gov/centers/pcmsc/news/usgs-led-team-discovers-pre-columbian-tsunami-deposits-puerto-rico>



Pre-Columbian tsunami deposit revealed in a core taken in mangrove pond at East Bajura, Puerto Rico (Credit Bruce Jaffe)

## UPCOMING NTHMP & RELATED EVENTS

- ♦ July 31-Aug 4, 2023—NTHMP Summer Meeting (Portland, OR)  
<https://nws.weather.gov/nthmp/index.html>
- ♦ September 19-24, 2023—AEG Annual Meeting (Portland, OR)  
<https://www.aegannualmeeting.org/>
- ♦ October 15-18, 2023 Geological Society of America Annual Meeting (Pittsburgh, PA)  
<https://community.geosociety.org/gsa2023/home>
- ♦ December 12-16, 2022—AGU Fall Meeting (Chicago, IL)  
<https://www.agu.org/fall-meeting>

