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)

FEBRUARY 2023 Volume 25, Number 1

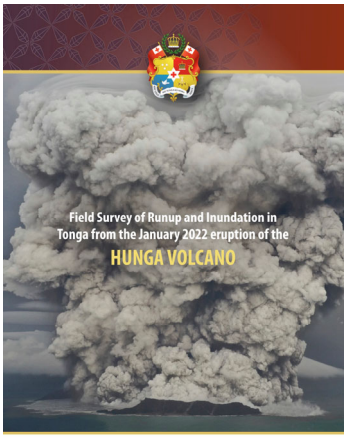
UNESCO & The Pacific Community Release New Report on 2022 HUNGA TONGA – HUNGA HA'APAI Tsunami

UNESCO Intergovernmental Oceanographic Commission News Release January 12th, 2023

IN THIS ISSUE:

Based on data collected by the Geological Service of Tonga, with the assistance of technical experts from New Zealand and the United States, the new report sheds light on the 15 January 2022 tsunami that followed the eruption of the Hunga Tonga and Hunga Ha'apai volcanoes in Tonga.

While tsunamis are mostly generated by earthquakes, over history 6% of tsunamis have been caused by volcanic eruptions. On 15 January 2022 Tonga's Hunga Volcano erupted in a sudden and explosive way causing a large local tsunami that devastated villages and resorts along the western shore of Tongatapu and in the Ha'apai island group as well as a far-field tsunami that caused damage and deaths thousands of kilometers away.



Report Cover Photo: The Hunga volcano erupting on the afternoon of 14 January 2022, approximately 24 hours before the main eruption. (Photo Taaniela Kula, Tonga Geological Services)

To mark the first anniversary of the tsunami event, UNESCO and the The Pacific Community are releasing the much awaited Hunga Tonga – Hunga Ha'apai (HTHH) Post-Tsunami Field Survey, compiling critical tsunami runup and inundation measurements, videos and photos, and field observations from the tsunami generated by the 15 January 2022 eruption of the Hunga Tonga and Hunga Ha'apai Volcanoes.

Under normal circumstances, UNESCO's Intergovernmental Oceanographic Commission (IOC/UNESCO) facilitates International Tsunami Survey Teams (ITST) of international scientists to work with the impacted country to collect tsunami data within the first week or month following a significant tsunami such as 2009 Samoa, 2010 Chile, 2018 Indonesia.

In the case of Tonga in 2022, however, the immediate post-disaster needs of the community and COVID-19 travel restrictions to and within Tonga prevented International Tsunami Survey Teams to deploy and delayed the development of a comprehensive field survey.

The newly unveiled Survey sheds light on important aspects of the 2022 HUNGA TONGA – HUNGA HA'APAI Tsunami, such as:

(Continues on page 2)

TsuInfo Alert

Prepared and published bimonthly by the Washington State
Department of Natural Resources, Washington Geological Survey,
on behalf of the National Tsunami Hazard Mitigation Program (NTHMP),
a state/federal partnership led by the National Oceanic and Atmospheric Administration (NOAA).
This publication is free upon request and is available in print by mail and online at:
http://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/tsunamis/tsuinfo-alert

Assembled and edited by Stephanie Earls,
Librarian, Washington Geological Survey
Washington Dept. of Natural Resources
1111 Washington St. SE, MS 47007
Olympia, WA 98504-7007
360-902-1473 (p) 360-902-1785 (f)
stephanie.earls@dnr.wa.gov

NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM LIBRARY CATALOG:
http://d92019.eos-intl.net/D92019/OPAC/Index.aspx

UNESCO & The Pacific Community Release New Report on 2022 HUNGA TONGA – HUNGA HA'APAI Tsunami

UNESCO Intergovernmental Oceanographic Commission News Release January 12th, 2023

(Continued from page 1)

- Wave runup heights of up to 20 meters on islands to the south, east and north of the volcano suggesting a radially symmetric wave front emanating from the source.
- Extensive coastal inundation and complete overwash of the Hihifo Peninsula on Tongatapu and smaller islands in the Ha'apai such as Kelefesia, Mango and Nomuka-Iki. This overwash caused the near complete destruction of buildings and structures as well as stripping extensive coastal forests to bare sand and causing significant geomorphic change to coastal landforms.
- The relative timing of the tsunami surges, with eyewitness accounts suggesting that the first arriving tsunami waves served as a natural warning and prompted a near complete evacuation of the area prior to the arrival of a larger second surge some 30 minutes later. This was a major factor in the extraordinarily low number of casualties resulting from this event.
- Tales and accounts of survival from residents in western Tongatapu who evacuated as the first waves were coming ashore while ensuring that others were aware of the impending danger and evacuated as well. As well as the remarkable account of a man who survived nearly 30 hours in the water after being washed off a small island during the tsunami.

(Continues on page 3)

UNESCO & The Pacific Community Release New Report on 2022 HUNGA TONGA – HUNGA HA'APAI Tsunami

UNESCO Intergovernmental Oceanographic Commission News Release January 12th, 2023

(Continued from page 2)

Post-Tsunami Field Surveys are a critical tsunami mitigation activity. Documentation of the event for lessons learned is essential for improving tsunami preparedness, mitigation, and the warning system. The post-event collection of tsunami wave runups, flow depths, inundation, and damage to the built and natural environment records the quantitative impact. These are complemented by eyewitness descriptions detailing the wave's arrival (its timing, character, strength, direction, recurrence, etc.), and powerful accounts of people reacting to and escaping the sudden tsunami.

The field survey data were collected by Tongan national teams, led by the Tonga Geological Services, and remotely assisted by international technical experts from New Zealand and the United States. The international efforts were jointly coordinated by The Pacific Community and UNESCO's Intergovernmental Oceanographic Commission (IOC/ UNESCO), through the International Tsunami Information Centre (ITIC), and the IOC Tsunami Unit based in Suva, Fiji.

The Summary Report represents a coordinated, collaborative effort of the Tongan government, the University of Auckland, eCoast Maine Consulting and Research (New Zealand), the Pacific Community (SPC), IOC/UNESCO and its International Tsunami Information Center, the University of Southern California and the Governments of New Zealand and the United States. The cooperation between these organizations enabled the assessment to run relatively smoothly, given the enormous logistical, transportation, and communications challenges.

The IOC/UNESCO International Tsunami Information Centre, the Pacific Community and New Zealand have been working together since the early 2000s in disaster risk reduction and tsunami training – most recently on tsunami inundation modelling for Southwest Pacific countries and tsunami warning centre operations for Tonga in 2019.

A scientific journal paper based on this report and containing additional insight and analysis has also been recently published in Pure and Applied Geophysics and is available as open access at the link below.

Key links:

- HTHH Post-Tsunami Field Survey Report
- Tsunami Runup and Inundation in Tonga from the January 2022 Eruption of Hunga Volcano: Pure and Applied Geophysics
- IOC-UNESCO Tsunami Programme
- International Tsunami Information Centre (ITIC)

Link to original press release:

https://ioc.unesco.org/news/unesco-pacific-community-release-new-report-2022-hunga-tonga-hunga-haapai-tsunami

Mitigation and Education Subcommittee (MES)
NTHMP Winter Meeting – January 2023

By Todd Becker (Cal OES), Nic Arcos (NOAA/NCEI), Regina Browne (VITEMA)

The Mitigation and Education Subcommittee (MES) session of the NTHMP Winter Meeting was held on Tuesday, January 24th in Palm Springs, California. NTHMP partners from participating territories, states, federal agencies, and local representatives attended the MES sessions both in person and virtually for a day of discussion, sharing, and collaboration.

The first part of the MES session started with Lightning Briefs where MES partners shared tsunami education and outreach program accomplishments, and partners were also asked to share gaps, needs, and challenges faced in implementing their tsunami education and outreach programs. This was a great opportunity to hear from all the MES partners about the great tsunami education and outreach work going on throughout the regions. The gaps, needs, and challenges brought up by the MES partners were recorded by the MES co-chairs for further discussion later in the day. All slides shared by the MES partners are available on the NTHMP website. A big Thank You to all the MES partners for contributing to these presentations that always highlight the significant efforts throughout the regions in continually working towards the NTHMP Strategic Plan Education and Preparedness Theme desired outcome of *"at risk Individuals know what to do during a tsunami"*.

NTHMP partners share information and lead discussions at the NTHMP Winter Meeting in Palm Springs, California.

The second part of the MES session was used to explore some of the MES annual work plan activities. Presentations during this session were provided by work plan activity leads and included discussions on TsunamiReady® for maritime communities; Hazus Expansion for U.S East Coast and Gulf Coast States; Hazus methods for identifying potentially vulnerable populations; Tsunami debris and vertical evacuation guidebooks; and Tsunami canned messaging. These work plan activities are linked to projects that MES partners are currently working on and the end products can be beneficial and useful to the NTHMP throughout the regions. MES partners will support the work plan activity leads on project development in the coming months. Work plan activity slides from the Winter Meeting are available on the NTHMP website.

The third part of the MES session began with a recap of the Tsunami Wave Arrival Workshop from December 2022 followed by a discussion of next steps. A goal of the workshop and continued discussions is for the NTHMP to formulate a definition for tsunami arrival time that is consistent among the partners. This was not the only time Tsunami Wave Arrival was discussed at the Winter Meeting, and a focused work team will continue to pursue this goal following the meeting.

The MES session then wrapped up with a discussion linking back to the gaps, needs, and challenges presented during the partner Lightning Briefs. The goal for this discussion and future efforts is to use the MES to identify where common gaps, needs, and challenges exist throughout our programs and where our collective efforts can be used to address these.

Mapping and Modeling Subcommittee of the NTHMP Holds its Winter Meeting in Palm Springs, California

By Alex Dolcimascolo, WGS; Jon Allan, DOGAMI; and Summer Ohlendorf, NTWC

Many partners of the NTHMP traveled back to Palm Springs, California (this time not in 115°F heat), to participate in their annual winter meeting. The members of Mapping and Modeling Subcommittee (MMS) met on Thursday, January 26, 2023 and picked up right where they left off discussing a variety of topics on their work plan through both in-person and virtual participation. Specific meeting notes and presentations from the MMS Winter 2023 meeting can be viewed on the NTHMP website.

Stephanie Ross (USGS) kicked off the MMS meeting by providing an update on the Powell Center Workshop efforts, which are working to develop tsunami sources for future probabilistic tsunami hazard analyses (PTHA). To date, there have been four Powell Center workshops. Workshop #5 on Pacific Tsunami Sources other than the Aleutian-Alaska and Cascadia subduction zones, and Workshop #6 on crustal faults, non-seismic sources, and wrap up are planned for March-27-31 and 2024, respectively. Stephan Grilli (URI) and Jay Patton (CGS) further presented specific updates on the methodologies and development of a landslide PTHA (framework from meeting #3) and a Cascadia PTHA (framework from meeting #4), respectively.

NOAA National Centers for Environmental Information (NCEI) continue to develop digital elevation models (DEMs) to meet the tsunami modeling needs of each NTHMP member. Completed DEMs are available for public access via Digital Coast and discoverable via the NCEI Bathymetric Data Viewer. New DEM development is currently in progress for Puget Sound (Washington), Santa Cruz (California), and the Columbia River (Oregon/Washington). Newly requested locations for DEM development include San Juan Islands/Rosario Strait (Washington) and the communities of Hyder, Angoon, Tenakee Springs, and Kake (all Alaska).

Switching gears, recent edits to an existing maritime document that outlines guidance for 1) tsunami hazard analysis, 2) tsunami preparedness and outreach, and 3) mitigation and recovery, are ready for MMS review. The MMS aims to maintain the updated version of this document on the NTHMP website. Additional maritime efforts are being spearheaded by both California and Oregon to develop more specific offshore depth guidance for tsunami safety, and other maritime guidelines. This type of specific, model-based guidance will be incorporated into an overall maritime checklist that will also contain product descriptions and information on connecting currents to damage potential, depths to vessel groundings, and other tsunami drawdown information. Upcoming workshops on debris and sediment movement modeling will influence these maritime guidance efforts and future product development for ports and harbors. Tentative dates for the workshops are May 22nd-23rd and August 4th-5th, 2023, respectively. For more information, please contact Pat Lynett (USC; debris) or Jim Kirby (U. Delaware; sediment).

Furthermore, 'tsunami wave arrival' has been a continued topic of conversation since it was first introduced at the NTHMP annual summer meeting (July 2022). These conversations put in motion an effort to develop an informal 'Tsunami Arrival Time Tiger Team' consisting of all interested NTHMP members. The first task of this working group will be to inventory how all NTHMP partners are using tsunami wave arrival in their products and messaging, which will then become a basis for drafting future guidance on the topic.

Heading into the next cycle of NTHMP funding, there were many proposals for new MMS-endorsed projects and tasks. These include developing publications summarizing both the landslide and sediment transport modeling workshops, establishing a Maritime Council, and evaluating a suite of products regarding debris transport. The MMS voted unanimously to endorse each of these tasks.

Last, but surely not least, the MMS introduced a new Co-Chair. Elizabeth Vanacore (UPR) will be joining Summer Ohlendorf (NTWC) and Alex Dolcimascolo (WGS) as Co-Chairs following Jon Allan (DOGAMI) stepping down after 4 years of great service in this role. Welcome Elizabeth, and thank you Jon!

Island Caucus Winter NTHMP Meeting 2023

By Wildaomaris González Ruiz, PREMB/ Island Caucus Co-Chair

During the 2023 Winter Island Caucus Meeting, members from American Samoa, Commonwealth of the Northern Mariana Islands, Guam, Hawaii, Virgin Islands, Alaska, and Puerto Rico participated. The main topics of the meeting discussion were tsunami sirens, the TsunamiReady® Program, and warning communication and dissemination. Members expressed concern about the challenges with buying new sirens or finding parts to repair those already in use. Storms and hurricanes have damaged some sirens significantly in the past few years. Staff in American Samoa had sirens out of operation for a period of two years because of those limitations. Due to this situation, some islands stated they use other methods to alert the public such as bells, and that it is vitally important to educate communities about the natural signs they must observe in order to react appropriately to a tsunami emergency. It is also important to think about the communication with the public before and after siren system testing takes place, so coming up with general guidance documents was recommended.

After the recent events that have affected American Samoa, all the islands were urged not to depend solely on tsunami siren activation to evacuate since in a local source event the sirens may not be activated in time. The unique geography of the various islands has potential for local source tsunamis, which makes it imperative to have redundancy in the warning systems, so that tsunami warnings can be recieved and disseminated to the public in the shortest possible time, and thus saving as many lives as possible.

As for the TsunamiReady® Program, the delays in the program due to Covid-19 restrictions were presented. The general recommendation is to visit communities more, carry out more evacuation exercises, and provide the communities that participate in exercises with an After-Action Report so they can improve the exercise the next time around. Communities should also be encouraged to develop family emergency plans that allow them to be better prepared for a tsunami emergency, and that they can test during an exercise in order to improve them. It is also recommended that islands use more social media to disseminate information about tsunamis so the communities can be better prepared and more resilient.

Lastly, the Island Caucus welcomes Elinor Lutu-McMoore from American Samoa as a new Co-Chair. Welcome Elinor!

Mitigation and Recovery Planning Work Group (MRPWG) Meets at Winter NTHMP Meeting

By Rick Wilson and Nicholas Graehl, California Geological Survey

The NTHMP Mitigation and Recovery Planning Working Group (MRPWG) held a 90-minute meeting to discuss annual work plan tasks devoted to community tsunami resilience as well as planning future meetings over the 2023-24 time period. The MRPWG meeting had good representation from state, territory, and federal partners, including new officials from FEMA who were enthusiastic to participate and assist.

Nation's first tsunami vertical evacuation tower (Washington Military Administrator, 2022).

The annual work plan tasks include developing a wide range of tsunami mitigation and recovery products and guidance for state and local communities to use. Tsunami maritime mitigation and recovery best practices and funding-request templates will help harbor and port officials reduce impacts from tsunamis to docks and infrastructure. Guidance for use and communication of probabilistic tsunami hazard analysis products will provide a risk-based approach to various land-use and construction levels. Tsunami debris cleanup, which can account for up to 40% of recovery costs, is a focus of MRPWG work developing best practices for debris modeling and planning. A funding-request template for siting and constructing a tsunami vertical evacuation structure is also being completed.

The MRPWG plans to hold monthly meetings combining presentations by subject-matter experts with discussions about task specific work. These meetings will start with experts who have experience successfully funding tsunami hazard mitigation projects addressing maritime planning and vertical evacuation structures. The processes used will be documented and help inform guidance and create templates for others to follow. The MRPWG intends to make significant strides this next year leveraging existing and new capabilities and resources from NTHMP partners and others to help keep communities tsunami resilient in the future.

Fantastical Tsunamis

By Lori Dengler/For the Times-Standard, December 10th, 2022

What is the largest possible tsunami? The highest tsunami ever recorded occurred in Lituya Bay, Southeastern Alaska. In July 1958, an earthquake triggered a massive landslide that tumbled into the head of Lituya Bay, creating a giant slosh that scraped the hills bare of old growth Sitka spruce. You can still see a faint scar today at 1,720 feet above sea level.

Lituya Bay is an unusual setting. The fjord is a narrow slot 7 miles long, 2 miles wide and 720 feet deep. The landslide displaced all the water at the head that surged out to the coast. 1958 wasn't the first time a huge tsunami struck Lituya Bay. Previous landslide-triggered surges struck in 1854, 1874, 1899, and 1936. Outside the confines of the Bay, these tsunamis quickly dissipated and were unnoticed in other areas of the Gulf of Alaska.

(Continues on page 8)

Fantastical Tsunamis

By Lori Dengler/For the Times-Standard, December 10th, 2022

(Continued from page 7)

1958 Lituya Bay can claim to be the highest historic tsunami, but certainly not the largest in terms of volume, areal extent, or impact. Unlike earthquakes, we don't have a widely accepted tsunami magnitude scale. A number of scales have been proposed, some based on the height of surges far away, others attempting to estimate the total energy in the tsunami. None have yet to be widely accepted in the tsunami community.

Lituya Bay 1958 after the tsunami. Shows the ring of damage around much of the bay.

For impacts, the 2004 Indian Ocean tsunami tops the scale. Nearly 230,000 lives were lost from 14 different countries in the Indian Ocean. Five other countries experienced damage. More than 2200 deaths were tourists and travelers from 45 other countries. The tsunami was recorded on almost every coastal tide gauge on the planet. The highest water surges were 167 feet, far less than Lituya Bay. But tsunami heights in excess of 60 feet were recorded along 140 miles of the Aceh coast and approached 30 feet in Sri Lanka 1200 miles away.

There are other candidates for 'largest' tsunami. The 1960 magnitude 9.5 Chile earthquake caused damage throughout the Pacific basin and was powerful enough to produce surges over 30 feet high in Hilo 6,600 miles away from the source region. The champion for largest wave far from the source is arguably 1946. A M8.6 earthquake in the Aleutians produced 60-foot waves in the Marquesas Islands 4,500 miles from the source region.

But these historic tsunamis are small potatoes compared to tsunamis in the more distant geologic past. The size of a tsunami depends on the source – how large the source is and how much it displaces the ocean floor. Megathrust earthquakes such as those in 1946, 1960 and 2004 do a pretty good job of moving a lot of water. With source dimensions of hundreds of miles and fault slip of 60 feet or more, they produce major tsunamis. But for really big tsunamis, look to the sky.

Last October, a group of scientists led by Molly Range of the University of Michigan published an article in AGU Advances about the tsunami caused by the asteroid impact 66 million years ago. Most scientists agree that the impact led to mass extinction at the end of the Cretaceous period.

In early 1980, the father and son team of Luis and Walter Alvarez proposed a massive asteroid impact led to the demise of the dinosaurs and many other flora and fauna. Since then, we've learned far more about the location and size of that impact and have a pretty good idea of where it hit and how big it was.

Chicxulub crater in Mexico's Yucatán Peninsula was discovered nearly a decade before the Alvarez's impact hypothesis. 110 miles wide and 12 miles deep, it is the second largest impact structure on earth, exceeded only by the 2-billion-year -old Vredefort crater in South Africa. By the early 1990s, Chicxulub had emerged as the best candidate for the Cretaceous-ending impact site.

(Continues on page 9)

Fantastical Tsunamis

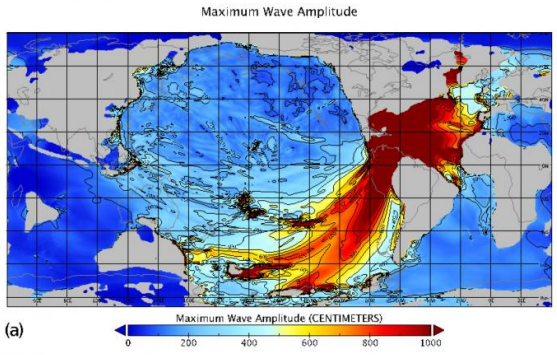
By Lori Dengler/For the Times-Standard, December 10th, 2022

(Continued from page 8)

The AGU Advances paper is the next chapter in the impact story. Range's group gathered evidence of asteroid size and impacts, reconstructed the likely ocean bathymetry and continent outlines, and ran numerical models on the tsunami that would result. Molly Range described the tsunami as "strong enough to disturb and erode sediments in ocean basins halfway around the globe, leaving either a gap in the sedimentary records or a jumble of older sediments."

One of the members of the tsunami modeling group was Vasily Titov who I've worked with on tsunami field surveys and known for three decades. He argues that there are many uncertainties, particularly in the reconstruction of the sea floor and coast lines 66 million years ago. But the study gives a reasonable general picture. The model is posted at https://pmel.noaa.gov/news-story/first-global-tsunami-simulation-chicxulub-asteroid-impact-66-million-years-ago.

Asteroids don't just impact earth. In 2016, scientists from the Planetary Science Institute in Tucson, Arizona proposed tsunamis on Mars. The team led by J. A. Rodriguez were studying depositional features associated with ancient oceans that covered areas of Mars early in its history and found evidence of disturbed sediments outside of the ocean beds.



Maximum tsunami wave amplitude, in centimeters, following the asteroid impact 66 million years ago. Credit: From Range et al. in AGU Advances, 2022.

They examined evidence from Mars Orbiter thermal images showing boulder strewn regions bordering flat sediment layers. Two weeks ago, the group released new data identifying an impact structure, similar to Chicxulub could have been the tsunami source. Named Pohl, the Martian crater is similar in dimensions to the Yucatán structure and was produced 3.4 bullion years ago. Based on estimates of the Martian ocean depth at the time, a tsunami over 600 feet high may have been the result.

The Pohl impact out-of-this-world tsunami carries even more uncertainty than reconstructing the 66-million-year earth asteroid. But the geomorphic evidence of water on Mars is irrefutable to me and asteroid impacts were certainly likely in the period of Martian oceans.

Back on earth it is important to remember that most tsunami damage is caused by far more moderate tsunamis. Our last two damaging North Coast tsunamis in 2006 and 2011 never made it above the high tide level yet were able to damage dock and harbor structures to the tune of $45 million.

Note: Listen to a father and son recount their experience on a fishing boat on Lituya Bay in 1958: https://www.dailymotion.com/video/xhqagp.

See original article: https://kamome.humboldt.edu/sites/default/files/12_10_22_fantastic_tsunamis%20.pdf

Social Media Posts Reveal Human Responses to Deadly Tongan Eruption

Quantifying human responses to natural disasters could improve preparation for future threats, scientists say

By Erin Martin-Jones, Eos, v. 103, Published on December 14th, 2022

The January 2022 eruption of Hunga Tonga–Hunga Ha'apai was among the most powerful ever recorded. It generated atmospheric shock waves that circled the globe several times, and its impacts claimed the lives of six people, including two in Peru, 9,600 kilometers away from Tonga.

Hunga Tonga–Hunga Ha'apai erupted on 15 January 2022, releasing a colossal ash plume and tsunami waves. This satellite image was taken on 16 January 2022. Credit: NASA/Kayla Barron, CC BY-NC-ND 2.0.

In the aftermath of the eruption, social media videos depicted the nation of Tonga inundated by ashfall and tsunami waves. Now, scientists are examining these videos to quantify human responses and improve warning systems and will present their research on 15 December at AGU's Fall Meeting 2022.

"Gauging the social response to events as complex as this [is] difficult, other than through interviews after the fact," said Jacob Lowenstern, a volcanologist with the U.S. Geological Survey (USGS) and director of the Volcano Disaster Assistance Program who was not involved in the study. Quantifying that social response, however, could improve disaster preparedness in the future.

Predicting Unpredictable Reactions

People behave unpredictably during disasters, said Dare Baldwin, a psychologist at the University of Oregon who contributed to the study. "It's important to understand the diversity of reactions so we can tailor education and early warnings to different people."

To improve messaging and warning systems in hazard-prone regions, Sara McBride, a social scientist from USGS who will present the research, used closed-circuit television footage and social media clips to gauge how people responded to the Tongan eruption.

"A lot of physical scientists talk about how unique this event was," McBride said. "We also wanted to understand people's behavior during the crisis, whilst respecting the enormous challenges they faced."

The researchers collected 480 videos that were posted to Reddit, Twitter, TikTok, and YouTube following the event, including 180 videos filmed in Tonga itself, plus tsunami footage from 11 countries across the Pacific.

McBride and a team of geoscientists and social scientists—including Tongan researchers and those involved in the Pacific tsunami response—watched the videos to identify what people did during and after the event.

They analyzed the videos using a method previously established to quantify earthquake response. This included noting whether people evacuated, took cover, or protected others, for example.

(Continues on page 11)

Social Media Posts Reveal Human Responses to Deadly Tongan Eruption

Quantifying human responses to natural disasters could improve preparation for future threats, scientists say

By Erin Martin-Jones, Eos, v. 103, Published on December 14th, 2022

(Continued from page 10)

Shirley Feldmann-Jensen, professor of emergency services administration at California State University, Long Beach, and a pioneer of the video analysis method, said she is pleased to see other researchers apply the technique to different natural disasters. "Knowledge of what people actually do, rather than what they report they do, informs improved education and preparation for such events."

One Eruption, Multiple Hazards

The videos captured an ash cloud burgeoning over Tonga. This was closely followed by at least 13 separate shock-wave-type booms around the archipelago that coincided with tsunami waves that lurched across the Pacific.

Heavy ashfall and tsunami waves damaged islands throughout Tonga following the Hunga Tonga–Hunga Ha'apai eruption. Credit: New Zealand Air Force/Wikimedia Commons, CC-BY-4.0

Baldwin said the eruption's onset and early shock waves may have warned nearby communities of the devastating effects to come. "What was hopeful was that we saw quite a few videos where people seemed to have proactively taken protective action, like filming from up high and a fair distance from shore," she said. Similarly, McBride noted that people tended to evacuate once they saw tsunami waves breaching seawalls.

But when faced with multiple hazards, such as earthquake and tsunami effects, the response was more haphazard. Under these circumstances, people tended to congregate with others rather than protect themselves by taking shelter or high ground. "We saw that exposure to cascading hazards like this can really confound people, and understandably so," said McBride.

The findings highlighted the growing need for multihazard drills, McBride said. Every year, millions of people across the world practice earthquake drills by taking part in the Great ShakeOut, but multihazard drills are much more rare. Currently, New Zealand is leading the way with its multihazard ShakeOut, which includes an earthquake drill and a tsunami hīkoi (evacuation walk).

It makes sense to combine these drills, McBride said, both to save time and to better simulate simultaneous hazards. Multihazard drills could prepare communities to respond and clarify dizzying hazards that might otherwise muddle life-and-death decisions.

Citation: Martin-Jones, E. (2022), Social media posts reveal human responses to deadly Tongan eruption, Eos, 103, https://doi.org/10.1029/2022EO220553. Published on 14 December 2022.

TSUNAMI RESEARCH & EVENTS

RESEARCH

Annunziato, Alessandro, 2022, Tsunami Detection Model for Sea Level Measurement Devices: Geosciences, v. 12, no. 10, p. 386, https://doi.org/10.3390/geosciences12100386.

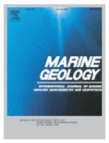
Brink, Uri ten; et al, 2023, Seafloor Observations Eliminate a Landslide as the Source of the 1918 Puerto Rico Tsunami: BSSA, v. 113, no. 1, p. 268-280, https://doi.org/10.1785/0120220146.

Gallotti, G.; et al, 2023, The tsunamigenic potential of landslide-generated tsunamis on the Vavilov seamount: Journal of Volcanology and Geothermal Research, v. 434, article 107745, https://doi.org/10.1016/j.jvolgeores.2023.107745.

Ghent, J. N.; Crowell, B. W., 2022, Spectral Characteristics of Ionospheric Disturbances Over the Southwestern Pacific From the 15 January 2022 Tonga Eruption and Tsunami: Geophysical Research Letters, v. 49, no. 20, article e2022GL100145, https://doi.org/10.1029/2022GL100145.

Golriz, Dorian; et al, 2023, Real-Time Seismogeodetic Earthquake Magnitude Estimates for Local Tsunami Warnings: JGR Solid Earth, v. 128, no. 1, article e2022JB025555, https://doi.org/10.1029/2022JB025555.

MacConamhna, O. A. P., 2023, A seismic tsunami in the Irish annals, recorded at Iona in October 720: Marine Geology, v. 456, article 106973, https://doi.org/10.1016/j.margeo.2022.106973.



Nishikawa, Yasuhiro; et al, 2022, Observation and simulation of atmospheric gravity waves exciting subsequent tsunami along the coastline of Japan after Tonga explosion event: Scientific Reports, v. 12, article 22354, https://doi.org/10.1038/s41598-022-25854-3.

UPCOMING NTHMP & RELATED EVENTS

- March 23, 2023—CARIBE WAVE 23 Tsunami Exercise https://www.weather.gov/itic-car/caribewave

- March 27-31,2023—California's Tsunami Preparedness Week https://www.tsunamizone.org/california/

- April 17-20, 2023—Seismological Society of America Meeting (San Juan, Puerto Rico) https://meetings.seismosoc.org/

- July 11-20, 2023—IUGG General Assembly/Joint Tsunami Commission Meeting and Session (Berlin, Germany) https://www.iugg2023berlin.org/