2026 NATIONAL REPORT
Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS)

For the ICG/CARIBE-EWS XIX Meeting: April 22-24, 2026

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Standard Operating Procedures for United States (U.S.) Domestic Tsunamis

Local (< 1 hour travel time)
Regional (1-3 hour travel time)
Distant Tsunamis (> 3 hour travel time)

The standard operating procedures for tsunamis in the United States are largely the same for local, regional, and distant tsunamis. Where there are differences, they are noted here.

What organization identifies and characterizes tsunamigenic events?

The Pacific Tsunami Warning Center (PTWC) in Honolulu, Hawaii provides domestic tsunami alert services for state of Hawaii, U.S. Territories American Samoa, Guam, the Commonwealth of the Northern Mariana Islands (CNMI), Puerto Rico and the U.S. and British Virgin Islands.

The National Tsunami Warning Center (NTWC) in Palmer, Alaska provides domestic tsunami alert services for the continental United States, Alaska, and Canada.

Each TWC serves as the other's backup or operational failover, in case the need arises.

Both TWCs independently characterize potential tsunamigenic events that occur in the Caribbean and Atlantic, depending on their areas of responsibility. To minimize the potential for conflicting information during events, each TWC is assigned tsunami source regions for which they are the authoritative sources for official products and information regarding the event. However, the information about preliminary earthquake parameters appearing in official products is the same.

What is the threshold or criteria for declaring a potential tsunami emergency?

PTWC issues initial messages based solely on an earthquake's preliminary location, depth, and magnitude determined from a rapid seismic analysis as well as the distance of the earthquake from Puerto Rico and the Virgin Islands in terms of tsunami travel time or kilometers.

<u>Puerto Rico and the Virgin Islands</u>
For earthquakes located further than three hours tsunami travel time from Puerto Rico and the Virgin Islands, PTWC uses the seismic criteria in Table 1 to determine initial products.

Earthquake					Alert Level
Sea	**Land**	**Depth**	**Magnitude**	**ETA**	
Yes	Yes	< 62 miles (100 km)	6.5 - 7.8	> 3 hr	Information statement No threat
Yes	Yes	≥ 62 miles (100 km)	≥ 6.5	> 3 hr	Information statement No threat
Yes	Near Sea	< 62 miles (100 km)	≥ 7.9	> 6 hr	Information statement Potential threat
Yes	Near Sea	< 62 miles (100 km)	≥ 7.9	3–6 hr	Watch

Table 1. Criteria for PTWC initial tsunami products for Puerto Rico/Virgin Islands for distant earthquakes. *Source: Users' Guide Tsunami Warning Products for Puerto Rico, U.S. Virgin Islands, and British Virgin Islands Version 1.21, December 8, 2023*

For earthquakes located within three hours of tsunami travel time of Puerto Rico and the Virgin Islands, PTWC uses the earthquake's proximity to polygons created for populated islands of Puerto Rico and the Virgin Islands and the preliminary seismic parameters in Table 2 to determine initial products.

Earthquake			Alert Level
Source Location	**Depth**	**Magnitude**	
Within 186 miles (300 km) of Puerto Rico/Virgin Islands	< 62 miles (100 km)	4.5-6.4	Information Statement
	≥ 62 miles (100 km)	≥ 4.5	
	< 62 miles (100 km)	≥ 7.1	Warning
	< 62 miles (100 km)	6.5–7.0	Advisory
Between 186 miles (300 km) and 621 miles (1000 km) of Puerto Rico/Virgin Islands	< 62 miles (100 km)	≥ 7.6	Warning
	< 62 miles (100 km)	7.1–7.5	Advisory
> 621 miles (1000 km) of Puerto Rico/Virgin Islands	< 62 miles (100 km)	≥ 7.9	Warning
	< 62 miles (100 km)	7.6-7.8	Advisory

Table 2. Criteria for PTWC initial tsunami products for Puerto Rico and the Virgin Islands for nearby earthquakes.

Notes:

- *If the earthquake has a preliminary depth less than 62 miles (100 km) with preliminary magnitude of 6.5 or greater but does meet location criteria above for an advisory or warning, then only an information statement will be issued indicating no tsunami threat.*
- *If the preliminary earthquake depth is greater than or equal to 62 miles (100 km) and the preliminary earthquake magnitude is greater than or equal to 6.5, then only an information statement will be issued indicating no tsunami threat from a deep earthquake.*

Source: Users' Guide Tsunami Warning Products for Puerto Rico, U.S. Virgin Islands, and British Virgin Islands Version 1.22. April 28, 2024 (https://tsunami.gov/operations/PRVIUserGuide.pdf)

Once PTWC generates a forecast for an event, alert levels may be revised in supplemental messages to reflect forecast wave heights as shown in Table 3 or based on observed wave heights.

Maximum Expected Rise of Sea Level above the Tide	Alert Level
0–1 feet (0–0.3 m)	None
1–3.3 feet (0.3–1 m)	Advisory
> 3.3 feet (> 1 m)	Warning

Table 3. Criteria for PTWC supplemental text products for Puerto Rico/Virgin Islands.
Source: Users' Guide Tsunami Warning Products for Puerto Rico, U.S. Virgin Islands, and British Virgin Islands Version 1.22. April 28, 2024 (https://tsunami.gov/operations/PRVIUserGuide.pdf)

PTWC may increase alert levels if new information justifies such an increase. They will not lower alert levels before impact unless an updated evaluation has a very high level of confidence and there is a clear benefit to lowering the alert. They may lower alert levels after impact as conditions warrant until cancellation.

What organization acts on the information provided by the agency responsible for characterizing the potential tsunami threat?

Puerto Rico and the Virgin Islands

- Puerto Rico Bureau of Emergency Management and Disaster Administration (also a CARIBE-EWS Tsunami Warning Focal Point)
- U.S. National Weather Service San Juan, Puerto Rico, Weather Forecast Office (also a CARIBE-EWS Tsunami Warning Focal Point, Alternate)
- Puerto Rico Seismic Network, University of Puerto Rico at Mayaguez (also a CARIBE-EWS Tsunami Warning Focal Point, Alternate)
- Virgin Islands Territorial Emergency Management Agency (also a CARIBE-EWS Tsunami Warning Focal Point)
- British Virgin Islands Department of Disaster Management (also a CARIBE-EWS Tsunami Warning Focal Point)
- British Royal Police Force (also a CARIBE-EWS Tsunami Warning Focal Point, Alternate)
- U.S. Coast Guard, Sector San Juan

How is the tsunami information (warning, public safety action, etc.) disseminated within your country? Who is it disseminated to?

In general, tsunami information is disseminated from PTWC to the officially designated responsible government agencies in each jurisdiction through a variety of channels as depicted in Figure 1.

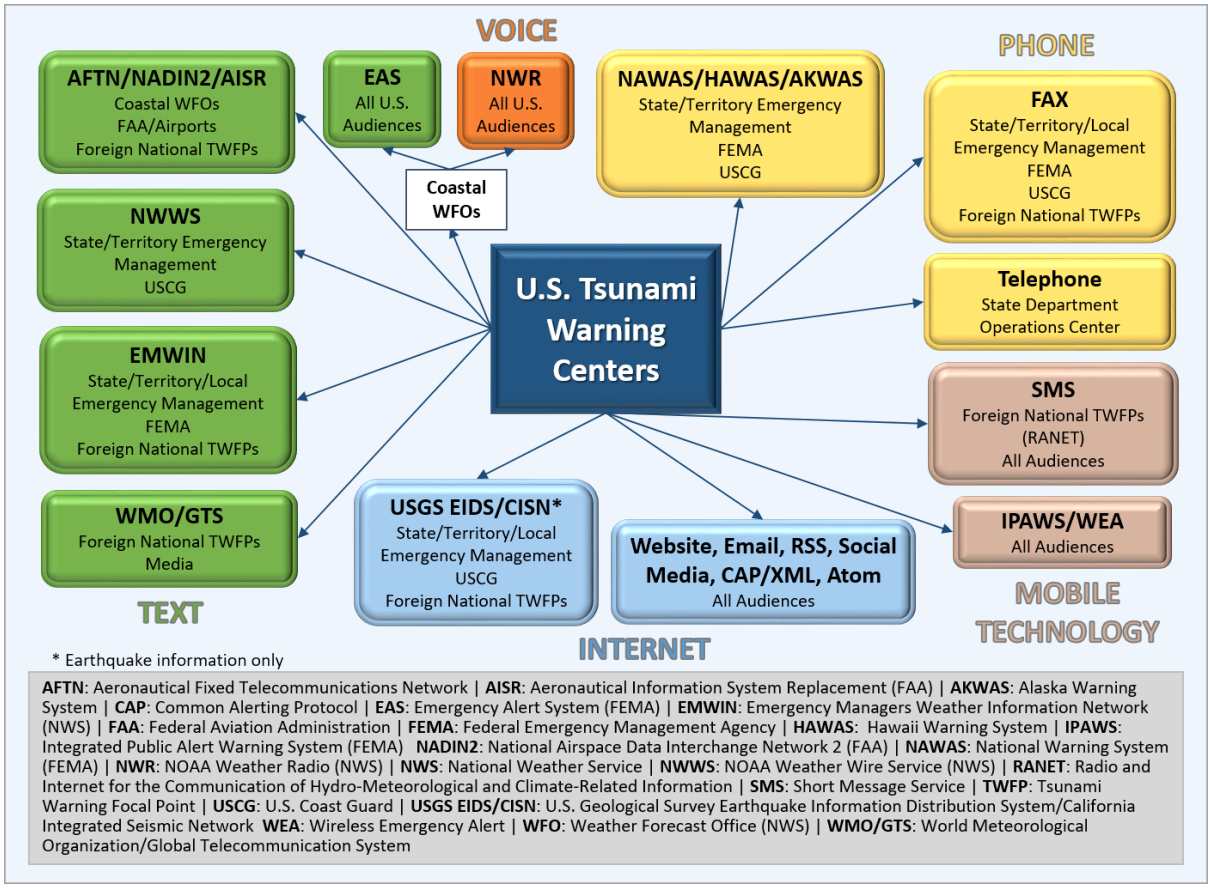

Figure 1. Dissemination methods for messaging from US Tsunami Warning Centers

Puerto Rico and the Virgin Islands

- The Puerto Rico Emergency Management and Disaster Administration Bureau and local municipalities alert the public (through interoperability systems, sirens, and other means); police, fire, rescue, other response agencies, and media outlets (Figures 2 and 3). The Wireless Emergency Alert (WEA), through FEMA's Integrated Public Alert and Warning System (IPAWS) capability was tested in Puerto Rico on March 19, 2026 as part of CARIBE WAVE 26 exercise.
- The U.S. Virgin Islands (USVI) Territorial Emergency Management Agency (VITEMA) alerts the public (through interoperability systems, sirens, and other means); police, fire, rescue, other response agencies, and media outlets. USVI utilizes Alert VI - mass message notification / Everbridge which reaches 21% of the population (2020 U.S. Census). VITEMA activates WEA/IPAWS which requires FCC approval during training and drills. Capability was tested in the Virgin Islands on March 19, 2026 as part of CARIBE WAVE 26 exercise.
- The Puerto Rico Seismic Network (PRSN) provides guidance to the emergency management agencies in Puerto Rico and the Virgin Islands, the media, and the San Juan Weather Forecast Office as well as the Instituto Dominicano de Meteorologia (INDOMET). The PRSN further disseminates official PTWC tsunami messages through RSS, email, SMS, web page, social media, phone calls, radio, and more (Figure 2 and 4). Capability was tested in Puerto Rico on March 19, 2026 as part of CARIBE WAVE 26 exercise.
- The NWS San Juan Weather Forecast Office (WFO), as TWFP Alternate, activates the Emergency Alert System (EAS) for Puerto Rico and the U.S. Virgin Islands to interrupt

commercial radio and television with a message and broadcasts tsunami information over NOAA Weather Radio (Figures 2 and 5). Capability was tested in Puerto Rico on March 19, 2026 as part of CARIBE WAVE 26 exercise.

- Upon receipt, the media may also interpret and re-disseminate tsunami information. ITIC-CAR may also interpret and re-disseminate tsunami information. Capability was tested in Puerto Rico on March 19, 2026 as part of CARIBE WAVE 26 exercise.

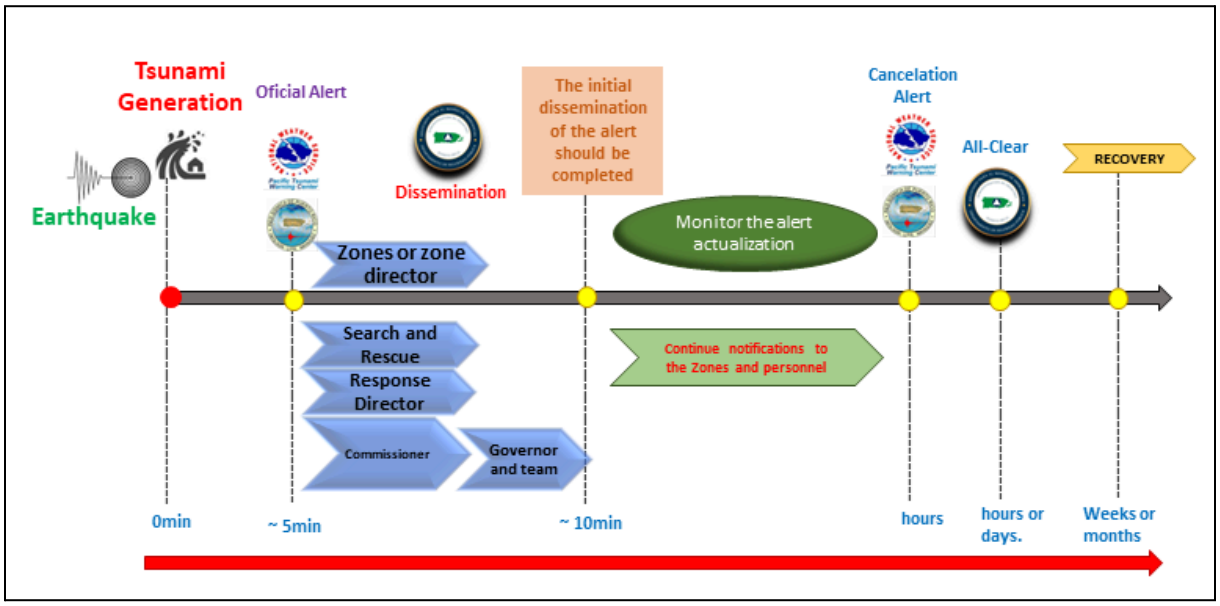

Figure 2. Timeline of Puerto Rico for issuance and dissemination of tsunami alert and updates from event origin time.

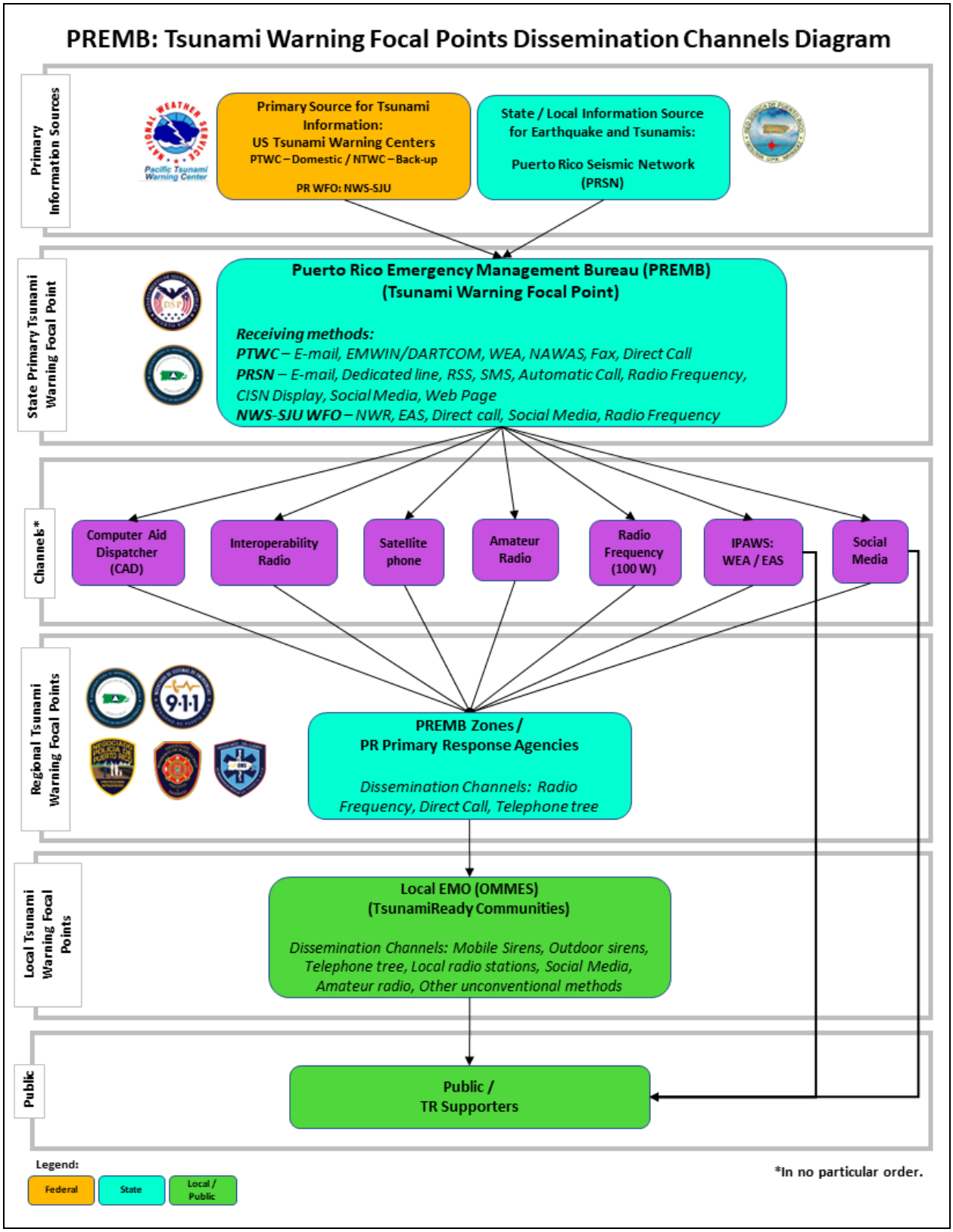

Figure 3. PREMB Tsunami Warning Focal Point Dissemination Flowchart (Rev 2024).

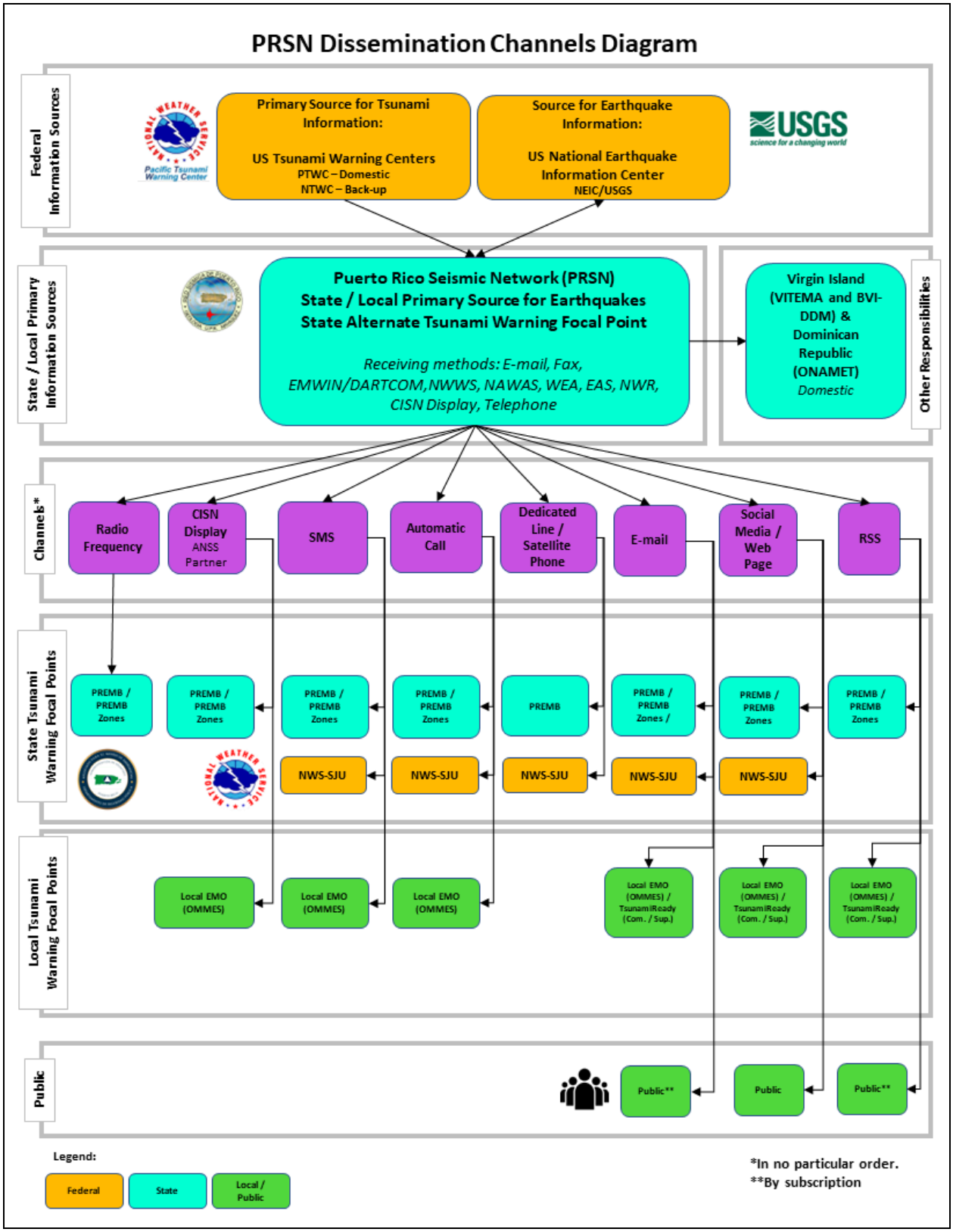

Figure 4. PRSN Tsunami Warning Focal Point Dissemination Flowchart (Rev 2024).

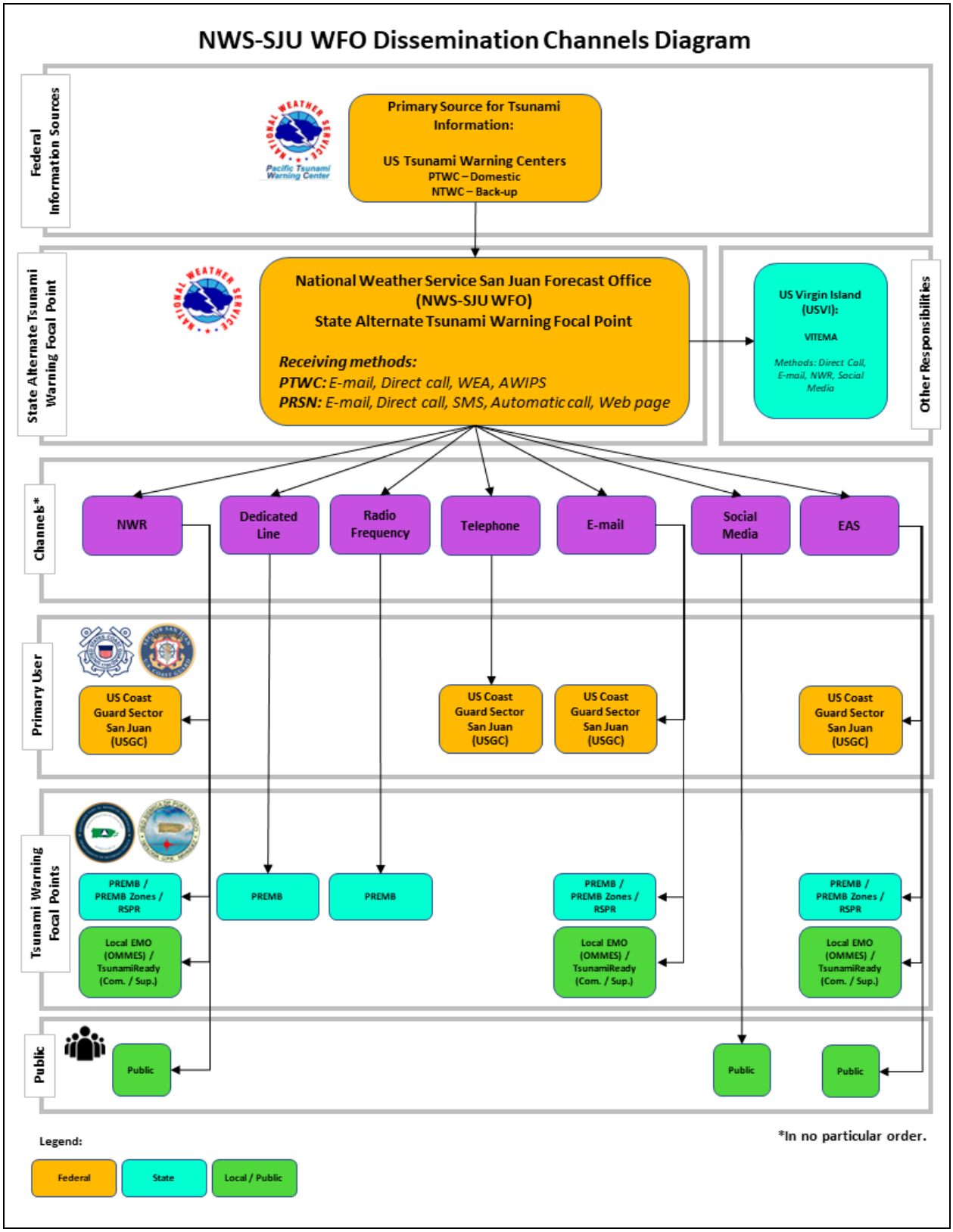

Figure 5. WFO San Juan's Warning Focal Point Dissemination Flowchart (Rev 2024).

Communication Testing
As shown in Figure 2, PTWC confirms communication links with each of the key recipient agencies in Puerto Rico and the Virgin Islands following the issuance of a product – typically about once a month. Agencies also receive the monthly CARIBE-EWS communication tests and the test associated with each year's CARIBE WAVE Exercise.

- PREMB does live WEA test as part of the CARIBE WAVE (March) and ShakeOut earthquake exercises (October). Local emergency management agencies who operate sirens within their jurisdiction are encouraged to do an audible test last Wednesday of every month at noon (12 pm) Eastern Time (ET).
- PRSN also tests communication lines monthly and annually as part of the CARIBE WAVE and ShakeOut tsunami and earthquake exercises.
- WFO San Juan's forecast does live NOAA Weather Radio and EAS test as part of the CARIBE WAVE (March) and ShakeOut earthquake exercises (October).
- VITEMA tests their Tsunami Sirens territory wide the third Thursday of each month at 11am ET. The Tsunami Working Group meets twice a month to review the status of its siren systems and coordination of communication tests where the results are analyzed and gaps and successes are noted.

How is the emergency situation terminated?

Puerto Rico and the U.S. Virgin Islands
PTWC issues a cancellation after an evaluation of water-level data confirms that a destructive tsunami will not impact an area under an alert (warning, advisory, or watch) or that a tsunami has diminished to a level where additional damage is not expected. This does not mean it is safe to return to evacuated areas. Local authorities determine when it is safe (issued all clear) to return based on local information about continuing wave conditions and related hazards such as fires or downed power lines.

For distant tsunamis, what actions were taken in response to warnings issued by PTWC and/or US NTWC during the intersessional period?

There were no warnings for U.S. Caribbean, Gulf, or Atlantic coasts issued by PTWC or NTWC during the intersessional period.

1. Seismic Monitoring Network

The United States supports an extensive network of seismic sensors in the Pacific, Atlantic, Caribbean, and Gulf. A number of other entities also support earthquake monitoring activities in the Caribbean and adjacent regions.

- The U.S. Geological Survey (USGS) National Earthquake Information Center (NEIC) and Albuquerque Seismological Laboratory coordinate field and monitoring operations to ensure reliable mission-critical data to the tsunami warning centers. One hundred and fifty of these stations are part of the Global Seismographic Network (GSN) and are jointly operated by the USGS, and the EarthScope Consortium. An additional 97 stations in the U.S. are part of the Advanced National Seismic System (ANSS). Seismic station details are provided at the GSN and ANSS URLs listed in Section 9.
- The PR network (PRSN - Puerto Rico Seismic Network and the PRSMP - Puerto Rico Strong Motion program, both UPRM agencies), and in partnership with the ANSS, monitors the seismic activity in Puerto Rico and the U.S. and British Virgins Islands. The stations operated by the PR network include 35 seismic stations and more than 100 strong motion stations (75 free-field in Puerto Rico and the Virgin Islands and 12 in nearby countries, including Anguilla and Aruba as well as the Dominican Republic); the

broadband stations are equipped with velocity and acceleration sensors. Some stations are equipped with Global Navigation Satellite System (GNSS) displacement sensors.

- In response to the damage caused by 2017 hurricanes, USGS ASL worked with PRSN to upgrade a total of 25 seismic stations. Each site was upgraded with new sensors (posthole broadband seismometer and accelerometer), digitizers, and solar power backups. Twelve (12) of these sites have VSAT connections to PRSN and NEIC to maintain monitoring capability if island wide power and internet go down again. The backbone network of strong motion stations was updated as well, and the communications improved mostly with cell phone circuits and telemetry. The PRSN, with the support from the Puerto Rico Science Trust, installed a network of type-C accelerometers (100 in the first stage), this equipment, together with the Raspberry Shake network, and the permanent networks of the Island, are being used to study the feasibility of developing an earthquake early warning in Puerto Rico.

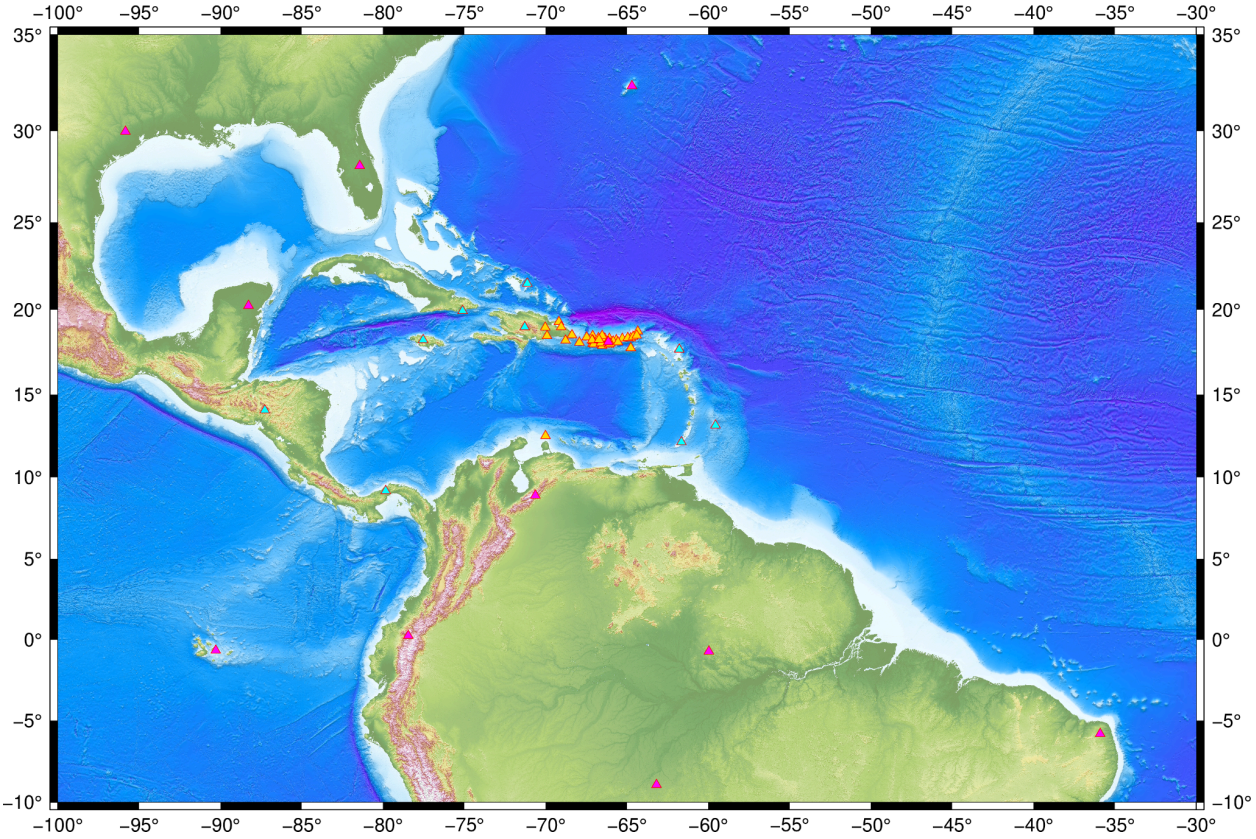

Figure 6. Distribution of seismic instruments supported or operated by PRSN/PRSMP (PR-gold) and the USGS (IIU - magenta, CU-cyan) in the CARIBE-EWS region. A table of these instruments is available as Appendix A (below).

2. National Sea Level Network

The U.S. supports an extensive sea level network in the Pacific, Atlantic, Caribbean, and Gulf of America. In the Caribbean, this includes coastal water-level stations and Deep-ocean Assessment and Reporting of Tsunami (DART) systems as described below and cataloged in Table 5.

U.S. Caribbean Coastal Water-Level Stations

Coastal water-level stations in the United States are operated by a variety of entities. Many of these stations are part of the international Global Sea-Level Observing System (GLOSS), which is coordinated by UNESCO/IOC. The data from these stations are made available to the NOAA tsunami warning centers and can be viewed on the UNESCO/IOC Sea Level Data Facility and through programs like Tide Tool, which is run in many CARIBE EWS tsunami warning centers.

- NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) operates 11 stations in the Caribbean (Puerto Rico, U.S. Virgin Islands, Bermuda) as part of its National Water Level Observation Network (NWLON). These multi-purpose stations have, at a minimum, a primary and backup sensor and data collection platform. High-frequency 1-minute water-level data are collected and transmitted every six minutes over GOES-East, telephone, IP modem, or Iridium to the tsunami warning centers. The NWLON also includes stations along the U.S. East and Gulf Coasts.
    - Tide gauge data from the NOAA-operated stations are quality controlled (for research), de-tided when possible, as well as archived at NOAA's National Centers for Environmental Information (NCEI). Data is available for download from an interactive timeline at https://www.ncei.noaa.gov/products/natural-hazards/tsunamis-earthquakes-volcanoes/tsunamis/tide-gauge-data.
- The University of Hawaii Sea Level Center (UHSLC) operates 10 regional stations, assisting with additional installations and maintenance. However, NOAA/NWS Tsunami Program funding for UHSLC station operation has ended, limiting future UHSLC support for these stations and the broader Caribbean tide-gauge network. UHSLC stations utilize primary and backup sensors, sampling once per minute. Data is transmitted via GOES-East or Iridium, typically every five minutes, and no longer than ten minutes at most locations.
- With support from the government of Puerto Rico and the University of Puerto Rico, the PRSN operates ten stations in Puerto Rico and the Dominican Republic, and assists DDM with the BVI tide gauge in Tortola. These stations transmit data every six minutes via GOES-HRIT, and some transmit minute-by-minute data via the internet using an earthworm module and seedlink protocol. NOS CO-OPS displays the 1-minute data. PRSN plans to reinstall the station in Caja de Muertos and install new stations in Anegada (BVI) and Samana (Dominican Republic).
- The Smithsonian Institution has installed, operates, and maintains two tsunami-capable water-level stations in Belize and Panama that transmit data every five minutes. The station in Belize is offline as of January 2026.

U.S. Caribbean Deep-ocean Assessment and Reporting of Tsunami (DART) Systems

NOAA's National Data Buoy Center (NDBC) operates 32 DART systems in the Pacific Ocean and 7 in the Atlantic Ocean (including 1 in the Gulf and 3 in the Caribbean and adjacent seas region).

- DART system technology uses a bottom pressure recorder (BPR) that samples pressure at 15-second intervals. Data is communicated via an acoustic link with a surface buoy.
- The system has two data reporting modes: standard and event. In standard mode, DART systems transmit data every six hours with a 15-minute subsampling of the full 15-second sampling intervals.

DART systems will enter event mode if tsunami detection algorithm identifies an event in the BPR or manually by a tsunami warning center. The NDBC's Mission Control Center continuously monitors the DART systems and validates triggers with the Tsunami Warning Centers. In event mode, a DART system delivers several minutes of full resolution data at 15-second intervals followed by one-minute averages. If no further events are detected or if it is not manually reset to event mode, the system reverts to its standard transmission mode after four hours.

NDBC receives DART data via Iridium and reformats it into messages for distribution on the Global Telecommunication System (GTS) and NOAAPORT. Data from the seven Atlantic DART systems goes out under the GTS bulletin header SZNT01 KWNB. NDBC also posts the data to its website. The high-resolution 15-second data is sent to NCEI for, quality control, tidal analysis, and long-term archive. Data is available from an interactive timeline at https://www.ncei.noaa.gov/products/natural-hazards/tsunamis-earthquakes-volcanoes/tsunamis/dart-ocean-bottom-pressure.

Vandalism or unintentional interference to DART systems and other sensors in the region has impacted their operations over the past decade. NOAA is working with international partners under the IOC and World Meteorological Organization (WMO) to educate members of the fishing community and others to combat the incidence of vandalism and interference. Regional marine fisheries organizations are also collaborating to address the issue. All members are encouraged to share the importance of these sensing systems for accurately forecasting tsunamis and vandalism can make vulnerable communities even more at risk.

SMART Cables offer a complementary deep-ocean sensing capability that addresses some of the vulnerabilities inherent to surface-deployed systems. By embedding seismic, pressure, and temperature sensors directly into submarine cable systems on the seafloor, SMART Cables are not exposed to vandalism or surface interference, providing a more resilient monitoring layer for the Caribbean's deep-ocean environment. The U.S. supports the exploration of SMART Cable deployment along strategic Caribbean routes as a means to strengthen and diversify the region's earthquake and tsunami network.

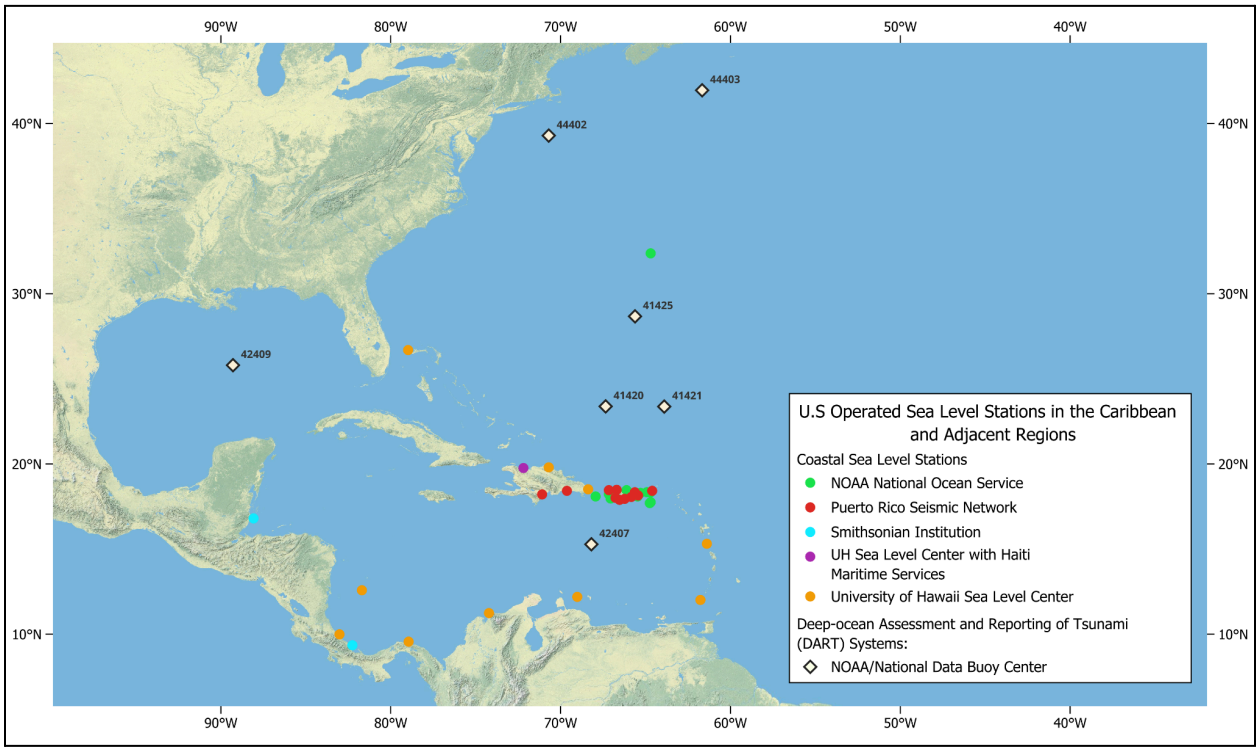

Figure 7: U.S.-operated sea level stations in Caribbean and adjacent regions. The U.S. also operates numerous stations along its Gulf and East Coast that would contribute to the assessment of tsunamis originating in the Atlantic or Gulf regions.

3. National GNSS Networks

The U.S. is actively pursuing techniques that will enable real-time, dynamic characterization and modeling of earthquake-generated tsunami sources. One of the most promising emerging datasets to accomplish this is the displacement vectors measured by the GNSS (Global Navigation Satellite System). While the United States does not currently have the capability to perform this type of characterization in an operational setting, we continue to support the deployment and maintenance of the underpinning networks. Continuously operating real-time GNSS stations in the United States and the Caribbean region are operated by a number of entities, including EarthScope Consortium that operates the National Geophysical Facility (NGF) and Network of the Americas (NOTA) for NSF, NASA, USGS, NOAA, and the PRSN.

GNSS Network Name	Region	Number of GNSS stations	Number of Stations Providing 1-Hz Data Streams in Real Time to Enhance Caribbean Tsunami Early Warning	Operator
Network of the Americas (NOTA)	U.S./Alaska/ Caribbean/ Mexico	1147	67	NGF/ EarthScope Consortium
PRSN	Puerto Rico/Virgin Islands	25	20	Puerto Rico Seismic Network
CORS	Worldwide	42 stations: 3 in Caribbean region	0	National Geodetic Survey (NOAA)

Table 5. U.S.-operated GNSS Networks in the Caribbean and adjacent regions.

Figure 8. Caribbean regional GNSS assets within the Network of the Americas (NSF-NGF operated by the EarthScope Consortium). This includes 67 stations that are currently operational and streaming 1-Hz data which could be utilized for tsunami hazard monitoring.

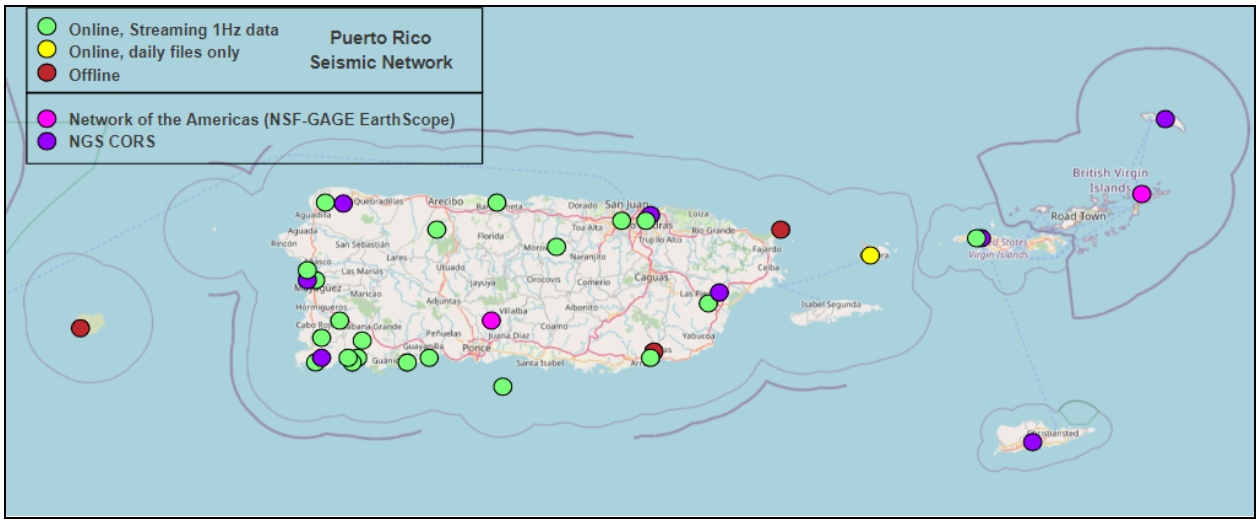

Figure 9. GNSS reference stations within Puerto Rico, the US Virgin Islands, and British Virgin Islands. The majority of these stations are operated by the Puerto Rico Seismic Network, with some from the Network of the Americas and the crowd-sourced NOAA CORS Network managed by the National Geodetic Survey.

<u>EarthScope Contribution: The Network of the Americas</u>
The NSF-funded NGF, is operated by the EarthScope Consortium. EarthScope is a non-profit university-governed consortium funded by the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the United States Geological Survey (USGS).

Most of the RT-GNSS resources that national, regional, or state EEW and TWS will use once fully operational, are cGNSS assets that were funded primarily by the NSF through the previous Earthscope MREFC and GAGE Facility CAs. NOTA consists of stations producing high-quality, low-latency GNSS data and data products from 1,147 continuously operating GNSS stations, over 900 of which provide both 1-Hz raw GNSS code and phase data and ambiguity-resolved precise point positions in real time which are required for tsunami warning. Sixty-seven (67) of these real-time stations are located in the Caribbean Basin and currently operational.

The EarthScope Consortium, has tested real-time algorithms to determine Peak Ground Displacement (PGD) from RT-GNSS position estimates (Hodgkinson et al., 2020). For events greater than ~M7, the system worked well and has been able to estimate the “final” magnitude with high accuracy and in a timely way (<300 s) for several events in Alaska, Mexico, and the Caribbean (Hodgkinson et al., 2020).

<u>Puerto Rico Seismic Network Contribution</u>

- The Puerto Rico Seismic Network (PRSN) operates a GNSS network of 25 real-time/high-rate stations, with 10 using current-generation Trimble Alloy receivers, supplemented by non-real-time stations maintained by NOAA's NGS across the Caribbean.
- Twelve PRSN stations utilize Trimble's RTX service for 1-Hz position corrections; data is shared via the EarthScope server, PRSN earthworm/seedlink, and a dedicated NTRIP caster for real-time access.
- PRSN continuously logs data in three sessions with varying sampling rates, transfers data daily, and makes it available for download through EarthScope's Data Archive, with an Earthworm module serving real-time RTX-corrected positions.

NOAA National Geodetic Survey

NOAA National Geodetic Survey (NGS) manages crowd-sourced cGNSS stations in the Caribbean. Most stations belong to NOTA, some to commercial operators, three to NOAA, one to NASA, one to FAA, and several others belonging to countries such as France, Cayman Islands and Germany. In September 2025 NGS repaired and upgraded its own GNSS stations in Saint Thomas and Saint Croix, USVI as well as scout for a new station location on Saint John USVI. NGS also evaluated three stations belonging to the Government of the USVI and two stations belonging to the National Park Service in the USVI for possible acceptance into the NOAA CORS Network.

4. Summary Plans for Future Tsunami Warning and Mitigation System Improvements

Tsunami detection and measurement. The U.S. continues to work toward a near-real-time, direct tsunami detection and measurement capability. If realized, we expect this will yield significant improvement in tsunami forecast accuracy. We expect this capability will consist of analyzing and integrating a number of discrete real-time data inputs, including traditional seismic waveforms and w-phase Centroid Moment Tensor (CMT) calculations, but also place increasing emphasis on direct deep ocean and coastal sea-level readings and added emphasis on determining coseismic deformation through GNSS offset data.

DART 4G: NOAA's 4th generation of DART is currently being deployed. It provides a more robust communications and mooring capability, and through the use of seismic band-pass filters, allows the bottom pressure recorder to be placed much closer to the seismic source than was possible with previous generations. This presents the opportunity to make direct tsunami detections within 10s of minutes as opposed to 1 hour, provided the instruments are properly relocated and densified. Final upgrades to firmware are necessary to activate 4G filtering, but NOAA is exploring a revised DART deployment grid to take advantage of the 4G capability to include the CARIBE EWS region.

GNSS Update: To facilitate incorporation of GNSS into TWC operations, the NOAA Center for Tsunami Research NCTR) has built a testbed at the Pacific Marine Environmental Laboratory (PMEL) in Seattle, WA for testing algorithm development done at various academic institutions into a prototype operational analysis system. As of Q3 of fiscal year 2022 the testbed has been detecting and characterizing small events. The Geodetic First Approximation of Size and Time (GFAST) system is yet to be installed at Tsunami Warning Centers with no firm timeline established. PMEL staff are also working to study the use of the Ionospheric Total Electron Content (see Research section, below). PRSN is working in the implementation of the GNSS-IR methodology GNSS-IR Site Map. The Tsunami Warning Centers are working with the Scripps Institution of Oceanography (SIO) through a Joint Project Agreement (JPA) on the development of a Seismogeodetic Early Warning System (SEWS) with an intended transfer their full SEWS software suite. SEWS combines seismic and GNSS/GPS data to create seismogeodetic surface velocity and displacement time series that do not clip in the nearfield during intense shaking and can be used to rapidly characterize earthquake source parameters like magnitude and related tsunamigenic potential particularly for large and complex events.

Seismogeodetic Data: PTWC has a project with Scripps Institute (University of California, San DIego) to incorporate seismogeodetic data into the tsunami warning system. This project combines accelerometer data with GPS, resulting in a seismogeodetic data stream. Seismogeodetic data can be used in the near field of the earthquake and enables a rapid estimate of the Moment Magnitude of Great Earthquakes.

SMART Cables: The Science Monitoring And Reliable Telecommunications (SMART) Cables integrate environmental sensors directly into submarine telecommunications infrastructure, creating dual-purpose cables that both transmit data and monitor oceanic conditions crucial for tsunami detection. SMART Cables incorporate seismic, pressure, and temperature sensors at repeater stations spaced approximately 60-120 km apart along submarine cable routes. This strategic placement enables high-resolution, real-time monitoring of seafloor movements and pressure changes that indicate tsunami formation and propagation. Unlike traditional tsunami detection systems that rely on surface buoys, SMART Cables offer continuous monitoring from the seafloor with immediate data transmission through existing telecommunications networks. Recent technological developments have brought SMART Cables closer to widespread implementation.

The proof of concept has been delivered with the InSEA Wet Demo in front of the coast of Sicily, Italy. Two pioneering SMART Cable projects are now advancing toward construction: the Tamtam cable, which will connect New Caledonia and Vanuatu with 4 SMART modules along its 400 km route, and the Atlantic CAM system in Portugal, which will form a ring connecting Lisbon, the Azores, and Madeira with 20 SMART modules.

For the CARIBE EWS region specifically, SMART Cables present a tremendous opportunity to enhance tsunami detection and warning capabilities. The Caribbean's complex seismic environment, with multiple fault systems and submarine landslide potential, makes rapid and accurate tsunami detection particularly challenging. SMART Cables would complement the existing network of DART buoys and coastal sea-level stations by providing continuous, high-resolution seismic and tsunami monitoring in deep-ocean environments where tsunamis first form. By integrating sensors into planned commercial cable infrastructure, tsunami monitoring capabilities can be deployed at a fraction of the cost of standalone systems. This dual-use approach maximizes return on investment while enhancing the resilience of both telecommunications networks and early warning systems. Partnerships between tsunami warning agencies, telecommunications companies, and regional stakeholders will be essential for advancing SMART Cable implementation in the Caribbean. Strategic deployment along key routes could improve warning times for coastal communities throughout the region, potentially saving lives and reducing economic losses from future tsunami events.

A region-led process is now underway to advance SMART Cable readiness in the Caribbean. In January 2026, the ITU/WMO/UNESCO-IOC Joint Task Force on SMART Cables (JTF) and its International Programme Office (SMART IPO) convened initial coordination meetings with IOCARIBE, ITU Regional Office, the Caribbean Telecommunications Union (CTU), and the WMO Regional Office. These meetings established a shared framing and phased approach, recognizing that submarine cables are primarily telecommunications infrastructure with environmental sensing as an added, high-value societal benefit.

The shared regional goal is to build, over approximately three years, a common understanding of SMART Cable value for: (1) early warning and disaster risk reduction (tsunami, earthquake, and volcano-related hazards); (2) ocean observing; and (3) regional resilience. The three UN sponsoring agencies with a Caribbean presence (IOCARIBE, WMO, and ITU/CTU) are leading this process, with the JTF and SMART IPO in a facilitating role.

Planned near-term activities include two tailored initial webinars (one for the technical and scientific community and one for decision-makers and policy stakeholders) to build awareness, recruit a core Caribbean working group, and develop a step-by-step sequencing for regional engagement. Reference cases from advancing SMART Cable

projects (including the Atlantic CAM in Portugal and Tamtam in the Pacific) will be used to demonstrate that implementation is real and moving. The JTF Governance Framework, anchored to ITU-T G.9730.2 and WMO Resolution 1 (Cg-Ext(2021)), provides the neutral UN-anchored governance model that supports this region-led process and ensures data remain open, free, and available to both operational warning centers and the scientific community.

As the technology continues to mature and initial implementations demonstrate success, the CARIBE EWS is prioritizing a coordinated regional strategy for SMART Cable integration, identifying priority routes for sensor deployment, and building capacity for utilizing this transformative technology in tsunami warning operations.

U.S. Tsunami Warning Center (TWC) Alignment. The U.S. National Weather Service (NWS) continues progressing on technological and procedural alignment initiatives, as part of the comprehensive redesign of the U.S. Tsunami Warning System. The U.S. NWS operates two Tsunami Warning Centers (TWCs), the National TWC (NTWC) in Palmer, Alaska and the Pacific TWC (PTWC) in Honolulu, Hawaii, which have operational tsunami monitoring systems, data ingest feeds, and operational procedures that prevent timely, seamless, full-service backup and 100% failover capability. The primary technological component of this alignment is the development of an application that ingests real-time observational data, process the data into a common parameterization schema for use in analyzing seismic and sea level data in the same manner, through the same system at both TWCs. This new system, called the Common Analytic System (CASS) will have a number of enhanced and modernized analytical tools, as well as many of the current algorithm-based tools, to ensure both TWCs are working from the same scientific and procedural baseline when a tsunami event occurs. Prior work to solidify major components of the modeling system that will be a key component of CASS made strides in 2025, with demonstrations of file sharing from modules installed at both TWCs, displaying real-time results, instantly -- a first for both TWCs. This work was performed by the NOAA's Pacific Marine Environmental Laboratory (PMEL), with continued work on the CASS prototype for the tsunami modeling engine of the system. Having the same operational hardware ensures that the process of message creation and seamless backup capabilities will be possible, once the appropriate testing and evaluation activities is complete.

The second goal of the redesign is to ensure that NWS tsunami core partners, such as U.S. State and territorial emergency management agencies and international core partners (Pacific and Caribbean country national tsunami warning centers and emergency management agencies, tsunami warning focal points, and tsunami national contacts) receive Impact-based Decision Support Services (IDSS) designed to meet their needs to provide warnings and public safety. IDSS is defined broadly to encompass both routine (non-event) and episodic (event) services. Routine IDSS activities prepare in advance for the next tsunami, and can encompass training (informational, operational, hazard risk assessment, response, etc), exercises, education, and awareness. Episodic IDSS activities in real time during the actual event to ensure that the TWC products are received and understood, and so enable core partners to make more informed public-safety decisions.

Progress on new Tsunami.gov Public Webpage. The legacy visualization of information on the legacy tsunami.gov website (https://www.tsunami.gov/) will be replaced by a modern-looking and interactive elements once the current prototype, in-development, is onboarded later this year. This major redesign contains many elements that have been long-requested by users and partners worldwide and stakeholders of the information that desire more interactivity and instantly-accessible metadata about real-time events and products and services issued by the two NWS TWCs. The goal is improved usability, enhanced functionality, and more dynamic methods to display, download, and ingest data from the site. Among the improvements is a dynamic GIS-based web display of recent notable and/or current seismic events, as well as

archived, historical tsunami cases. Metadata and issued products will be more readily available and displayed in a more aesthetically appealing manner to review event data in dashboard offering. As of the Spring of 2026, further enhancements are needed in order to prepare the webpage for public access for real-time events, primarily, with onboarding efforts into a new cloud-based enterprise architecture. An exact launch for the new page has yet to be determined but the internal goal is by the end of the calendar year (2026).

Hazard Simplification for NWS Tsunami Headline Products. The U.S. National Weather Service (NWS) is evaluating the effectiveness and clarity of the current headline terms for tsunami messages (Watch, Advisory, and Warning). This is a supplemental effort to a larger study for these terms for other weather-based service program areas (i.e. Winter, Public, Fire, Marine, and Tropical) that was performed a few years prior. This project is utilizing behavioral sciences to assess the effectiveness of current tsunami hazard messaging (i.e., headline terms, messaging body) via a survey of members of the public, core partners, and stakeholders. Eastern Research Group, Inc. (ERG) is leading this project to develop and deploy a survey instrument, testing the current terms, potential new terminology, and other options for improved messaging. Headlines and messages tested in this study must be compatible with established dissemination and communications methods. Domestic CARIBE EWS products will not be adjusted at this time, as the NWS is aware that many countries have followed and adopted U.S. NWS domestic alert messages.

In early 2026, ERG released a public and stakeholder survey to over 1,200 respondents, primarily across U.S. states along the Pacific coast with some respondents from the U.S. East Coast and Puerto Rico. Generally, the results point to a low overall understanding of NWS tsunami terms (i.e. the difference between a Watch, Warning, Advisory and “Information Statement”) as they relate to relative risk and action-taking, based on the terms. Alert delivery methods, including EAS and WEA, were addressed in the results. Complete results of the survey will be finalized in a report that will be delivered to the NWS with recommendations.

Seismic Monitoring. The U.S. supports an extensive Global Seismograph Network (GSN) in the Pacific, Indian Ocean, Atlantic, Caribbean, and Gulf.

- The U.S. Geological Survey (USGS) National Earthquake Information Center (NEIC) and Albuquerque Seismological Laboratory coordinate field and monitoring operations to ensure reliable mission-critical data to the tsunami warning centers. One hundred and fifty of these stations are part of the Global Seismographic Network (GSN) and are jointly operated by the USGS and the EarthScope Consortium. In addition to the GSN stations, 97 U.S. backbone stations are part of the Advanced National Seismic System (ANSS). Over the last several years the primary sensors at many of the GSN stations have been upgraded to the latest generation of very broadband seismometers. To obtain real-time data from the USGS, email David Wilson (dwilson@usgs.gov). To access realtime or archived data from Earthscope visit https://ds.iris.edu/ds/.
- The PRSN is working with the Dominican Republic to maintain the five seismic stations operated there. In Puerto Rico, the PRSN is planning the installation of one new broadband seismic station, and one GNSS - IR station. PRSN plans to use the CARICOOS High Frequency (HF) radars to analyze tsunami currents, with a planned installation of a hydrophone in one of the buoys.
- The PRSN released two new software modules to feed a central Earthworm system with real-time data streams from tide gauge satlink data servers and RTX GNSS corrected data messages.
- PRSN operates three tsunami cameras and will work together with wave maps project to add some more.
- The ITIC-CAR in coordination with the PTWC, network operators and CARIBE EWS WG 2, will continue to prepare and share monthly maps on seismic data availability at PTWC.

Sea level monitoring. The ITIC-CAR in coordination with the PTWC, PRSN and the IOC Sea Level Monitoring Facility, network operators and CARIBE EWS Working Group 2 will continue to prepare and share monthly maps on sea level data availability at PTWC (https://www.weather.gov/itic-car/) and biannual reports on CARIBE EWS sea level stations through the intersessional period. ITIC-CAR looks forward to reviewing the reports with the WG 2 and the way forward. A new tsunami-capable tide gauge is planned for installation in the British Virgin Island of Anegada.

In parallel, the United States supports the active exploration of SMART Cables as a complementary deep-ocean pressure sensing capability for the Caribbean. Unlike coastal tide gauges and surface-deployed DART buoys, SMART Cable sensors are embedded in submarine cable systems on the seafloor, enabling continuous real-time pressure and seismic monitoring at depths and locations not currently covered by the existing network. Integration of SMART Cable data streams into PTWC operations would further strengthen the region's end-to-end tsunami detection capability.

Seismic Hazard Map for Puerto Rico and the U.S. Virgin Islands

- The Puerto Rico and U.S. Virgin Islands National Seismic Hazard Model (2025 PRVI NSHM) is nearing official release. Documentation for the 2025 PRVI NSHM includes a model overview paper along with companion papers describing the earthquake rupture forecast (ERF), ground-motion characterization (GMC), and other model components. The overview paper is expected to be published online in April 2026. Associated input data and hazard results, including estimates of epistemic uncertainty, are already available as a data release. For the most up-to-date documentation status and links to publications, review panel reports, supporting datasets, and software, please visit the 2025 PRVI NSHM website.
- In conjunction with online publication of the 2025 PRVI NSHM overview paper, the NSHMP will host a one-day in-person public meeting in San Juan, Puerto Rico on May 1, 2026. Presentations will include an overview of the 2025 PRVI NSHM, an introduction to corresponding risk products, and discussions on building code applications. A dedicated User-Needs session in the afternoon will guide participants through the available USGS web tools, providing demonstrations, hands-on examples, and opportunities for feedback.

Digital Elevation Models (DEM).

- DEMs are available via the NCEI Thredds data server, NCEI Coastal Relief Model or NOAA's Digital Coast.

US TsunamiReady® Program

- Through the National Tsunami Hazard Mitigation Program (NTHMP), NOAA will continue to support renewals of 50 communities and 22 TsunamiReady Supporters recognized by the US National Weather Service in Puerto Rico and the US Virgin Islands, including the strengthening of local and territorial capabilities.

UNESCO IOC Tsunami Ready Programme

- ITIC-CAR with US funding facilitated the Tsunami Ready renewal of Anguilla. ITIC-CAR with US funding is conducting tsunami hazard assessments for Saint Vincent and the Grenadines and Honduras (Pacific coast).
- ITIC-CAR with US State Department funding is supporting Tsunami Ready implementation in Barbuda (Antigua and Barbuda), Becquia (Saint Vincent and the Grenadines), Belize City (Belize), Choiseul (Saint Lucia), Northern and Northeastern Districts (Dominica), Omoa, Tornabe and Cedeno (Honduras). Activities have included site visits and training, evacuation mapping and response planning.

- ITIC-CAR provides on request guidance to member states in the implementation and renewal of Tsunami Ready communities. U.S. Department of State funding supported the 2nd Tsunami Ready Summit (Willemstad, Curaçao; April 20-21, 2026). Dr. Laura Kong, Director of ITIC, is the Chair of the UNESCO/IOC Tsunami Ready Coalition. The purpose of the Coalition is to raise the profile of the program and identify resources to support TR initiatives.
- ITIC-CAR is supporting the creation of videos highlighting implementation of the TRRP in the countries supported by US State Department funding, such as in Saint Lucia and Anguilla. https://www.youtube.com/channel/UCFeJ5u2-zNiH7FYF-b8yHxg.
- ITIC-CAR is developing proposal for coastal multi-hazard awareness sign, including tsunamis, which would be adaptable to diverse coastal communities.
- ITIC-CAR is developing a program that could be installed at NTWC/TWFPs that would convert the PTWC product (Information statement and Threat Statement) to a national product.
- ITIC-CAR is developing a program that could create draft local tsunami response plans based on prompts provided by the user, to include text and figures.

Capacity Enhancement and IDSS

- **Tsunami Occurrences**:
    - Since May 2025, PTWC issued 9 Tsunami Information Statements for the Caribbean, including one for the largest event, the Mw 7.6 Drake Passage earthquake on October 10, 2025. PTWC also issued 8 additional Tsunami Information Statements specifically for Puerto Rico and the Virgin Islands for nearby potentially felt earthquakes (Mw 4.5–5.8).
- **Exercises:**
    - CARIBE EWS MG 86: ITIC-CAR with funding from the US State Department will be supporting this Multiannual Tsunami Exercise Planning workshop and CARIBE WAVE Task Team meeting in mid-2026, dates yet to be determined.
    - ITP-TWES:
        - ITIC conducted a 2-week training program, the ITIC Training Programme on Tsunami Early Warning Systems and the PTWC Enhanced Products, Tsunami Evacuation Planning and Tsunami Ready Programme on Tsunami Early Warning Systems (TEWS), in late August 2025 in Honolulu, HI.
        - Participants: 24 from the Pacific and 7 from the Caribbean.
        - The next ITP will be held in Chile, August 10-21, 2026 and hosted by the Chilean Hydrographic and Oceanographic Service (SHOA), who serves as the ITIC Associate Director.
    - OTGA: ITIC, as an IOC Ocean Teacher Global Academy Specialized Training Center (OTGA STC), is developing online and hybrid training courses that are available to all CARIBE EWS Member States, and globally. The courses are developed in coordination with the IOC Tsunami Resilience Section. UNESCO-IOC courses that are currently available are:
        - Tsunami Awareness (6-hr online, self-paced), since July 2024
        - Tsunami Ready (3-hr online, self-paced), since January 2025
        - Tsunami Ready for Facilitators (3-hr online, self-paced) which is planned for August 2026
        - Tsunami Warning Center Minimum Staff Competencies (planned Quarter 1 2027). Envisioned as series of 7 courses covering.
    - Content is as approved by the PTWS (2023) as the Core Minimum Competencies. These are based on ITIC in-person course, with contributions from other Pacific Member State Advanced TWCs. These cover Prerequisites (Awareness, Tsunami Ready), Core Science (tsunamis, earthquakes), decision-support tools, Core Operations (tsunami warning center operations, including forecasting) and

decision-making using the TSP products. Courses are self-paced and blended, based on ITIC in-person training courses). In order to enroll in the following course, the learner must pass the earlier course. The last module will be a 3-4 week in-person training at the ITIC/PTWC.

- US MetED COMET courses included are Tsunamis (updated to 2026), and a new course on Communicating Risks using the PTWC Pacific Tsunami Products
- In April 13-17, 2026, the ITIC conducted the regional training for Pacific Island Countries for Tsunami Maps, Plans, and Procedures, including inundation mapping (TEMPP), focusing on hands-on evacuation map creation, and community response plans.
- TsuCAT (application): ITIC and PMEL continue to develop and distribute the Tsunami Coastal Assessment Tool, "TsuCAT", to assist countries in hazard assessment, response planning, and in conducting exercises (scenario development, PTWC message generation, exercise situational injects). Current version is 4.8.1.
- ITIC will continue to collaborate with all Caribbean countries in coordination with CTIC to organize and provide training in tsunami warning, response, and evacuation planning and warning decision support tools, facilitate Tsunami Ready implementation, and support outreach and awareness-building activities.
- The USGS has developed a tool for Pedestrian Evacuation Modelling which has been used by Puerto Rico to help determine the best routes for evacuation and the selection and placement of vertical evacuation structures. Subject to funding availability the USGS/PRSN may be able to provide training on these tools.

CARIBE WAVE Exercise

- The ITIC-CAR and PTWC will continue to coordinate and support this annual tsunami exercise, including the development of simulated products, handbook and reports, the conduct of webinars, survey, website (caribewave.org) and registration system (https://www.tsunamizone.org/).
- Locally the PRSN, the PR Bureau for Emergency Management (PRBEM), the NWS WFO in San Juan and VITEMA will continue to coordinate locally, participate and promote the participation in CARIBE WAVE.

World Tsunami Awareness Day (WTAD)

- ITIC and ITIC-CAR will continue to support World Tsunami Awareness Day by providing still and moving visuals and documentation, and subject matter expertise, like in the case of the CARIBE EWS 2025 WTAD Virtual Meeting on Tsunami Warning Dissemination and Communication held on November 5.
- Using all available social media platforms, the PRSN, the PR Bureau for Emergency Management (PRBEM) and VITEMA participate and promote the participation in the WTAD.

Outreach, Education, and Communications

- ITIC and ITIC-CAR will continue to distribute educational and decision support resources. ITIC-CAR will continue to support the IOC Caribbean Tsunami Information Center (CTIC) mission activities, including collaborating for tsunami training in warning, response, and evacuation planning and warning decision support tools, Tsunami Ready, and outreach and awareness building.
- ITIC-CAR will continue to distribute Tsunami Rules Brochure in Braille and large format text. ITIC-CAR will make available the Tori and Teo children's tsunami video with sign language and audio/sign effect for the visually impaired. ITIC CAR will also work towards the mainstreaming of actions for the integration of the blind and visually impaired into websites and work plans of corresponding agencies.

- ITIC and NCEI continue to update the Global Tsunami Source, Volcanoes, and Earthquake hazard map posters. These are now current through March 2026 and are planned to be printed.

Technology Warning Communications

- NOAA will continue to support the GEONET CAST Americas as an additional method to receive Tsunami products from PTWC.
- NOAA will continue to support the EMWIN as an additional method to receive Tsunami products from the Pacific Tsunami Warning Center.
- ITIC-CAR will continue to support ICG CARIBE EWS WG 3 and the Inventory of Tsunami Warning Dissemination and Communication Systems.

NATIONAL PROGRAMMES AND ACTIVITIES INFORMATION

5. Executive Summary

During the last intersessional period, the U.S. has continued to focus on improving tsunami detection, measurement and forecasting capabilities in the Caribbean as well as supporting advanced mitigation and preparedness efforts.

To accomplish its domestic and international missions, there is active ongoing collaboration between and thru NOAA line offices and programs (NWS, PTWC, ITIC, including its Caribbean Office, PMEL, NCEI, NCEP, NOS, NTHMP, San Juan Weather Forecast Office (WFO)), other US Agencies (USGS, FEMA), Puerto Rico and USVI academic and government agencies (PRSN, PREMB, VITEMA, UVI), UNESCO-IOC bodies (CARIBE-EWS, IOCARIBE, OD) and CARIBE EWS Member States. While funding for the domestic efforts comes from agency budgets including the US State Department, activities, those in and territories are also funded by territorial budgets, NTHMP and FEMA.

The United States continues to work toward tsunami detection and source characterization. Efforts include:

- Supporting the continued development of SMART cables to augment legacy tsunami detection and measurement networks.Continued development and testing of advanced tsunami detection and source estimation technologies, including the 4th Generation of DART with advanced seismic noise filtering for near-field placement, advanced geodetic analysis using GNSS station static offsets, and rapid EQ focal mechanism computation via the W-phase method.
- Supporting research into tsunami detection using the ionospheric Total Electron Content (TEC) methodology and aiding in the continued development of SMART cables to enhance existing tsunami detection and measurement networks.
- PTWC has an active collaboration with Scripps Institute regarding the use of seismogeodetic data streams for a more rapid determination of the magnitude and other earthquake parameters of great earthquakes. This technique combines seismic data streams with GPS.

The U.S. National Weather Service (NWS) is also undertaking a comprehensive re-design of the Tsunami Warning System. This includes the alignment of tsunami detection, measurement and forecasting procedures between U.S. TWCs, and proactive efforts to provide IDSS to core partners, such as U.S. emergency management agencies, and Pacific and Caribbean national agencies responsible for tsunami warning, such as national tsunami warning centers and emergency management agencies.

Real-time access to sea level data is critical for the timely and actionable tsunami analysis and decision-making on the potential for alerting. Furthermore, for tsunamis triggered by atypical earthquakes or non-earthquake sources, like volcanoes, sea level data is key for detection, analysis and forecasting. Once official messaging is issued for tsunami threats, cancellations are based on sea level observations. In the Caribbean, there are areas where the gaps in sea level observations can impact the ability for PTWC to perform critical analysis for their product and service decision-making. The U.S. recognizes potential benefits of exploring more effective ways to partner with the CARIBE EWS for sustainable solutions to address the current gaps in available sea level observations, either in areas with spare coverage or in situations with outages for sensors that have not been maintained or out of service. With tsunamis, it may be useful for early warning systems in the Caribbean to be multi-coastal hazard based, such as hurricanes, storm surge, sea level shifts, and coastal flooding. Sea level stations consists of sensors (most commonly radars and ocean pressure sensors), digital acquisition system and then transmission (GOES and/or telephone).

CARIBE WAVE 26 was conducted on March 19, 2026. ITIC-CAR supported the CARIBE EWS CARIBE WAVE Task Team to develop the format, create the handbooks and with the coordination of the registration, webinars and post-exercise evaluation tool and prepared the draft media and final reports. The PTWC provided the exercise messages. PRSN, NWS Forecast Office San Juan, PRBEM and VITEMA were actively engaged in the local coordination and issuing simulated products through its communication and dissemination systems. Of the 606,2530 persons registered, 220,423 participants were registered from Puerto Rico and 21,526 from USVI on the USG supported TsunamiZone.org.

Through the implementation of the NWS's TsunamiReady program (https://www.weather.gov/TsunamiReady/communities), Puerto Rico and the USVI have met the OD goal of 100% at risk communities are prepared and resilient to tsunamis. Currently there are 50 TsunamiReady® communities in Puerto Rico (47) and US Virgin Islands (3) and 22 TsunamiReady supporters in Puerto Rico..

NOAA, through the National Tsunami Hazard Mitigation Program (NTHMP), provides funding to Puerto Rico and the US Virgin Islands that supports TsunamiReady and other mitigation, preparedness and response activities.ITIC conducted outreach activities in which tsunami guidance is provided, including its 2-week ITIC Training Program in Tsunami Early Warning Systems held in Hawaii in 2025. PMEL, ITIC, and PTWC continued the development of new features in the TsuCAT software and made it available to training participants. New features for V4.4(released August 2024) include the addition of automated, customized exercise injects. PMEL continued to maintain and update ComMIT modeling tools for tsunami inundation simulations. ComMIT 1.8.3 is available and has been used for several IOC training and tsunami hazard assessment activities in the Pacific and Caribbean regions. ITIC also continues to support online training as an IOC Ocean Teacher Global Academy Specialized Training Center for Tsunamis, with courses available on UNESCO-IOC Tsunami Awareness and in 2025 UNESCO-IOC Tsunami Ready. ITIC developed informational training videos on the PTWC Products for the Pacific and Caribbean (English, French, Spanish), PTWC Product Staging for the Caribbean and Pacific (English), and a narrative video on PTWC TWC Operations for a Pacific earthquake are available for viewing with funding from US State Department, ITIC-CAR is supporting Tsunami Ready implementation in Barbuda (Antigua and Barbuda), Bequia (Saint Vincent and the Grenadines), Belize City (Belize), Choiseul (Saint Lucia), Northern and Northeastern Districts (Dominica), Omoa, Tornabe and Cedeno (Honduras). Activities include training, virtual coordination meetings, site visits, evacuation mapping and response planning.

ITIC-CAR has continued to support awareness and preparedness of the blind and visually impaired and has integrated efforts for people with other disabilities. Tsunami Rules Brochure is available in Braille and large format text in both English and Spanish. ITIC-CAR co produced the

"Tori and Teo" educational children's tsunami video in English and Spanish with sign language and audio/sign effect for the visually impaired. It is working towards the mainstreaming of these actions into UNESCO/IOC and other regional and international organizations working with blind and visually impaired and other people with disabilities.

The US is excited to celebrate the 20 years of achievements and advances of the CARIBE-EWS. Together with the Member States and Observer organizations it remains committed to addressing challenges to achieve the goal of 100% of communities are warned, prepared and resilient to tsunamis by 2030. This will require a more robust and sustainable observation system as well as strengthened warning and dissemination capabilities and continuous national and local awareness and preparedness.

6. Narrative

Focus Areas

The US is focused on two primary areas: (1) exploration and development of instrumentation and techniques to more rapidly detect and measure tsunamis independent of generating source; and, (2) ensuring capacities lifted across the region to enable *100% communities at risk are prepared for and resilient to tsunamis* through programs like the UNESCO IOC Tsunami Ready Recognition Programme. More specifically we will strive to accomplish this by:

1. Detection and Measurement
    a. Advocate full sharing of available data at time and space resolutions necessary for tsunami detection and measurement.
    b. Determine spatial and temporal resolutions necessary to detect and measure tsunamis from all sources.
    c. Identify candidate new capabilities to be tested and possibly deployed within the region.
    d. Consider new research initiatives to add detection and measurement capabilities not current developed (e.g. Ionospheric TEC, GNSS-IR).
    e. Identify instrumentation and or communications investments can make in order to contribute to the CARIBE EWS Rapid Tsunami Detection and Measurement initiative.
2. Risk Assessment, Warning Communications and Preparedness and Response
    a. Advance the understanding of tsunami risk and hazard assessments from all sources of tsunamis.
    b. Ensure that all people at risk from a tsunami are alerted and reinforce the warning messages.
    c. Maintain and augment the number of communities in the US and globally that are recognized by the US National Weather Service or UNESCO as Tsunami Ready.
3. Support multi hazard early warning alignment by linking hazard-specific systems together.

Improved tsunami detection and source characterization. These efforts include:

a. Continued testing of the 4th Generation of DART with advanced seismic noise filtering to allow for near-field placement.
b. Continued testing and development of advanced **geodetic analysis** in tsunami source estimation using GNSS station static offsets. We have implemented this ability in operations as experimental at both Tsunami Warning Centers and are in a one-year testing and evaluation phase.

Warning Center Operations

There were no significant changes to PTWC's domestic procedures or operations. The Revised Users Guide for the PTWC Procedures and Products for the Tsunami and other Coastal Hazards

Warning System for the Caribbean and Adjacent Regions was published in May 2025 by UNESCO/IOC. PTWC is in the process of updating its systems with the changes.
In support of Impact Decision Support Services, ITIC hosts a online listserv for TNC and agency contacts for the National Tsunami Warning Centers and Tsunami Warning Focal Points (TWFPs), with informal WhatsApp PTWS and CARIBE groups for instant communication.

Technology and Warning Communications

GEONETCAST-AMERICAS (GNC-A)

- GEONETCast Americas (GNC-A) is a near real time, global network of satellite broadcasts that disseminate meteorological and environmental data, products, and emergency communications to users. Because it is a standalone system that can be powered by a portable generator, GNC-A does not require internet service or commercial power to provide data to users and can be a reliable, timely way to receive information, especially during emergency situations.
- NOAA-NESDIS maintains the GNC-A broadcast. Data, products and information on the broadcast are provided for transmission by various countries, organizations, and users. Tsunami and other weather warning products take priority and are broadcast first.
- ITIC CAR with UNESCO/IOC, in support of CARIBE WAVE 26 exercise, co-organized a webinar on this system. To address the need for repairs and troubleshooting on stations, the GNC-A Forum was highlighted as a resource. In addition there is a WhatsApp Group for users. Another resource is INPE GNC-A Website (Brazil).
- Information on GNC-A was made available during CARIBE WAVE 26 webinar 2.
- CARIBE WAVE 25 Dummy Message was transmitted successfully over GNC-A.

Emergency Managers Weather Information Network (**EMWIN**)

- High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN) – HRIT/EMWIN is a NOAA-provided broadcast available from either GOES-R series East/West satellites. Both satellite broadcasts, in addition to EMWIN, re-broadcast DCS (https://www.noaasis.noaa.gov/GOES/GOES_DCS/goes_dcs.html) sensor data and a selection of high-resolution GOES imagery in LRIT format. GNC-A, with higher bandwidth, offers more products.
- The NWS EMWIN satellite broadcast and FTP file server services fully transitioned to the US NWS Enterprise Architecture at College Park, MD and Boulder, CO in December 2020. This transition enabled the EMWIN broadcast stream to be transmitted via the GOES-East (GOES-16, 75.2° West) and GOES-West (GOES-17, 137.2° West) satellites through the NESDIS HRIT/EMWIN broadcast service (1694.1 MHz) using Virtual Channels 20, 21 and 22.
- With the introduction of the GOES-16/17 HRIT/EMWIN modified broadcast format, EMWIN users had to replace their legacy EMWIN receivers with HRIT receivers if they desired to continue receiving products over a satellite broadcast. Unfortunately, the major EMWIN legacy satellite receiver manufacturers did not pursue the manufacture of affordable HRIT/EMWIN receiving systems due in part to the reported likelihood of interference from new G5 cell phone service upstarts in the recently auctioned adjacent radio frequency spectrum. Existing EMWIN users were left with a limited number of alternatives: (1) investing in a high-end commercial HRIT/EMWIN receiver costing upwards of 10x the price of the previous receiver, (2) constructing a hobbyist EMWIN receiving systems from parts and software and support the systems locally, or (3) looking elsewhere for dissemination services to meet the local information requirements. Consequently, a large segment of the EMWIN user community transitioned to alternate systems and services to receive timely alerts and warnings including, among others, the NWS NOAA Weather Wire Service (NWWS) and its associated internet dissemination

service via satellite SBN/NOAAPORT Channel 201 (https://www.weather.gov/nwws/) and the NESDIS GEONetcast-Americas satellite broadcast service.
- The NWS continues to investigate alternatives for the legacy EMWIN ByteBlaster Internet dissemination service which could not transition into the US NWS Enterprise Architecture at College Park, MD and Boulder, CO due to an inability to meet IT operational compliance requirements.
- Many users now only have access to EMWIN over internet, not satellite. The PRSN has installed several satellite based systems purchased from DARTCOM.
- Information on EMWIN was made available during CW 25 webinar 2.
- More HRIT/EMWIN Broadcast Information (https://www.noaasis.noaa.gov/ and https://www.weather.gov/emwin/).
- Questions regarding the content of the EMWIN data service, including the selection and addition of products should be addressed to nws.emwin.support@noaa.gov.
- Questions regarding the GOES HRIT/EMWIN Broadcast, for example apparent outages or missing products, can be addressed to hrit.manager@noaa.gov.
- For HRIT/EMWIN broadcast issues impacting user operations, especially outside of work hours, please contact the ESPC 24/7 Helpdesk at ESPCOperations@noaa.gov or (301) 817-3880.

Inventory of Tsunami Warning Dissemination and Communication systems.
- ITIC-CAR is supporting ICG CARIBE EWS WG 3 in the publication and sharing of the Inventory and Survey of Tsunami Warning Dissemination and Communication systems and a survey to Member States on training needs.
- ITIC-CAR helped organize a joint webinar with UNESCO-IOC, UNDRR and WMO on Early Warnings for All: Tsunami Warning Communication and Dissemination in the Americas and Caribbean". 452 people from the Americas and beyond participated in the virtual event.

Tsunami Research Projects and Publications

GNSS
- The NOAA Center for Tsunami Research continues to conduct research and develop software to incorporate the GNSS technology into the Short-term Inundation Forecasting for Tsunamis (SIFT) model. The GFAST system was installed at NOAA Tsunami Warning Centers, with Fastlane data feeds from Central Washington University. Peak Ground Displacement magnitude estimates are fed into SIFT within 90 seconds of origin time, and Finite Fault estimates within 3 minutes.
- NASA's Jet Propulsion Laboratory is developing the GNSS-based Upper Atmospheric Real-time Disaster Information and Alert Network (GUARDIAN) system, a near-time-time ionosphere-based disaster monitoring capability. It relies on monitoring measurements of the ionospheric total electron content (TEC) obtained through ground-based GNSS stations. This technique is particularly valuable because it allows the monitoring of disasters in a radius of about 1200 km around each station. The only delay in detection is the time it takes for sounds, (infrasound or gravity waves) to travel from the Earth's surface to the ionosphere – 8 to 40 minutes depending on the type of event or wave.
- The GUARDIAN system relies on three main components: the real-time collection of data and computation of observables, the automatic detection of disaster-related perturbations in those observables, and possible creation of relevant warnings. The architecture and the first component are described by Martire *et al.* (2023, 10.1007/s10291-022-01365-6). A publicly-accessible portal intended for subject matter experts displays near-real-time GNSS-based TEC measurements and first-order analytics. GUARDIAN is based on technologies originally developed using JPL's Global Differential GPS (GDGPS) system, also utilizes real-time GNSS stations as part of the

International GNSS Service (IGS) - all ensuring open-access and high-quality observations. AI-based automated detections have been demonstrated (Luhrmann *et al.*, 2025, 10.1007/s10291-024-01808-2) and will be implemented in the pipeline shortly. The GUARDIAN system's primary objective is to provide augmentation to already existing tsunami early warning systems. However, the technique may also be also applicable to monitoring other types of events including volcanic eruptions, various space weather phenomena, earthquakes, and anthropogenic hazards.

- The UPRM and the PRSN are working in an effort to study the use of the GNSS-Interferometric Reflectometry (GNSS-IR).

Other

- Updates to NCEI's DEM development processes and innovations included DEM validation using IceSat-2 elevation photons data, initial development of satellite-derived bathymetry capabilities, and improvements to spatial metadata and DEM uncertainty grids. (See Section 10, above).
- PTHA: With the support of the NTHMP Puerto Rico continues developing a Probabilistic Tsunami Hazard Analysis for the island concentrating on the off-shore fault sources. There is a preliminary version complete based on sources from both Powell Center and Caribe-EWS experts meetings. The PTHA is being expanded to include a logic tree based on the 2025 USGS Seismic Hazards Analysis for the PR and USVI region. The ultimate aim is to include the PTHA in future ASCE building codes.
- Puerto Rico, US Virgin Islands were included in FEMA's updated National Tsunami Risk Index (NRI) for tsunamis.

Improved tsunami documentation

- The global historical tsunami event and run-up database interface has been updated to include a "data dashboard." The dashboard will be able to answer common questions and improve in consistency on data related to historical tsunami occurrences: https://www.ngdc.noaa.gov/hazel/
- NCEI has developed an initial concept of a Tsunami Data Dashboard. The current minimum viable product will be enhanced in Summer 2026. The Dashboard will provide instant access to a visual representation of the data in the NCEI/WDS Global Historical Tsunami Database without having to navigate a more scientifically detailed search form. Additionally, a dashboard will improve consistency of tsunami information reported across user communities.
- NCEI's Image database has added approximately 200 images from 8 tsunami events since 2025, with ITIC being a major contributor. https://www.ngdc.noaa.gov/hazardimages/#/
- NCEI collaborated with the University of Colorado Library to catalog tide gauge records from microfilm rolls of tsunami events prior to 1994. Nine uncatalogued microfilm rolls have been scanned by NCEI to produce over 4,000 TIFF images. These records have now been catalogued
- NCEI is beginning the process of cloud migration to increase flexibility in compute and data storage resources. The cloud migration will allow for increased compute power, access to more software libraries, and access to data to develop more advanced products.
- NCEI is co-writing a Joint ICG/PTWS – IUGG/JTC Tsunami Data Workshop proposal. An objective of the workshop is the refinement of the existing tsunami database format, including data on tsunamis of non-seismic origin, data on small non-damaging tsunamis and data collected from emerging technologies (e.g., remote sensing, etc. This is expected to result in the proposed development of a new standard "Information on Tsunami Occurrences" for national reports from ICG member countries.

Tsunami Mitigation Activities and Best Practices

1) **TsunamiReady® Recognition and Program Support**
   - Puerto Rico and the US Virgin Islands have been TsunamiReady® since 2016 and 2014, respectively, with a three-year renewal cycle.
   - TsunamiReady communities (https://www.weather.gov/TsunamiReady/communities)
     - Puerto Rico: 47 recognized Communities and 22 Supporters
     - USVI: 3 recognized Communities.
   - NOAA/NTHMP provides funding to the Puerto Rico Seismic Network (UPRM), the Puerto Rico Emergency Management Bureau (PREMB), and VITEMA for TsunamiReady renewal activities, meetings, and trainings.
   - FEMA, through hurricane recovery and mitigation funding, has also supported activities associated with the TsunamiReady guidelines.
   - The ITIC-CAR, with U.S. funding, supported Anguilla's Tsunami Ready renewal in November 2025.
   - ITIC-CAR is supporting Tsunami Ready implementation in multiple Caribbean communities, including Barbuda (Antigua and Barbuda), Bequia (Saint Vincent and the Grenadines), Belize City (Belize), Choiseul (Saint Lucia), Northern and Northeastern Districts (Dominica), and Omoa, Tornabe, and Cedeno (Honduras).
2) **Outreach, Training, and Capacity Building**
   - ITIC (http://iticcar.org) maintains an office in Mayagüez, PR (ITIC-CAR) to support PR, USVI, and the greater Caribbean, conducting virtual and in-person outreach and trainings.
   - The International Tsunami Information Center (ITIC) conducted its 2-week ITIC Training Programme in Hawaii in September 2025 for 31 participants from 22 Pacific, Caribbean, and Indian Ocean countries, focusing on EWS, PTWC Enhanced Products, and Tsunami Ready.
   - ITIC-CAR delivered in-person training on Tsunami Early Warning Systems, PTWC Enhanced Products, Tsunami Evacuation Planning, and the UNESCO IOC Tsunami Ready Recognition Programme in Puerto Rico, USVI, and BVI, and Tsunami Ready and tsunami operations training in Antigua and Barbuda and Belize in January 2026.
   - ITIC has an online training portal as an IOC Ocean Teacher Global Academy (OTGA) Specialized Training Center (STC), offering courses like *Tsunami Awareness and Tsunami Ready*, as well as maintaining a YouTube Channel.
   - PRSN, PREMB, VITEMA, and ITIC-CAR routinely participate in outreach activities and provide tsunami guidance.
   - ITIC CAR has a Tsunami Rules brochure in English, is printing a Spanish Braille version, and offers a large text version.
   - ITIC-CAR, UPRM, and PRSN co-produced the "Tori and Teo" video on tsunami preparedness in Spanish with sign language and sound effects for visually and/or hearing-impaired children.
3) **Tsunami Hazard Assessment, Mapping, and Technical Tools**
   - PRSN, with NOAA/NTHMP funding, is updating the TsunamiMap tool (https://maptool.uprm.edu/) for online access to tsunami inundation, community pedestrian models, evacuation, and signage information.
   - PRSN is coordinating a protocol and pilot effort with NOAA/NTHMP funding to include Amateur Radio associations into the tsunami alerting system.
   - NCEI and ITIC updated the Global Historical Tsunami, Significant Earthquake, and Significant Volcanic Eruption posters (Reference Link) through March 2026 for outreach, historical reference, and media communication.
   - NCEI and ITIC are updating the *Historical Tsunami Effects: Caribbean, Central*

America, Mexico and Adjacent Regions (1530–2026) Poster.

- NCEI and ITIC are in the process of updating the Tsunami Glossary publication, with maps updated through 2026.
- PMEL, ITIC, ITIC-CAR, and PTWC continued developing the TsuCAT software (v4.8.1, April 2026), which supports hazard assessment and exercises, including automatic customized exercise injects and ingesting USGS real-time solutions.
- ITIC-CAR and PMEL/NCTR presented results of a Tsunami Ready tsunami hazard assessment for Antigua and Barbuda and are currently updating assessments for Saint Vincent and the Grenadines and Honduras (Pacific Coast).

Tsunami Exercises and Communication Tests

CaRIBE WAVE 2026

- Puerto Rico and the U.S. Virgin Islands participated in the CARIBE WAVE 26 exercise on March 19. It was both a domestic and international exercise and consisted of two exercise scenarios (Cayman Islands and Kick 'em Jenny)). The scenario chosen was Kick 'em Jenny. The PTWC prepared simulated domestic messages for this scenario, in addition to the international messages. According to TsunamiZone.org, 606,253 (up from 490,838 in 2025) people from Bermuda through Brazil were registered to participate. From Puerto Rico, 220,423 (up from 172,124) people were registered, while for the USVI, the number was 21,526 up from 18,144).
- For both exercises, the PTWC issued one dummy message at the start of the exercise that was followed by the simulated products, which were sent according to the scenario each country had selected. In Puerto Rico and the U.S. Virgin Islands, activities included communication tests, activation of the Emergency Alert System (EAS) and activation of WEAs through FEMA's IPAWS, testing the use of radio operators to disseminate information, and drills. The exercise was coordinated at the regional level by the ICG/CARIBE-EWS's CARIBE WAVE Task Team. The ITIC Caribbean Office served as exercise coordinator, with documentation, website, communication and webinars. Also, all reports and documentation for the exercise are now posted on the website (https://tsunami.ioc.unesco.org/en/caribewave) of the UNESCO-IOC Tsunami Programme. Locally the exercise was coordinated by the PRSN, the PREMB, the San Juan WFO, and the VITEMA. PRSN's contribution included providing support and guidance to local stakeholders to participate in the exercise. The University of Southern California (USC) supported the TsunamiZone.org registry web tool, which is funded through an NTHMP funded grant task.
- The U.S.is preparing to participate in and support the CARIBE WAVE 27 exercise as well as supporting coordination through its Caribbean Office of the ITIC.

Communication Tests

- Puerto Rico and the U.S. Virgin Islands also participated in international CARIBE EWS tsunami communication tests with PTWC.
- Puerto Rico Seismic Network conduct a local monthly test.
- Puerto Rico municipalities conduct a silent test of its sirens every first Wednesday of the month and audible test on the last Wednesday of every month.
- USVI tests their Tsunami Sirens territory wide the third Thursday of each month at 11am. The Tsunami Working Group meets twice a month to review the status of its siren systems and coordination of communication tests where the results are analyzed and gaps and successes are noted.
- USVI conducts our monthly internal test on the EAS system requiring monthly testing.

END REPORT

APPENDIX A:

National Tsunami-related Websites

General Resources

- U.S. Tsunami Warning System (operated by NOAA/NWS): https://www.tsunami.gov
- International Tsunami Information Center (ITIC):
  - NOAA/NWS page: https://www.tsunami.gov/?page=itic
  - IOC page: https://tsunami.ioc.unesco.org/en/pacific/itic?hub=48
- International Tsunami Information Center Caribbean Office (ITIC-CAR): https://www.weather.gov/itic-car/
- The "TsunamiZone": https://www.tsunamizone.org/
- National Tsunami Hazard Mitigation Program (NTHMP); NOAA-responsible external partner grant program: https://www.weather.gov/nthmp/
- National Centers for Environmental Information (NCEI) Tsunami Data and Information: https://www.ncei.noaa.gov/products/natural-hazards/tsunamis-earthquakes-volcanoes/tsunamis
- NOAA Office of Atmospheric Research's (OAR)Pacific Marine Environmental Laboratory (PMEL): https://www.pmel.noaa.gov/
  - PMEL's NOAA Center for Tsunami Research (NCTR): https://nctr.pmel.noaa.gov/index.html
- ITU/WMO/UNESCO-IOC Joint Task Force on SMART Cables: https://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx
- SMART Cables International Program Office: https://www.smartcables.org/

Map Viewers

- The NCEI Natural Hazards Viewer has been re-designed using modern web technologies/frameworks. Users will now see increased performance/responsiveness, better usability on mobile devices, and improved accessibility.
- NCEI will update the Caribbean and Adjacent Regions Tsunami Sources and Models (CATSAM) map viewer to use modern web technologies/frameworks.
- NCEI will update the Tsunami Coastal Locations Viewer to use modern web technologies/frameworksThe PRSN Tsunami Map Tool.
- NOS operates a Coastal Flood Exposure Mapper. The information in this product is based on the Roadmap for Adapting to Coastal Risk approach to assessing coastal hazard risks and vulnerabilities. The mapper enables users to explore maps that show people, places, and natural resources exposed to coastal flood hazards (including tsunamis) and create a collection of maps to share and communicate about flood exposure. Tsunami hazard zones are included in the product.

Warning Center User's Guides

- User's Guide for the Pacific Tsunami Warning Center Enhanced Products for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (CARIBE EWS, 2025). https://unesdoc.unesco.org/ark:/48223/pf0000259725.locale=en
- PR and USVI receive both the domestic and international products from the PTWC. While the domestic products establish the alert levels for PR and USVI, the international products support Impact-based Decision Support Services (IDSS) with additional text and graphical products.
- Users' Guide Tsunami Warning Products for Puerto Rico, U.S Virgin Islands, and British Virgin Islands (Version 1.22, April 28, 2024) https://tsunami.gov/operations/PRVIUserGuide.pdf

Seismic Information

- U.S. Geological Survey (USGS) Earthquakes Hazard Program: https://earthquake.usgs.gov/earthquakes/
- Puerto Rico Seismic Network (PRSN): http://redsismica.uprm.edu
- Earthscope CARIBE EWS Virtual Seismic Network: https://ds.iris.edu/gmap/#network=_CARIBEEWS&planet=earth
- Earthscope Data Management Center (DMC) https://ds.iris.edu/ds/nodes/dmc/
- International Tsunami Information Center Caribbean Office - Caribbean Tsunami Warning Program (Seismic Stations Reports and Maps): https://www.weather.gov/itic-car/

Sea Level Tools/Information

- NOAA/National Ocean Service/Center for Operational Oceanographic Products & Services (CO-OPS) tsunami website https://tidesandcurrents.noaa.gov/tsunami/
- International Tsunami Information Center (Tide Tool) For more information or for the files for this program please send an email to itic.tsunami@noaa.gov International Tsunami Information Center Caribbean Office (Sea Level Stations Reports and Maps): https://www.weather.gov/itic-car/
- National Data Buoy Center (NDBC) DART Program: https://www.ndbc.noaa.gov/dart/dart.shtml, https://www.ndbc.noaa.gov/obs.shtml
- NOAA/NOS's Tides and Currents (for the Caribbean/Puerto Rico): https://tidesandcurrents.noaa.gov/tsunami/
- University of Hawaii Sea Level Center (UHSLC): https://uhslc.soest.hawaii.edu/network/
- National Centers for Environmental Information (NCEI) Long-term Archive of NOAA Water-level Data:
    1) https://www.ncei.noaa.gov/products/natural-hazards/tsunamis-earthquakes-volcanoes/tsunamis/dart-ocean-bottom-pressure
    2) https://www.ncei.noaa.gov/products/natural-hazards/tsunamis-earthquakes-volcanoes/tsunamis/tide-gauge-data

APPENDIX B:

Seismic stations operated by Puerto Rico (PR) including PRSN and PRSMP and the USG (CU (USGS Caribbean Network) and IU (Global Seismic Network) in the CARIBE-EWS region.

Location	Latitude	Longitude	Operator	Net_Stat	Sensors	Status*
Anegada, British Virgin Islands	18.73 N	64.33 W	PR	ABVI	Velocity + Acceleration + GPS	No Comms
Tortola, British Virgin Islands	18.42 N	64.62 W	PR	TBVI	Velocity + Acceleration	OK
Virgin Gorda, British Virgin Islands	18.49 N	64.40 W	PR	VGBI	Velocity + Acceleration + GNSS	OK
Aguadilla, Puerto Rico	18.47 N	67.11 W	PR	AGPR	Velocity + Acceleration + GNSS	OK
Arecibo, Puerto Rico	18.35 N	66.75 W	PR	AOPR	Velocity + Acceleration + GNSS	OK
St. Croix, U.S. Virgin Islands	17.75 N	64.77 W	PR	CDVI	Velocity + Acceleration + GPS (CORS)	OK
Cerillos Dam, Ponce, Puerto Rico	18.07 N	66.58 W	PR	CELP	Velocity + Acceleration	OK
Cabo Rojo, Puerto Rico	18.01 N	67.11 W	PR	CRPR	Velocity + Acceleration + GNSS	OK
Culebra, Puerto Rico	18.31 N	65.281 W	PR	CUPR	Velocity + Acceleration + GNSS	OK
Manati, Puerto Rico	18.48 N	66.53 W	PR	EMPR	Velocity + Acceleration + GNSS	OK
Guanica, Puerto Rico	17.98 N	66.88 W	PR	GBPR	Velocity	OK
Guaynabo, Puerto Rico	18.31 N	66.08 W	PR	GCPR	Velocity + Acceleration	OK
Humacao, Puerto Rico	18.14 N	65.86 W	PR	HUMP	Velocity + Acceleration + GPS	OK
Isla Caja de Muertos, Puerto Rico	17.89 N	66.53 W	PR	ICMP	Velocity + Acceleration + GNSS	OK
Isla Desecheo, Puerto Rico	18.39 N	67.47 W	PR	IDE	Velocity	OK
Guayama, Puerto Rico	17.97 N	66.11 W	PR	IGPR	Velocity + Acceleration + GNSS	OK
Isla Mona, Puerto Rico	18.08 N	67.93 W	PR	IMPR	Velocity + Acceleration + GNSS	OK
Mayagüez, Puerto Rico	18.18 N	67.09 W	PR	LSP	Velocity	OK
Lajas, Puerto Rico	17.97 N	67.04 W	PR	MLPR	Velocity + Acceleration + GNSS	OK
Vieques, Puerto Rico	18.10 N	65.55 W	PR	MTP	Velocity + Acceleration	OK

Obispado, Ponce, Puerto Rico	18.04 N	66.61 W	PR	OBIP	Velocity + Acceleration	OK
Patillas, Puerto Rico	18.02 N	66.02 W	PR	PDPR	Velocity + Acceleration + GNSS	OK
U Puerto Rico Mayagüez, Puerto Rico	18.22 N	67.14 W	PR	PRSN	Velocity + Acceleration + GNSS	OK
St. John, U.S. Virgin Islands	18.33 N	64.77 W	PR	SJVI	Velocity + Acceleration	No Comms
St. Thomas, U.S. Virgin Islands	18.35 N	64.96 W	PR	STVI	Velocity + Acceleration + GPS	OK
Utuado, Puerto Rico	18.25 N	66.72 W	PR	UUPR	Velocity + Acceleration	OK
Corozal, Puerto Rico	18.32 N	66.36 W	PR	ECPR	Velocity + Acceleration + GNSS	OK
Ceiba, Puerto Rico	18.22 N	65.666 W	PR	FAPR	Strong Motion Seismometer	OK
Salinas, PR	18.029 N	66.235 W	PR	ASPR	Velocity & Acceleration	OK
Punta Cana, Dominican Republic	18.51 N	68.38 W	PR	PCDR	Velocity + Acceleration	OK
Miches, Dominican Republic	18.98 N	69.05 W	PR	MIDR	Velocity + Acceleration	OK
Samana, Dominican Republic	19.29 N	69.19 W	PR	SMDR	Velocity + Acceleration	OK
Isla Saona, Dominican Republic	18.19 N	68.78 W	PR	SADR	Velocity + Acceleration	OK
North Barbuda Island	17.67N	61.79 W	CU	ANWB	Velocity	OK
Gun Hill	13.14 N	59.56 W	CU	BBGH	Velocity	OK
Isla Barro Colorado	9.17 N	79.83W	CU	BCIP	Velocity	OK
Grand Turk	21.51 N	71.13W	CU	GRTK	Velocity	OK
Grenville	12.13N	61.65 W	CU	GRGR	Velocity	OK
Guantanamo Bay	19.23N	75.11 W	CU	GTBY	Velocity	OK
Mount Denham, Jamaica	18.23N	77.53W	CU	MTDJ	Velocity	OK
Presa de Sabenta, Dominican Republic	18.98N	71.29W	CU	SDDR	Velocity	OK
Tegucigalpa	14.06N	87.27W	CU	TGUH	Velocity	OK
Bermuda Institute of Ocean Sciences	32.37N	64.70W	IU	BBSR	Velocity	OK
Disney Wilderness Preserve	28.11N	81.43W	IU	DWPF	Velocity	OK

San Pablo	39.54N	4.35W	IU	PAB	Velocity	OK
Riachuelo	5.83S	35.90W	IU	RCBR	Velocity	OK
Samuel	8.95S	63.18W	IU	SAML	Velocity	OK
Santo Domingo	8.88N	70.63W	IU	SDV	Velocity	OK
Cayey	18.11N	66.15W	IU	SJG	Velocity	OK
Tepich	20.23N	88.28W	IU	TEIG	Velocity	OK
Aruba	12.51N	70.01W	PR	ACPR	Velocity	OK

APPENDIX C:

U.S.-operated sea level stations in Caribbean and adjacent regions, status as of April 15, 2026.

Location	Latitude	Longitude	Status*	Operator
Coastal Water-Level Stations**				
Christiansted Harbor, St. Croix, U.S. Virgin Islands	17.75 N	64.70 W	Fully Operational	NOAA/Center for Operational Oceanographic Products and Services[1]
Lime Tree Bay. St. Croix, U.S. Virgin Islands	17.70 N	64.75 W	Fully Operational	
Lameshur Bay, St. John, U.S. Virgin Islands	18.32 N	64.72 W	Fully Operational	
Charlotte Amalie, St. Thomas, U.S. Virgin Islands	18.34 N	64.92 W	Fully Operational	
Culebra, Puerto Rico	18.30 N	65.30 W	Fully Operational	
Esperanza, Vieques Island, Puerto Rico	18.09 N	65.47 W	Fully Operational	
Magueyes Island, Puerto Rico	17.97 N	67.06 W	Fully Operational	
Mayagüez, Puerto Rico	18.22 N	67.16 W	Fully Operational	
Mona Island, Puerto Rico	18.09 N	67.94 W	Fully Operational	
San Juan, La Puntilla, San Juan Bay, Puerto Rico	18.46 N	66.12 W	Fully Operational	
Bermuda, Biological Station	32.37 N	64.70 W	Fully Operational	
San Andres, Colombia	12.58 N	81.70 W	Fully Operational	University of Hawaii Sea Level Center
Santa Marta, Colombia	11.24 N	74.22 W	Fully Operational	
Limon, Costa Rica	9.99 N	83.02 W	Fully Operational	
Bullen Bay, Curacao	12.19 N	69.02 W	Fully Operational	
Roseau, Dominica	15.31 N	61.39 W	Fully Operational	
Puerto Plata, Dominican Republic	19.80 N	70.70 W	Fully Operational	
Punta Cana, Dominican Republic	18.51 N	68.38 W	Fully Operational	
Prickly Bay, Grenada	12.01 N	61.77 W	Fully Operational	
El Porvenir, Panama	9.56 N	78.95 W	Fully Operational	

Settlement Point, Bahamas	26.69 N	78.98 W	Fully Operational	
Aguadilla, Puerto Rico	18.46 N	67.16 W	Fully operational	University of Puerto Rico, Mayaguez, Puerto Rico Seismic Network * Operated in cooperation with INDOMET ** Operated in cooperation with DDM
Arecibo, Puerto Rico	18.48 N	66.70 W	Fully operational	
Caja de Muertos, Puerto Rico	17.89 N	66.53 W	Damaged [Not Operational]	
Salinas, Puerto Rico	17.949 N	66.226 W	Fully Operational	
Guayanilla, Puerto Rico	18.01 N	-66.77 W	Fully Operational	
Fajardo, Puerto Rico	18.338 N	65.631 W	Backup (BWL) Intermittent	
Isabel Segunda, Vieques Island, Puerto Rico	18.15 N	65.44 W	Intermittent	
Yabucoa Harbor, Puerto Rico	18.06 N	65.84 W	Fully Operational	
Tortola, British Virgin Islands**	18.42 N	64.61 W	Radar Operational	
Barahona, Dominican Republic*	18.21 N	71.09 W	Not Operational	
Puerto Caucedo, Dominican Republic*	18.42 N	69.63 W	Not Operational	
Cap-Haitien, Haiti	19.76 N	72.19 W	Operational	UH Sea Level Center with Haiti Maritime Services
Bocas del Toro, Panamá	9.35 N	82.26 W	Fully Operational	Smithsonian Institution
Carrie Bow Cay off Belize	16.80 N	88.08 W	Not Operational	
Deep-ocean Assessment and Reporting of Tsunami Systems				
South Puerto Rico—230 nautical miles southwest of San Juan, Puerto Rico (42407)	15.28 N	68.19 W	Fully Operational	NOAA/National Data Buoy Center
North Santo Domingo—328 nautical miles north northeast of Santo Domingo, Dominican Republic (41420)	23.38 N	67.35 W	Fully Operational	
North St. Thomas—300 nautical miles north of St Thomas, Virgin Islands (41421)	23.37 N	63.90 W	Not Operational	

Southwest Bermuda—200 nautical miles south southwest of Hamilton, Bermuda (41425)	28.67 N	65.62 W	Fully Operational	
Southeast Block Canyon—130 nautical miles southeast of Fire Island, New York (44402)	39.29 N	70.70 W	Fully Operational	
Sable Island Bank, Canada (44403)	41.95 N	61.67 W	Fully Operational	
Gulf of America–247 nautical miles south of New Orleans, Louisiana (42409)	25.80 N	89.29 W	Fully Operational	

* Status as of April 15, 2026
[1]** To see other NOAA/Center for Operational Oceanographic Products and Services coastal water-level stations in the Atlantic Ocean, visit https://tidesandcurrents.noaa.gov/tsunami/.