

# Tsunami Monitoring, Response Criteria and **Dissemination for Puerto Rico and US and British Virgin Islands**

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### Abstract

Puerto Rico and the Virgin Islands are located in the complex and active North America-Caribbean plate boundary responsible for the generation of historical tsunamigenic events (e.g. 1867, 1918, and 1946) that caused extensive damage and loss of life in Northeastern Caribbean. In addition, as evidenced by geological and historical records the tsunami generated by the 1755 Portugal Great Earthquake impacted the Eastern Caribbean Region. Over the last few years, the Puerto Rico Seismic Network (PRSN) of the University of Puerto Rico at Mayaguez has strived to establish a real-time tsunami monitoring system for our area of responsibility (AOR). PRSN operates 25 seismic stations in its AOR and receives real-time data from over 70 stations worldwide. Earthworm and Early Bird software are used for seismic data acquisition and processing. Data from seventeen tide gauges (7 operated by PRSN, 10 by NOAA) in our AOR as well as data from dart buoys and tide gauges located through the Atlantic also conforms part of our monitoring system. Redundant communications paths are being established to ensure dissemination of critical data and complete dissemination of tsunami products. We will be presenting PRSN tsunami monitoring procedures, response criteria, products and dissemination and communication methods and capabilities.





Tide Gauges in Puerto Rico and the Virgin Islands

The Puerto Rico Seismic Network (PRSN) of the University of Puerto Rico at Mayaguez has established a real-time earthquake and tsunami monitoring system for our area of responsibility (AOR). PRSN operates 25 seismic stations in its AOR; eighteen of which are equipped with broadband sensors while the remaining seven with short period instruments. Eight accelerometers (operated by PR Strong Motion Program) are collocated with broadband stations. PRSN receives realtime data from over 70 stations worldwide mostly located in the Caribbean and adjacent regions and operated by regional networks. PRSN is continuously working with its regional and international partners to improve data exchange and to implement efficient tools for the access of seismic data. Amongst the institutions we are currently exchanging seismic data are: IRIS, USGS, GEOSCOPE, ISU (Dominican Republic), SRC-UWI (West Indies), RSNC (Colombia), OVSICORI (Costa Rica), NA (Netherlands), SNET (El Salvador), INETER (Nicaragua) and Univ. de Colima (Mexico).

Seismic and strong motion data is acquired and processed using Earthworm, Antelope, and Early Bird software. All the seismic stations are integrated to Early Bird, PRSN automatic location system, designed by the West Coast Alaska Tsunami Warning Center (WCATWC). Early Bird, along with other location tools (e.g. PRDANIS) developed at PRSN, allows a rapid response to strong earthquakes generated in the PR/VI region, Caribbean and the Atlantic Ocean.

Data from seventeen tide gauges (7 operated by PRSN, 10 by NOAA) in our AOR as well as data from dart buoys and tide gauges located through the Caribbean and Atlantic Basins also conforms part of our monitoring system. Tide Gauge data is processed and analyzed using the Xconnect and TideView software.







Two agencies provide tsunami alerts for Puerto and the Virgin Islands (PR-VI): Puerto Rico Seismic Network at the local (state) level and the West Coast/Alaska Tsunami Warning Center (WCATWC) at the federal level. Tsunami alerts are broadcasted and disseminated, through various mechanisms, to the focal warning points of the PR-VI Region:

- •PRSEMA Puerto Rico State Emergency Management Agency •NWS - National Weather Service
- •VITEMA Virgin Islands Territorial Emergency Management Agency •DDM - British Virgin Islands Department of Disaster Management
- These focal points are responsible for disseminating the tsunami alerts to the public and activating the tsunami response.
- communication services can be severely affected during a large earthquake thus ensuing the importance of ham radio to communicate critical information.





## **PRSN Felt Event and Tsunami** Response Criteria

| <b>TI</b> = Tsunami Intensity = $V \rightarrow$ Strong: Amplitude > 1.0 m |  |                           |   |   |
|---|--|---------------------------|---|---|
|   | $I$ = Intensity = VIII (as felt by analyst) $\rightarrow$ Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Fall of columns, monuments, walls. Heavy furniture overturned. Persons driving cars disturbed. |                           |   |   |
| a   |  |                           |   |   |
|   | Western Caribbean  |                           | Atlantic (Teletsunami)  |   |
|   | Depth ≤ 100.0 km   | Depth > 100.0 km          | Depth \$ 100.0 km<br>& latitude > 5 N   | Depth \$ 100.0 km<br>or latitude \$ 5 N |
|   | ( 6.0 - 7.89 )<br>TIS  | ( 6.0 - 7.89 )<br>TIS     | ( 6.0 – 7.89 )<br>TIS   | (≥ 6.0)<br>TIS                          |
|   | Felt Event/  | Felt Event/               | Felt Event/   | Felt Event/                             |
|   | <u>Tsunami</u>   | <u>Tsunami</u>            | <u>Tsunami</u>  | <u>Tsunami</u>                          |
|   | <u>Bulletin</u>  | <u>Bulletin</u>           | <u>Bulletin</u>   | <u>Bulletin</u>                         |
|   | "No threat of<br>tsunami"  | "No threat of<br>tsunami" | "No threat of<br>tsunami"   | "No threat of<br>tsunami"               |
|   | (≥7.9)   |                           | (≥7.9)  |   |
|   | <u>_Tsunami</u><br><u>Advisory</u> for<br>PR/VI  |                           | <u>Tsunami</u><br><u>Watch</u> for PR/VI<br>(Tsunami arrival<br>time ≥ 3 hours) |   |
|   |  |                           |   |   |



