

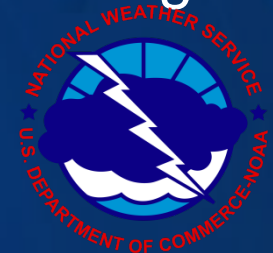


# The Caribbean Tsunami Warning System

**Christa G. von Hillebrandt**

Manager, Caribbean Tsunami Warning Program

Chair, ICG/CARIBE EWS



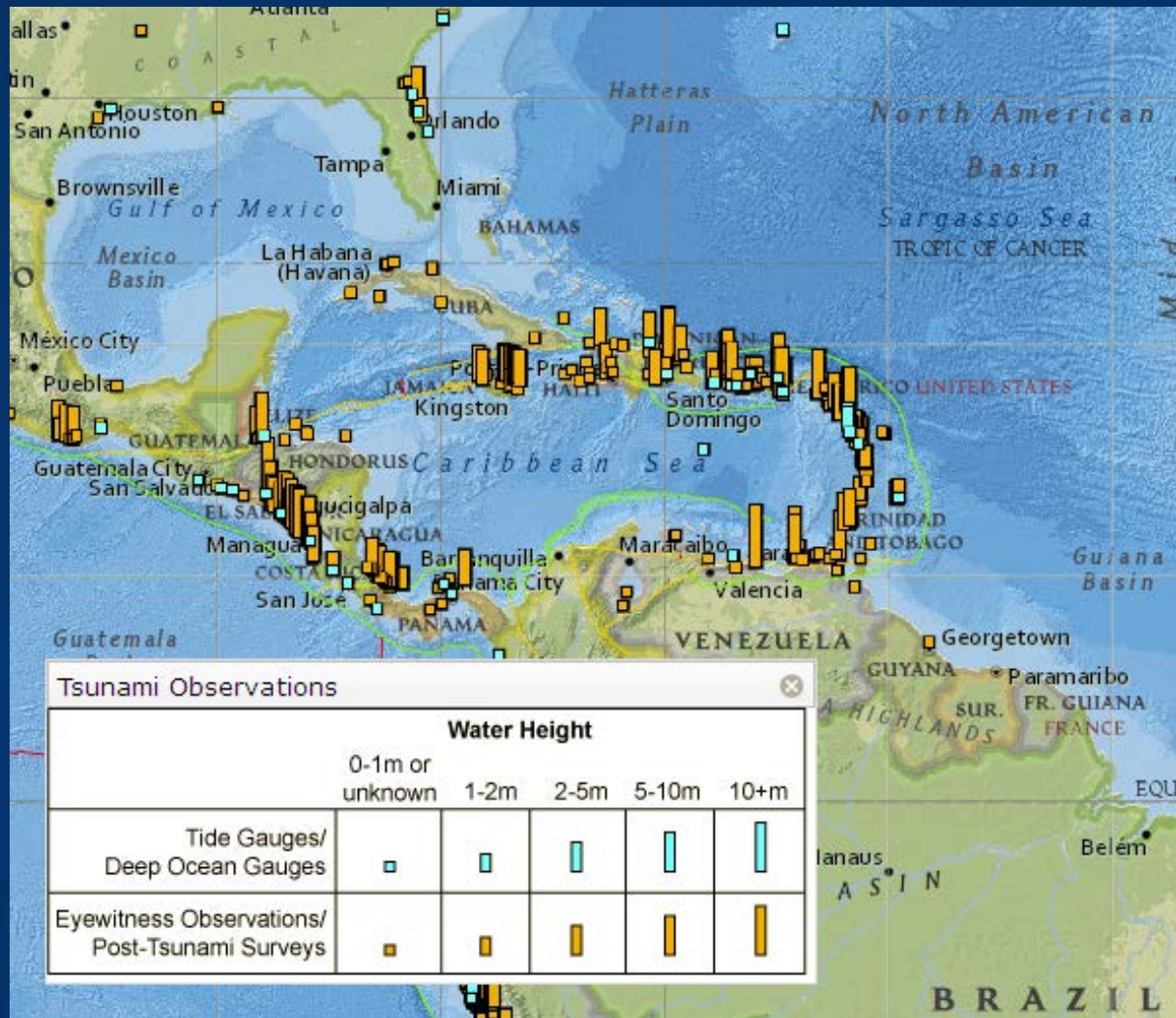
**CRRT**

**San Juan, PR**

**August 8, 2013**

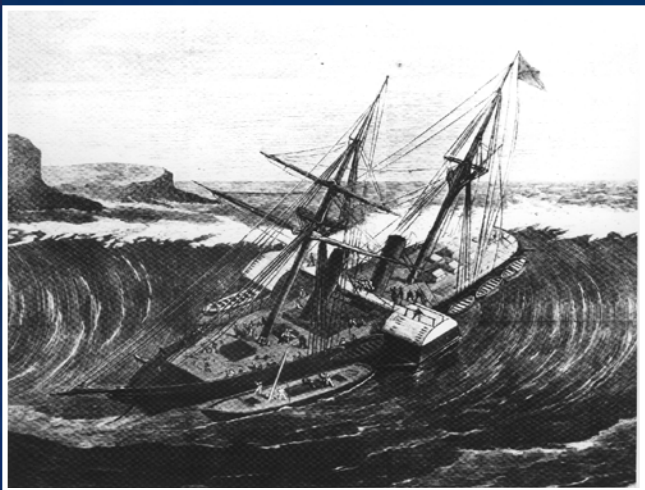
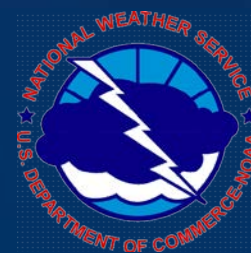


# 1500-2013 Tsunami Events in the Caribbean



# Risk to Life and Economic Prosperity

For example: Port at Charlotte Amalie Bay, St. Thomas, USVI .



20 Foot tsunami, November 18, 1867

Same bay in St. Thomas today with the lives of 25,000+ tourists & residents at risk ! **80% of jobs and Gross Territorial Product are Tourism Dependant**

**30 people lost their lives on November 18, 1867 in a 20 ft tsunami.**





Tsunami Alerts are currently provided for Puerto Rico and the Virgin Islands by NOAA NWS WCATWC (Alaska) and for the rest of the Caribbean by NOAA NWS PTWC (Hawaii) . Nicaragua and PRSN also provide tsunami warning services.



# CTWC

“Providing regional service, strengthening local capabilities...”

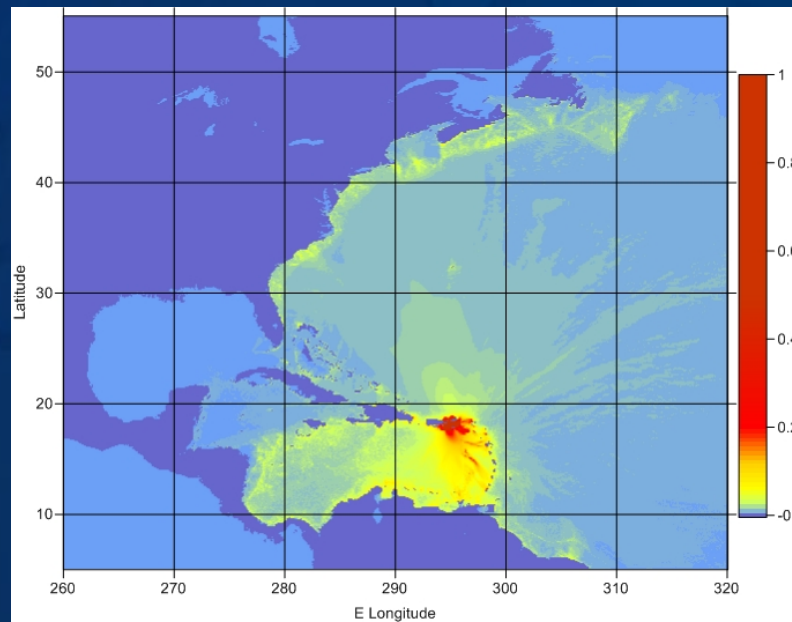
- NOAA NWS established in February 1, 2010 the **Caribbean Tsunami Warning Program**, jointly located at the Puerto Rico Seismic Network at the University of Puerto Rico at Mayagüez as a 1st step of the U.S. towards the establishment of a Caribbean Tsunami Warning Centre.
- Currently staffed by Manager (Christa G. von Hillebrandt-Andrade) and Part time students
- ICG VI endorsed the establishment of the CTWC in Puerto Rico and has urged the US to continue with full implementation



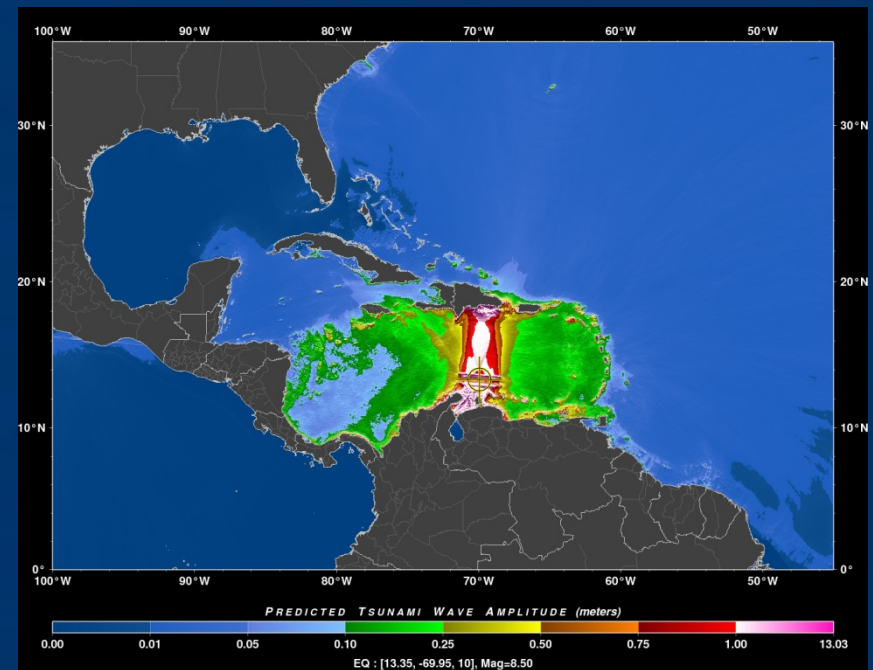
# TSUNAMI EXERCISE

## CARIBE WAVE LANTEX 2011 AND 2013 (March 20, 2013)

### 2011 Scenario



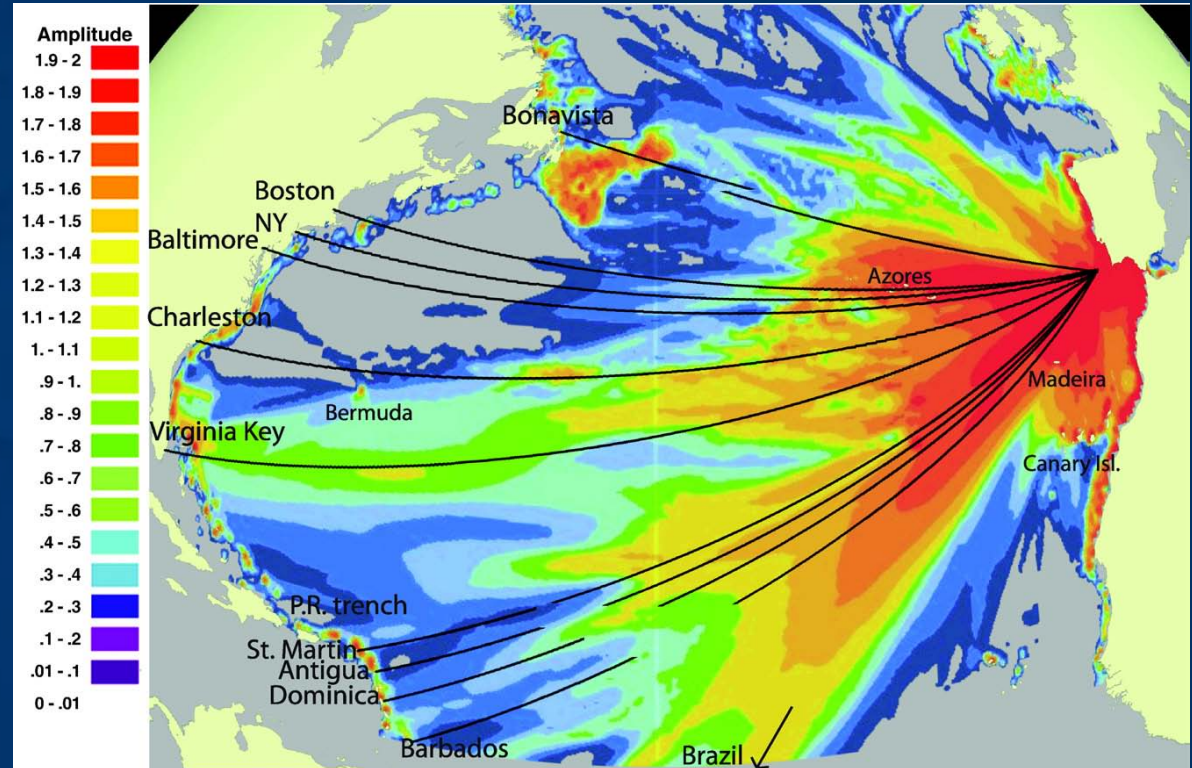
### 2013 Scenario





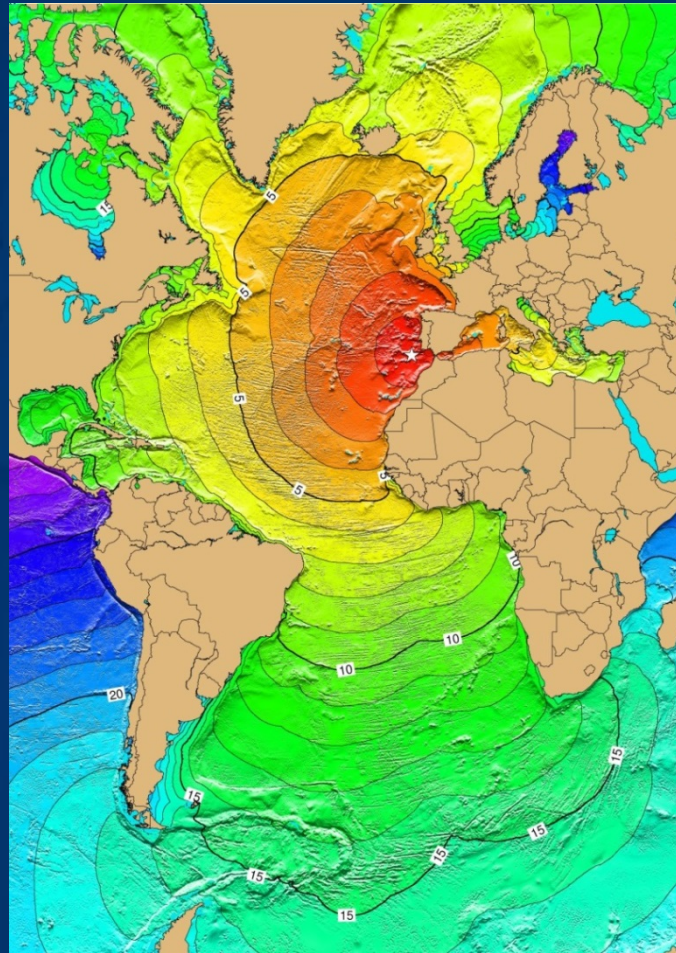
# CARIBE WAVE/LANTEX 14

- Wednesday, March 26, 2014
- Lisbon 1755 Scenario
- Start messages to be disseminated by PTWC and WCATWC



Simulation by Barkan et al, 2009

# Tsunami Travel Times





## Tsunami Event

Date						Tsunami Cause		Tsunami Source Location				Tsunami Parameters			
						Val	Code					Max Water Height	Magnitude		Tsu Int
Year	Mo	Dy	Hr	Mn	Sec			Country	Name	Latitude	Longitude		Abe	Iida	
1755	11	1	9	30		4	1	PORTUGAL	LISBON	36.000	-11.000	30.00		3.60	

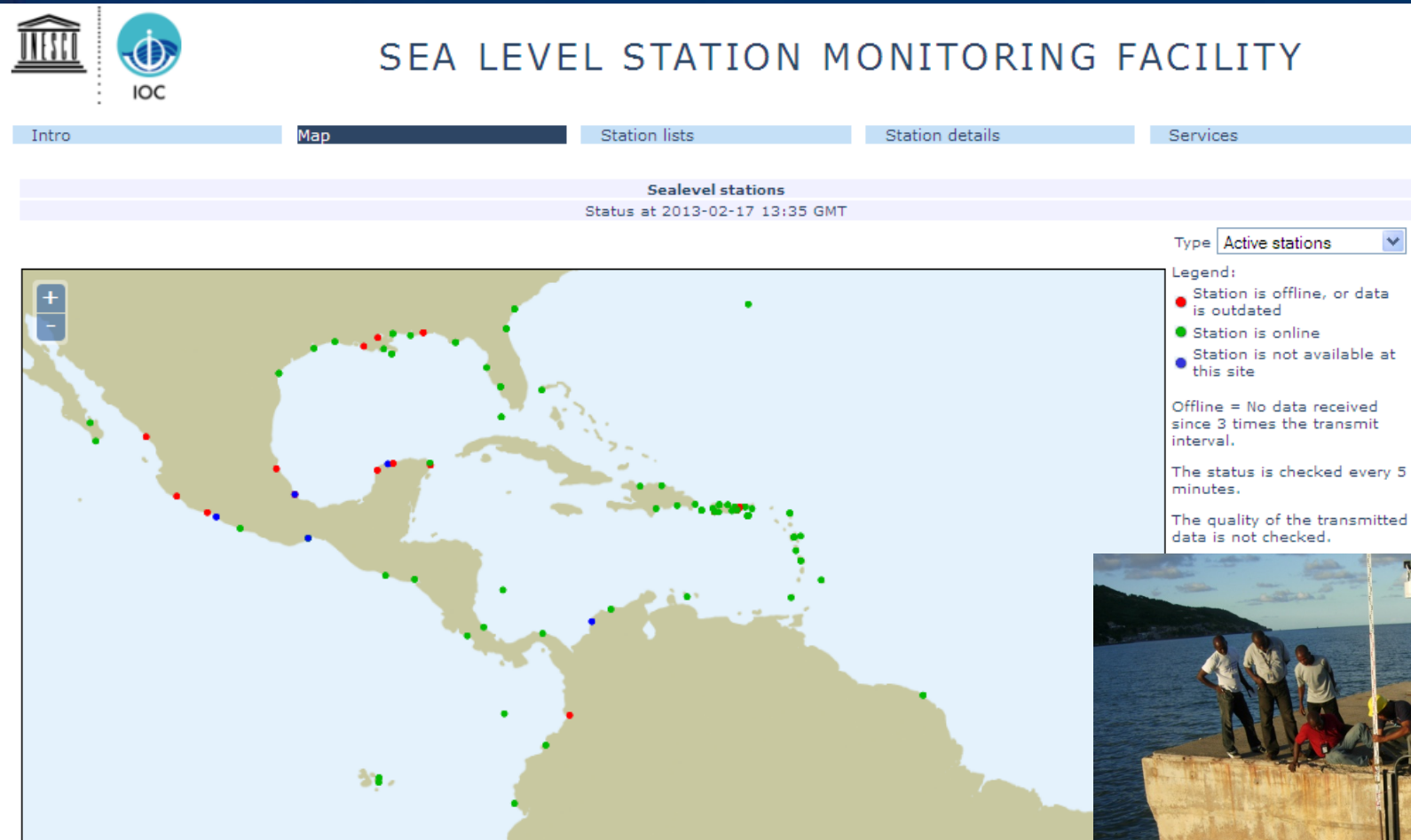
### Tsunami Runups

Addl Info	Doubtful Runup	Tsunami Runup Location					Tsunami Wave Arrival						Tsunami Runup Measurements						
		Country	State/Province/Prefecture	Name	Latitude	Longitude	Distance from Source	Initial Wave			Max Wave			Max Water Height	Max Inundation Distance	Type	Per	1st Mtn	
								Arrival		Travel Time	Arrival								
								Day	Hr		Min	Hrs	Min						Day
*		ANTIGUA AND BARBUDA		ANTIGUA ISLAND	17.12000	-61.78000	5401				9				3.70		1		R
*		BARBADOS		CARLISLE BAY, BARBADOS	13.08300	-59.61700	5467								1.50		1	5	R
*		BERMUDA		BERMUDA	32.36700	-64.70000	4895									1			
*		BRAZIL		BRAZIL (unknown location)												1			
*		CANADA	NL	CAPE BONAVISTA, NEWFOUNDLAND	48.70000	-53.08300	3680									1			
*		CUBA		SANTIAGO DE CUBA	20.00000	-75.81700	6492									1			
*		DOMINICA		PORTSMOUTH	15.56700	-61.45000	5468								3.70	1			
*		DOMINICAN REPUBLIC		SAMANA BAY	19.21700	-69.31700	5952								3.70	1			
*		DUTCH TERRITORY		SABA ISLAND	17.63300	-63.10000	5487								6.40	1	1		
*		FINLAND		TURKU	60.45000	22.25000	3596									7			
*		FRANCE		BORDEAUX	44.83300	-.56700	1319									7			
*		FRANCE		LEHAVRE	49.50000	.10000	1750									7			
*		HAITI		PORT-AU-PRINCE	18.55000	-72.33300	6261									1	1		
*		IRELAND		CORK, IRELAND	51.75000	-8.25000	1765									7			
*		IRELAND		KINSALE, IRELAND	51.70000	-8.53300	1757									1			
*		MARTINIQUE (FRENCH TERRITORY)		MARTINIQUE	14.74000	-61.18000	5496								1.80	1	1	F	
*		SAINT MARTIN		SAINT MARTIN HARBOR	18.08300	-63.08300	5459								4.50	1	1		
*		SAINT VINCENT AND THE GRENADINES		LESSER ANTILLES	12.00000	-62.00000	5747								4.50	1			

# Sea Level Data Availability in the Caribbean

100% (6/6) of the DART stations are installed

44% (44/100) of coastal sea level gauges are operational and transmitting at least every 15 minutes



Port au Prince, Haiti sea level station,  
installed in 2012



# Tsunami Modeling





- USA – Puerto Rico, near, regional, tIs and landslide sources
- France
- Haiti – north shore by France
- BVI-new bathymetry and near coastal data was gathered
- Dominican Republic – lack of bathymetry data
- Need for additional training and digital elevation models with appropriate resolution.




# Caribbean Tsunami Information Center

- The Government of Barbados is hosting the Center
- Initial funding from the Government of Italy thru Tsunami Unit and UNDP Office for the Organization of Eastern States and Barbados
- Interim Director is in the process of being hired
- Focus on SOP's and Educational and Awareness materials

**TSUNAMI SAFETY RULES**

- 1 ALWAYS BE PREPARED, A TSUNAMI MAY OCCUR ANYTIME**
  - Prepare a family emergency plan
  - Prepare a safety backpack including medicine and first aid items
  - Identify danger zones, assembly locations, designated evacuation routes or the quickest way to reach higher ground safely with the help of your local disaster management officials
- 2 IN CASE OF AN EARTHQUAKE PROTECT YOURSELF**
  - Drop
  - Cover
  - Hold on
- 3 RUN TO HIGH GROUND IF ANY OF THESE WARNING SIGNS OCCUR AT THE COAST**
  - FEEL a very strong or long earthquake (it is difficult to walk, there are falling objects, damage to structures, earthquake lasts for about 1 minute or more)
  - SEE a sudden rise or fall (exposing the ocean floor, reefs and fish) of the sea level
  - HEAR a strange or loud noise (can be a roar) coming from the sea, or receive official tsunami warning messages by siren, radio, television, commercial radio or emergency alert radios
- 4 MOVE AWAY FROM HAZARDOUS AREAS (IN PREFERENCE ORDER DEPENDING ON YOUR LOCATION OR SITUATION)**
  - Run away from the coast to an assembly point or higher ground
  - Go to the third floor of a building or higher
  - Climb a tree
  - If time permits, vessels should navigate offshore to waters 100-400 meters deep
- 5 STAY IN THE SAFE AREA UNTIL AUTHORITIES INDICATE THE DANGER HAS PASSED, THIS MAY TAKE MANY HOURS**

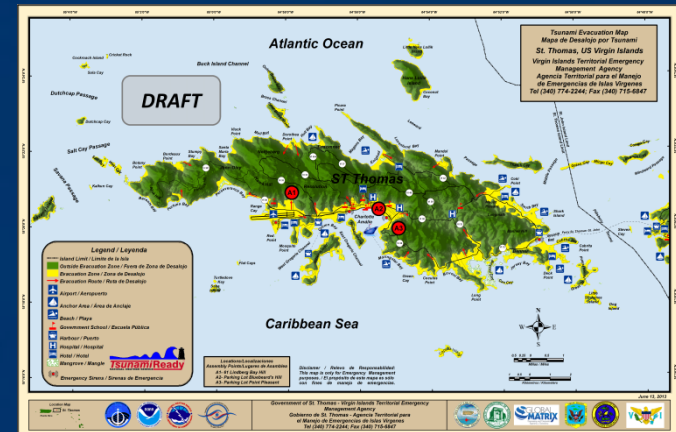
  
[www.ico.unesco.org](http://www.ico.unesco.org) | [www.bbandp.org](http://www.bbandp.org) | [www.tsunami.gov](http://www.tsunami.gov) | [www.weready.org](http://www.weready.org)

Contributing Sources: US NWS Caribbean Tsunami Warning Program, the Puerto Rico Seismic Network, MCEM New Zealand and the International Tsunami Information Center

# TsunamiReady© Recognition Program (US NWS AND USNWS/UNESCO)

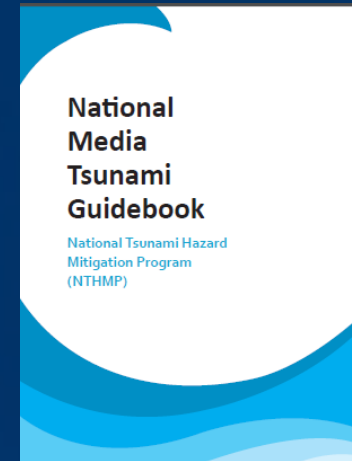


- 31/44 communities in Puerto Rico
- 1/40 Caribbean nations/territories
- 24 Hour Focal Point to receive and disseminate tsunami messages
- Tsunami Evacuation Map
- Tsunami Signage
- Tsunami evacuation exercise
- Tsunami response plan
- Average Investment: \$40,000
- Puerto Rico Govt. is tying in the maintenance of TsunamiReady status to Emergency Planning Funding



# Standard Operating Procedures

- Developed for Barbados, Grenada, Antigua & Barbuda, St Lucia and Anguilla
- Being developed for Haiti
- Puerto Rico Seismic Network updated its SOP's and also developed a Tsunami Media Guide for Puerto Rico with the NWS and National Tsunami Hazard and Mitigation Program.
- USVI also has a Tsunami Annex, being updated as part of the TsunamiReady recognition process





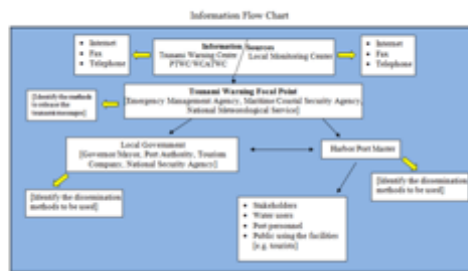
# Preparedness Materials Maritime Community

## Tsunami Protocol Template for the Caribbean Port and Harbor Operators

UPRM Puerto Rico Seismic Network, NOAA NW3 Caribbean Tsunami  
Warning Program, National Science Foundation

### INTRODUCTION

Tsunami (tsu=wave, nami=sea) is a Japanese word meaning harbor wave. A tsunami is a series of waves with a long wavelength and period (time between crests) generated by a large, impulsive displacement of sea water. Time between crests of the wave can vary from a few minutes to over an hour, but generally are in the range of 15 to 25 minutes. Tsunamis are often incorrectly called tidal waves; they have no relation to the daily ocean tides, although depending on the stage of the tide, the tsunami will reach a higher or lower elevation. Tsunamis are generated by any large, impulsive displacement of the sea level. The most common cause of a tsunami is sea floor uplift associated with an earthquake. Tsunamis are also triggered by landslides into or under the water surface, and can be generated by volcanic activity and meteorite impacts.



# TSUNAMI

## WHAT TO DO?

### TSUNAMI SAFETY FOR BOATERS

1. Since tsunami waves cannot be seen in the open ocean, do not return to port if you are at sea and a tsunami warning has been issued. Port facilities may become damaged and hazardous with debris. Listen to mariner radio reports when it is safe to return to port.
2. Tsunamis can cause rapid changes in water level and unpredictable dangerous currents that are magnified in ports and harbors. Damaging wave activity can continue for many hours following initial tsunami impact. Contact the harbor authority or listen to mariner radio reports. Make sure that conditions in the harbor are safe for navigation and berthing.
3. Boats are safer from tsunami damage while in the deep ocean (>200 fathoms, 1200 ft, 400 m) rather than moored in a harbor. But, do not risk your life and attempt to motor your boat into deep water if it is too close to wave arrival time. Anticipate slowdowns caused by traffic gridlock and hundreds of other boaters heading out to sea.
4. For a locally-generated tsunami, there will be no time to motor a boat into deep water because waves can come ashore within minutes. Leave your boat at the pier and physically move to higher ground.
5. For a tele-tsunami generated far away, there will be more time (one or more hours) to deploy a boat. Listen for official tsunami wave arrival time estimates and plan accordingly.
6. Most large harbors and ports are under the control of a harbor authority and/or a vessel traffic system. These authorities direct operations during periods of increased readiness, including the forced movement of vessels if deemed necessary. Keep in contact with authorities when tsunami warnings are issued.

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Photo: Tsunami on St. Thomas, VI, Tsunami de: Harper's Weekly, 23 Jan. 1861, p. 49. Private collection



available at:

<http://www.srh.noaa.gov/srh/ctwp/>

and <http://prsn.uprm.edu>

# Pending Actions/Strengthening Activities

- Testing of new tsunami products from the PTWC
- Establishment of a Caribbean Tsunami Warning Center in the region
- Consolidation and recurrent funding/seconding for CTIC, including Public Awareness and Education Strategy
- Strengthening and development of SOP and Preparedness Plans
- Annual regional tsunami exercises
- Coordination with NEAMTWS

# If we let infrequency of Earthquakes and Tsunamis disarm us, DISASTER will strike again

## Indian Ocean 2004



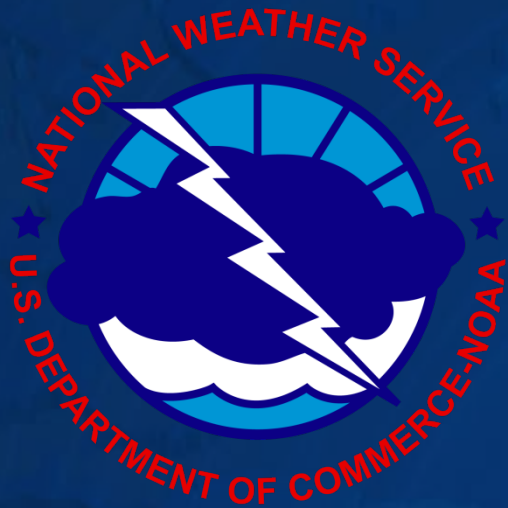
## Haiti 2010





# Caribbean Tsunami Warning Program

“Protecting lives and securing economic prosperity  
in the Caribbean and Western Atlantic”



## Programa de Alerta de Tsunamis del Caribe

“Protegiendo vidas y salvaguardando prosperidad económica  
en el Caribe y Atlántico Occidental”

<http://www.srh.noaa.gov/srh/ctwp/>