



Tsunamis : Preparations for the Caribbean Shipping Community

Caribbean Shipping Association Annual General
Meeting

Bridgetown, Barbados

October 11, 2011

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NOAA NWS Caribbean Tsunami Warning Program
Vice President UNESCO ICG CARIBE EWS
President Seismological Society of America
With input from Carolina Hincapie, Puerto Rico Seismic Network

Thank you for the invitation!

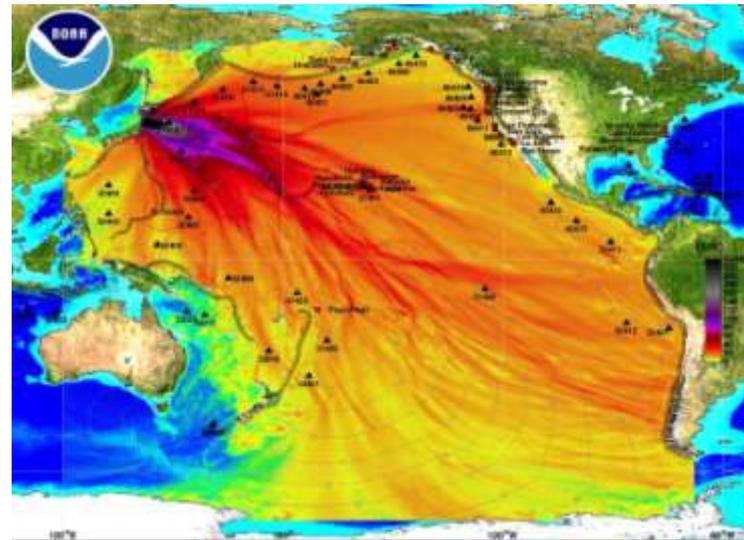


Videos on Tohoku Tsunami and its Impacts on the Maritime Infrastructure

- <http://www.youtube.com/watch?v=NW7vENdDu1o&feature=related>
- <http://www.youtube.com/watch?v=TVuJd1Jdluk>
- <http://www.youtube.com/watch?v=zy8GKjiPd04&feature=related>
- <http://www.youtube.com/watch?v=zy8GKjiPd04&feature=related>
- <http://www.youtube.com/watch?v=e3LCVU74bsY&feature=related>

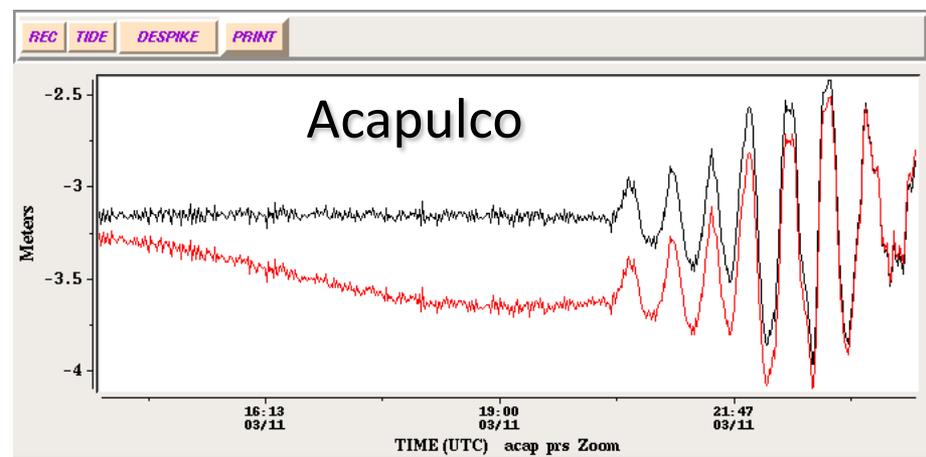
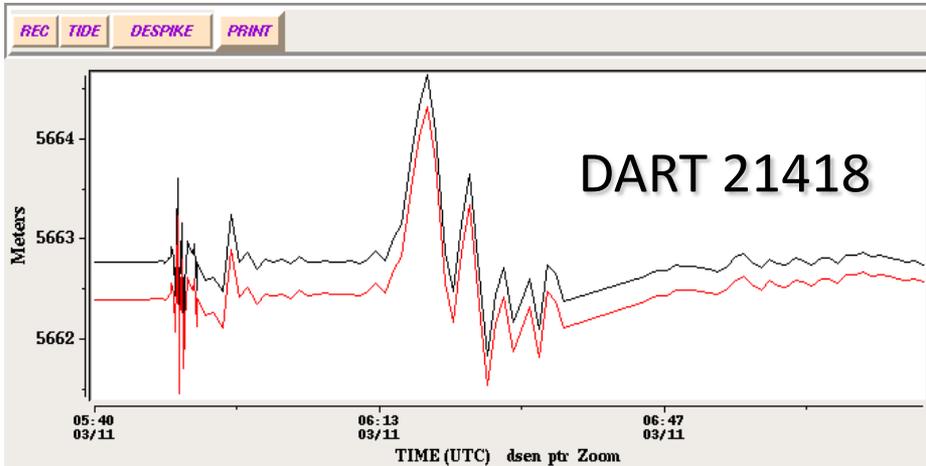
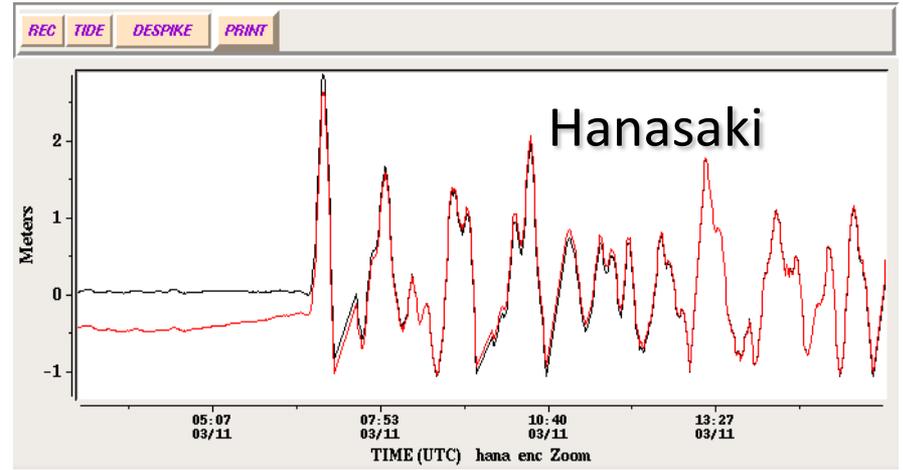
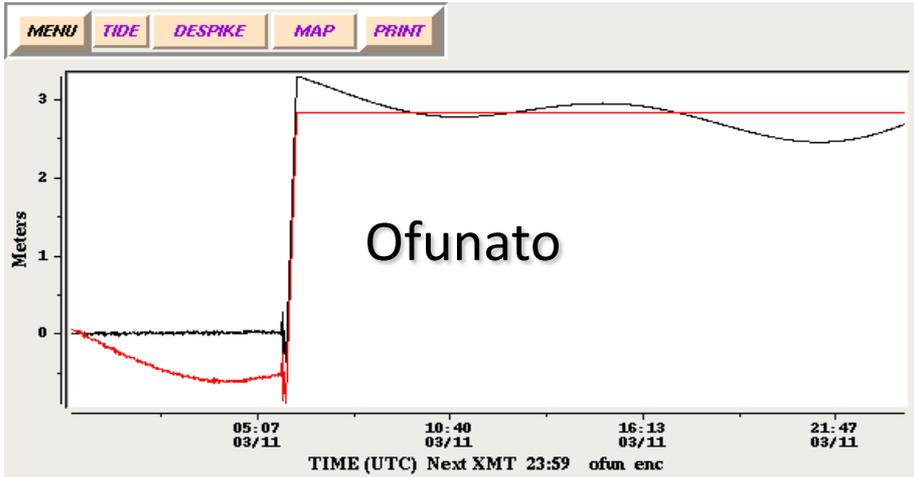
Tohoku Earthquake and Tsunami

March 11, 2011, Mw 9.0, Runups: 40 m

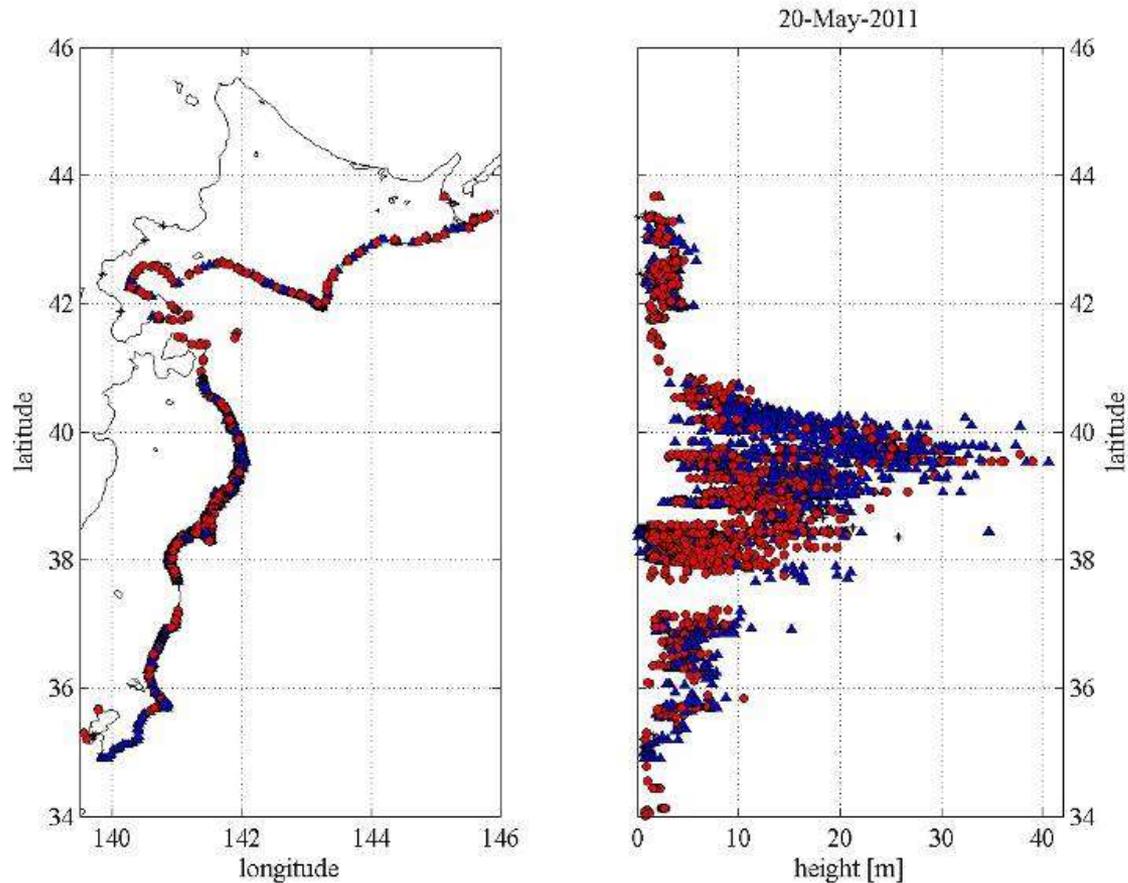


<http://www.guardian.co.uk/world/video/2011/mar/14/japan-tsunami-amateur-footage-video>

Mareograms Tohoku Tsunami

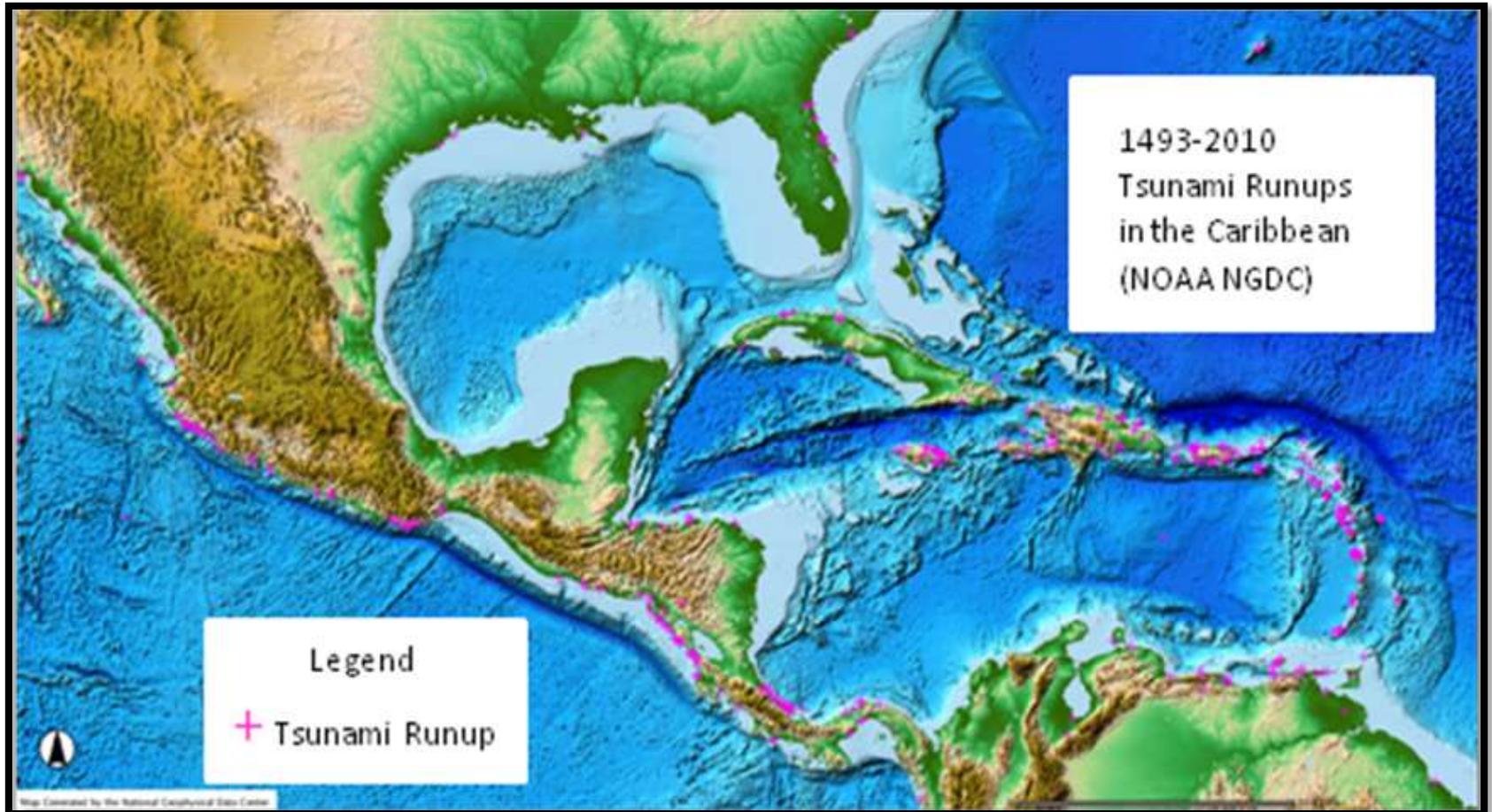


Tsunami Heights in Japan



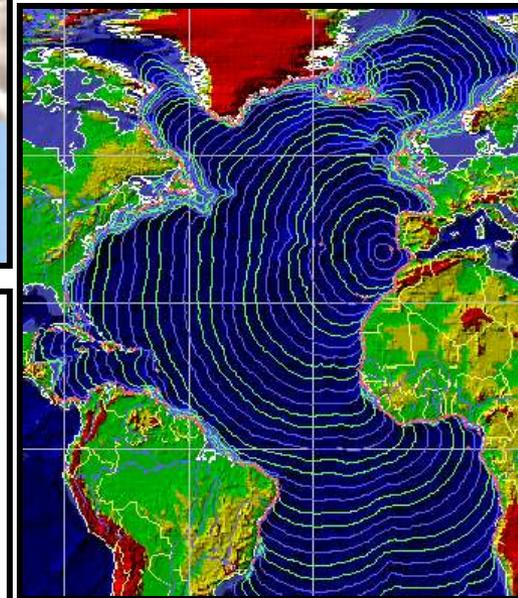
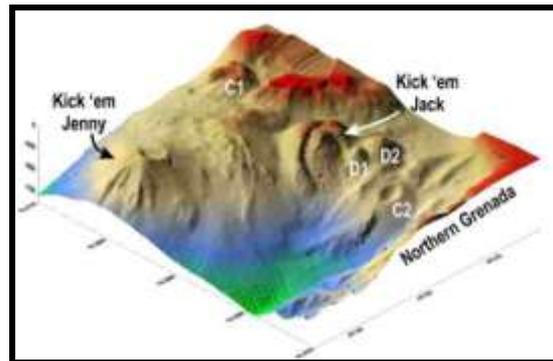
Preliminary Information; no tide correction. Red circle: inundation depth. Blue triangle: run-up height.

In the past 500 years more than 75 tsunamis have been observed in the Caribbean causing the death of at least 3,510 people.

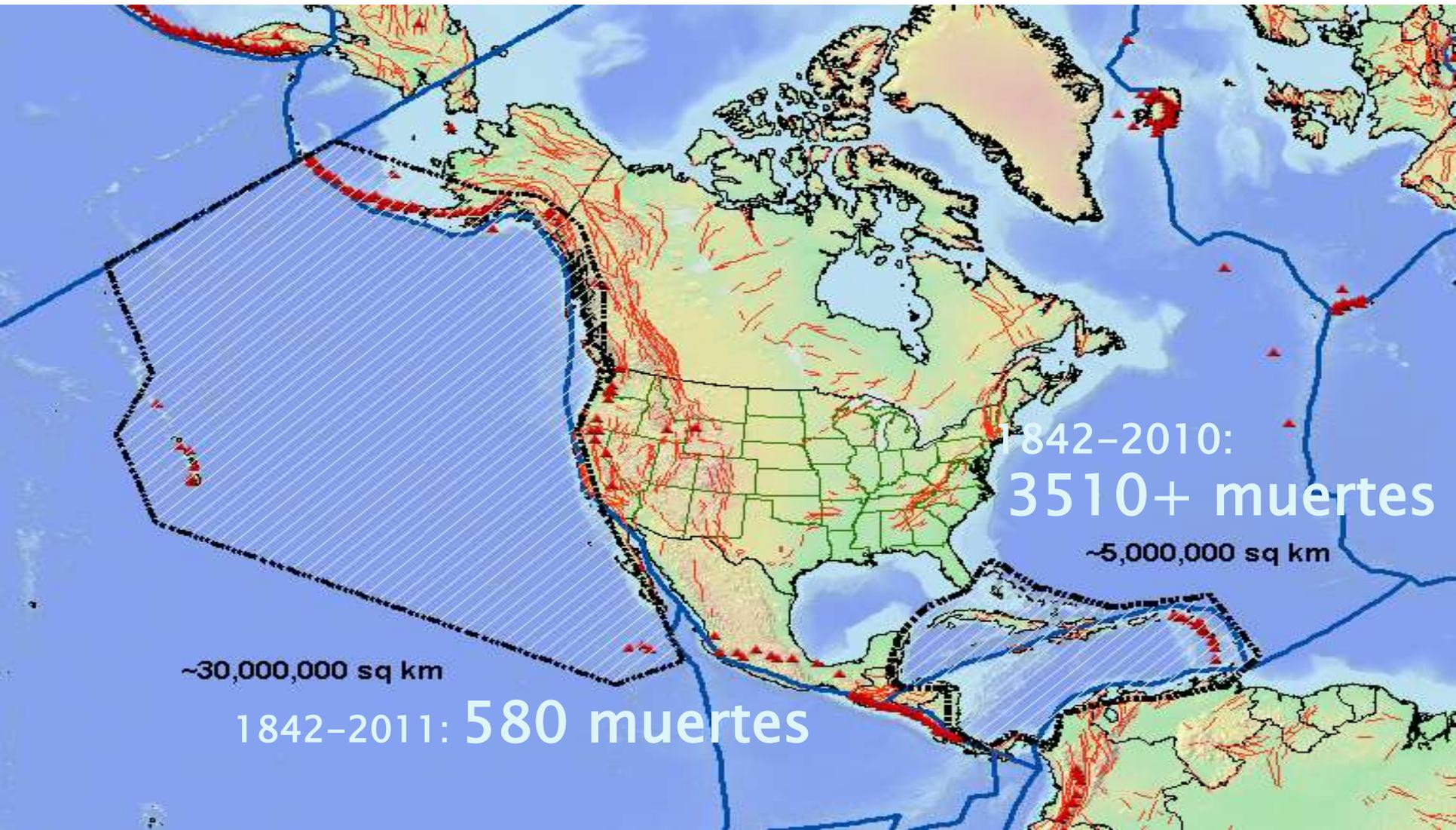


Different Sources of Tsunamis in the Caribbean

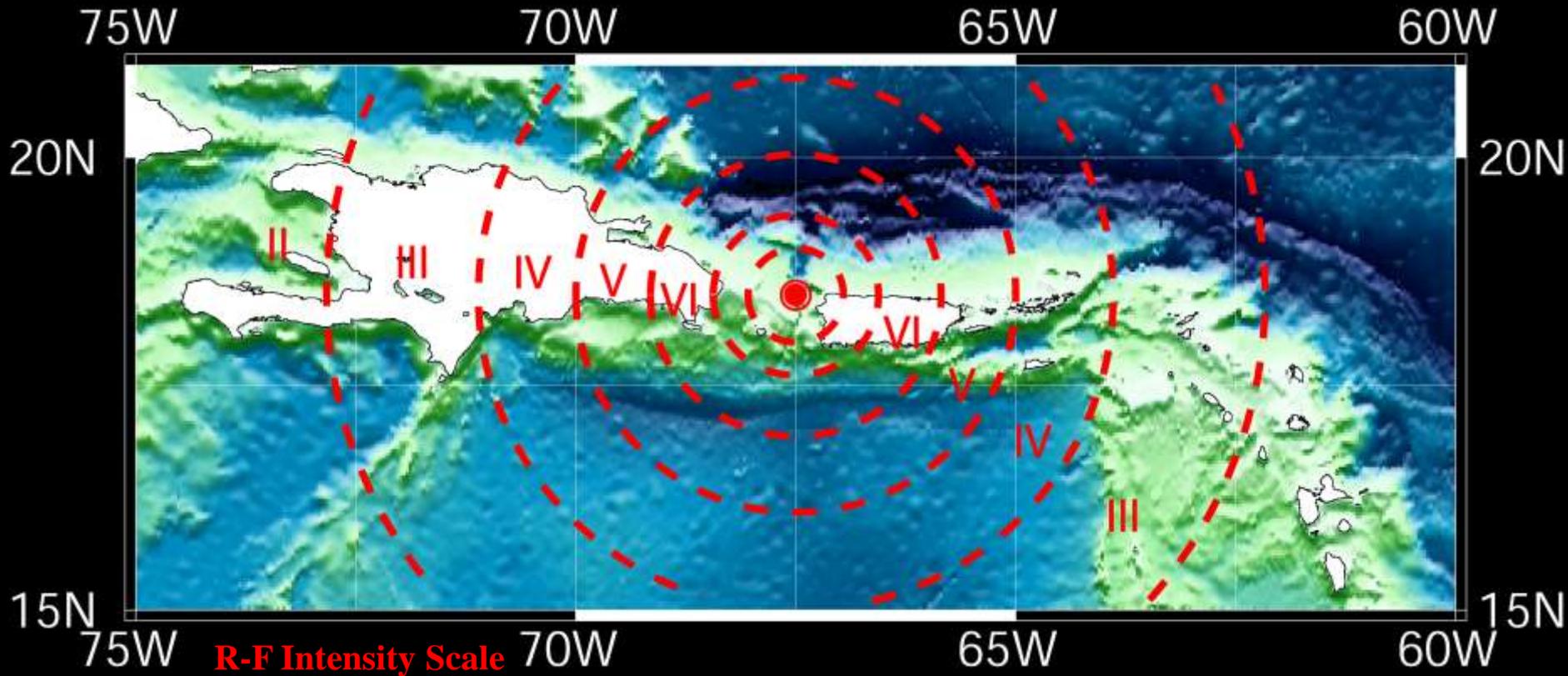
- ▶ Earthquakes (90%)
subduction zones
and other faults
- ▶ Landslides (1%)
trench, continental
platforms.
- ▶ Volcanoes (8%)
submarine and
subareal
- ▶ Tele-tsunamis (1%)
eg. “Lisboa” Nov. 1,
1755



Since 1842, at least 3,510 people have lost their lives from tsunamis in the Caribbean (Haiti, Jamaica, VI, PR, Dom. Rep. Venezuela, Panamá...)
With 1/5 the area of the Pacific NE, there have been 6x more deaths!
deaths!



October 11, 1918 Puerto Rico Earthquake and Tsunami



The risk from tsunamis has increased dramatically due to population growth, coastal infrastructure development and tourism



US Virgin Islands, 1867

US Virgin Islands, today



During high season, there can be as many as 25,000 people arriving on cruise ships during a day. During low season, as much as 15,000 people/day.

Intergovernmental Coordinating Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG CARIBE EWS)

- UNESCO/IOC body
- 30 member states, commonwealths, territories
- Established in 2005
- 6 Sessions have been held in Barbados, Venezuela, Panama, Martinique, Nicaragua and Dominican Republic
- Next session: March 2012, Curacao
- Main recommendations:
 - Identification of Tsunami Contacts and Warning Points in each country
 - Establishment of a Caribbean Tsunami Information Center
 - Establishment of a Caribbean Tsunami Warning Center

● Bermuda



Caribbean Tsunami Warning Center

“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 1rst step of the U.S. towards the establishment of a Caribbean Tsunami Warning Centre.
- **Fully endorsed by the UNESCO IOC** Intergovernmental Coordination Group for Tsunamis and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions
- **When will the Program become a Centre?**
 - **Funds are appropriated**

Tsunami Alerts are currently provided for Puerto Rico and the US and British Virgin Islands by NOAA NWS WCATWC (Alaska) and Puerto Rico Seismic Network (Mayagüez) and for the rest of the Caribbean by NOAA NWS PTWC (Hawaii)



TSUNAMI ALERT LEVELS/PRODUCTS

Vary within the Caribbean

West Coast & Tsunami Warning Center
<http://www.ndbc.noaa.gov>
Puerto Rico Seismic Network
<http://tsunami.gov.com.edu> Telephone: 787-833-8633
TSUNAMI MESSAGES



- Danger!
- Run for high ground!
- Follow emergency instructions.

WARNING



ADVISORY

- Possible strong and dangerous local currents.
- Get out of the water and off the beach.
- Stay tuned for local emergency guidance.



- Potential danger.
- Stayed tuned for more information.

WATCH



- Relax.
- No danger.
- A distant (over) basin may be in danger.

INFORMATION STATEMENT

WEST COAST & ALASKA TSUNAMI WARNING CENTER

Pacific Tsunami Warning Center
<http://www.weather.gov/phus/index.php>
Caribbean Tsunami Warning Program
<http://www.nhc.noaa.gov/sth/stwa>
TSUNAMI MESSAGES FOR THE CARIBBEAN EXCEPT FOR PUERTO RICO AND THE US VIRGIN ISLANDS.



- Danger for all coasts within the Caribbean Region!
- Run for High Ground!
- Follow the instructions of the emergency management officials.

CARIBBEAN SEA WIDE TSUNAMI WATCH



- Danger for coasts within a thousand kilometers from Earthquake!
- Run for High Ground!
- Follow the instructions of the emergency management officials.

REGIONAL TSUNAMI WATCH



- Danger for coasts within a hundred kilometers from Earthquake!
- Run for High Ground!
- Follow the instructions of the emergency management officials.

LOCAL TSUNAMI WATCH

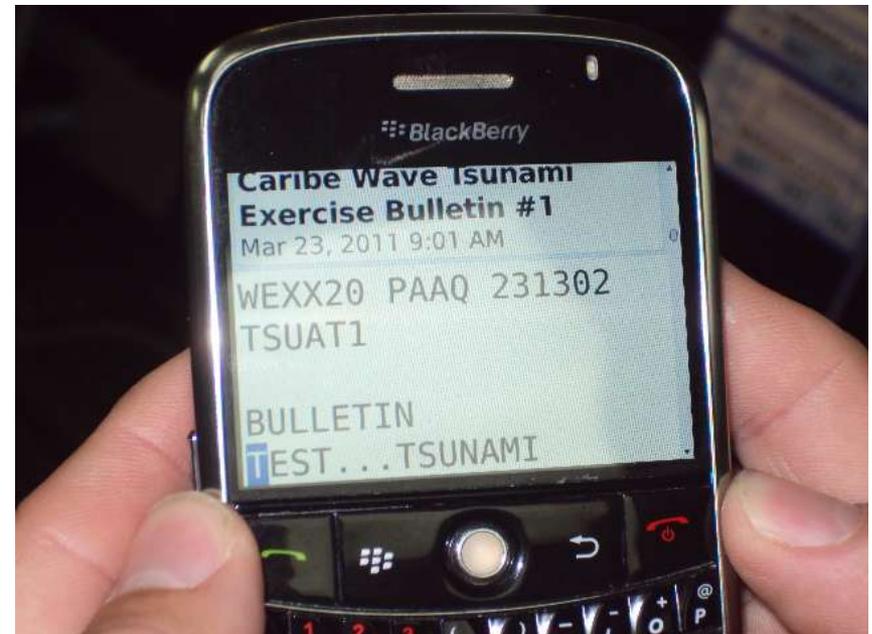


- Relax.
- No Danger.
- A more distant place may be in danger.

INFORMATION STATEMENT

How can one receive the Tsunami Products

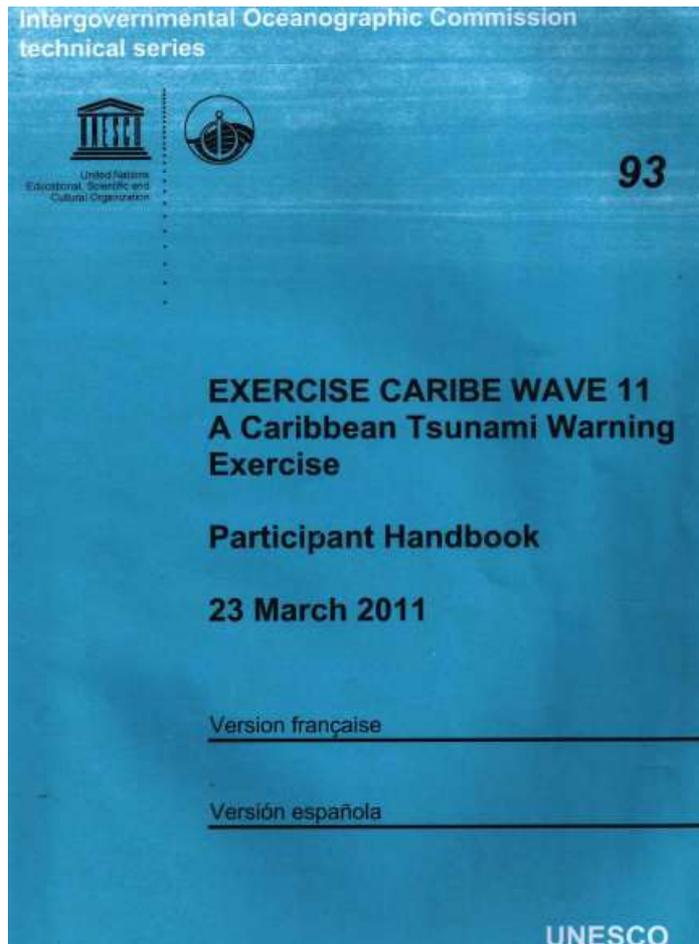
- NOAA NWS Email subscription service <http://tsunami.gov>
 - Puerto Rico, US and British Virgin Islands West Coast Alaska Tsunami Warning Center
 - Rest of the Caribbean: Pacific Tsunami Warning Center
- Local Services
 - Emergency Alert Systems – Radio / TV
 - NOAA Weather Radio or other local alert
 - Sirens



CARIBE WAVE 2011

First Caribbean Wide Tsunami Exercise

March 23, 2011...



- 75% of the member states of the CARIBE EWS participated
- 50% of the countries had tsunami response plans
- 47% indicated that the plan was adequate
- Next regional exercise: 2013

ANGUILLA

1st IOC-NOAA

TsunamiReady

Community

- 24 Hour Focal Point to receive and disseminate tsunami messages
- Tsunami Evacuation Map
- Tsunami Signage
- Tsunami evacuation exercise
- Tsunami response plan
- Cost: \$15,000



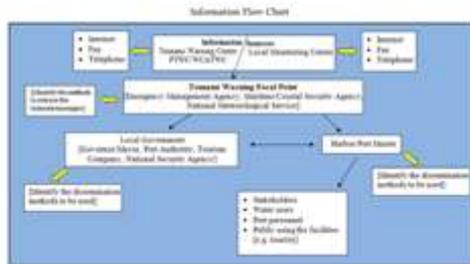
Maritime Community Specific Materials

Tsunami Protocol Template for the Caribbean Port and Harbor Operators

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

INTRODUCTION

Tsunami (tsunami) 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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Honolulu, Hawaii 96813-3213 USA
Tel: <1> (808) 532-4422 Fax: <1> (808) 532-5576
Correo electrónico (e-mail): itic@tsunami.gov
Página electrónica: <http://tsunamiwave.info>
Ilustración por: Lucas Rawah, Papua, Nueva Guinea, 1998
Traducción al español: María E. Frost, UPR Sea Grant
Red Sismica de Puerto Rico
Universidad de Puerto Rico en Mayagüez
Tel: <1> (787) 832-4433
Correo electrónico (e-mail): staff@redsisn.uprm.edu
Página electrónica: <http://redsisnica.uprm.edu>



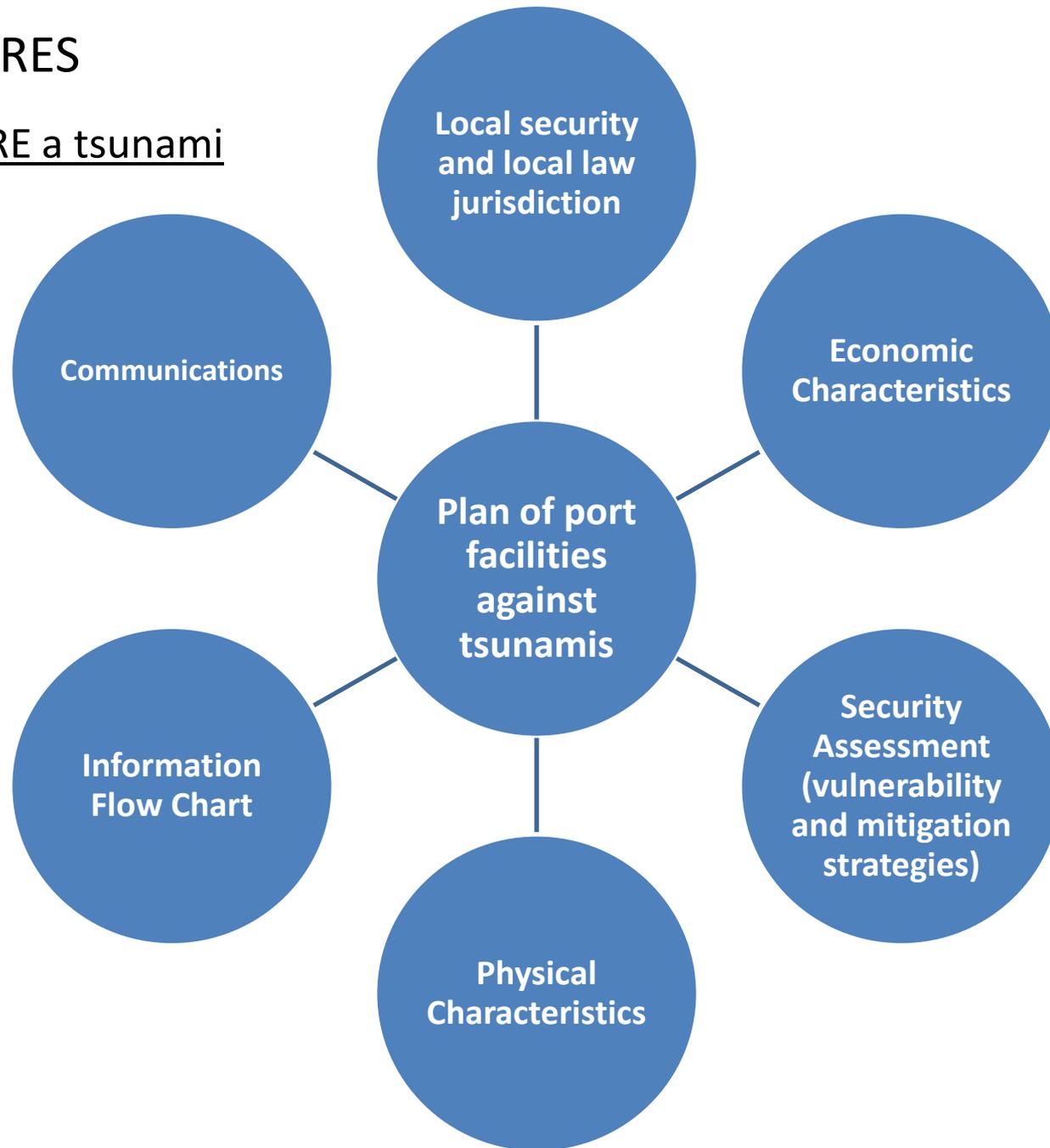
Photo: Tsunami on St. Thomas, P.R. Tsunami de: Harper's Weekly, 23 Jan. 1886, p. 49. Private collection



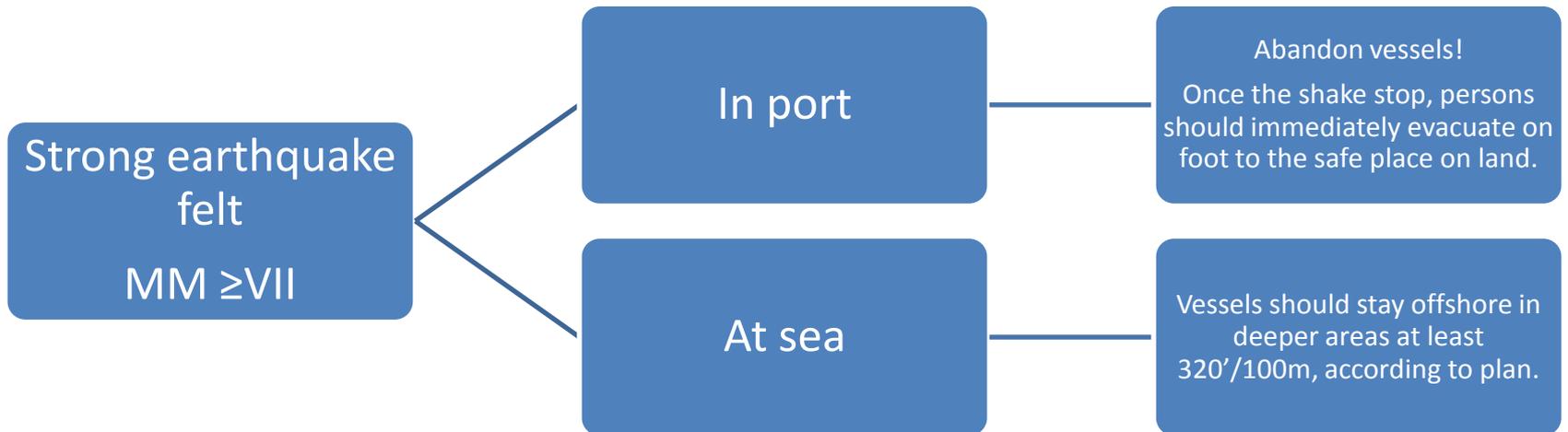
available at:
<http://www.srh.noaa.gov/srh/ctwp/>
and <http://prsn.uprm.edu>

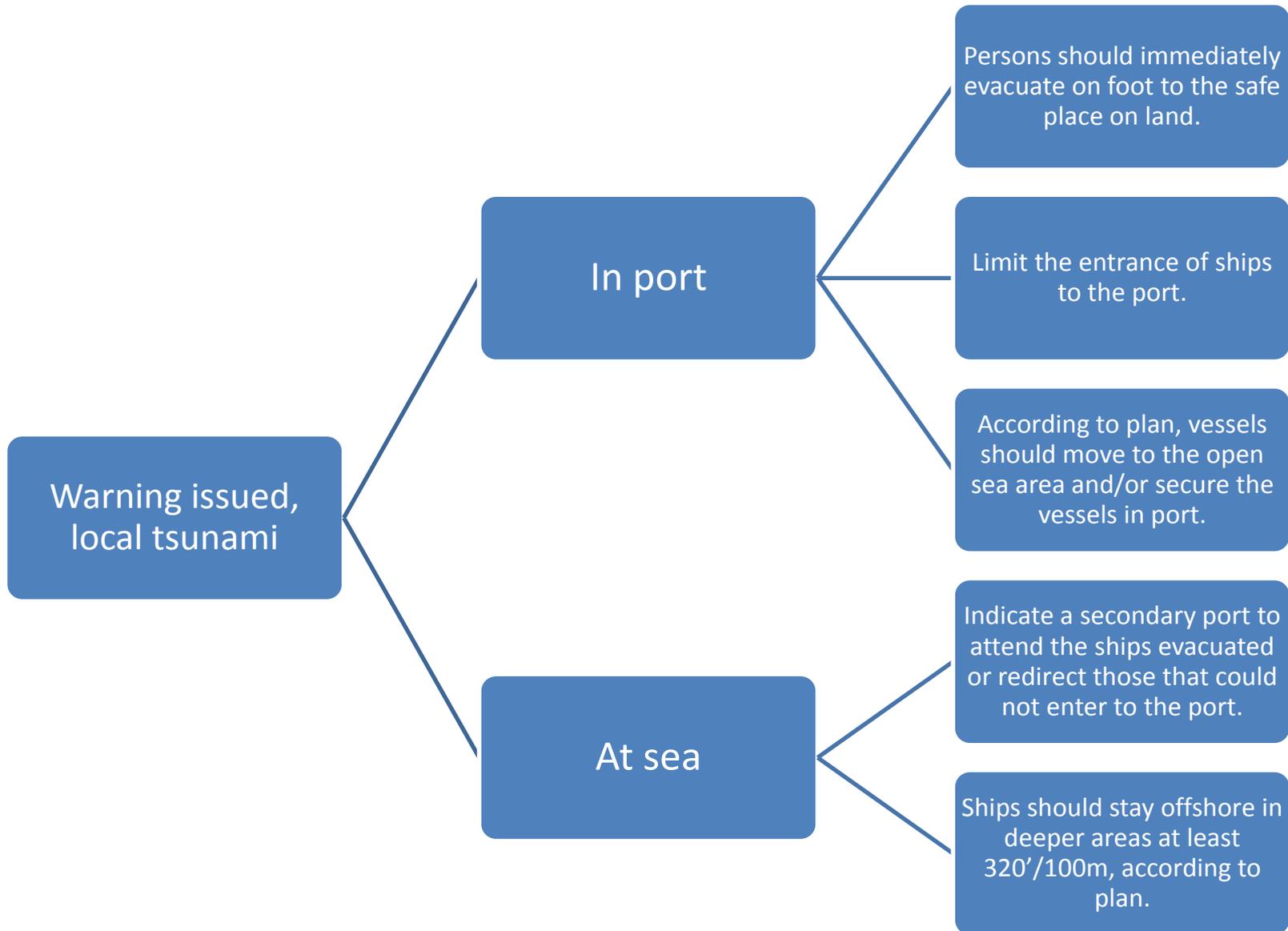
PROCEDURES

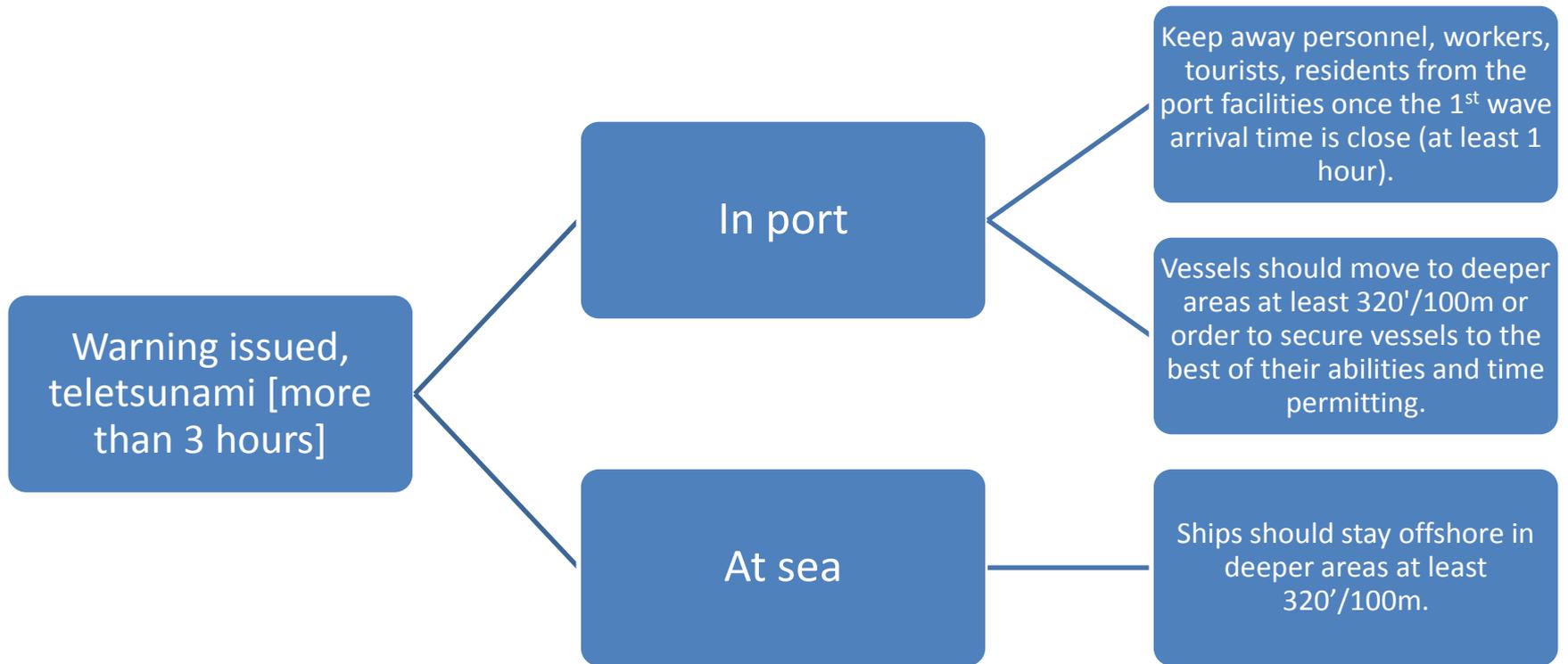
Now, BEFORE a tsunami



DURING a tsunami event







Education and Outreach – Collective and Individual Preparation



Tsunami Safety Rules

- 1 Always be prepared, a tsunami may occur anytime**
 - a. Prepare a family emergency plan
 - b. Prepare a safety backpack
 - c. Identify the danger zones, safe areas and the Assembly location
- 2 Pay attention to any of these warning signals**
 - a. Identify evacuation routes
 - b. Very strong earthquake (it is difficult to walk, there are falling objects, damage to structure)
 - c. Long duration earthquake (about 1 minute or more)
 - d. Official message by sirens, commercial radio, television, NOAA radio
 - e. Sudden sea level change
 - f. Loud noise coming from the sea
- 3 In case of an earthquake protect yourself**
 - a. Drop
 - b. Cover
 - c. Hold on
- 4 Move away from hazard areas (in preference order depending on your location)**
 - a. Run to higher ground and / or away from the Coast
 - b. Go to a third floor or higher
 - c. Climb a tree
 - d. Run to an assembly point
 - e. 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.**



Per recommendation of the CARIBE EWS a Caribbean Tsunami Information Center is in the process of being established in Barbados

In preparing and planning for a tsunami, it is very important to take into consideration the impacts of an earthquake itself, because port facilities are often built on reclaimed land, they are susceptible to EQ damage



Images from the 2011 New Zealand earthquake, M 6.3





Stations of CARIBE EWS Core Seismic Stations on IRIS and PRSN

NOAA NWS Caribbean Tsunami Warning Program



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



● Contributing RTX IRIS/PRSN, ● Contributing RTX PRSN, ● Contributing RTX IRIS, ● Existing, ● Gap, ● Planned

Despite the advances, we are still no as ready as we should be, there are still critical elements of the TWS that are absent or need to be strengthened: Caribbean Tsunami Warning Center, Individual Preparation, Improved Planning...



We can't let the infrequency of the Tsunamis in the Caribbean disarm us, because **DISASTER** will strike

Indian Ocean 2004



Haiti 2010



Topics for Discussion with CSA

- Need to know your specific needs
 - Lead times required
 - Information in products
- Adaptation of the Caribbean tsunami protocol for ports and harbor operators
- Support for new TsunamiReady communities
 - Tsunami evacuation maps
 - Emergency response planning
- Hosting of sea level stations at port facilities
- Participate as an observer in CARIBE EWS

***We will never be
Tsunami Proof but we
need to continue
working to be as
Ready as possible
when the next
earthquake and
tsunami strikes our
region...***





More Information...

- NOAA NWS Caribbean Tsunami Warning Program
 - <http://www.srh.noaa.gov/srh/ctwp> Tel. 787-833-8433, 249-8307, christa.vonh@noaa.gov
- PRTWMP tsunamis inundation maps
 - <http://poseidon.uprm.edu>
- UNESCO IOC Caribe EWS
 - <http://www.ioc-tsunami.org/>
- PRSN Brochures, tsunami evacuation maps, sea level and seismic information
 - <http://redsismica.uprm.edu>, Tel. 787-833-8433

No Watch, Warning or Advisory is in effect for Puerto Rico and the Virgin Islands

Below information is preliminary

Magitude	Depth	Time (GMT)	Latitude	Longitude	Depth	Region
7.0	10	01/01/2010 12:12	18.00	-72.00	10	Caribbean Sea
6.5	10	01/01/2010 12:12	18.00	-72.00	10	Caribbean Sea
6.0	10	01/01/2010 12:12	18.00	-72.00	10	Caribbean Sea
5.5	10	01/01/2010 12:12	18.00	-72.00	10	Caribbean Sea
5.0	10	01/01/2010 12:12	18.00	-72.00	10	Caribbean Sea

The CTWP also are on Facebook, like us today...



Thank you very much...