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Caribbean Tsunami  
Information Centre  
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Ministry of Foreign Affairs

Regional Training Workshop on Pacific Tsunami Warning  
Center Enhanced Tsunami Products for ICG/CARIBE EWS  
31 October – 02 November, 2017  
Cartagena, Colombia

# 2.3 Key Stakeholders: What do TER agencies provide to the Public? Challenges in Alerting, Evacuation, and Safe to Return

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# Tsunami Emergency Response (TER)

- TER: Race Against Time!
- Goal: Save lives.  
Reduce property damage.
- Must: Act FAST without confusion.
- Notes:
  - Tsunamis may (or may not) cause damage. May be “*Destructive*” or “*Non-Destructive*”
  - *Non-destructive tsunamis are small, but measurable on sea level gauges.*

# TER Expectations

## Key Question:

Has a destructive tsunami been generated?

Yes or No?

Tsunami Decision-Making Environment:

TER want “black & white => Yes or No answer”



TWC operate in “shades of grey color”



# Tsunami Warning Center (TWC) and Tsunami Service Providers (TSP)

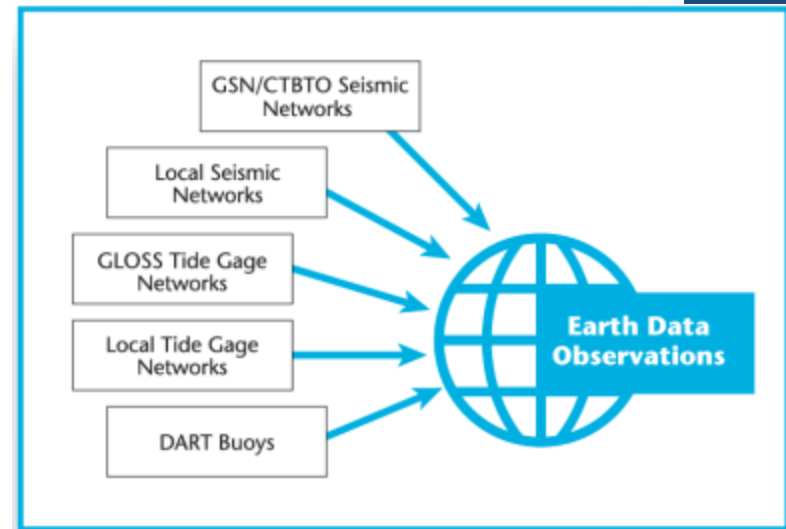
TWC/TSP: “eyes and ears” are earthquake and tsunami **detection instruments**.

Limitations include:

- Lack of timely data.
- Lack of time to analyze data before wave impact.

*Result =>*

TWC/TSP may not be able to confirm existence of local destructive tsunami prior to official TER evacuation decision making.



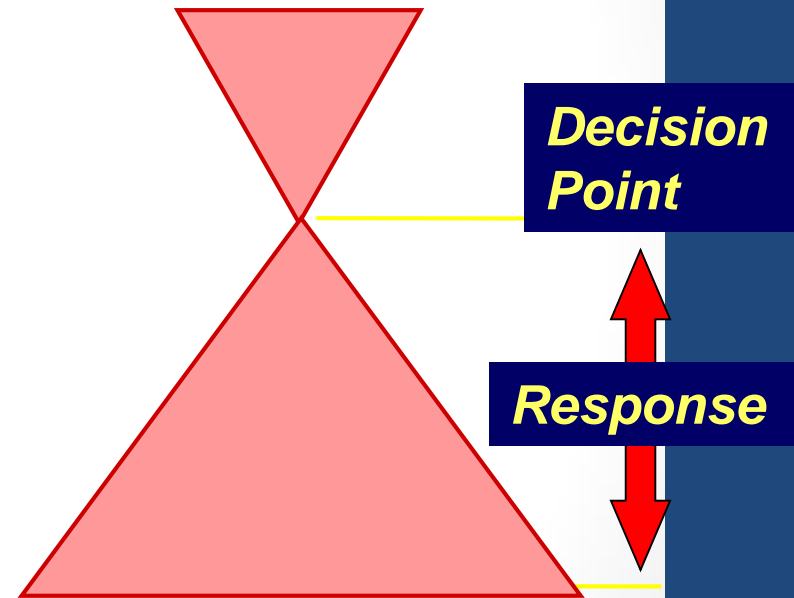
# Local Tsunami

- Preliminary analysis:

There is “potential” of a destructive tsunami.

- At time of official evacuation decision making:
  - Likely **NO confirmation** of intensity of tsunami waves.
  - Local Warning issued **based only on seismic data**.

**Warning Center/Service Provider:**  
Science, Technology,  
Forecast



**Emergency Operations Center:**  
Public Safety Advisory  
Lives saved, Damage less

# TER – Alerting Requirements

- 4 R's: Redundant, Reliable, Ready, Rapid
- Wide Accessibility
- Speed
- Accurate and reliable
- Live updates
- 24/7
- Skilled Human Resources
- Established Infrastructure
- Established Broadcasting SOP
- Experience in Breaking News
- Provide Guidance



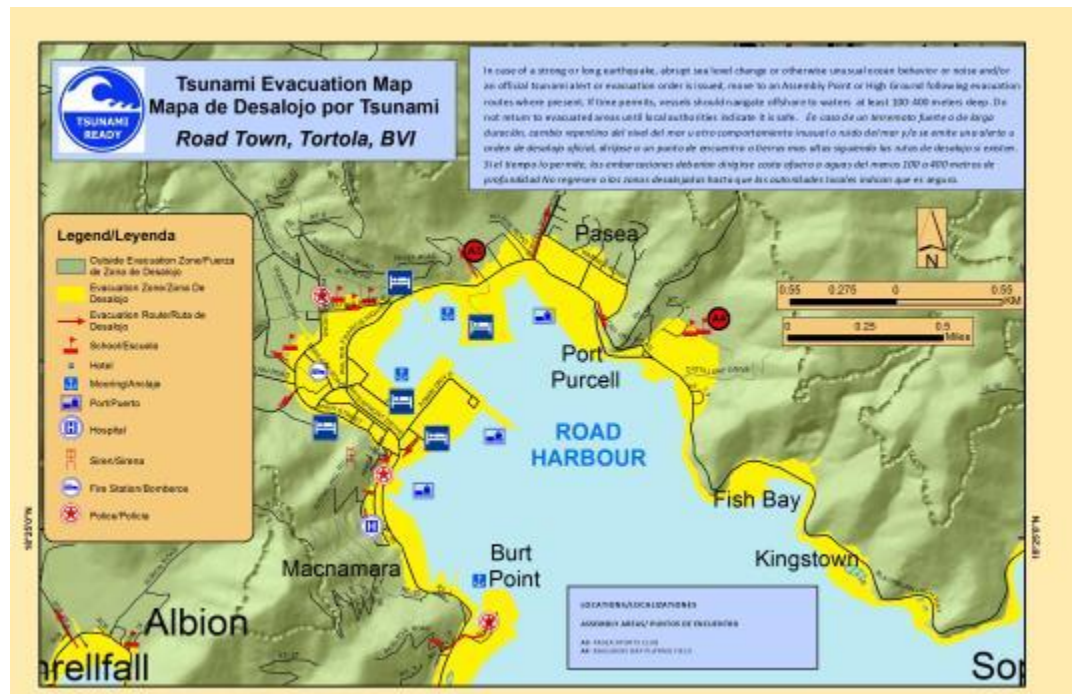
# Alerting - Challenges

- Utility and communications systems disrupted or destroyed due to earthquake
- Areas where electricity is scarce
- Time of day (night people are sleeping TV/radio off)
- Communication system overloaded



# Tsunami Evacuation

Modeling  $\longrightarrow$  Inundation map  $\longrightarrow$  Evacuation map



**Tsunami evacuation maps are community-owned**



# Evacuation - Challenges

## Distant & Local tsunami responses:

- Day time or night time
- People awake or asleep
- Regular business / school hrs vs. non-duty hrs
- Weekday vs. weekends
- Tourist Peak vs. Off-season
- Traffic jams and rush-hour periods
- Television and radio stations off-air
- Little to no response personnel available to support evacuation (*during local tsunami*)

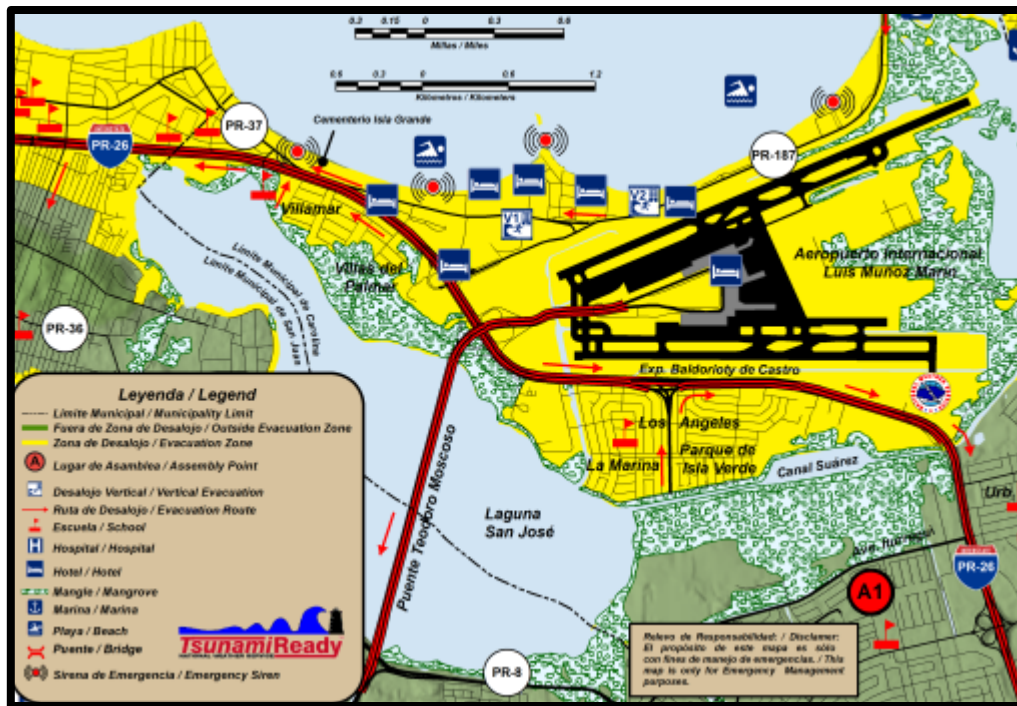
# Evacuation Problems?

## Issues:

- No high ground
- No time to go inland
- Special needs populations

## Solution:

- Vertical evacuation



# Evacuation Siting, Spacing, and Sizing

Warning time	Ambulatory Speed*	Travel Distance**	Required Spacing
> 2 hrs	3.2 km/hr (1 m/s) 2 mph	6.4 km 4 miles	12.8 km 8 miles
30 min	3.2 km/hr (1 m/s) 2 mph	1.6 km 1 mile	3.2 km 2 miles
15 min	3.2 km/hr (1 m/s) 2 mph	0.8 km 0.5 mile	1.6 km 1 mile

\* Assumed average speed of mobility-impaired population

\*\* Must allow time for vertical circulation within refuge

# Vertical Evacuation - costs

- Structural costs higher
- Structural only a portion of total building costs (5% to 40%)
- Tsunami-resistant structures estimated 10% to 20% increase in total constructions costs



# TER – Safe to Return (All-Clear)

- Tsunami is a series of waves striking coastline for hours
- Resonance in bays / harbors
- Debris (floating)
- HAZMAT spills
- Additional earthquake damage

Who declares “All-Clear”?

National/Provincial/Local TER...?

# Evacuation Decision affects TWS Credibility

<b><i>ACTION</i></b>	<b><i>RESULT</i></b>	<b><i>PERFORMANCE</i></b>
<b>Official Evacuation</b>	<b>Destructive Tsunami</b>	<b>Successful TWS</b>
<b>No Official Evacuation</b>	<b>Non-destructive Tsunami</b>	<b>Successful TWS</b>
<b>Official Evacuation</b>	<b>Non-destructive Tsunami</b>	<b>TWS limitation - Credibility Downgraded</b>
<b>No Official Evacuation</b>	<b>Destructive Tsunami</b>	<b>Failed TWS</b>

*Note: There will be public criticism if alert notifications took too long to reach people on the coastline, or people not notified at all.*

# Hawaii example: Cost of “False warning”

Pacific-wide Tsunami Warnings Issued  
Sirens sounded, Statewide evacuations

**BUT small, non-destructive tsunamis**

- 1986 - mid-afternoon to pm rush hour  
1994 - early morning to am rush hour

## Losses

(DBEDT Study) => \$50M

(extrapolated) => \$30M

(extrapolated) => \$68M



- **Media reports shape public opinion**

# Achieving Successful Outcomes

- *Disclose “End-to-End” TWS limitations beforehand* to Stakeholders (agencies, key decision-makers at National / Provincial / Local levels)
- **Convene Press Conference shortly after** Warning cancellation to explain what happened and how official evacuation decisions were determined.





# Improving Tsunami Response

## Community-level focus / customize outreach:

- Know tsunami natural warning signs
- Have evacuation maps
- Know evacuation routes/assembly areas
- Have community support network
- Have family plan and preparedness kit
- Know response for local and distant tsunamis
- Know community warning system



# How to Improve Tsunami Response

## Exercises Drills – CARIBE WAVE

- Drill evacuation of schools and communities
- Exercise communications protocols
- Exercise all levels of government





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# Thank You

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