



Tsunami Evacuation Maps, Plans, and Procedures (TEMPP)

... communities knowing what to do and where to go

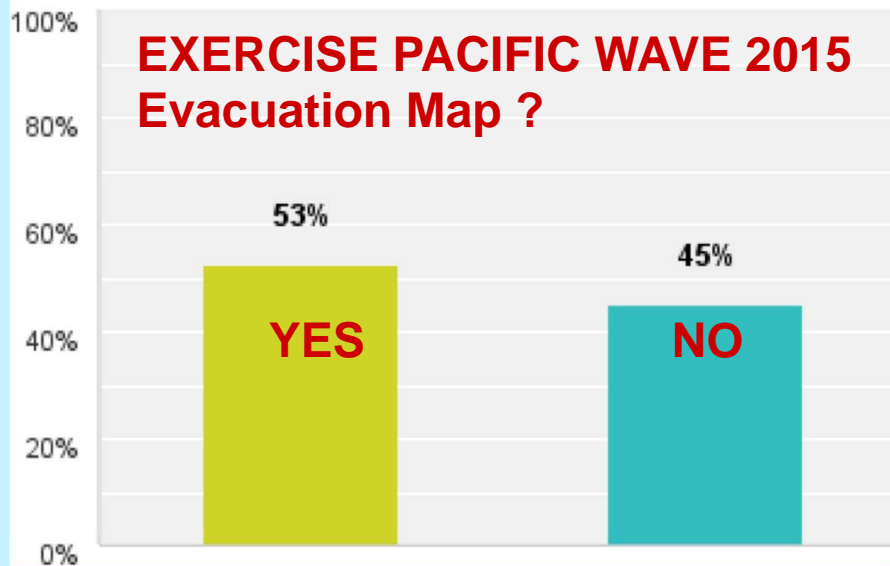
*ITIC Essential Community Preparedness
Capacity Building, Honduras, Central America, 2015-16*



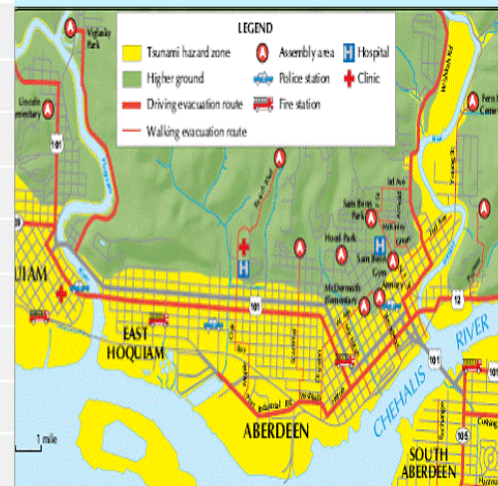
PTWS Next Priority (5 yrs) – Preparedness

Since 2014 PTWS PTWC New Products start, Preparedness:

- *Communities must know what to do and where to go when a tsunami is imminent (> 50% lack plans)*
- *ITIC capacity building course –Tsunami Evacuation Maps, Plans, and Procedures (TEMPP)*



Tsunami Signage



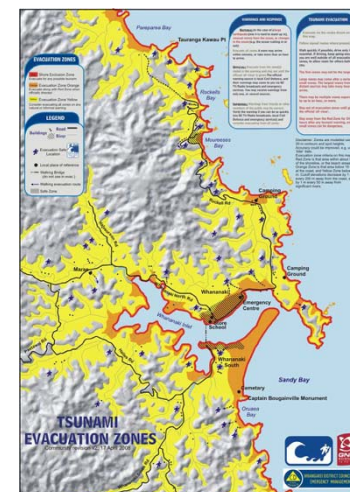
TEMPP Course: 2015-2017

GOAL:

- *Reliable tsunami evacuation maps done by communities and govt agencies.*
- **Globally applicable standardized tools and methodologies**
- ◆ **Develop with Pilot – Central America, in Spanish**
- ◆ **5 linked training workshops over 1.5 years (2015-16)**
Start with modeling. End with functional exercise
- ◆ **Final Product: IOC Publication (2017) – TEMPP**
Review from ICGs, Global TOWS Inter-ICG TT Disaster Mgmt & Preparedness
- ◆ **Simultaneous pilots other countries possible subject to funding**

Course Development - Partners

- ❑ **ITIC lead**, with USA (CTWP, PMEL, NTHMP), NZ, Philippines, IOC, PTWS WGs, TOWS WG
- ❑ **Course Development Team** -
Warning, Modeling, Disaster Mgmt, Community Preparedness, Educ/Outreach practitioners
- ❑ **Pilot Country (Honduras) feedback**
- ❑ **PTWS Task Team Evac Planning and Mapping**
 - Chair – Dr. Laura Kong, ITIC
 - Caribbean: Alison Brome, CTIC; Patrick Tyburn, Martinique, France
 - Central America: Norwin Acosta, INETER, Nicaragua
 - SE Pacific: Representative, NDMO (Chile ONEMI or Peru INDECI), Chair, PTWS Southeast Pacific Working Group
 - SW Pacific: 'Ofa Fa'anunu, Tonga Metl Svc; Chair, PTWS SWP WG
 - DRR and Community Preparedness: Julie Leonard, PTWS WG 3 Vice-Chair; John Kimbrough, USAID/OFDA/LAC
 - IO and SE Asia: Ardito Kodijat, IOTIC; Irina Rafliana, Indonesia
 - Mediterranean and North Atlantic: Gerassimos Papadopoulos, Greece



New Zealand

Focus and Stakeholders:

Scientists make Inundation Maps for Evacuation

1. Simple approach (poor bathymetry):

- Historical observations provide value of maximum tsunami run-up in locality
- This constant value of maximum run-up will be used to determine inundation line everywhere in the community

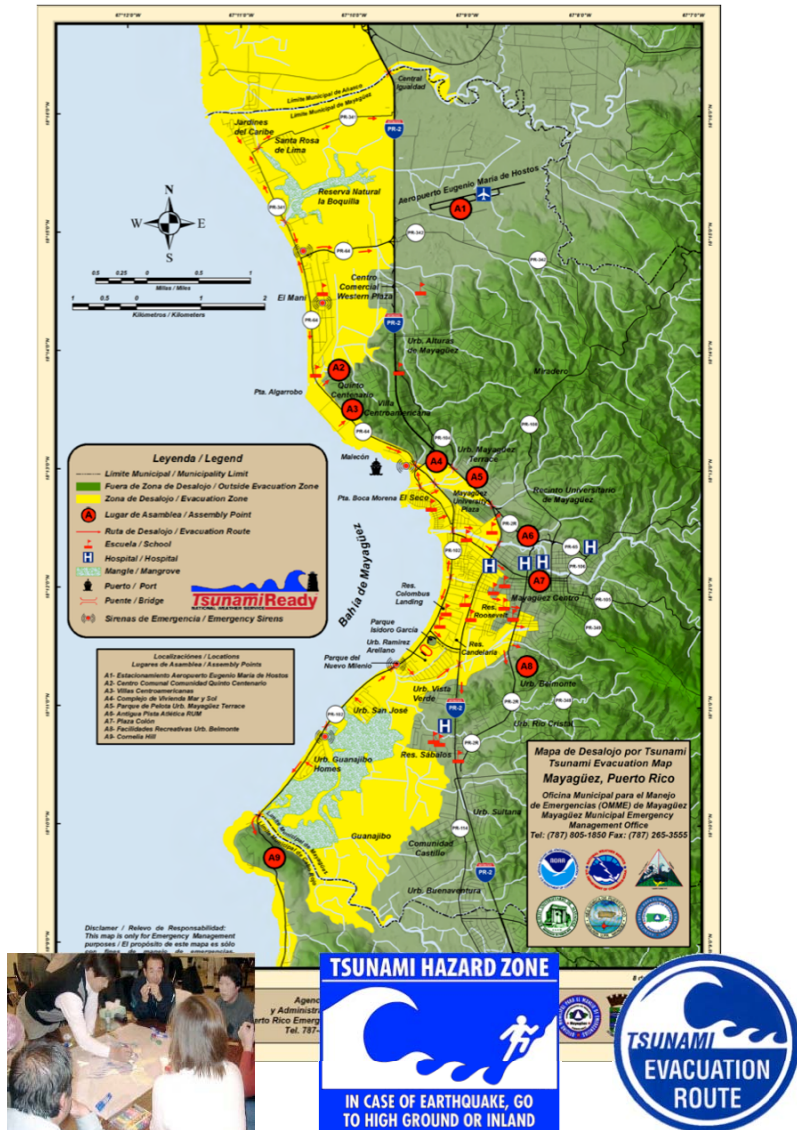
2. Refined approach:

- Historical seismic events are used as tsunami sources in hydrodynamic models.
- Hydrodynamic models are used to compute tsunami inundation and run-up. Variable maximum run-up will be used at different locations

3. Sophisticated approach (good bathymetry):

- A Credible Worst Case scenario is evaluated from all available data (historical, seismic, tectonic)
- Hydrodynamic models are used to compute tsunami inundation and run-up. Variable maximum run-up will be used at different locations

Focus and Stakeholders: Communities make Evacuation Maps



- ✓ Local workshops
- ✓ All Stakeholders
- ✓ GIS-facilitated maps
- ✓ Critical facilities, Schools, Hospitals, Special needs
- ✓ Safe Assembly areas
- ✓ Time of day, year
- ✓ Walking routes, Practice Exercises

WORKSHOP / TRAINING SCHEDULE	DATES	PURPOSE / GOAL
TEMPP 1: Tsunami Inundation Modeling – ComMIT/MOST tool	27-31 July 2015	Inundation modeling training using ComMIT tool and MOST model
TEMPP 2: Seismic Tsunami Sources for Honduras Meeting	29 Feb– 1 March 2016	Identification of credible worst-case tsunami scenarios to use for inundation mapping
TEMPP 2: Inundation Mapping for Evacuation – process	2-3 March 2016	Create Inundation map for a given community as an ensemble of inundation scenarios. Output results in GIS formats
TEMPP 3: Evacuation Mapping – process, Intl Tsunami Ready (TR)	15-19 Aug 2016	Create Evacuation Map from Inundation Map using GIS and community process; Implement national TR program
TEMPP 4: Response Plans and SOPs, Socialization, Community Exercises	27-30 Sep 2016	Create Response Plan (warning / evacuation SOPs); Develop Exercise Plan, Create essential awareness materials (signage, maps, flyers)
TEMPP 5 Official Adoption Ceremony, Functional Exercise	Nov / Dec 2016	Official Adoption of Maps, Functional Tsunami Exercise, inc evacuation, TR recognition, Pilot Wrap-up

Pilot Activities: May – June, 2015

1. IOC CL 2578, Pilot Announcement, May 2015

Honduras selected (1 Pacific, 1 Caribbean community)

2. Pilot Kick-off, June 15-19, 2015

- ❑ Stakeholders coordination meeting
- ❑ Brief on process. ID communities/agencies/govt/NGO

3. Course Development, June 22-26, 2015 + continuing

- ❑ Inundation and evacuation mapping best practices – Japan, Hawaii/WA/PR States, Philippines, NZ, IOC
- ❑ Hazard Assessment tools: NOAA ComMIT, GIS



TEMPP1: ComMIT Modeling - July 27-31, 2015

- Inundation and evacuation mapping best practices:
- Hazard and evacuation mapping tools: ComMIT, GIS



TEMPP Input and Planning, Feb, June 2016

- PTWS Task Team on Evacuation Mapping and Planning and TOWS TTs - input
- TOWS Task Team on Disaster Management & Preparedness (TT-DMP)
 - *TEMPP Project to establish Evacuation Mapping Guidelines (TT-DMP activity)*



TEMPP2, Feb 29 – Mar 3, 2016

- Seismic Tsunami Sources for Honduras – Expert Mtg
- Tsunami Inundation Mapping for Evacuation training

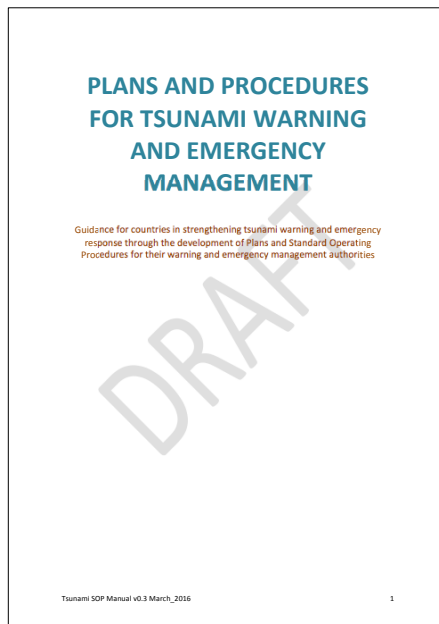


Course Documents

- ❑ **Evacuation Overview**
- ❑ **Numerical Models in Hazard Assessment**
- ❑ **ComMIT tool manual (MOST model), including Appendices (abridged requirements, in Spanish)**
- ❑ **Seismic Worst-Case Scenarios for Tsunami Hazard Assessment (no credible sources)**
- ❑ **Establishing Tsunami Inundation for areas not-modeled or with low-hazard (no history, low population, poor DEM)**
- ❑ **Creating Evacuation Maps – 2013 Japan National Guidance, Philippines, NTHMP**
- ❑ **How to Create Tsunami Response Plans – UNESCO SOPs, NTHMP (Hawaii, CA)**
- ❑ **How to Conduct Community Tsunami Exercises - NTHMP**

Tsunami SOP Manual (2016)

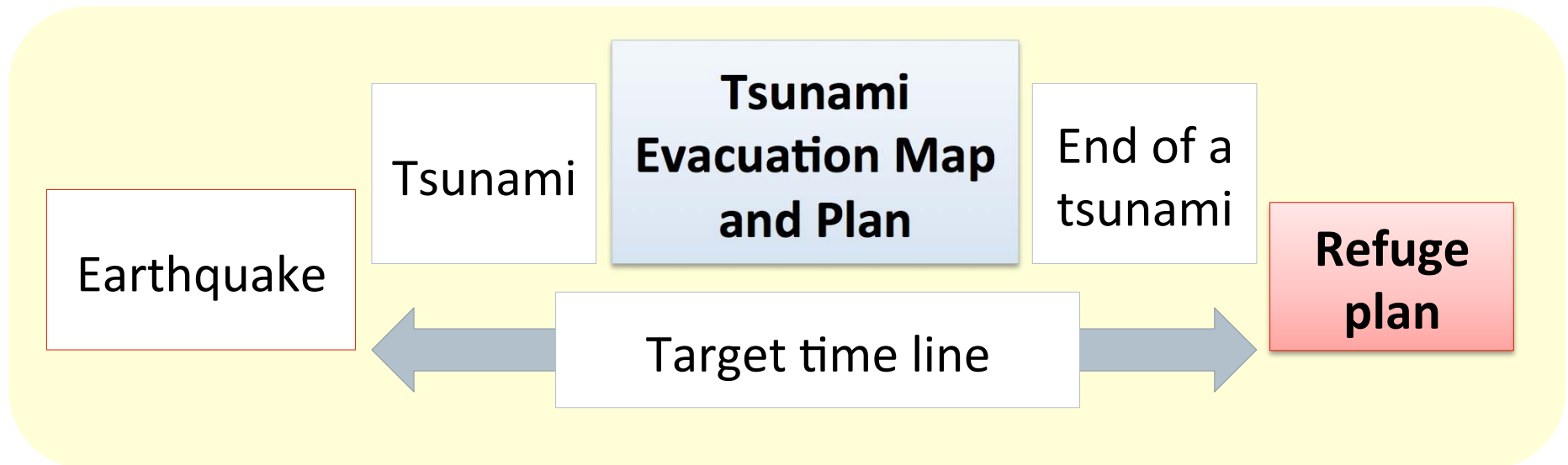
- ❑ UNESCO - ITIC Project *(from 2008)*
- ❑ US Examples (HI, CA)
 - Response Plans
 - EOC Checklists



READER'S GUIDE.....	
1. INTRODUCTION.....	
2. END-TO-END TSUNAMI WARNING SYSTEM	
2.1 What is a Tsunami Warning System (TWS)?	
2.2 Understanding the end-to-end system	
2.3 Documents supporting a TWS	
3. TSUNAMI WARNING	
3.1 Introduction	
3.2 Roles and Responsibilities of a TSP	
3.3 Roles and Responsibilities of a NTWC	
3.4 NTWC Operations Manual	
3.5 NTWC SOPS	
3.6 NTWC SOP Development	
3.7 Core activities of a NTWC – event response operations	
3.8 Core activities of a NTWC – post and non-event operations	
4. TSUNAMI EMERGENCY RESPONSE	
4.1 Introduction	
4.2 The Roles and Responsibilities of a EMA.....	
4.3 Tsunami emergency response plans	
4.4 Tsunami emergency response SOPs.....	
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5. GENERAL BIBLIOGRAPHY.....	
6. ANNEXES.....	
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Annex C CASE STUDIES National Tsunami Warning and Emergency Response Plan, NTWC SOP, TER SOPS (Distant-generated Tsunami SOP; local-generated Tsunami and Earthquake SOP, Plans and Planning Template, Tsunami Evacuation SOP	64
Annex D SOP STRENGTHENING PROJECT	

Japan Fire & Disaster Management Agency

- ❑ **2013 Report: Study Group of Promoting Guideline for Tsunami Evacuation Countermeasures**
- ❑ **National - Guideline for Municipality to make Tsunami Evacuation Map and Plan**



Prefecture

Tsunami Evacuation Planning – flow chart

Set tsunami evacuation areas

Guideline for Municipalities to Make Tsunami Evacuation Map and Plan

Municipality

Identify evacuation actions for warning or advisory

Expected casualties and/or property damage

Identify actions for tourists, fishermen, and harbor workers

Designate tsunami evacuation area

Resident Cooperation

Workshops

- Specify safety level of emergency evacuation points – what is purpose
- Educate on evacuating to safe places
- Identify emergency evacuation points by regional workshops
- Identify building tsunami evacuation towers or artificial elevations

Identify difficult evacuation area (vertical)

Safe emergency evacuation points selected by municipality

Official designation of emergency evacuation points

Safe evacuation routes selected by municipality

Official designation of evacuation roads and routes

What is known and needed:

- Expected Tsunami Arrival Time
- Set evacuation goals
- Set evacuation roads and routes
- Set Evacuation possible distance

Workshop – Responding Topics

- Initial actions
- Ensuring safety of participants to lead evacuation
- Authoritative tsunami information and transmission
- Issuing evacuation order
- Tsunami education and outreach
- Evacuation drill
- Other notes

————→ yes

.....→ no

Make Tsunami evacuation plan and hazard map. Socialize

Review through drills etc.

Workshop Steps

① Understand tsunami danger

What is making a regional evacuation plan important. Understand the regional tsunami danger

- Understanding about the purpose of workshop (3.3.1)
- Understanding about disasters (3.3.2)
- Understanding about regional risks (3.3.3)



② Consider how to evacuate from a tsunami

Consider the evacuation (When, How, Where)

- What are the evacuation actions (3.3.4)
 - ✓ Making the tsunami evacuation map (evacuation routes and points)
 - ✓ Thinking about actions before the evacuation, things to bring, the means to get information, and so on.



③ Verify evacuation map and plan through drills (3.3.5)

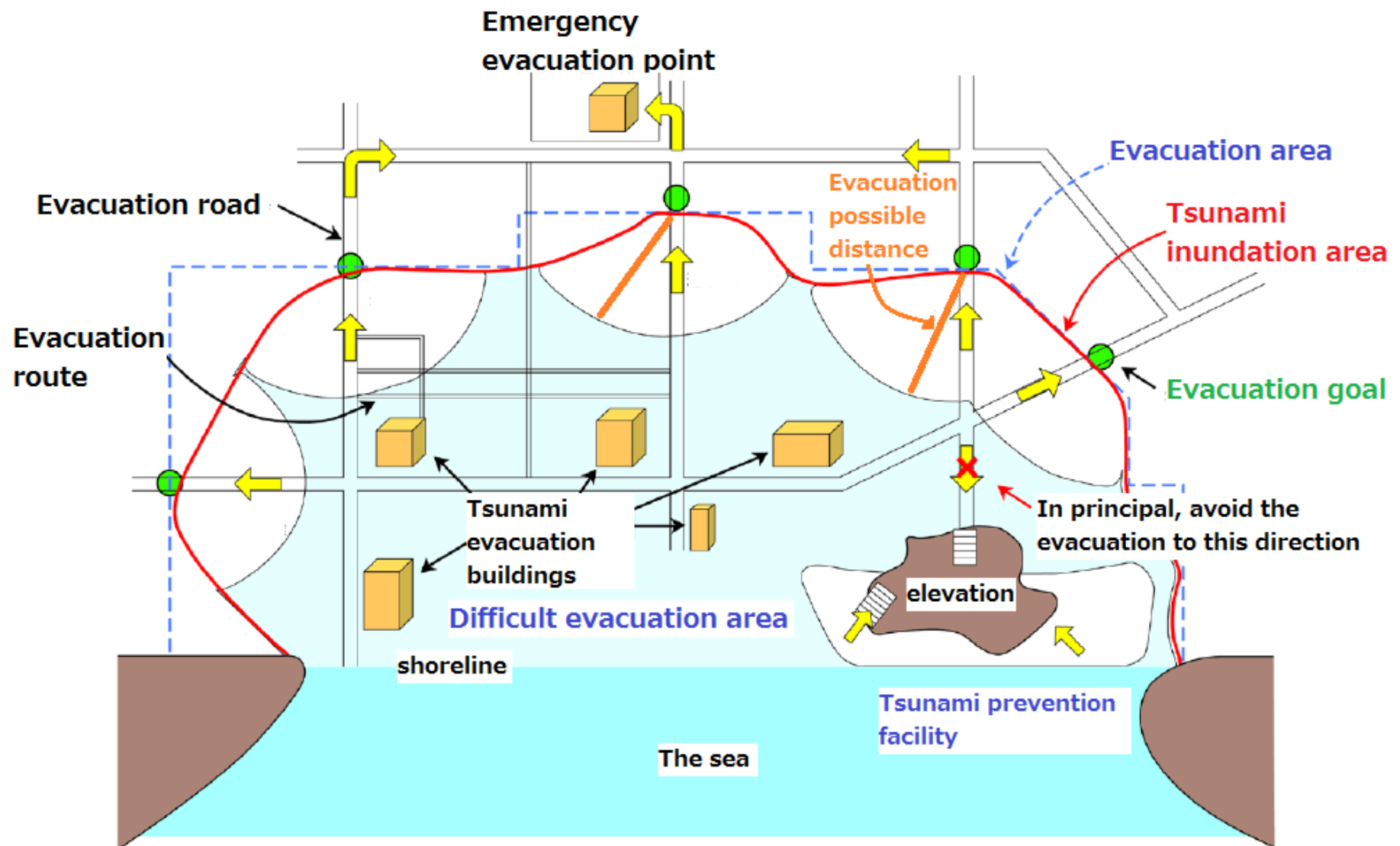
Practice an evacuation drill, and review evacuation routes or actions based on lessons learned



④ Consider future tsunami measures (3.3.6)

Consider how to make use of what was learned in the workshop as future tsunami mitigation measures

Conceptual Diagram for Tsunami Evacuation Map and Plan



•Tsunami Drills

•Japan example

個別訓練タイムトライアル



★訓練のすすめ方

簡略版では実際に避難しながら、自宅から避難場所までの経路と所要時間を確認する作業が中心になります。ハザードマップなどを参照しながら、どこへどのように逃げるのかを事前に考えておく必要があります。

ビデオ撮影を加える場合、訓練の一部始終を子供たちがビデオカメラで撮影します。2台のカメラを用いて、1台は訓練参加者の表情を、もう1台は周囲の状況を撮影します。さらに別の子供が、その時々状況をメモに記録します。たとえば、「そろそろ疲れてきた」「避難のためには、周囲の協力やリヤカーの利用が必要かも」といった具合です。

★動画カルテ

ビデオ撮影を加えた場合、すべての結果を「動画カルテ」と呼ぶ映像にまとめます。画面は4分割されています。

左上の画面には1台目のカメラ映像、右下には2台目のカメラ映像、右上には訓練参加者の感想(赤字)と子供たちからのメッセージ(青字)、そして左下の地図には、避難経路と現在位置が赤色の線と丸印で表示されています。画面中央には、地震発生時点からの時間経過の表示があり、4つの画面はスタートからゴールまでずっと連動しています。(右写真を参照ください)



さらに本格的にする場合は、左下の地図に津波浸水シミュレーションの映像を、訓練者の動きと重ねて表示することも可能です。これによって、たとえば「ここまで逃げたときに、自宅はすでに津波が押し寄せてきている。間一髪だった」ということが一目瞭然でわかります。

★期待される効果

自分自身が「主役」をつとめる避難訓練を通して、津波避難を「わがこと」として意識して、決してあきらめることなく、逆に油断することなく、自分(家族)の津波避難の課題を見つけ、その解決方法を個別具体的に考えることができます。

学校での防災学習と組み合わせる実施すれば、子供を含む地域住民の防災意識を高め、津波に関する知識を増すだけでなく、地域、学校、行政の間の協力関係をさらに強める効果も期待できます。

また子供たちから、訓練に関するメッセージを訓練参加者(たとえば高齢者)にお届けしますので、世代を越えて「一緒に逃げよう」、「ともに津波の危険と向き合おう」という気持ちを高めることにもつながります。

禁無断転載 © 京都大学防災研究所 矢守研究室



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動画カルテ

地震発生



まず、身を守る



避難路を進む



高台への上り坂



避難広場が見えてきた



無事到着



HOW TO CONDUCT TSUNAMI DRILL

A **TSUNAMI** is a series of waves commonly generated by undersea earthquakes. Because of this, tsunami areas.

A **TSUNAMI HAZARD MAP** shows areas that can be affected by a tsunami. Hazard maps are meant to educate and prepare the community and can be used as tools in planning evacuations. These maps are generated by experts and specialists after careful study of the area.

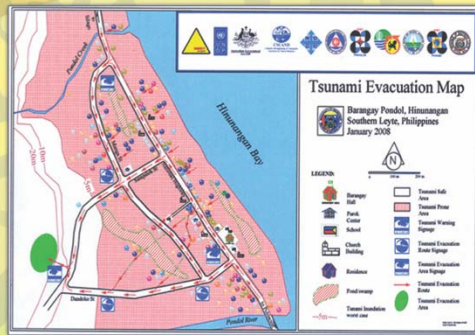


Hinunangan, Southern Leyte Tsunami Hazard Map

DESIGNING A TSUNAMI EVACUATION PLAN

Step 1 Acquire a tsunami hazard map
Acquire detailed community map

A **TSUNAMI** hazard zone direction to



Tsunami Evacuation Map of Brgy. Pondol, Hinunangan, Southern Leyte, January 2008

A **TSUNAMI EVACUATION MAP** shows areas identified within hazard zones and areas which are safe. This map provides direction to identified evacuation sites.

DESIGNING A TSUNAMI EVACUATION PLAN

Step 1	Acquire a tsunami hazard map Acquire detailed community map
Step 2	Identify safe evacuation areas The following are possible bases for site selection: (a) Should be outside identified Tsunami Hazard Zone; (b) Can be reached by foot within the shortest possible time; (c) The total area of the site can hold an entire community (or certain percentage of population of the community if several sites are selected); and (d) Can be easily identified by residents (examples: a prominent hill, a school, an open park, among others).
Step 3	Recommend evacuation routes The Tsunami Evacuation Map should show the best routes (safest, shortest/fastest way) for people to use in case of emergencies. The following are some characteristics of ideal evacuation routes: (a) wide streets, if possible, no bridges; (b) away from landslide-prone areas; and (c) limited overhead power lines and similar hazards. While in the process of designing the plan, it is best to walk along routes to identify hazards and check on ground conditions that may not be obvious on maps.
Step 4	Discuss with community leaders and residents to put up three kinds of signages: a) tsunami prone area, b) tsunami evacuation route, and c) tsunami evacuation site • Create draft of tsunami evacuation plan / working map showing tsunami inundation zone, identified evacuation areas and routes. • Organize a small group workshop with community leaders and residents. • Discuss draft map and seek comments and inputs to improve map.
Step 5	Develop complete version of the map Finalize map from the inputs of community members and leaders. Evacuation maps should be simple and easy to read, and should include essential information only such as: (a) tsunami hazard zones; (b) safe evacuation areas; (c) recommended evacuation routes; and (d) local landmarks to help people orient themselves on the map.

After coming up with the final tsunami evacuation plan:

The **Barangay Disaster Risk Reduction and Management Committee (BDRRMC)** should take the lead in implementing the plan (e.g. assign specific roles to each member of the community, and conduct regular tsunami drills).



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A **TSUNAMI EVACUATION MAP** shows areas identified within hazard zones and areas which are safe. This map provides direction to identified evacuation sites.

PHASES OF A TSUNAMI DRILL

1 ALARM PHASE:

1 minute alarm signifying a strong earthquake



2 REACTION:

People do the response procedure during the earthquake such as the "duck, cover and hold"



3 EVACUATION PHASE:

Residents quickly move out of their houses to go to designated evacuation areas

4 ASSEMBLY PHASE:

Families from the same area or puroks should group together to better facilitate headcount/ accounting of residents



5 HEADCOUNT PHASE:

How many are expected to arrive based on barangay population information?

6 DRILL TERMINATION:

The drill master should inform the participants that the drill has ended



7 POST-DRILL EVALUATION:

Assessing the conduct of drill is important for improving future activities

**Philippines
example**

International Tsunami Ready (I-TR) Guidelines

- **UNESCO IOC - 2015**
- Pilot – Caribbean:
Anguilla, BVI, St Kitts & Nevis (2016), DR, Haiti? (2017)
- Pilot – Pacific (2017):
Honduras, Ecuador, Vanuatu, Samoa, Tonga
- Pilot – Indian Ocean:
Regional discussion on World Tsunami Awareness Day (2016)

INTERNATIONAL TSUNAMI READY (I-TR)	DONE
MITIGATION (MIT)	
MIT-1. Have designated and mapped tsunami hazard zones	X
MIT-2. Have a public display of tsunami information	X
PREPAREDNESS (PREP)	
PREP-1. Produce easily understood tsunami evacuation maps as determined to be appropriate by local authorities in collaboration with communities.	X
PREP-2. Develop and distribute outreach and public education materials	X
PREP-3. Hold at least three outreach or educational activities annually	X
PREP-4. Conduct an annual tsunami community exercise.	X
RESPONSE (RESP)	
RESP-1. Address tsunami hazards in the community's emergency operations plan (EOP).	X
RESP-2. Commit to supporting the emergency operations center (EOC) during a tsunami incident if an EOC is opened and activated.	X
RESP-3. Have redundant and reliable means for a 24-hour warning point (and EOC if activated) to receive official tsunami threats.	X
RESP-4. Have redundant and reliable means for 24-hour warning point and/or EOC to disseminate official tsunami alerts to the public.	X

(Caribbean Guidelines, 2015)



Thank You

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