Mainstreaming Disaster Risk Reduction (MDRR) Project

Project Background

- **Funding Source:** Government of Japan
- **Administered by:** World Bank
- **Total Funding:** VT251 Million
- **Duration:** 2013 to 2016 (4 years)
- **Project Sites:** Port Vila & Greater Port Vila (South Efate) and Luganville & Greater Luganville (South Santo) i.e. pilot sites
- **Implementing agency:** Vanuatu Meteorology and Geo-hazards Department in partnership with the National Disaster Management Office (NDMO)
MDRR Project Components

- Component 1: Risk Mapping to Support Urban Preparedness and Planning (~VT66 Million)
- Component 2: Establish a tsunami warning system for Port Vila and Luganville (~VT136.5 Million)
- Component 3: Strengthen the National Advisory Board on Climate Change and Disaster Risk Reduction (~VT21 Million)
Risk Mapping and Planning for Urban Preparedness Project (RMPUP Project)

- As part of the MDRR project implemented by VMGD
- LiDAR data were collected by Becca and GNS Science in 2012/13
- LiDAR data used to generate high quality digital elevation models (DEM) of South Efate (Port Vila & Greater Port Vila) and South Santo (Luganville & Greater Luganville) with assistance from Becca and GNS Science
- Stage 3 of the RMPUP Project covers the Urban Risk Management Strategy (Becca, GNS Science, NIWA), and Tsunami Evacuation maps are an integral part of that strategy
- Numeric modelling of 15 tsunami generating earthquake scenarios was undertaken by GNS Science to provide an estimate of maximum credible tsunami amplitude at coast from all possible sources affecting the region
Greater Lunganville Study Area showing the municipality boundary and extent of LiDAR (grey topographic data); South Santo

Tsunami Risk (Maximum for all scenarios) for Port Vila and Greater Port Vila; South Efate
Tsunami Risk (Maximum for all scenarios) for Lugarville and Greater Lugarville; South Santo

South Efate Tsunami Evacuation Zones

<table>
<thead>
<tr>
<th>Evacuation Zone</th>
<th>Intention for use</th>
<th>Potential run-up at coast</th>
<th>High Tide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>0.3-1 m tsunami threat warning</td>
<td>2 m</td>
<td>0.45 m</td>
</tr>
<tr>
<td>Orange</td>
<td>1-3 m tsunami threat warning</td>
<td>6 m + 20% = 7.2 m</td>
<td>0.45 m</td>
</tr>
<tr>
<td>Yellow</td>
<td>Maximum credible tsunami or ‘greater than 3 m’ tsunami threat warning</td>
<td>35 m</td>
<td>0.45 m</td>
</tr>
</tbody>
</table>
South Santo Tsunami Evacuation Zones

<table>
<thead>
<tr>
<th>Evacuation Zone</th>
<th>Intention for use</th>
<th>Potential run-up at high tide</th>
<th>High Tide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>0.3-1 m tsunami threat warning</td>
<td>2 m</td>
<td>0.5 m</td>
</tr>
<tr>
<td>Orange</td>
<td>1.1-3 m tsunami threat warning</td>
<td>4 m + 20% = 7.2 m</td>
<td>0.5 m</td>
</tr>
<tr>
<td>Yellow</td>
<td>Maximum credible tsunami or ‘greater than 3 m’ tsunami threat warning</td>
<td>25 m in the east part of the coast</td>
<td>0.5 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35 m for the remainder of the coast</td>
<td></td>
</tr>
</tbody>
</table>

Tsunami Early Warning

- VMGD issued tsunami information, advisory or warning after significant earthquake (local, regional, trans-Oceanic/Distant)
- MDRR; Sirens, SMS, Website, Email (basically a dissemination platform)
- Natural Warning Signs of pending tsunami:
  - Strong and/or long earthquake (does not have to be both)
  - Change in sea level
  - Roaring Sound
Tsunami Sirens

Luganville and Greater Luganville Siren Sites; Southeast Santo

- Environmental and Social Screening Safe (ESSS) guard conducted
- Siren pole foundations under construction since last month
Tsunami Sirens
Port Vila and Greater Port Vila Siren Sites; South Efate

Tsunami Response

- Tsunami Response is a life saving activity = **Tsunami Evacuation**
- Products developed to aid evacuation
  - *Tsunami Evacuation Maps* (**Tsunami Evacuation Plan**)
  - *Tsunami Information Boards* (**Tsunami Evacuation Plan**)
  - *Tsunami Evacuation Signs*
    - Danger zone sign
    - Safe Route signs
    - Safe Location sign
Tsunami Evacuation Map

- Draft tsunami evacuation maps are created using QGIS for community consultations and workshops in Greater Port Vila (South Efate) and Greater Luganville (South Santo)
- Tsunami evacuation maps are created using QGIS after community consultations and workshops in Greater Port Vila and Greater Luganville
- The tsunami evacuation map is basically a tsunami evacuation plan to aid communities, general public and visitors to evacuate to a safe location when there is a tsunami threat or a warning is in effect
- Understanding the map is crucial in executing the plan efficiently and calmly during tsunami threats or warnings

Tsunami Evacuation Map

- Village/Community consultation process
- Provincial and Municipality Meetings
- Facilitator Training
- Presentation
- Break-out groups

Example of activity during meeting with provincial and municipality authorities; seen here are Luganville municipality councillors having a go on a draft Luganville evacuation map

Example of presentation used during Facilitator Trainings

Example of presentation used during Community Consultations
The main features on the map:

- Land and sea; the sea is pink whilst the land is either red, orange, yellow or just plain vegetation
- There are 3 different evacuation zones on land;
  - Red - coastal low lying areas, areas around an estuary or flood plain. Generally all land areas from 0-2 m above mean sea level.
  - Orange - coastal low lying areas, areas around an estuary or flood plain. Generally all land areas from 2-7.5 m above mean sea level.
  - Yellow - all land areas from 7.5-35 m above mean sea level.
- Vegetation – all land areas located 35 m or more above mean sea level. Generally land areas outside the evacuation zones.

Tsunami Evacuation Map

- The map has a scale; usually on the right bottom corner. Generally scale converts centimeter length on map to meter scale on ground. Provides an idea on distance one needs to move during evacuation.
- The map has a title; usually at top center e.g. PORT VILA
- The directions on the map are as follows;
  - Top—the top half of the map is always the North
  - Bottom—the bottom half of the map is always the South
  - Right—the right side of the map is always the East
  - Left—the left side of the map is always the West
Tsunami Evacuation Map

- The map has a legend. The legend explains the different evacuation zones and the main map features to aid tsunami evacuation.

Explanation of the 3 different evacuation zones

- Language: Bislama, English & French

Tsunami Evacuation Plan

- Apart from the map, the tsunami evacuation plan has the following:
  - Key Tsunami Message—this is highlighted in yellow. Generally re-emphasizing the natural warning signs of a Local Tsunami.

**Worning - Warning - Alerte**

Long taem blong wan strong o longfala etkwek, muv aot hariap long ol evakuesen zon. No wet long wan sanming. Tekem moa long wan mimit o tekem taem blong muv, bae hemi no tufala step ia.

In a long or strong earthquake if you are in an evacuation zone, immediately go to a safe location. Longer than a minute OR hard to stand up, it doesn’t have to be both.

Au moment de grands tremblements de terre ou de tremblements de terre de plus d’une minute, évacuez les zones immédiatement.

N’attendez pas ! Les deux types de tremblement ne peuvent pas se produire en même temps : SOIT celui où il est difficile de se tenir debout
SOIT celui de plus d’une minute.

Tsunami Key Message

- Language: Bislama, English & French
Tsunami Evacuation Plan

- Tsunami Evacuation Message—this provides guides on how to evacuate, facts about tsunamis and some advise on evacuation and official warnings

Wokbaot o ron long baesikel long ol rod blong evri evakuesen zone
If you are in an evacuation zone, walk or ride bicycles quickly following routes to a safe location. Don’t use cars.

Circulez à pied ou à vélo suivant les voies tracées pour sortir de toutes les zones

I posibol se fes wev i no bigfala wev iet, I save tekem plante haoa bifo bigfala wev i kam.
The first wave may not be the largest. It may take many hours for the largest wave to arrive
La première vague peut ne pas être la plus grande. La vague la plus grande peut prendre plusieurs heures pour arriver.

No mas entarem ol evakuesen zone kasem taem we NDMO i talem se hemi orae!
Stay in safe places until all clear from NDMO
Restez hors des zones d’évacuation jusqu’à ce que le BNGC lève l’alerte

Kamaot long ol zone we oli talemaot long ol oifisol woning
Evacuate from the zones stated in the official warning
Quittez les zones faisant l’objet d’alerte officielle

Tsunami Evacuation Message
Language: Bislama, English & French

A complete Tsunami Evacuation Map using QGIS

Port Vila ~15; Greater Port Vila ~25 maps; Luganville 11 maps and Greater Luganville ~24 maps combined total of 75 maps
Disclaimer — is a legally-based sentence or a few sentences indicating that the person/company cannot be sued (no “claims” can be made against it, they are not responsible for something)

Tok Sawak: Ples teknim not se ol zones lo map hem i indikativ nomo mo i bes lo available saecint nolej mo modeling lo tam blo productin map la Disclaimer: Ples note that the evacuation zones are indicative only and based on current science and modelling as at date map published

Avertissement: Si vous plait note que les zones d’évacuation sont données à titre indicatif et sont basées sur la science et la modélisation actuelle qu’à la date de la carte publiée

Language: Bislama, English & French
• Break-out groups
  • Drawn on proposed evacuation routes using arrows
  • Draw on sign locations for the sign groups
  • Location names that help people read the map
  • Write or correct English, French and Bislama version of evacuation maps, information boards and signs
  • Each group presented their work in front while others listen and ask questions after each presentation (Discussion)
  • After which all used draft materials were collected

Example (left) a break-out group discussing their ward evacuation map, (routes and locations added), and (right) a break-out group explaining a change in the word and language used on the Danger Zone sign during their presentation up front
Draft tsunami information boards are created using QGIS for community consultations and workshops in Greater Port Vila (South Efate) and Greater Luganville (South Santo).

The Tsunami Information Board is basically a Tsunami Evacuation Plan to aid communities, general public and visitors to evacuate to a safe location when there is a tsunami threat or a warning is in effect.

The main feature in the plan is the Tsunami Evacuation Map and the Tsunami Evacuation Signs.

Understanding the map and signs is crucial in executing the plan efficiently and calmly during tsunami threats or warnings.

The main features on the map:
- Land and sea; the sea is pink whilst the land is either red, orange, yellow or just plain vegetation.
- There are 3 different evacuation zones on land:
  - Red - coastal low lying areas, areas around an estuary or flood plain. Generally all land areas from 0-2 m above mean sea level.
  - Orange - coastal low lying areas, areas around an estuary or flood plain. Generally all land areas from 2-7.5 m above mean sea level.
  - Yellow - all land areas from 7.5-35 m above mean sea level.
- Vegetation – all land areas located 35 m or more above mean sea level. Generally land areas outside the evacuation zones.
- The map has a scale; usually on the right bottom corner. Generally scale converts centimeter length on map to meter scale on ground. Provides an idea on distance one needs to move during evacuation.

- The map has a title; usually at top center e.g. PORT VILA

- The directions on the map are as follows:
  - Top—the top half of the map is always the North
  - Bottom—the bottom half of the map is always the South
  - Right—the right side of the map is always the East
  - Left—the left side of the map is always the West

Evacuation Map for Central Ward of Port Vila Municipality

- The map has a legend. The legend explains the different evacuation zones and the main map features to aid tsunami evacuation.

Explanation of the 3 different evacuation zones and Main features to aid tsunami evacuation

Language: Bislama, English & French
Apart from the map, the information board has the following:

- An explanation on Tsunami Warning and Response

### Explanation on Tsunami Warning and Response

- **Warnings and Responses**
  - **Alerts if intervention**
    - **Natural:** Long wave strong swell from one case storage glid from ocean (i.e. Tsunami). When you hear an alert, get to higher ground. If it glides long wave long tsunami glider is difficult to escape. If you hear an alert we no strong tsunami clear ocean warning, i.e. every 5 min. (or as much as possible). Regularly check alerts. Keep safe.
    - **Natural:** In a strong earthquake that it is difficult to stand up or the earthquake tests longer than one minute, jet engine-like sound coming from ocean direction, or ocean rushing in or out like a floating river. Evacuate all zones. A wave may arrive within minutes or on hour.
    - **Avert any early warning systems or tsunami**
      - In a zone where it is difficult to see too difficult to see: when the tremors delivered several minutes of an minute, the evacuation of all the zones must be necessary to all to respond immediately to the threat of a tsunami. A wave can travel 1000 km in an hour.

- **Informal:** In the event of a tsunami: do not run! Do not run to the coast and get long wave in zone 2 if you can. Stop in safe zone and wait for the tsunami. Informal warnings from friends or other members of the public may be correct. Informal warnings are highly unreliable and may not be true.

- **Official:** NMO and Department of Meteorology and Geohazards are in charge of immediate tsunami warning. To save nations of warning (or long term TBV, at least 30 min. Protection zone zone 1. Keep safe and wait for the tsunami warning. If we get an alert, we will stop long wave in zone 1, go to safe zone or long wave in zone 2, go to safe zone or long wave in zone 3, the tsunami warning is not clear.

- **Official:** The official warning source in the NMO and the Department of Meteorology and Geohazards are in charge of immediate tsunami warning. In the event of a tsunami, if you hear an alert, you should evacuate immediately to the nearest high ground.

- **Informal:** Informal warnings from friends or other members of the public may be correct. Informal warnings are highly unreliable and may not be true.

### Language: Bislama, English & French

- More detailed explanation of the different evacuation zones on the map

- **Ekspilenisen blong ol Zone**
  - **Explanation of Zones**
    - **Question: What are the zones?**
      - **Red:** Red aris hani derja zone. Hami aris we derja i maas bigawan ma fe ples we el man i maas muv aot long hem ween we i get of differen tsunami warning (natural, informal or official).
      - **Red:** The red zone is the highest risk zone and the first place people should leave in any warning.
        - **Zone rouge:** La zone rouge est une zone à haut risque et doit être évacuée.
      - **Orange:** Orange aris hani evan evae ol man i evaluates long term basin of official warning. Small tsunami over long time. Informal or official.
        - **Orange:** Une zone susceptible d'être évacuée à toute heure. Les tsunami de sources historiques arrivent centenaires au-delà de cette zone. L'évacuation est également nécessaire en cas d'informations tremblements de terre.
      - **Yellow:** Yellow aris hani wean ples we el man i maas muv aot long hem long term basin otsale bigale tsunami wantwee, otel we l.channel we bigale long wave river. Informal or official.
        - **Yellow:** Une zone suspecte de tsunamis, exemple de tsunami de grande taille. L'évacuation est nécessaire à toute heure.

### Language: Bislama, English & French
Key Tsunami Message—this is highlighted in yellow. Generally re-emphasizing the natural warning signs of a Local Tsunami.

- **Woning - Warning - Alerte**
  Long taem blong wan strong o longfala etkwek, muv aot kwik long ol evakuassen zone. Hemi ol etkwek we i stap bitim wan minit o i had tumas blong stanap from kraon i muv muv tumas.

  In a long or strong earthquake if you are in an evacuation zone, move immediately to a safe location. Longer than a minute OR difficult to stand up, doesn't have to be both.

- **Lors d’un tremblement de terre enorme ou d’une duree plus longue, trouvez immediatement un endroit sur si vous vous trouvez dans une zone d’evacuation. Un tremblement de terre peut etre enorme OU d’une duree plus longue, mais pas les deux a la fois.**

Language: Bislama, English & French

- The Tsunami Information Board has some basic information on what is a Tsunami, advise on Tsunami Evacuation, Tsunami Signs and a piece of Tsunami History in Vanuatu

- **An explanation of “What is a Tsunami”**?

  - **Wanem la Sunami? What is a Tsunami?**
    Sunami hemi ol bigfala wev blong salwara we ol etkwek, tanстав ol volkena ne i taanap andamit long solwora i kosome.
    A tsunami is a series of gigantic waves caused by earthquakes, submarine landslides or underwater volcanic eruptions.
    Un tsunami est une serie de vagues gigantesques provoques par un tremblement de terre, un glissement de terrain sous-marin ou une eruption de volcans sous-marins.

Language: Bislama, English & French
Tsunami Evacuation Message—this provide guides on how to evacuate, facts about tsunamis and some advise on evacuation and official warnings

**Tsunami Evacuation Signage**—this provides an explanation on the 3 different Tsunami Signage that will aid Tsunami Evacuation

An explanation of where you will see the 3 Tsunami Evacuation Signs

Language: Bislama, English & French
Tsunami History—a piece of Tsunami History in Vanuatu. Generally depicting that it has occurred and history repeats itself, sometimes more disastrous.

A piece of Tsunami History in Vanuatu

On January 24, 1927 a large earthquake off the coast of South Malekula generated a tsunami that struck Port Vila harbor within an hour after. Elders on the offshore island of Ilfra collected fish and other marine life among coastal vegetation. On Port Vila, the tsunami inundated all areas of the waterfront including the Fatumaru Bay coastal areas. Le 24 janvier 1927, un grand tremblement de terre au large de la côte sud de Malekula a provoqué un tsunami qui a atteint la baie de Port Vila dans moins d’une heure. Les anciens de l’îlot d’Ilfra ramassaient des poissons et autres animaux marins dans la végétation côtière. À Port-Vila, le tsunami a inondé toutes les zones du front de mer, y compris les zones côtières de Fatumaru Bay.

Disclaimer - is a legally-based sentence or a few sentences indicating that the person/company cannot be sued (no “claims” can be made against it, they are not responsible for something)

Word of thanks – Municipality/Area Council and Residents (Wards/Zones/Communities)

Word of thanks to authority and residents for their contribution
A complete Tsunami Information Board using QGIS

Port Vila ~26 information boards; Greater Port Vila ~48 information boards; Luganville ~25; Greater Luganville ~27 hence combined total of 126 information boards
- Mapping and Site Survey
  - Mapping Consultation Sites
  - Site Survey (Mapping Signs & IB Sites)
  - Revisions

Figure x. Consultation sites for Pango Area Council

Figure xx. Signs and Information Board sites for Pango Area Council
Figure x. Consultation sites for Luganville Municipality

Figure xx. Signs and Information Board sites for Central Ward, Luganville Municipality
<table>
<thead>
<tr>
<th>Location</th>
<th>Name of Site</th>
<th>Danger zone</th>
<th>Safe Route</th>
<th>Safe Location</th>
<th>Information Board</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fatumaru Bay</td>
<td>DZ</td>
<td></td>
<td></td>
<td>IB</td>
<td>17°43.981'S 168°18.672'E</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>RL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>DZ</td>
<td></td>
<td></td>
<td></td>
<td>17°44.309'S 168°18.800'E</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td>17°44.251'S 168°18.813'E</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>DZ</td>
<td></td>
<td></td>
<td></td>
<td>17°44.309'S 168°18.800'E</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>RL</td>
<td></td>
<td></td>
<td></td>
<td>17°44.368'S 168°18.868'E</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td>17°44.373'S 168°18.967'E</td>
</tr>
<tr>
<td>8</td>
<td>Market House</td>
<td>DZ</td>
<td></td>
<td></td>
<td>IB</td>
<td>17°44.433'S 168°18.850'E</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td>17°44.523'S 168°18.865'E</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td>17°44.549'S 168°18.948'E</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td>17°44.777'S 168°18.876'E</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td>17°44.373'S 168°18.967'E</td>
</tr>
<tr>
<td>13</td>
<td>E.ST.J</td>
<td>SL</td>
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<td>17°44.087'S 19.018'E</td>
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<tr>
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<td>E.CEN.VIL</td>
<td>SL</td>
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<td>15</td>
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<tr>
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<td>L</td>
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<td>17°44.570'S 19.400'E</td>
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<tr>
<td>22</td>
<td></td>
<td>VCH</td>
<td></td>
<td></td>
<td>IB</td>
<td>17°44.549'S 19.265'E</td>
</tr>
<tr>
<td>23</td>
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<td>R</td>
<td></td>
<td></td>
<td></td>
<td>17°44.914'S 19.141'E</td>
</tr>
<tr>
<td>24</td>
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<td>L</td>
<td></td>
<td></td>
<td></td>
<td>17°44.921'S 19.210'E</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>RL</td>
<td></td>
<td></td>
<td></td>
<td>17°45.029'S 19.134'E</td>
</tr>
</tbody>
</table>

Left (L) 3
Right (R) 5
Back-to-back (RL) 3

<table>
<thead>
<tr>
<th>DANGER ZONE</th>
<th>SAFE ROUTE</th>
<th>SAFE LOCATION</th>
<th>INFORMATION BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>5</td>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>
Map of signs sites [examples from Central Ward, Port Vila Municipality]

Construction: 126 Information Board poles and frames

Evacuation Signs poles: c. 200+
SUMMARY

➢ Tsunami Early Warning; Siren, SMS, Website, Email
  ▪ Natural Warning Signs of pending tsunami:
    ▪ Strong and/or long earthquake
    ▪ Change in sea level
    ▪ Roaring Sound

➢ Tsunami Response = Tsunami Evacuation Products
  ▪ Tsunami Evacuation Maps – Tsunami Evacuation Plan (A3 Prints)
  ▪ Tsunami Information Boards – Tsunami Evacuation Plan (outdoor)
  ▪ Tsunami Evacuation Signs (outdoor)
    ▪ Danger Zone Sign
    ▪ Safe Route Signs
    ▪ Safe Location Sign
  ▪ All Tsunami Evacuation Products are in the 3 official languages; Bislama, English and French

Way forward

➢ Tsunami Response Plans
  ▶ Local authority
  ▶ Ward/Area Council
  ▶ Community Disaster Committees (CDCs)

➢ Review VMGD Tsunami Directive (Early Warning Center Operations; incorporating sirens)

➢ Tsunami Drill/Simulation

➢ Standard Operating Procedures (SOPs)
  ▶ Community-Based Tsunami Evacuation Maps and Signs (SOP 11)
  ▶ Creating Tsunami Evacuation Maps and Information Boards in QGIS (SOP 12)
Mainstreaming Disaster Risk Reduction (MDRR) Project

- South Santo and South Efate pilot sites

RESPOND EFFECTIVELY TO TSUNAMI THREATS/WARNING IN THE FUTURE
Thank you