

# Introduction

# RESPONSE CAPACITY



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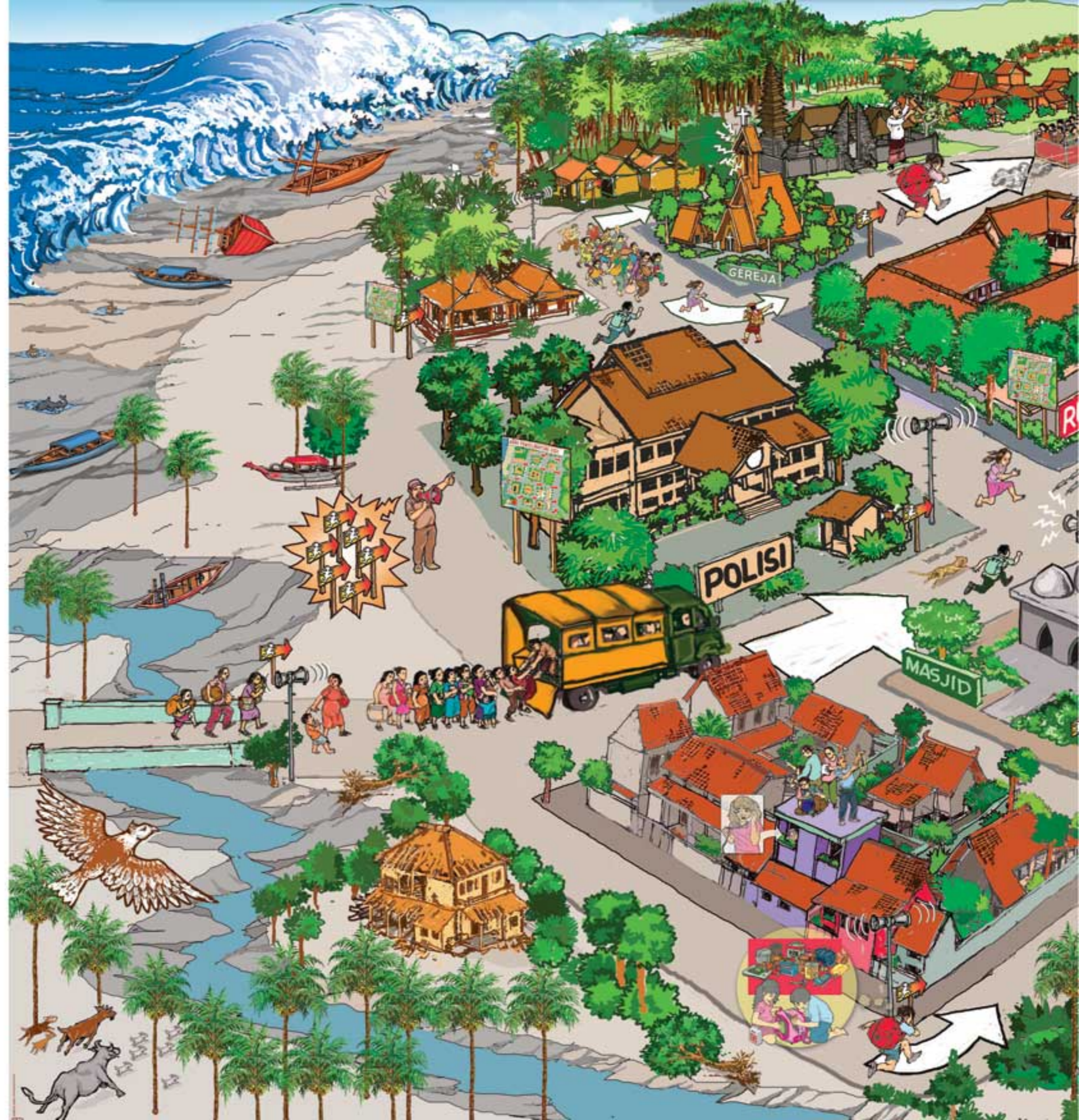
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# Content

<b>Local Response Capacity: Taking Timely and Appropriate Action</b>	<b>01</b>
<b>Understanding the Tsunami Risk</b>	<b>04</b>
<b>Accessing and Respecting Official Warnings</b>	<b>07</b>
<b>Knowing How to Respond Appropriately</b>	<b>10</b>
<b>Reaching a Safe Place in Time</b>	<b>12</b>
<b>Testing Response Capacity</b>	<b>19</b>
<b>The Content of the Tsunami Kit related to Response Capacity</b>	<b>21</b>

# Local Response Capacity: Taking Timely and Appropriate Action

Rather than being defenceless in the face of tsunamis, communities can be capable of reducing the risk from the threat. To achieve this, the Indonesian Tsunami Early Warning System (InaTEWS) plays an important role, as its ultimate goal is to enable people along the coast to take timely and appropriate action before a tsunami hits their shore.



01

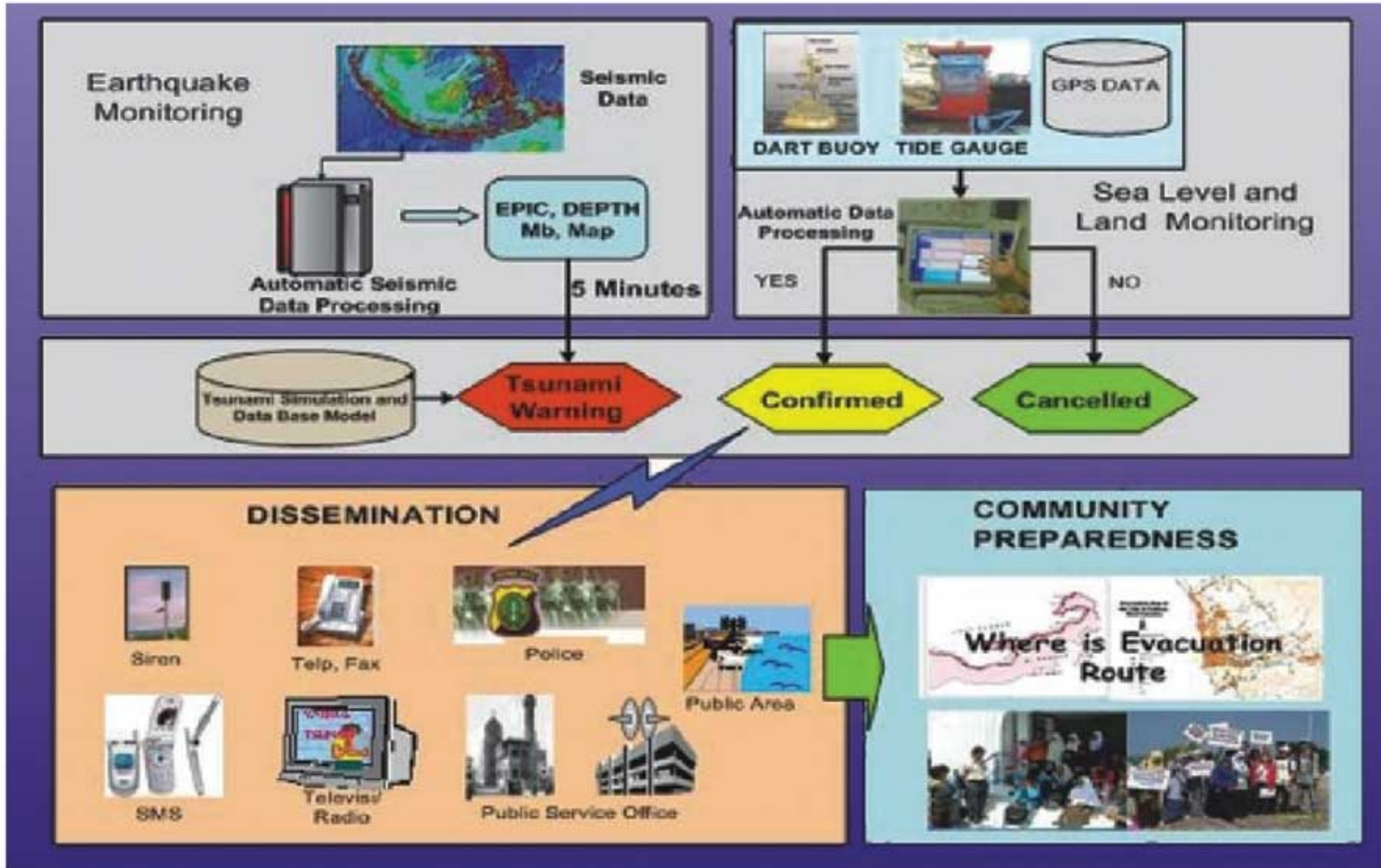
Local Response Capacity: Taking Timely and Appropriate Action

Coastal communities that are well prepared for tsunamis:

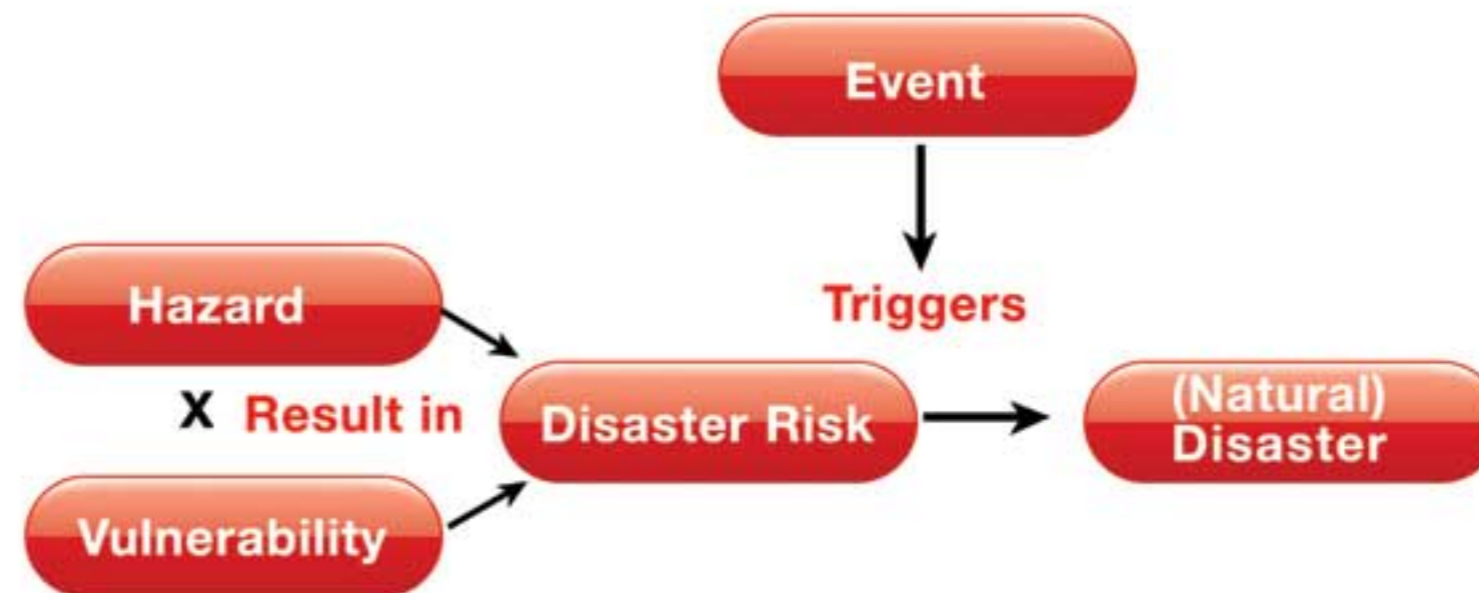
- understand their tsunami risk
- have quick access to, understand and respect warnings
- know how to react timely and appropriately to both the natural warning signs of a tsunami and official warnings
- are capable of reaching a safe place in case of emergency, and
- regularly exercise their response plans



Working towards this preparedness takes time and needs to involve the whole community. Local governments and civil society organisations need to engage the local population to understand and meet their preparedness needs. The active participation of all actors will contribute to appropriate risk communication and the development of sound local warning arrangements and realistic response plans.



## Understanding the Tsunami Risk



Awareness among coastal communities about the tsunami risk and the options to reduce their vulnerability is crucial to encourage people to prepare for future tsunamis. In order to learn about its risk, a community needs to find out about the tsunami hazard along its coast, its vulnerability to it and its capacity to respond appropriately.

Tsunami hazard maps show areas that a tsunami could flood. They indicate how high tsunami waters could be and how far they could reach inland. These maps can be the result of either highly scientific or simplified hazard estimations, and outline hazard zones and safe places.



The vulnerability of a community depends on how many people live in the hazard zone and on the community's characteristics. Women, children, the elderly, the disabled and socio-economically disadvantaged people who often have less access to information are more vulnerable than others. Hospitals, schools and places where many people gather are especially susceptible to threats. Due to their belief or perception of their place in society, some people might see tsunami disasters as fate, something they cannot avoid. This attitude inhibits their capacity to respond appropriately. Sound knowledge about tsunamis, e.g., on how long it takes tsunami waves to reach land after an earthquake and readiness to act in time, reduces vulnerability and increases people's response capacity. Communities are more capable to respond if they know the natural warning signs and are familiar with official warnings. Availability and familiarity with evacuation routes and safe places, as well as solid individual, family and institutional response plans make people less vulnerable and more capable to protect themselves.

Assessments of the vulnerability of a community and its response capacity are best accomplished by directly involving the people exposed to the tsunami hazard. Discussions during community meetings, informal interviews and surveys are ways to get a better understanding of people's vulnerability and how to increase their response capacity. Often, social science experts and NGOs conduct these assessments, which can be either highly scientific or simplified appraisals. The results of these assessments help to tailor local warning arrangements, evacuation routes, shelter and response plans, as well as outreach campaigns, to the needs of everyone in a community – including those most vulnerable.



# TSUNAMI HAZARD MAP BANTUL DISTRICT D.I. Yogyakarta Province



Legend	
	Hazard zone affected in warning level 1 Warning wave height $H_{max} \geq 1.0$ m
	Hazard zone affected in warning level 2 Warning wave height $H_{max} < 1.0$ m

**Hazard Map Information and Methodology**

The hazard map was developed on the basis of a report base map. The data in the base map are the result of the combination of information from the map including: bathymetry, coastline, and topographic features in different elevation levels from the topographic map.

Using the contour lines that the potential hazard is based on two different warning levels: 1. Warning level wave height of 1.0 m. For estimation of hazard on land, a wave height of 1.0 m was used. 2. Warning level wave height of 0.5 m. For estimation of hazard on land, a wave height of 0.5 m was used. The hazard map was developed based on the 1.0 m warning level.

The estimated hazard on land of the tsunami was compared to the single tsunami hazard map. All areas in red are potentially affected in a warning level 1 event while the areas shown in orange are potentially affected in a warning level 2 event.

**Scale 1 : 25,000**  
Scale bar: 0 to 500 m

**Projection:** UTM  
**Datum:** WGS 1984  
**Unit:** Meter  
**Year of Publication:** June 2018

**Geographic Map:**  
Bantul District (D.I. Yogyakarta)  
Scale: 1 : 25,000  
BANTUL DISTRICT, 1:25,000

**Logos:** BNPB, GTZ, and other partner organizations.



## Accessing and Respecting Official Warnings



People can only respond appropriately to a warning and guidance message if they receive it in time, understand its contents, personalise the warning and believe the information is credible. Even if this is the case, people often still want to confirm that the warning is true and that others are also taking action.

People along the Indonesian coast live in remote villages, reside in urban agglomerations or move seasonally between locations. The coast is also a pleasant and popular place for recreation. No matter where they live and who they are, all people on the coast need access to tsunami warnings. Local early warning arrangements must take the particular geography of the area into account.

to be effective. A tourist destination might need to focus on public beaches and include announcements in various languages, whereas for a rural area the use of traditional communication means, like wooden drums, may be a good solution. Communities may already have established their own mechanisms to access important information, such as specific forecasts on local weather conditions or sea wave heights, which can offer effective means to spread tsunami warnings to the people. Generally, people need to know where and how to get warnings, e.g., which radio or TV channel broadcasts information.

Clear agreements on procedures between a community and those who provide warnings help to ensure that more people receive a warning. It must be clarified what the content of a warning message or an alert means. The three-minute steady sound of a tsunami siren in Indonesia, for instance, is the sign for immediate evacuation. Besides the sirens, people require additional warning and guidance by authorities, e.g., via loudspeakers or on the radio. People are more likely to react appropriately if these announcements state in a clear, specific and consistent manner:

- the official warning source, i.e., the National Tsunami Warning Centre (NTWC) or the local government authority
- the source of the threat, i.e., information on the earthquake and the tsunami threat
- the area that might be affected by the tsunami, the estimated impact and that the threat directly concerns the community

- the urgency of the response; and most importantly
- clear instructions on how people must respond and where they can access follow-up information

Different communities use different languages – or use language differently. Warning content must be tailored to the needs of all communities in an area, taking into account their cultural, social and educational backgrounds. It is important not only what is communicated, but also who communicates it. Messages from formal or informal community representatives who are considered trustworthy and credible are more likely to encourage people to respond.

False alarms may reduce people's trust in the warning system. As early warning for local tsunamis involves a lot of uncertainty, it is important to explain that even though the first warning from the NTEWS – as it usually will be based on earthquake data only - does not provide 100% certainty about whether tsunami waves are on their way, immediate evacuation is required as the short arrival times of a locally generated tsunami will not allow people to wait for final confirmation. Communities will keep their trust in InaTEWS if they understand this uncertainty.

# Knowing How to Respond Appropriately



The short arrival times of tsunami waves that are caused by an earthquake close to the coast leave only a few minutes for warning and evacuation. When experiencing a strong and longer lasting earthquake people should not wait for an official warning. They need to start moving away from the beach and rivers to a safe place immediately. Official warning from the NTWC (broadcasted by TV and radio stations) and guidance from local authorities will reinforce evacuation if the earthquake has the potential to cause a tsunami or cancel evacuation if this is not the case. If promoted publicly, a clear standard reaction scheme helps people in tsunami risk areas to react appropriately to an earthquake and the tsunami threat.

Recent experiences in Indonesia show that a considerable number of people may not evacuate immediately after an earthquake. Often, they want to be more certain whether a tsunami will really occur. As many people remember

from the Aceh tsunami that a sudden retreat of the seawater is a certain sign of a tsunami, quite a lot of them decide to go to the beach after an earthquake to check whether the water is receding, unaware that by doing this they put their life in danger. To address this inappropriate and dangerous response, it is important to make people aware that there are only a few minutes between the moment the seawater retreats and the arrival of the first tsunami wave. They also need to understand that the seawater does not always retreat before a tsunami strikes and that waiting for it will put them in extreme danger. Especially in densely populated coastal plains without higher ground reachable in due time, they will not be able to escape the deadly waves. On the other hand, everyone should know that retreating seawater is a sign that a tsunami is imminent to strike and they need to escape immediately. People need to clearly understand the value and limitations of natural warning signs. Immediate evacuation after a strong earthquake is the right response; waiting for other signs that confirm a tsunami is not.

## Reaching a Safe Place in Time

People can only protect themselves from tsunamis if they get out of the hazard zone in time before tsunami waters flood coastal areas. Moving inland, away from the beach, away from river mouths and banks, and towards higher ground, like hills or tall, sturdy buildings that can serve as shelters, are the best ways to escape the tsunami threat.

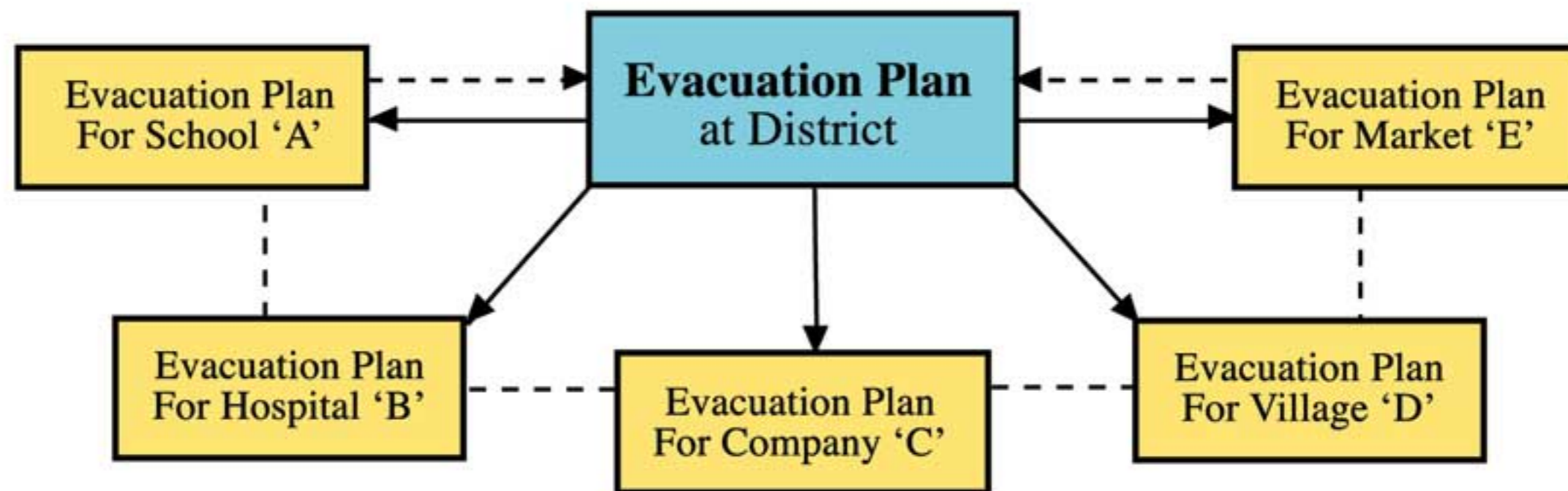




To be prepared, communities need to determine the best routes to safety and suitable places for people to gather during a tsunami evacuation. Local governments together with civil society organisations need to engage community representatives to create tsunami evacuation plans, i.e., develop maps and strategies.



A well-developed evacuation plan at the district or city level will help to create reliable consistent and reliable evacuation plans at the sub-district or sub-city level. District or city level evacuation maps need to be based on a solid estimation of the hazard. This is provided through district or city tsunami hazard maps. Evacuation planning at other levels, i.e., in an urban neighbourhood, a village or in facilities such as schools or hospitals should use the district or city evacuation plan as a reference to develop more detailed plans that take into account local conditions, e.g., smaller evacuation paths. In order to be recognised by and binding for government institutions and other stakeholders, district or city evacuation plans must be official government documents. Also, the local population is more likely to perceive an evacuation plan as credible when it is officially approved.



Developing evacuation plans involves representatives from the district or city government, civil society organisations, community groups, and the private sector. Often only a small group of knowledgeable people, these representatives need to gather all required information and agree on roles and responsibilities in the planning process.

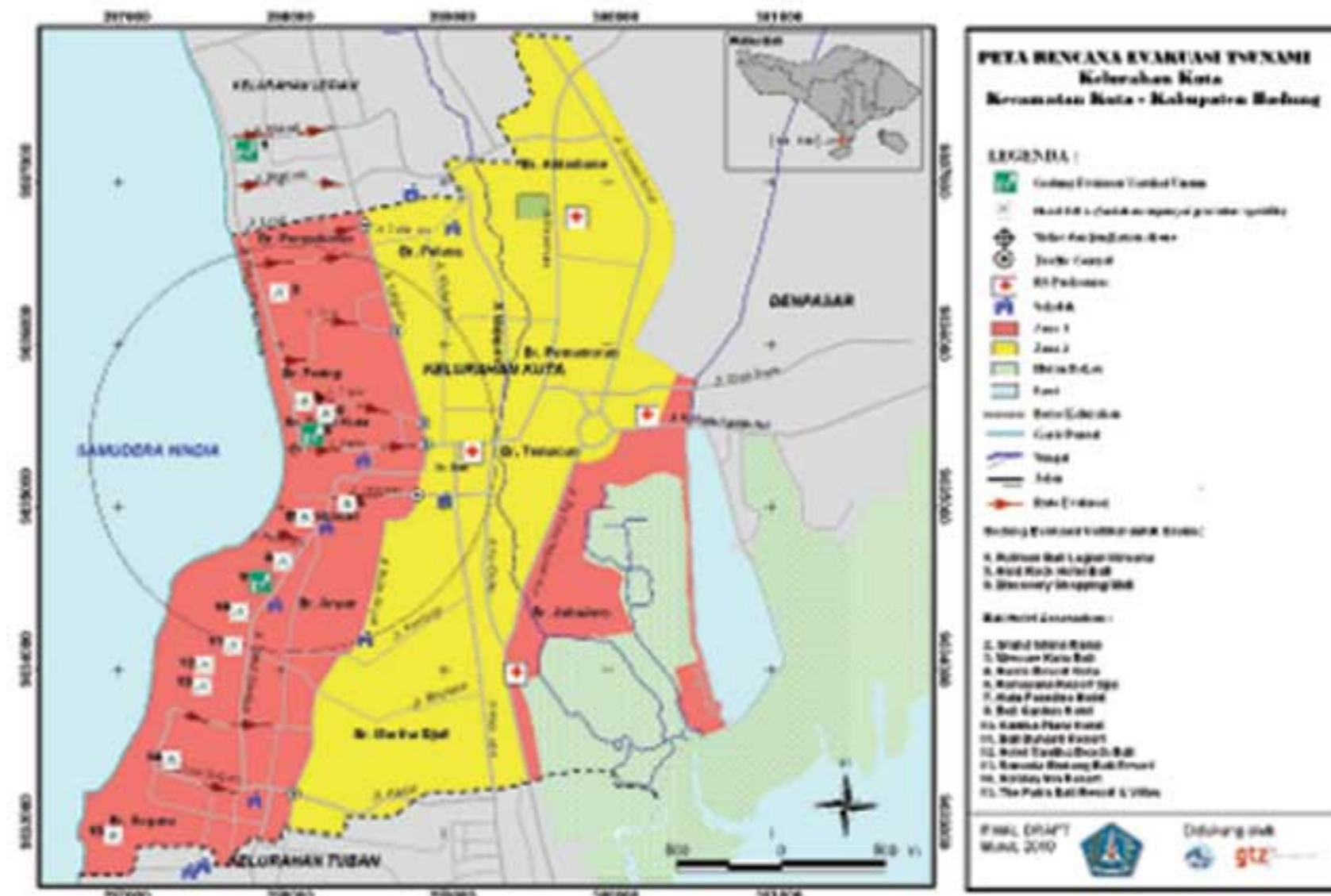
The minimum requirements to start evacuation planning are a tsunami hazard map that determines the areas that a tsunami could flood and a good knowledge of the local area, including the specific conditions of its communities and infrastructure. Detailed vulnerability assessments can estimate the time that different communities need to evacuate based on their location in the hazard zone, existing escape routes, the distance to potential safe locations, as well as social (e.g., perception of tsunami risk) and demographic (i.e., age and gender) factors. If available, these results provide useful tools to identify areas of high risk where people will have serious difficulties evacuating, and to improve evacuation infrastructure. If not available, a field visit during the evacuation planning process provides an opportunity to estimate evacuation time by simply walking through the evacuation routes.

The group of evacuation planners needs to agree on an overall evacuation strategy and define the following features of a tsunami evacuation map:

- zone to be evacuated based on the areas that are threatened by tsunami inundation, i.e., the tsunami hazard zone
- safe places outside the hazard zone where people can gather
- evacuation routes that lead to these safe places

- no-go areas, e.g., bridges, areas prone to landslides
- well-known landmarks that help people to identify locations and directions
- facilities that require special attention, i.e., schools, hospitals and places where many people gather
- tsunami sirens and other public dissemination devices (e.g., loudspeakers) that are used to provide official information and warning

Beside these features, the map should provide clear evacuation procedures and other relevant information that people should take into consideration when evacuating.



Wherever possible, evacuating people out of the hazard zone is the best option. However, communities in low-lying coastal plains, especially if they are densely populated and far from higher ground, need to consider tall buildings inside the hazard zone as so-called “vertical evacuation” shelters. Vertical evacuation is an option for those who cannot make it out of the hazard zone in time. The buildings for vertical evacuation need to be assessed by professional engineers to make sure that they are strong enough to withstand both an earthquake and a tsunami. Agreements with building owners must be reached in order to assure accessibility to the buildings in an emergency.

Once district or city evacuation plans are available, the public and other interested parties – like the private sector - must be able to access them. Authorities need to disseminate the evacuation plan to sub-district levels of government. Simple maps and instructions on the procedures can be posted on billboards and distributed via leaflets. They must be easily understandable without further explanation. The community must be encouraged to be prepared and develop family and individual response plans.

Communities in villages or urban neighbourhoods should be encouraged and supported to develop their own, more detailed, evacuation maps. They know their environment best and can identify alternative, small evacuation routes that lead to safety, and agree on their own procedures. Evacuation planning meetings at the grassroots level creates a momentum to raise tsunami awareness, to explain natural warning signs, warning sources, and appropriate response. Eventually, the evacuation plan needs to be tested and exercised to see whether it is effective.



## Testing Response Capacity

Testing warning dissemination and response helps to improve the warning system, train and prepare all players for the case of an emergency and raises awareness of the importance of preparedness.

These exercises should be based on realistic and probable scenarios and simulate a real tsunami event in order to test and improve emergency procedures. Depending on its scale and type, an exercise may aim to assess and improve the whole system or only focus on certain parts of the system, such as institutional coordination or community response. In order to be successful tests, all exercises need to be well prepared and evaluated.



A tabletop exercise only tests coordination and procedures for tsunami early warning among the local institutions involved. An evacuation exercise is limited to testing the evacuation procedures in a neighbourhood or a school, and people's readiness and response capacity. A full-scale tsunami drill can involve all parts of the system from the NTC to the local authorities and communities along the coast. The purpose of, and the available resources for, an exercise determine its scale.

Tsunami simulation exercises should be conducted on a regular basis. They should be authentic exercises and test existing procedures and conditions. The objective of an exercise is not to achieve perfect results, but to understand what needs to be improved to increase community response capacity. It is meant to assess the effectiveness of procedures, the division of roles and responsibilities and examine the state of preparedness. Therefore, it is important to thoroughly evaluate its results by involving external observers, taking the outcome serious and using it to improve the system's performance. The exercises that involve the general public must be well communicated beforehand. The results of public exercises should also be shared with the community.



## The Content of the Tsunami Kit related to Response Capacity

The Tsunami Kit's content with regards to response capacity is presented in the following documents:

**Checklist** – an assessment and monitoring tool for local response capacity

**Tool** – manuals and guidebooks

- Tsunami Evacuation Planning Guidebook

**Our Experience** – best practices and lessons learnt (fact sheets)

- Evacuation Planning in Kuta, Bali: A Local Strategy for the Case of Emergency
- Evacuation Planning in Tanjung Benoa: Successful Cooperation between Communities and the Private Sector
- How to get to the Safe Area: Developing Tsunami Evacuation Plans in the Pilot Area of Java

- Tsunami Drill in the District of Bantul: Exercising Warning Mechanisms & Reactions of the Community
- Tsunami Simulation Exercises: Types, Scales and Recommendation for Future Exercises
- Learning from Earthquake Experience: Lessons for Tsunami Preparedness in Padang

**Info** – information about other initiatives within InaTEWS (fact sheets)

- National Tsunami Drills in Indonesia: Commemoration and Preparedness
- Indian Ocean Wave Exercise 2009: a Try Out for the Indian Ocean Tsunami Warning System
- Evacuation Signage: National and ISO Standards
- Tsunami Contingency Planning to Enable Timely, Effective and Appropriate Responses

**Further Resources** – other useful documents

- Evacuation plans and maps from GITEWS pilot area Bali
- A Guideline for tsunami drills by RISTEK
- The tsunami drill in Bantul (manual, video and information booklet)

