

Introduction

DISSEMINATION and COMMUNICATION



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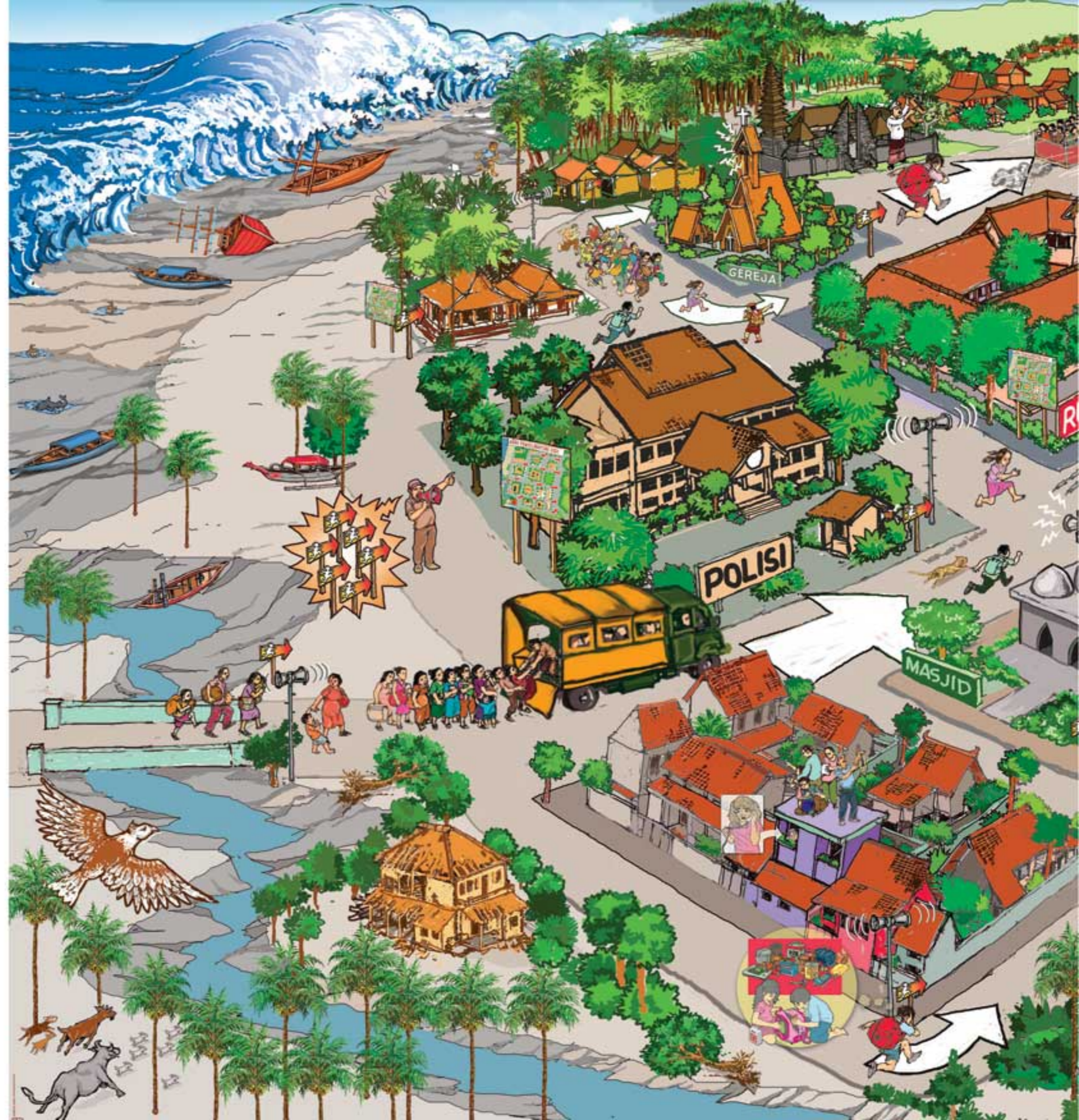
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Capacity Building in Local Communities

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Warning Dissemination – Getting the Message to the People

Tsunami warnings must reach those at risk on in time. Clear messages containing simple, understandable and useful information are critical to enable proper responses that will save lives. National, regional and community level communication systems must be in place and appropriate authoritative voices established. The use of multiple communication channels is necessary to ensure that as many people as possible are warned, to reinforce warnings and to deal with failure of any one channel.

Local tsunamis come quickly after an earthquake – in Indonesia as soon as 20-40 minutes. Warning times are very short and therefore information addressed to those at risk must travel fast and directly. If people’s lives can be saved because they received a warning early and reacted appropriately, the goal of tsunami early warning has been achieved.

The Indonesian Tsunami Early Warning System (InaTEWS) has “upstream” and “downstream” parts. Data from monitoring equipment, e.g. seismometers, flows “upstream” to the National Tsunami Warning Centre (NTWC), which is operated



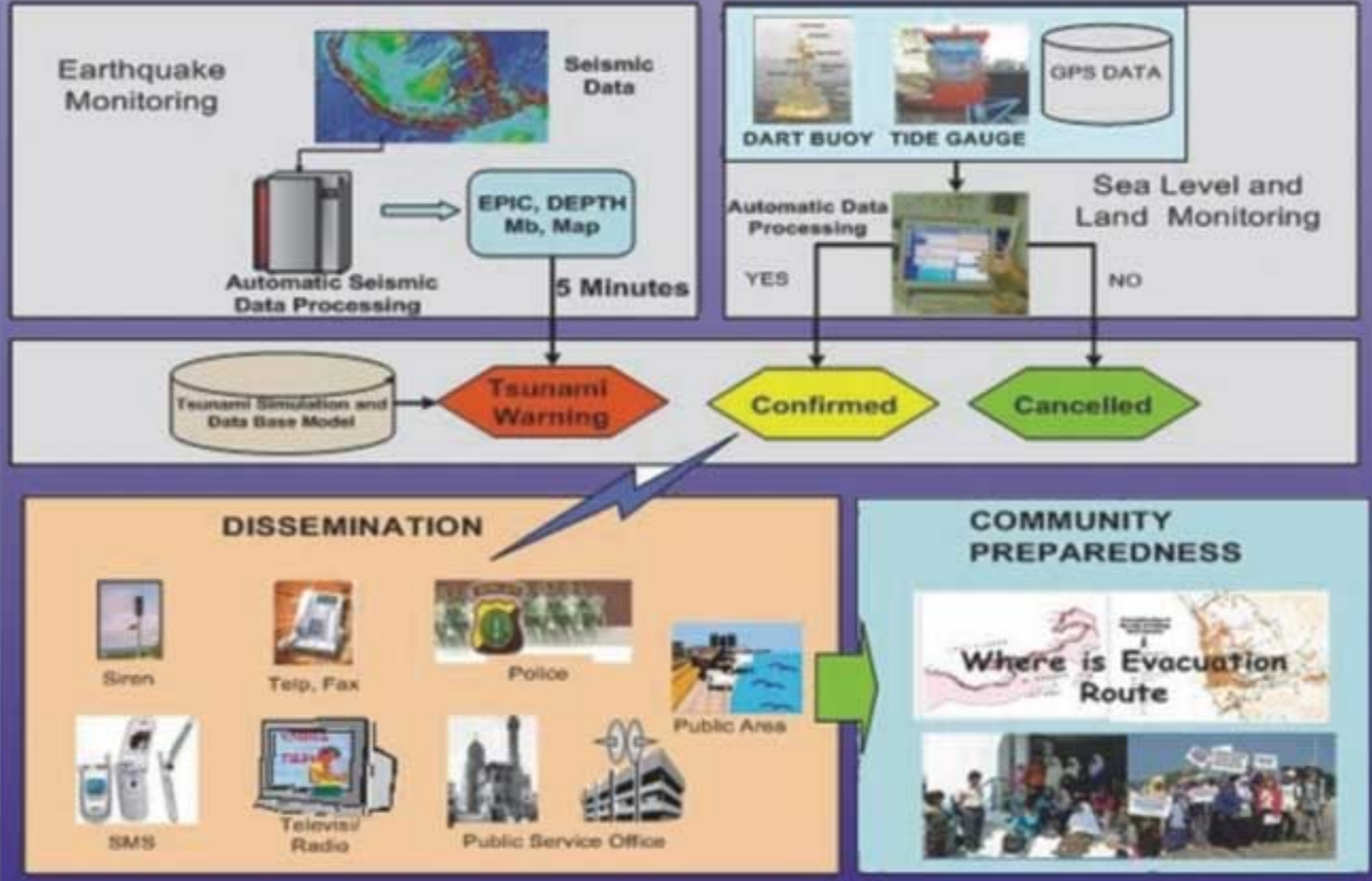
by the National Agency for Meteorology, Climatology and Geophysics (BMKG). BMKG uses this data to decide whether or not there is a tsunami threat.



Once the NTWC at BMKG decides to issue a tsunami warning, the “downstream” process starts. BMKG disseminates the warning to TV and radio stations, local authorities and several interface institutions. Local authorities must respond immediately, forward warnings to the public and tell their community what to do. All actors that are in charge of warning dissemination must perform in a timely manner and in accordance to their roles and responsibilities to make the system work.



BMKG



Upstream

Downstream

Roles and Responsibilities in Warning Dissemination

The **NTWC** at **BMKG** in Jakarta is the central tsunami-warning provider for Indonesia. It provides earthquake information, tsunami warnings and advice to:



- province, district and city governments and their local operations control centres,
- national TV and radio stations, and
- interface institutions, most importantly the National Disaster Management Agency BNPB, the military and the police.

Local governments take up a key role in the warning dissemination – or “warning chain” – of InaTEWS. They are the only ones who have the mandate and responsibility to officially call for evacuation once BMKG has issued a warning. This means they must decide whether their people should leave coastal areas immediately and move to higher ground or not. They must translate the warning from BMKG into clear and immediate guidance for their community.

This guidance helps the people at risk to know what to do and clarifies immediate action that will save lives. To achieve this local governments must disseminate information to as many people as possible in a very short time.

Other important **interface institutions** in the warning chain of InaTEWS are the National Disaster Management Agency (**BNPb**), the **police**, and the **military**. All three institutions are instrumental in forwarding warnings from BMKG to the public and support the redundancy of the system. Besides that, they need to mobilize their



institutions for emergency response, based on the information from BMKG. Warnings from BMKG enable them to be ready to respond immediately and launch search and rescue operations after a tsunami is over.

TV and radio stations are also important actors for warning dissemination because they have immediate and wide access to the public. TV and radio stations are responsible to forward information and warnings from BMKG directly to their audience. Therefore, they must interrupt their broadcasts to deliver warnings and guidance through their networks.

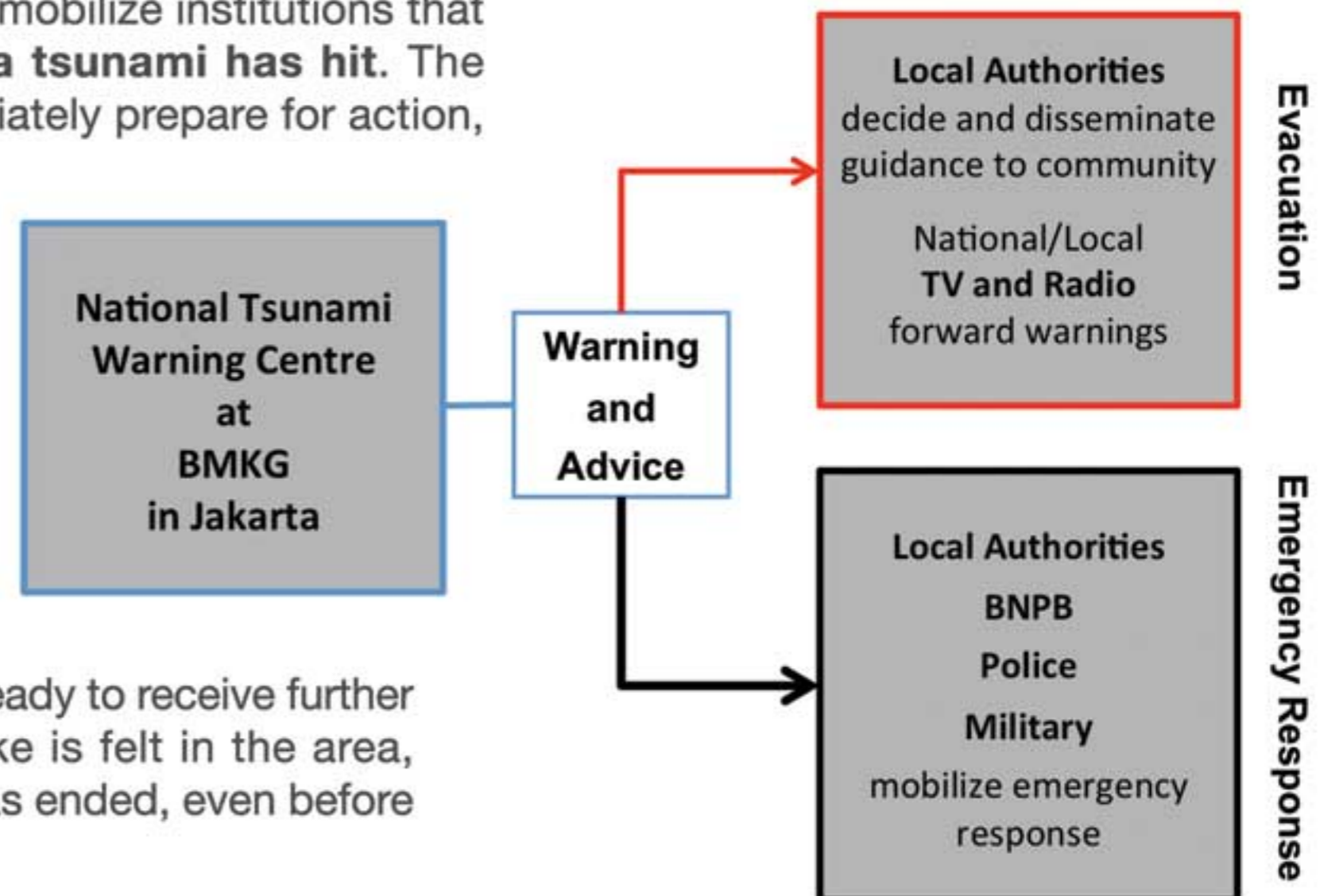


Warnings Trigger Evacuation and Emergency Response

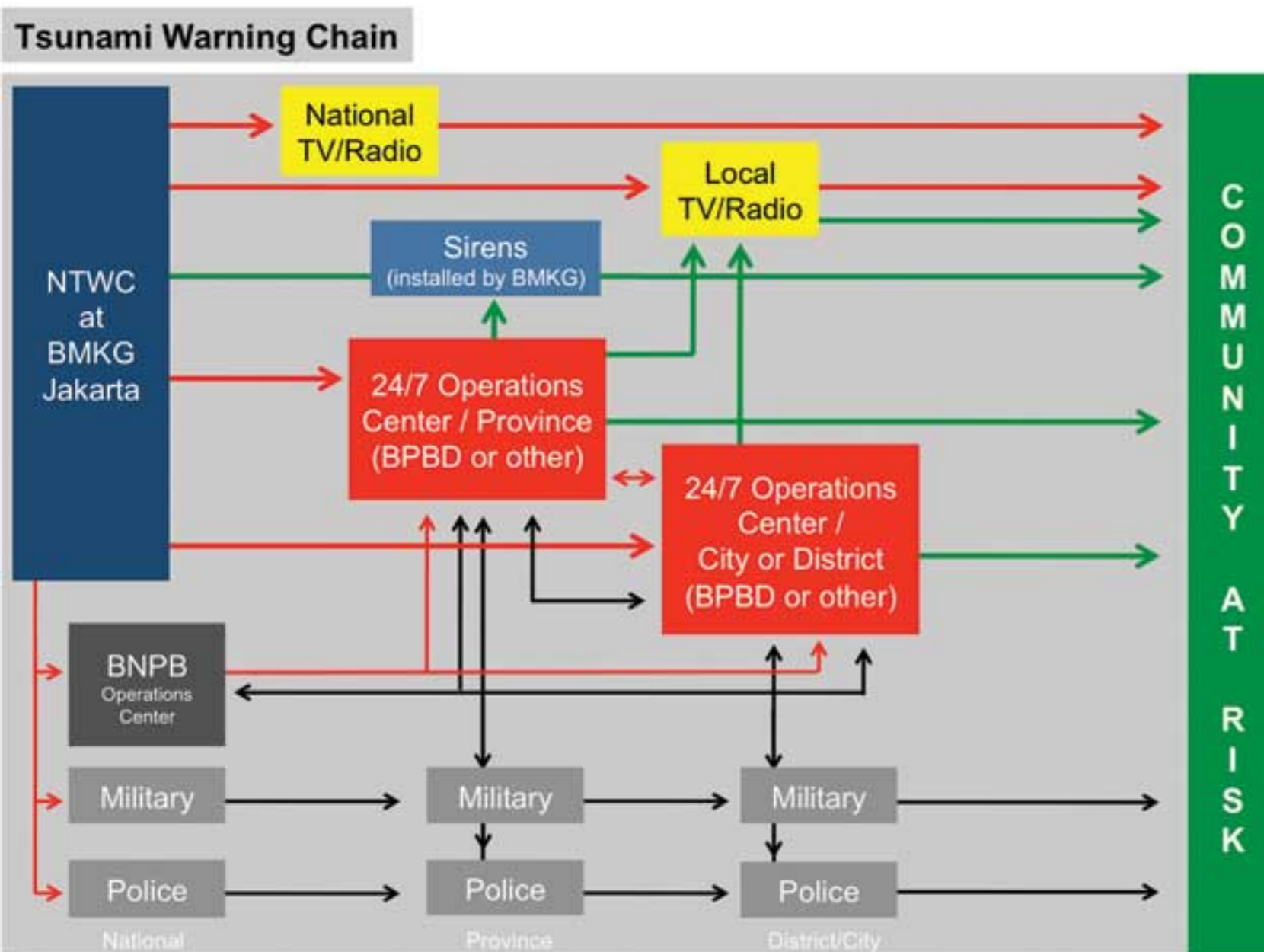
The ultimate goal of the tsunami warning chain is to **alert people on the coast** and local authorities as quickly and directly as possible about a tsunami threat. This enables them to **evacuate** from hazard areas **before a tsunami strikes**.

The **second purpose** of the warning chain is to mobilize institutions that are in charge of **emergency response after a tsunami has hit**. The information from BMKG enables them to immediately prepare for action, to help people who have escaped the waves and to launch search and rescue operations after the last tsunami wave has retreated.

These two processes: evacuation and emergency response, are activated at the same moment and by the same information: the first warning from BMKG. Instantly, local agencies in charge of early warning and emergency response must mobilize their institutions and be ready to receive further information from BMKG. In case the earthquake is felt in the area, immediate reaction is required after the tremor has ended, even before a warning is received.



Often the local institutions involved in early warning also handle emergency response. A BPBD (Regional Disaster Management Agency), if already established, is in charge at all times: before, during and after a disaster. Local operations control centres (PUSDALOPS), either a unit of BPBD or other civil defense agencies must disseminate warnings. At the same time, a PUSDALOPS is in charge of preparing and coordinating the emergency response.

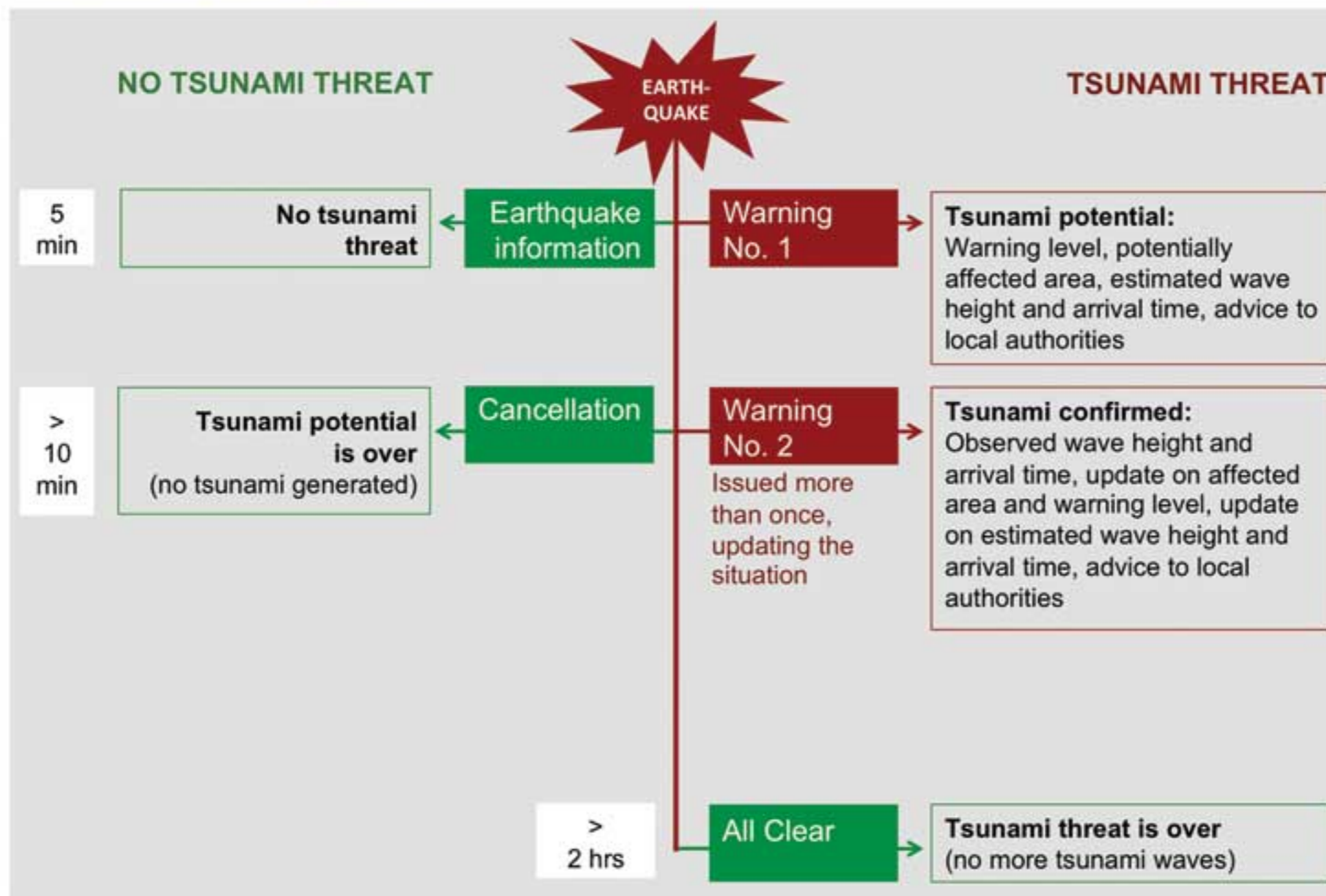


BNPB can play an important role in reinforcing warning dissemination. Their key role, however, is to mobilize immediate emergency response for an area hit by a tsunami. Local military and police must support and guide evacuation and reinforce warnings. After the tsunami is over they must assume their role in emergency response.

Warnings from BMKG: Sequence and Content

The InaTEWS Warning Scheme

The InaTEWS Warning Scheme: Earthquake Information and Warning Messages from BMKG



When an earthquake happens, BMKG receives data from seismometers within a few minutes of the tremor. The analysis of this data can lead to two results: either the earthquake has the potential to cause a tsunami or it has not. If the earthquake has no tsunami potential, BMKG only sends out **earthquake information**. This information is issued only if the earthquake's magnitude is higher than 5 on the Richter Scale. If there is a tsunami threat from the earthquake, BMKG sends out a tsunami warning. The NTWC sends out this "**Warning No. 1**" of a (potential) tsunami threat no later than 5 minutes after an earthquake.

After the first warning, BMKG analyses ocean observation data to determine whether a tsunami is actually on its way to the coast. As soon as BMKG knows that no tsunami was generated, BMKG sends out a "**cancellation**" message. This means that the tsunami threat is over. If, however, a tsunami was detected, BMKG sends out "**Warning No. 2**". This warning confirms the occurrence of a tsunami.

BMKG sends out this Warning No. 2 several times. In each of these messages the NTWC updates the information on areas that are already or may be affected by the tsunami and the estimated arrival times of tsunami waves.

The last message that BMKG sends out in case a tsunami has occurred is an "**All Clear**" message. This last message indicates that the tsunami is over and no more waves are expected.

The InaTEWS Warning Levels and Warning Messages from BMKG

InaTEWS uses **one advisory level** and **two warning levels** to describe the tsunami threat for a coast. These levels are based on the tsunami wave height at coast that is estimated by the NTWC at BMKG for a particular location. To distinguish the levels, BMKG assigns different terms and color-codes for the three levels. In their warning messages the NTWC translates these different levels into different levels of advice to local authorities. The level may be higher for one coastal area than for another area. Local authorities must translate this advice into appropriate action. The major warning level, for instance, requires a different reaction than the advisory level.

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The InaTEWS Warning Levels and Warning Messages from BMKG

STATUS (warning level)	Estimated tsunami wave height	Color code	Advice from NTWC to province, district and city governments
MAJOR WARNING (AWAS)	≥ 3 meter	red	Province/District/City governments that are at "Major Warning" level are expected to pay attention to this warning and immediately guide their communities for full evacuation .
WARNING (SIAGA)	0,5 - 3 meter	orange	Province/District/City governments that are at "Warning" level are expected to pay attention to this warning and immediately guide their communities for evacuation .
ADVISORY (WASPADA)	< 0,5 meter	yellow	Province/District/City governments that are at "Advisory" level are expected to pay attention to this warning and immediately guide their communities to move away from the beach and river banks .

Using a standard format, the messages from BMKG come in a short version (e.g., SMS) and a long version (e.g., via WRS). The **long version** has the following four components:

The header indicates the **information source**: BMKG as the warning provider of InaTEWS.

The second component gives the **earthquake parameters**.

The **evaluation** section assesses the tsunami threat and provides information on **affected areas**:
The respective **warning level**, the **estimated wave height** and the **estimated arrival time** of the tsunami.

The **advice** section gives recommendations to local governments on how to react to the tsunami threat.

```

BMKG:.....!!TEST!!.....BMKG:.....!!TEST!!.....BMKG
                Indonesian Tsunami Early Warning System (InaTEWS)
                Address: Jl. Angkasa I no.2 Kemayoran, Jakarta, Indonesia,
10720
                Tel.: (+62-21) 4246321/6546316, Fax: (+62-21) 6546316/4246703
                P.O. Box 3540 Jkt, Website: http://www.bmg.go.id
*****
                Issued date: 02-Sep-2009, 08:10:23 UTC
                (Message No. 3 related to this earthquake)

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS:

Magnitude : 7.5 RS
Date       : 02-Sep-2009
Origin Time: 07:55:01 UTC
Latitude   : 8.26 S
Longitude  : 107.22 E
Depth     : 51 Km

Location   : Java, Indonesia
Remarks   : 120 km SOUTHWEST of Banjar
            138 km SOUTHWEST of Tarogong
            140 km SOUTHWEST of Soreang

Evaluation:

THERE IS THE POSSIBILITY OF A TSUNAMI IN THE FOLLOWING AREAS:
-----
Province Warning Segment      Warning Level ETA [UTC]  EWH
-----
LAMPUNG Kota-Bandar-Lampung Pantai-P MAJOR WARNING 12:19:53  2.8m
BENGGULU Bengkulu-Utara S      MAJOR WARNING 12:15:54 13.5m
BENGGULU Bengkulu-Utara U      MAJOR WARNING 12:34:52  4.0m
BENGGULU Kaur                  ADVISORY      12:10:28  0.4m
LAMPUNG Kota-Bandar-Lampung     MAJOR WARNING 12:10:28  4.4m
-----

ACTUAL ARRIVAL TIMES AND WAVE HEIGHTS MAY DIFFER AND THE INITIAL WAVE
MAY NOT BE THE LARGEST.

Advice:

Province/District/City governments that are at "Major Warning" level
are expected to pay attention to this warning and immediately guide
their communities for full evacuation.

Province/District/City governments that are at "Warning" level are
expected to pay attention to this warning and immediately guide their
communities for evacuation.

Province/District/City governments that are at "Advisory" level are
expected to pay attention to this warning and immediately guide their
communities to move away from the beach and river banks.

BMKG:.....!!TEST!!.....BMKG:.....!!TEST!!.....BMKG
    
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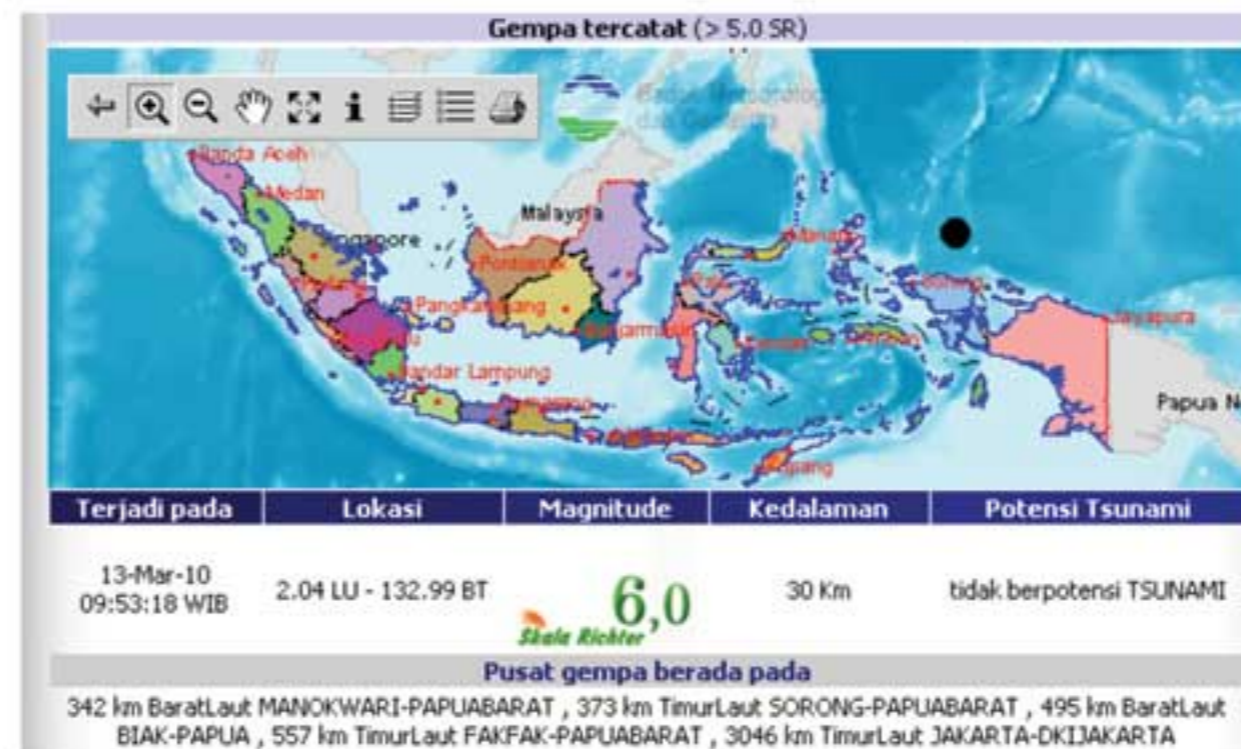

Due to the limited number of characters, the **short version** of a warning only gives the earthquake's parameters and advisory or warning level, but does not pass on advice to local authorities. The message provides warning and advisory levels by province, referring to the highest level within a respective province.

TEST! Major Tsunami Warning in BENGKULU, Tsunami Warning in JABAR, Advisory in BALI, Eq Mag:7.5RS, 02-Sep-09 07:55:01 UTC 07:55:01 UTC, Loc: 8.265/ 107.22E, Dep:51km:::BMKG



Dissemination of Information and Warnings by BMKG

BMKG uses multiple communication channels to ensure that as many people as possible are warned, to reinforce warnings and to deal with failure of any one channel (principle of redundancy). BMKG uses the following channels to disseminate information and warnings in the so called **5-in-1** dissemination system:



- SMS
- E-mail
- Fax
- WRS
- Web

The numbers of cellular phone, fax, and landline numbers, as well as the email addresses and WRS clients, need to be registered with BMKG beforehand.

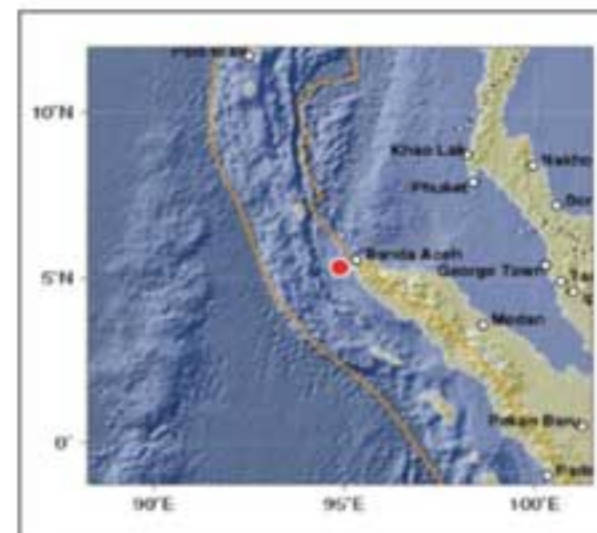
The Warning Receiver System (**WRS**) shares information between a web server at BMKG and all registered WRS computer clients (e.g. computers of local authorities, TV and radio stations, police, military). Remote WRS clients are connected with BMKG via Internet or Digital Video Broadcasting (DVB, which replaces the former RANET, Radio Internet, connection). Preinstalled WRS software on local computers automatically sounds an alarm tone. A window pops up and shows a map with the epicentre, and provides earthquake and tsunami information. This WRS software also allows for further local dissemination.

Earthquake information and tsunami warnings can also be retrieved from the **BMKG website** (www.bmg.go.id). This requires an internet connection and browser.

A foundation called **air putih** has developed a software that automatically taps into the BMKG server and provides warnings from BMKG on a computer that is connected to the internet (<http://airputih.or.id>).



PERINGATAN DINI TSUNAMI
BADAN METEOROLOGI KLIMATOLOGI DAN GEOFISIKA



Magnitude **8,1**
 Waktu : 02-Jun-09 09:05:55
 Lokasi : 0.13 LS - 133.36 BT, Kedalaman : 10 Km
 Keterangan lokasi gempa bumi :
 112 km BaratDaya BANDA ACEH-NAD
 143 km BaratLaut SABANG-NAD
 145 km BaratLaut LOKSAUMAWE-NAD
 243 km BaratLaut MEDAN-SUMUT
 323 km BaratLaut PEKANBARU-RIAU

Nama Kota	Ketinggian	Waktu Tiba
Aceh Besar	4 m	02-Jun-09 09:08,12 WIB
Banda Aceh	3 m	02-Jun-09 09,11:13 WIB
Sabang	3 m	02-Jun-09 09,12:13 WIB

Warning Dissemination by TV and Radio Stations

National, as well as local, television and radio stations have direct access to the public and are able to broadcast a warning about a tsunami threat in a very short time. They are obliged to interrupt their programmes and immediately broadcast a tsunami warning.

The media forwards the warning message from BMKG without any adjustment. Radio and television stations disseminate the warning by interrupting their programmes. On TV, this is indicated by a high alert tone (for about 30 sec) to draw attention before the warning is screened. After this, the warning display continues as a running text at the bottom of the screen. TV and radio stations also broadcast breaking news. However, this news broadcast requires several minutes of preparation.

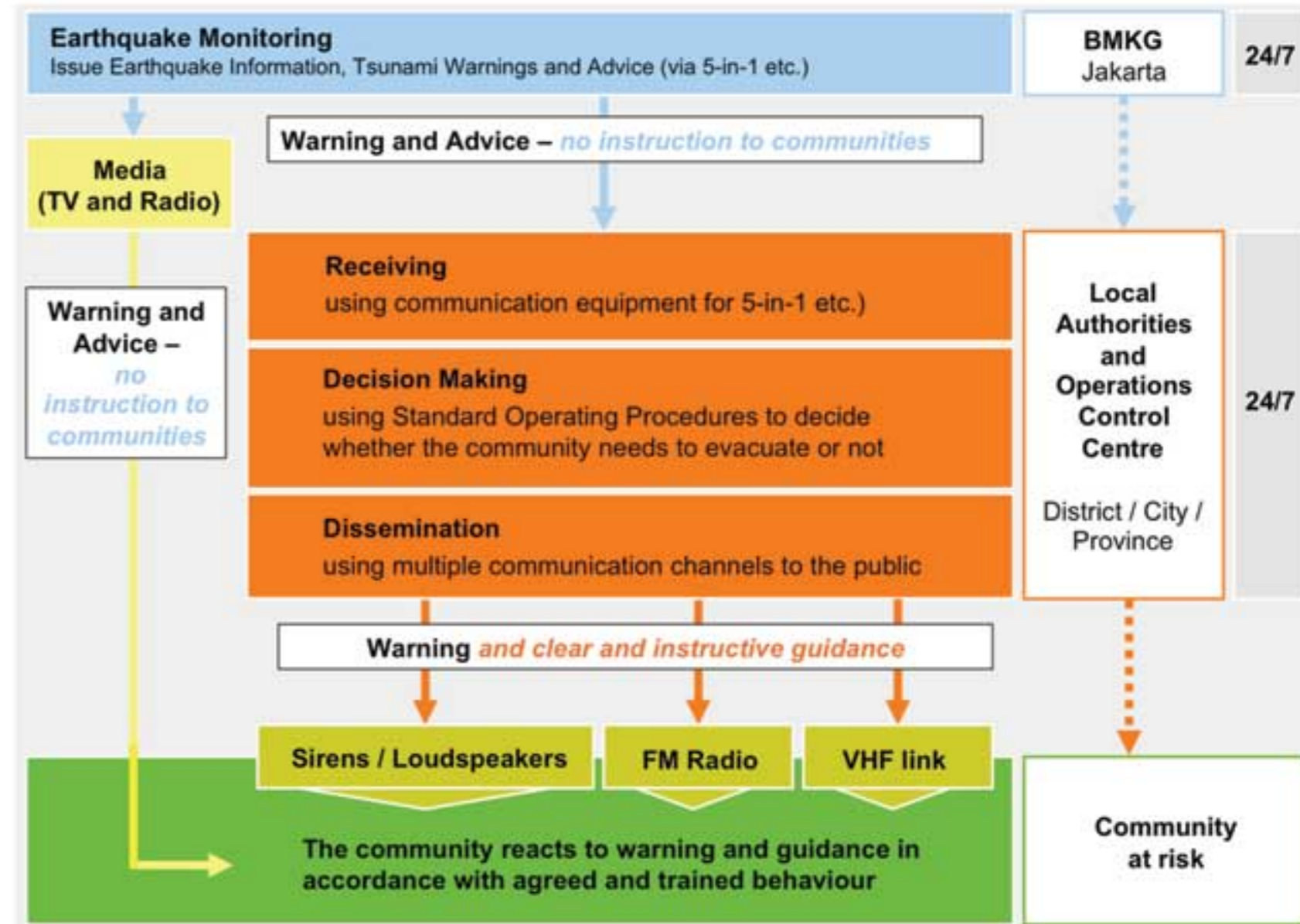
Local TV and radio stations can broadcast warnings that they received directly from BMKG. They also serve as direct dissemination channels for local authorities.

Local Dissemination: Quick and Clear Guidance is Key

Warnings from BMKG provide advice to local authorities. But the NTWC does not give direct instructions to the community on what to do. This instruction or guidance must come from the local authorities.

Strong earthquakes usually lead to power failures, the breakdown of communication networks and chaos. However, local authorities must make sure that warnings and guidance reach their people even under such circumstances.

Within minutes after an earthquake, local authorities have only two kinds of information: the ground shaking (if felt) and, 5 minutes later, information from BMKG. Because tsunami waves come quickly, time is very limited and local authorities need to make an immediate decision about what their communities must do.



When an earthquake can be felt on the coast, there is no time to waste. Communities do not need to wait for a warning, but must start moving away from the coast and to higher ground immediately. However, an official call for evacuation that reinforces consistent community reaction should be based on information from BMKG.

Local authorities must have the communication equipment in place to receive warnings from BMKG. If they are well-equipped and operating 24 hours, local Operations Control Centres can receive information and warnings at any time.

STATUS (warning level)	Advice from NTWC to province, district and city governments	Guidance from local governments to their communities
MAJOR WARNING (AWAS)	Province/District/City governments that are at "Major Warning" level are expected to pay attention to this warning and immediately guide their communities for full evacuation .	Immediate call for evacuation!
WARNING (SIAGA)	Province/District/City governments that are at "Warning" level are expected to pay attention to this warning and immediately guide their communities for evacuation .	
ADVISORY (WASPADA)	Province/District/City governments that are at "Advisory" level are expected to pay attention to this warning and immediately guide their communities to move away from the beach and river banks .	Advice to stay away from the beach and river banks!
Earthquake information	Earthquake on land, earthquake with small magnitude or deep earthquake – no tsunami threat	No need to evacuate

Once they have the information, local authorities must decide whether or not they need to call for an evacuation. The advice from the BMKG will support this decision. The decision must be made immediately, as soon as the information is available; not a minute can be wasted.

Therefore, the mandate for decision-making and dissemination must be given to an institution that has permanent access to BMKG and the means to quickly disseminate guidance. Local Operations Centres can do the job if they are officially authorized. Officially approved Standard Operating Procedures (SOPs) must clearly state mandates and actions in the case of emergencies. This allows for decision-making and dissemination of an evacuation call even without prior approval from the head of government, who might not be reachable. The ultimate criterion for these SOPs is: the quicker guidance reaches the people, the better.



Local Dissemination: Getting Guidance to the People

Immediate and direct public dissemination from the authorities to the public is key to quickly reaching as many people as possible. Using multiple ways of delivering the message is important in dealing with possible failure of any one channel. Local dissemination technology must be resistant to failures caused by earthquakes. It requires a power back-up system. Radio communication (via VHF or FM radio stations) has proven to be most reliable. Remotely operated sirens and loudspeakers allow for direct public dissemination. Cellular phone networks often break down and do not qualify as a single solution.



Dissemination solutions must be in line with local resources, especially for maintenance. Using well-proven and already established dissemination systems is often better than setting up new ones only for tsunami warning. Tailor-made solutions for dissemination are required. They depend on the geography of an area and its population distribution. The success of local dissemination systems does not depend only on technical solutions. The public must be informed about how they can receive information long before any case of emergency.

The following devices can be used for local warning dissemination:

Remotely operated sirens transmit an alert tone directly to the public. The tsunami siren protocol by BMKG suggests a steady tone that lasts for three minutes. This siren means: immediate evacuation of coastal areas to higher ground. Sirens can include an announcement function that allows for transmitting additional guidance. The protocol also suggests regular testing on the 26th day of every month, at 10 am.

Radio communication (via VHF and HF) is a very common and cost-effective way of a two-way communication system. Resistant to failure, it has proven to be the most effective means of communication in the aftermath of an earthquake. The technology can be used to receive information, coordinate actors, and disseminate information. However, VHF and HF signals reach only those who have access to a communication radio.

VHF signals can also be transferred into FM frequencies. This means that an announcement that is made via VHF can be received with a normal (car or transistor) radio. If connected to mosque loudspeakers this technology allows even wider access to neighbourhoods without access to VHF and HF signals.





Local radio and TV stations can receive information directly from BMKG, as well as local authorities, and broadcast it on their programmes.

When information from local authorities reaches a neighbourhood, e.g. via communication radio, people can use simple tools like *kentongan*, a traditional wooden tool that is struck to attract attention. Using an agreed tone, this alerts others and spreads the information.

The Content of the Tsunami Kit Related Warning Dissemination

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

Checklist – an assessment and monitoring tool for local warning dissemination

Tool – manuals and guidebooks

- The Tsunami Warning Chain of InaTEWS
- Operations Manual for Tsunami Early Warning in local Operations Control Centres at Province, District and City Levels
- Dissemination of Tsunami Early Warning at the Local Level in Indonesia: an introduction to methods and technologies

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

- Local Operations Control Centres: Key Players in Tsunami Early Warning in Indonesia
- Getting the Warning to the People: Local Dissemination Solutions for the Last Mile

- How Warnings Reach People? Dissemination Technology Development in the Pilot Area of Java
- FM - Radio Data System: Introduction and Testing of FM-RDS for TEW

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

- The BHA (Bali Hotel Association) Tsunami Early Warning Service
- Media in the Warning Chain: The Role of Media in Disaster Preparedness
- Communication Network of SARs: Linking SAR Communities along the South Coast of Java

Further Resources – other useful documents

- KOMINFO's Regulations on Warning Dissemination

