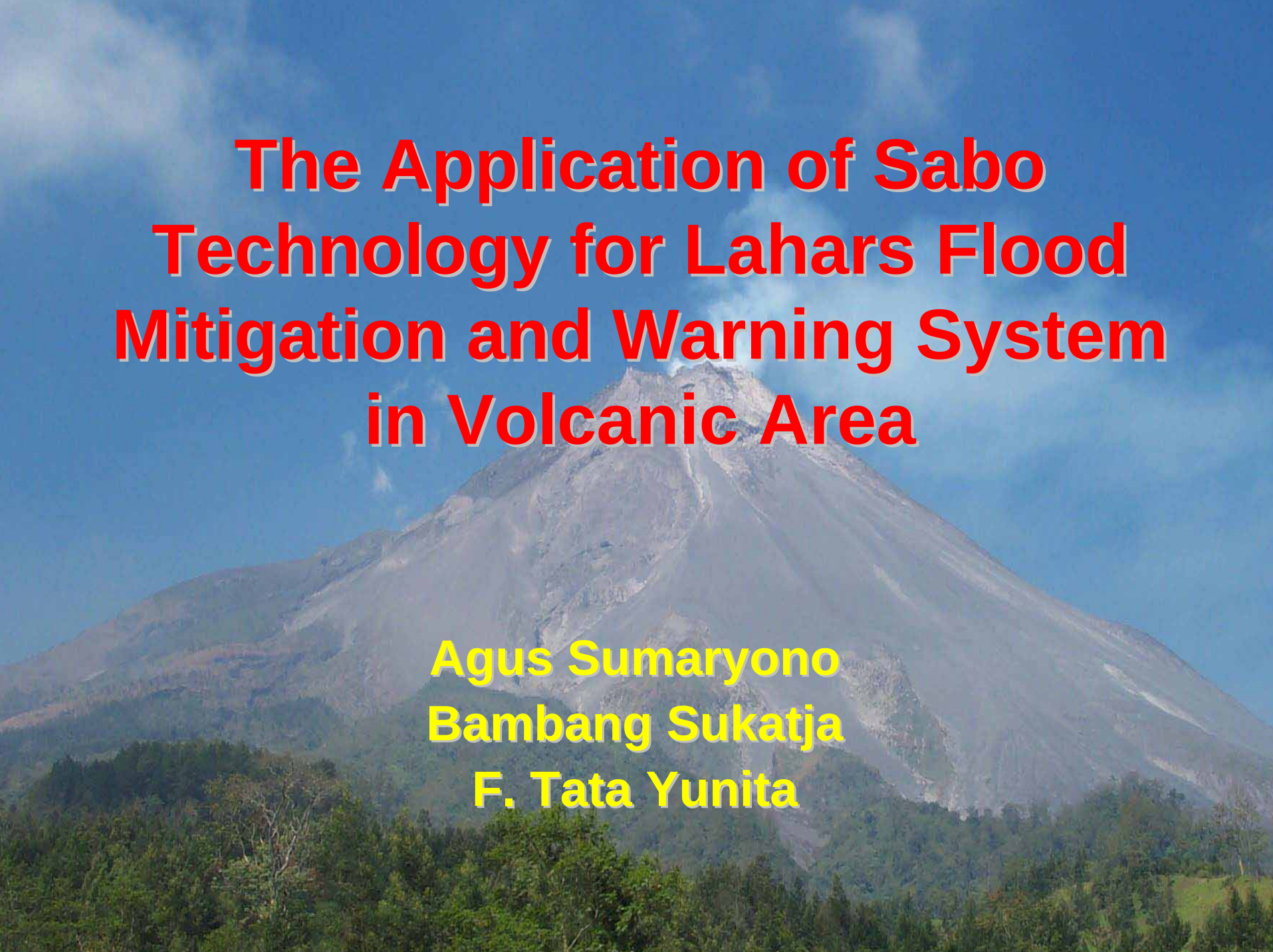

# The Application of Sabo Technology for Lahars Flood Mitigation and Warning System in Volcanic Area

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# BACKGROUND

Indonesia is one of the countries which are rich of active volcanoes (129 active volcanoes).

The activities volcanoes caused disaster such as loss of life and properties, damages of infrastructures and farmland, and also damages of hydraulic structure.

The Indonesia Government has constructed several sediment control structures along the lahars river and established warning and evacuation system in Mt. Merapi and Mt. Semeru.

The sediment control works have shown good results, on the other hands the warning and evacuation system showed insufficient result due to some reason.

# SCOPE OF ACTIVITIES

**The existing sediment control structures, warning and evacuation system against lahars flood in:**

1. **Mt. Merapi**
   - **Boyong River (upstream)**
   - **Code River (downstream)**

2. **Mt. Semeru**
   - **Mujur R**
   - **Rejali R**
   - **Glidik R**

# The Eruption of Merapi Volcano in 1994

- hundreds hectares of forest damaged,
- tens houses were destroyed,
- tens hectares of farmland were buried,
- 64 people and 10 cattle died.

The eruption produced 4 million cubic meter of pyroclastic which was deposited on the south slope of Merapi Volcano.

# Lahar Flow in Boyong & Code River

After 1994 Merapi eruption, ± 80% of pyroclastic material deposited the upstream of Boyong R.

In rainy season, the rain water mixed with sediment deposit and the mixture flow downward in the form of lahar flow.

The dense populated area along Boyong and Code River are effected by lahars floods.

It is needed to construct a series of sediment control structure and establish a forecasting and warning system along Boyong River.

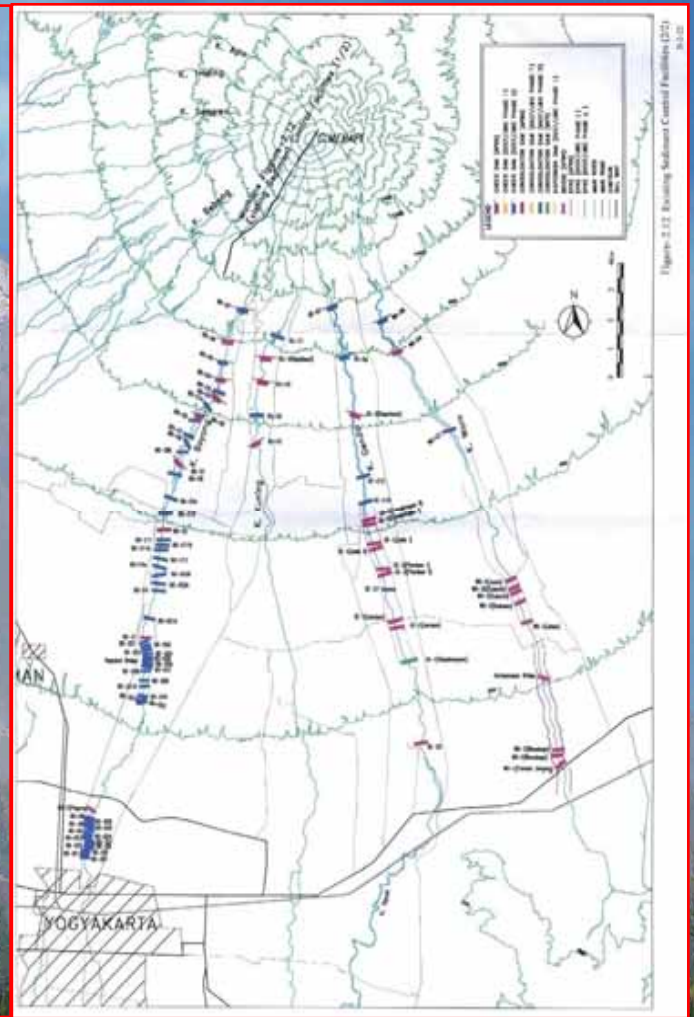
# Lahar Flood Control Works in Boyong & Code River

**The existing sediment control structures along Boyong and Code River:**

- Check dams : 8 units
- Consolidation dams : 19 units
- Groundsills : 23 units
- Bed girdle : 6 units
- Revertments : 9.167 m
- Training dikes : 3.880 m

**The planned capasity of sediment control works is 2,827,300 $m^3$.**

**The existing volume of sediment controled by the structures is 1,509,000 $m^3$.**



# The existing sediment control stuctures in Boyong River

BO-D1, Convensional Type Checkdam

BO-D5, Slit Type Check dam

BO-C12, Consolidation Dam

# The existing .....

BO-GS2B, Groundsill

BO-C10,
Multi-function sabo dam

# Lahars Flood Warning & Evacuation System in Boyong River

**The existing warning & evacuation system :**

- Automatic Rain Gauge : 1 unit
- Lahars Flood Sensor : 1 unit
- Ultrasonic Water Level Gauge : 2 units
- Telemeter system : 1 unit

# The exixting warming system equipment

Boyong River

Automatic rain gauge
in Kaliurang

Telemeter System of
Automatic Rain
Gauge in Plawangan

# The existing....

## Boyong River

Control Room of Telemeter System in Experimental Station for Sabo in Yogyakarta

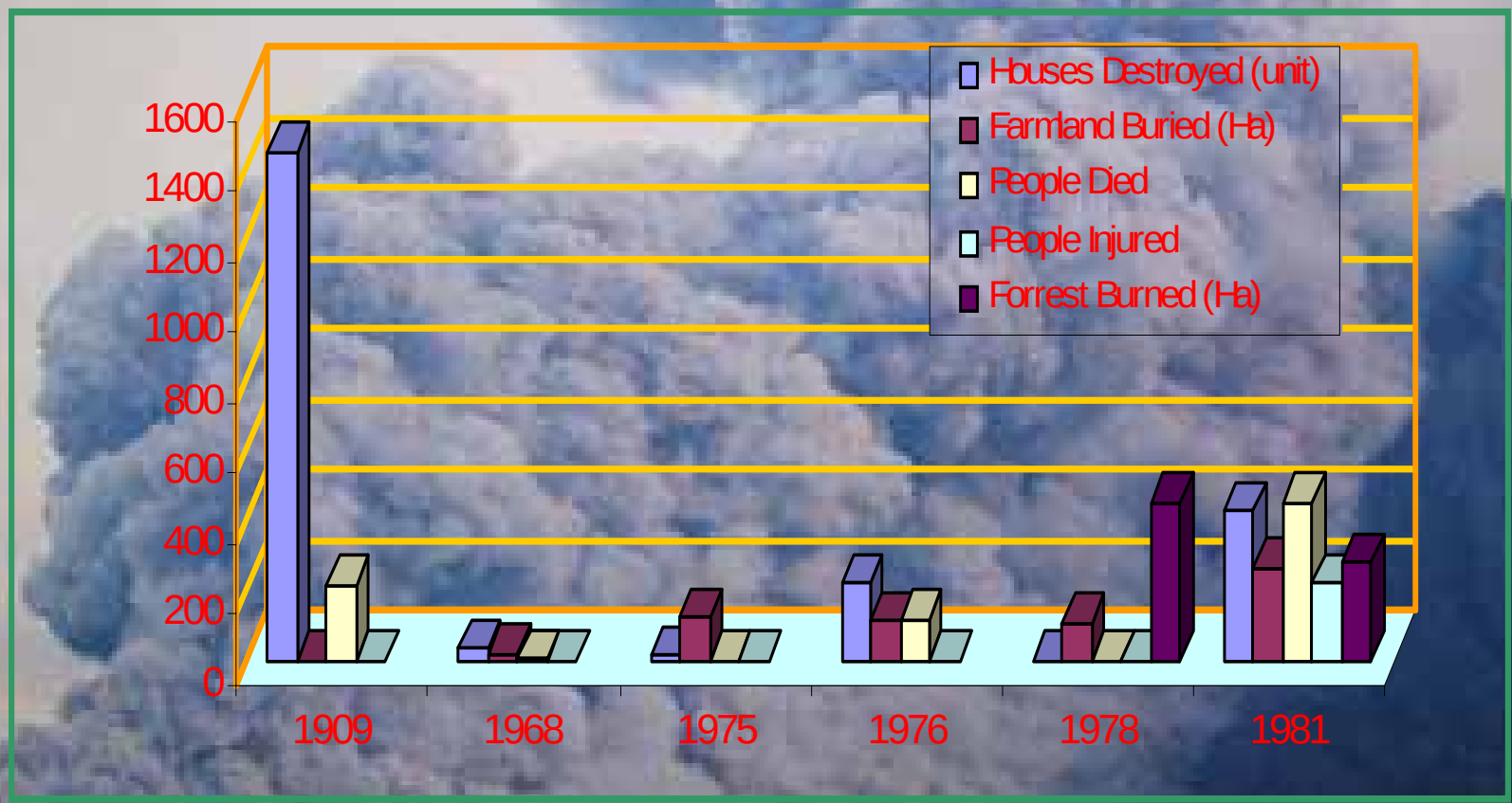
Automatic Water Level Gauge in Pulowatu

# Evacuation Drill in Merapi Area

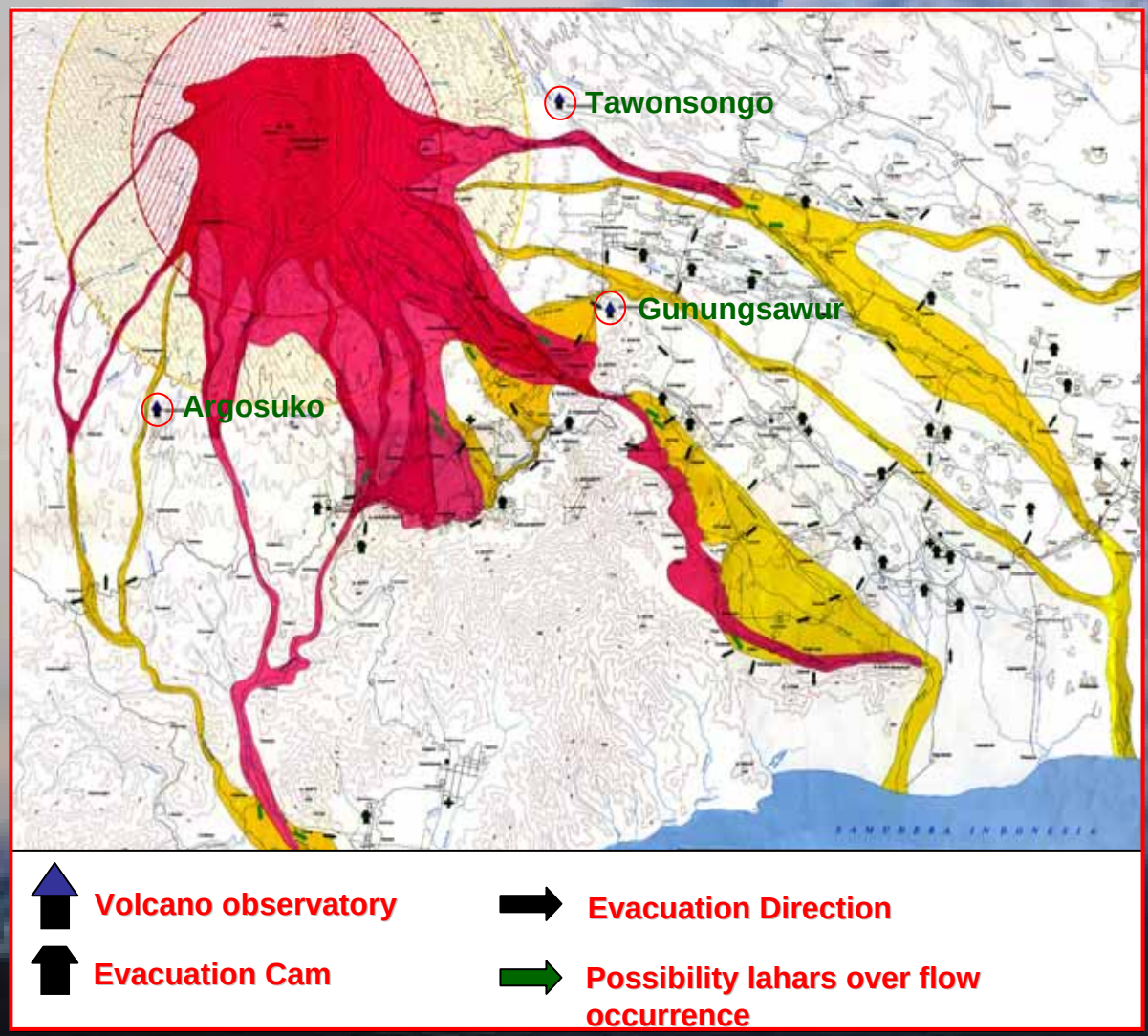
The operator was receiving warning signal for evacuating the people from vulnerable area

Evacuation drill was done by local people.

# Lahar Flood Disaster in Mt. Semeru Area



# Lahar Flood Countermeasure in Mt. Semeru




1. Structural : sediment control structures.
   - Mujur
   - Rejali
   - Glidik

2. Non Structural :
   - lahar flood forecasting
   - Warning & evacuation system

# Forecasting & Warning System in Semeru Volcanic Area

| No | River Catch-ment | ARG | | AWLG | | Lahar Sensor | | Radio Station | |
|---|---|---|---|---|---|---|---|---|---|
| | | Exist | Add | Exist | Add | Exist | Add | Exist | Add |
| 1 | Mujur | 2 | 2 | - | 2 | 1 | 1 | 1 | 5 |
| 2 | Rejali | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 |
| 3 | Glidik | - | 3 | - | 2 | 1 | 2 | 2 | 3 |

Note : *ARG : Telemeter Automatic Rainfall Gauge*
*AWLG : Telemeter Automatic Water Level Gauge*
*Exist : Existing,*
*Add : Additional*

# The lahar forecasting system equipment

Main Control Station of Lahars Warning System in Lumajang

Telemeter System of Automatic Water Level Recorder in Besuk Koboan River

Non-telemeter Automatic Rain Gauge in Mujur River Catchment Area

SEMERU

# The exixting warning system equipment

SEMERU

Radio and Siren Equipment at Station of Warning System

Station of Lahars Warning System in Lumajang

Main Station of Lahars Warning System in Lumajang

# DISCUSSION

1. Lahar Flood Countermeasure in Boyong River, Mt. Merapi Area
   - The number of sediment control structures is sufficient to control sediment discharge and to protect Yogyakarta City from lahar flood.
   - The existing equipment for lahar forecasting and warning system is in good condition and can be operated well without any significant problem.

2. Lahar Flood Forecasting & Warning System in Mt. Semeru Area
   - The early warning and evacuation system should be improved by installing additional warning equipment as well as the capacity of human resources.
   - The evacuation routes and camps should be clearly designated.
   - Evacuation drill should be carried out yearly.

# CONCLUTION

1. The existing sediment control structures in Boyong River, Merapi Volcanic Area is sufficient to protect Yogyakarta city from lahar flood as well as to secure the inhabitant who live surrounding the river.

2. The existing forecasting and warning system along Boyong River can work well in order to send the information and warning to the local people who live in the vulnerable area.

3. The existing forecasting and warning system against Lahars flood in Semeru Volcanic Area should be developed in order to send the information and warning to the local people who live in the vulnerable area well.


THANK YOU