



# Eruption of Mount Sinabung, North Sumatera, Indonesia, and SMS Gateway for Disaster Early Warning System

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# Objectives

- To identify the characteristic of Mt Sinabung eruption that threatening surrounding area
- To test and apply a model of such an information and communication systems for early warning in the disaster-prone areas by SMS gateway.



# Location of the Studi Area

- The volcano is located in Karo District, North Sumatera Province, Indonesia, geographically on 3°10' North Latitude, and 98°23', East Longitude.
- It is about 2460 m high above sea level, and the highest volcano of Sumatera.





# Location of the Study Area



# Activities History

- Mount Sinabung, the sleeping volcano since the year 1600 awakened and erupted in 2010, 2013, and 2015.
- Estimated about 400 years long inactive, therefore categorized as B type of volcano.
- Erupted on 27 August 2010, again on November 2013, in Jan to Sep 2015, and in Feb - May 2016.
- Awakening of the volcano hypothetically has been triggered by last decade earthquakes happened in North Sumatera, including the great earthquake and tsunami of Aceh, December 2004 that caused about 115,000 people died.



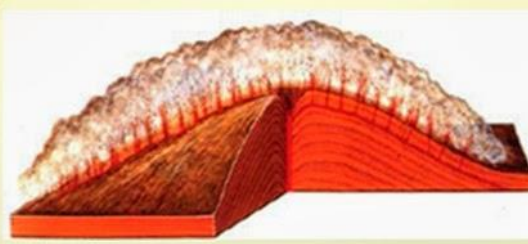
# Eruption Characteristic

- Mt. Sinabung eruption of 2010 and 2013 were characterized by moderately high gas pressure upward, and classified into vulkanian type.
- Eruption in 2015 was characterized by the occurrence of lava dome and avalanche pyroclastic flow, the eruption of Mt. Sinabung changes to be Merapi and Pelean types.
- Area which is highly threatened by Mt. Sinabung volcanic hazards is the Karo District, North Sumatera.





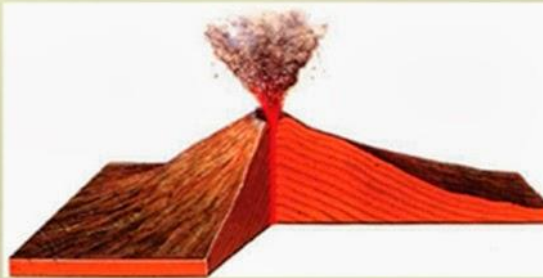
# Types of Volcanic Eruption



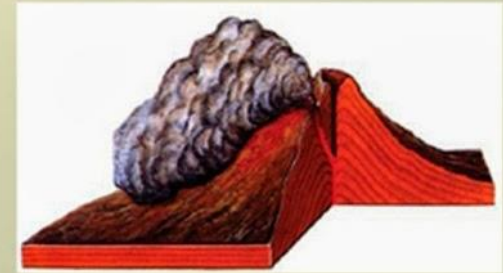
Gambar : Tipe Hawaii



Gambar : Tipe Stromboli



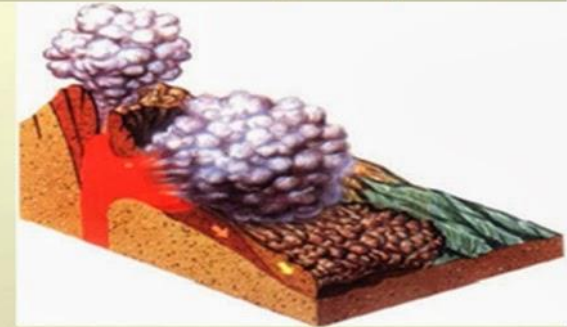
Gambar : Tipe Vulcano



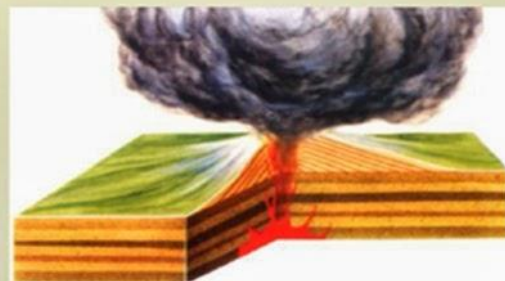
Gambar : Tipe Merapi



Gambar : Tipe Perret atau Plinian



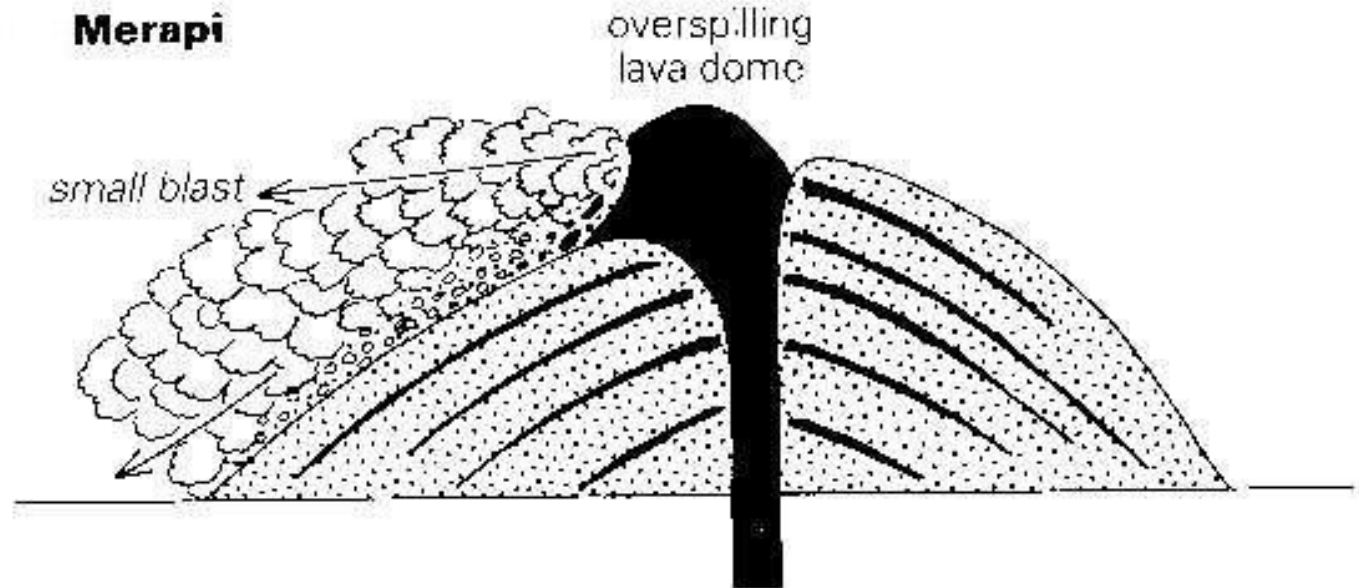
Gambar : Tipe Pelee



Gambar : Tipe Sint Vincent

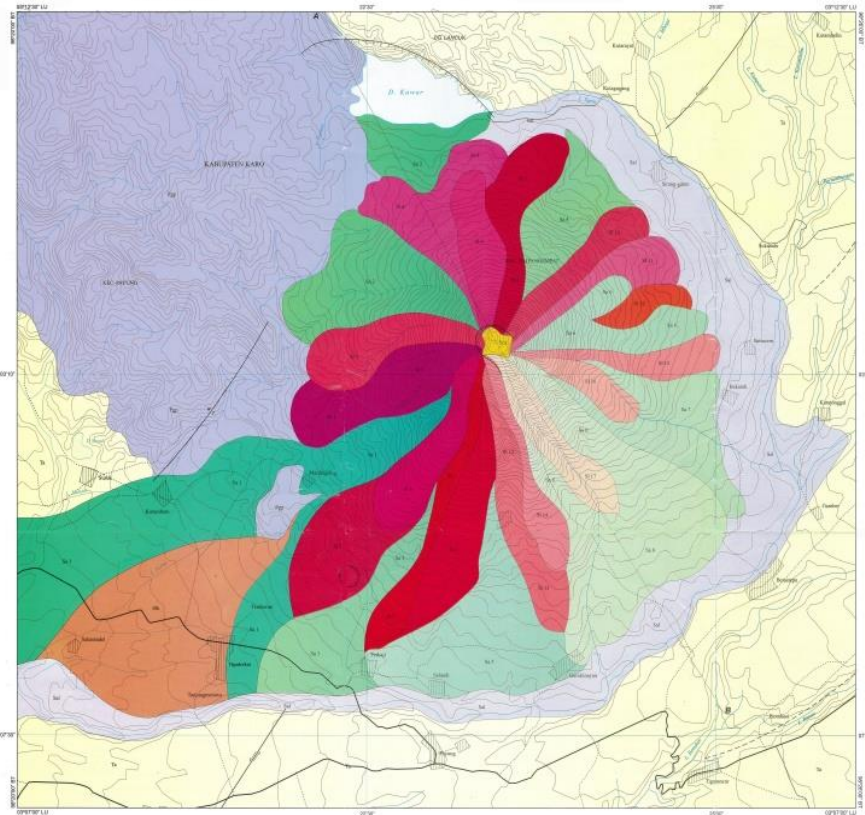


# Merapi type



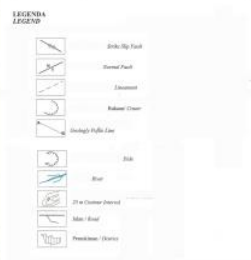


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KORELASI SATUAN PETA  
 CORRELATION OF MAP UNIT

NO. UNIT	NAMA UNIT	KETERANGAN	SATUAN BATUAN / ROCK UNIT	
			SIKAP	STRUKTUR
1	Lava Flow 1			
2	Lava Flow 2			
3	Lava Flow 3			
4	Lava Flow 4			
5	Lava Flow 5			
6	Lava Flow 6			
7	Lava Flow 7			
8	Lava Flow 8			
9	Lava Flow 9			
10	Lava Flow 10			
11	Lava Flow 11			
12	Lava Flow 12			
13	Lava Flow 13			
14	Lava Flow 14			
15	Lava Flow 15			
16	Lava Flow 16			
17	Lava Flow 17			
18	Lava Dome			
19	Pyroclastic Flow 1			
20	Pyroclastic Flow 2			
21	Pyroclastic Flow 3			
22	Pyroclastic Flow 4			
23	Pyroclastic Flow 5			
24	Pyroclastic Flow 6			
25	Pyroclastic Flow 7			
26	Pyroclastic Flow 8			
27	Alluvium			
28	Lahar Deposits			
29	Toba Pyroclastic Flow			
30	Limestone			



GEOLOGICAL MAP OF SINABUNG VOLCANO, NORTH SUMATERA PROVINCE

(Revisi 2011)  
 O. PRAMBADA, A. ZAENUDDIN, BRYANTO, I. SANTOSA, N. SAKADA & M. YOSHIMOTO  
 2011

LEGENDS

SEDIMENTS

- Alluvium

VOLCANIC DEPOSITS

- Lava Flow 17
- Lava Flow 16
- Lava Dome
- Pyroclastic Flow 8
- Pyroclastic Flow 7
- Lava Flow 15
- Pyroclastic Flow 6
- Lava Flow 14
- Lava Flow 13
- Pyroclastic Flow 5
- Lava Flow 12
- Lava Flow 11
- Lava Flow 10
- Pyroclastic Flow 4
- Lava Flow 9
- Lava Flow 8
- Lava Flow 7

- Lava Flow 6
- Pyroclastic Flow 3
- Lava Flow 5
- Lava Flow 4
- Lava Flow 3
- Pyroclastic Flow 2
- Lava Flow 2
- Lava Flow 1
- Lahar Deposits
- Pyroclastic Flow 1

TOBA DEPOSITS

- Toba Pyroclastic Flow

SEDIMENTARY ROCK

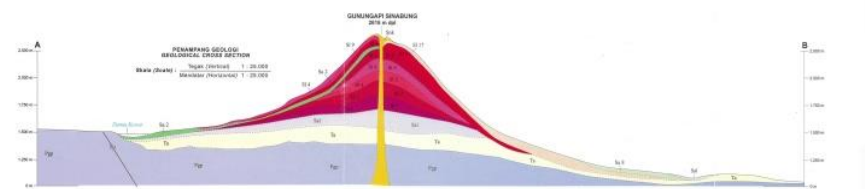
- Limestone

REFERENSI / REFERENCES

Prambada, O., Zaenuddin, A., Bryant, I., Santosa, I., Sakada, N., & Yoshimoto, M. (2011). Geological map of Sinabung volcano, North Sumatra Province, Indonesia. *Journal of Volcanology and Geothermal Research*, 101, 1-12.

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Eruption impact, 2015

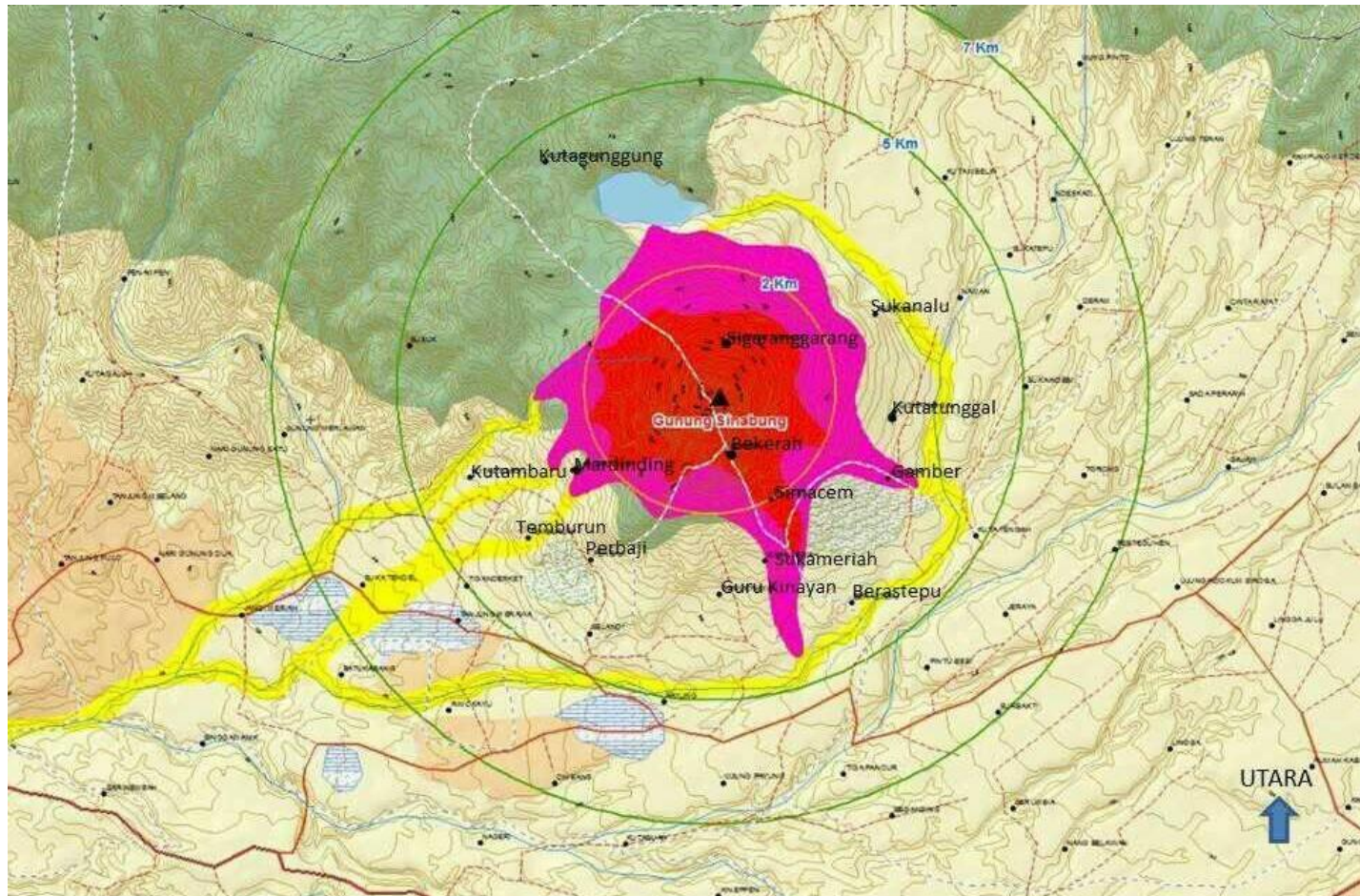
Eruption impact, 2016







# Map of disaster prone area of Mt. Sinabung (Geologic Survey of Indonesia, 2015)



Pyroclastic flows zone



Danger zones



UTARA





# SMS Gateway for Disaster Management

- SMS gateway is developed as a model of environmental communication for early warning system in disaster management.
- In disaster mitigation there are two things that interdependent one another, including human and environment.
- All of the stakeholders involving in the system have their own role to participation.
- Operating system and the application server of SMS is done by COMBINE, connected to the Internet with a public I-Phone.



- SMS gateway system is built in two parts, the technical application and the program management.
- It was constructed through several stages:
  - Dissemination process;
  - The collection and management of mobile phone number in the system;
  - Media Management Center;
  - Socialization and training for the user;
  - Preparation of Standard Operating Procedure development; and
  - Management of information systems

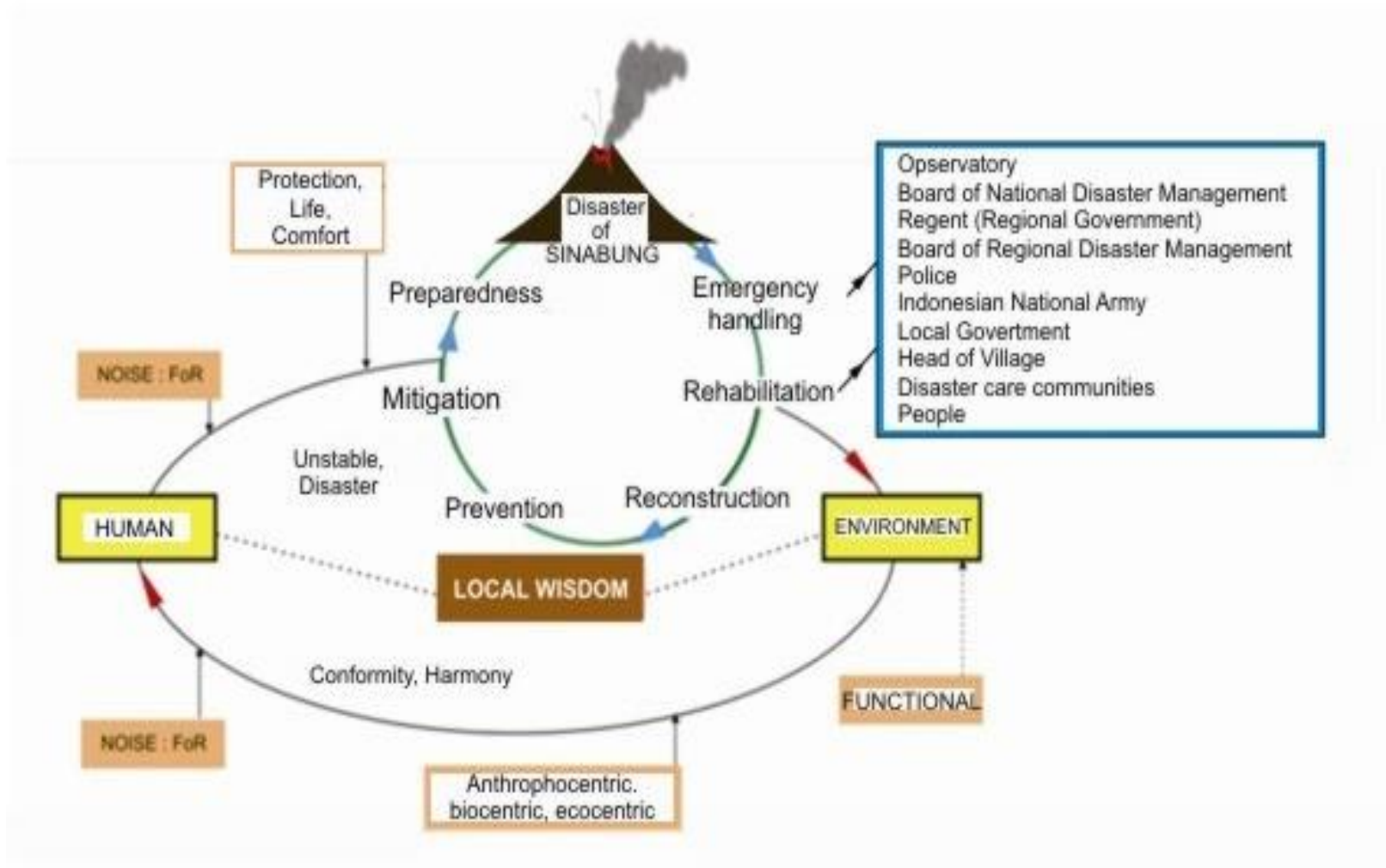


- Standard Operation Procedure (SOP) is a guideline or a reference to perform job duties in accordance with the functions and performance.
- SMS Gateway for early warning system was tested in Sinabung area. There are two audiences/key target groups, namely government and society.  
Government, as an SMS recipient, has the role as the policies decision-maker, the community is expected to obtain the decision for the security and safety of themselves, based on SMS information.



- Both groups get information from the Volcano Observatory of Mount Sinabung as the media center or SMS gateway administrator for Early Warning of the eruption.
- Government gets detailed and essential information, which is necessary for regional policy decisions.
- SMS information to the community groups is related to the volcano, knowledge and disaster education, emergency situation, and the status of the volcano, such as emergency or alert.





# Obstacle

- The operator is roled by a staff of the Department of Communication and Information Technology who performs as only an additional jobs among other duties
- He/she does not show a serious responsibility to handle his/her duty in disaster management, especialy as the operator of SMS Gateway





# Conclusions

- Mt Sinabung now becomes to be the most active volcano of Indonesia
- It changes its eruption characteristic from Vulkanian type to be Merapi and Pelean types.
- Map of disaster prone area of Mount Sinabung has been developed by the Geologic Survey of Indonesia
- SMS Gateway for communication system in disaster management of Mt Sinabung is developed although there is an obstacle in its implementation.
- The main constrain making SMS Gateway does not successfully implemented (in this time) is due to the operator that is not professional



**Thank You  
for Your Attention**

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