Sep. 17, 2023

# Utilization of satellite data in the recent volcanic disaster at Mt. Semeru, Indonesia

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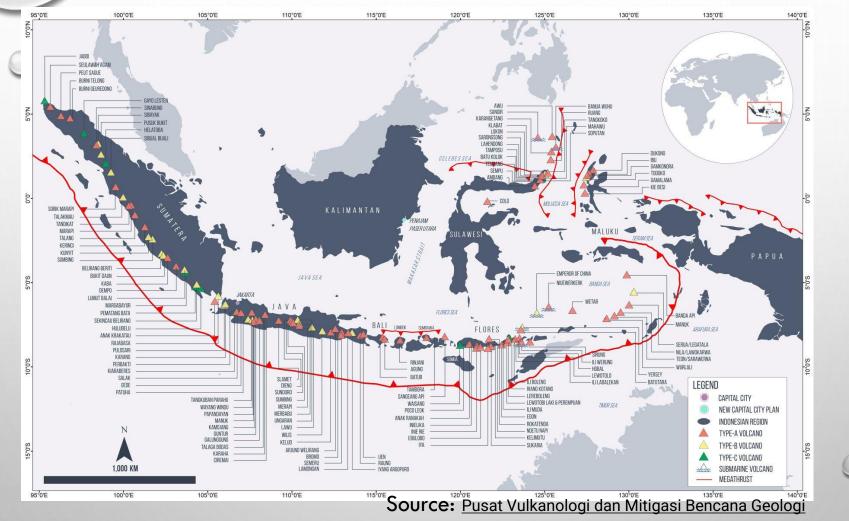
- 1. Outline of Volcanoes in Indonesia
- 2. Outline of Mt. Semeru Volcano
- 3. Utilization of Satellite data in Mt. Semeru

Volcano disasters

4. Conclusion



### **Outline of Volcanoes in Indonesia**



There are 128 active volcanoes in Indonesia, 16% of all world volcanoes.

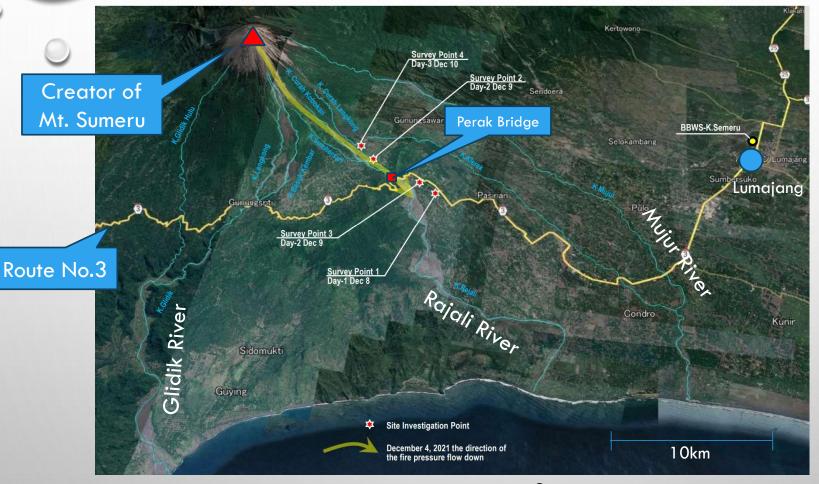
# Outline of Mt. Semeru Volcano(1)



### Location of Mt. Semeru



### Outline of Mt. Semeru Volcano(2)



Source: Yachiyo Engineering Co.Ltd.

5

### Mt. Semeru and Surroundings

### Outline of Mt. Semeru Volcano(3)



### Mt. Semeru (3675.7m)

6



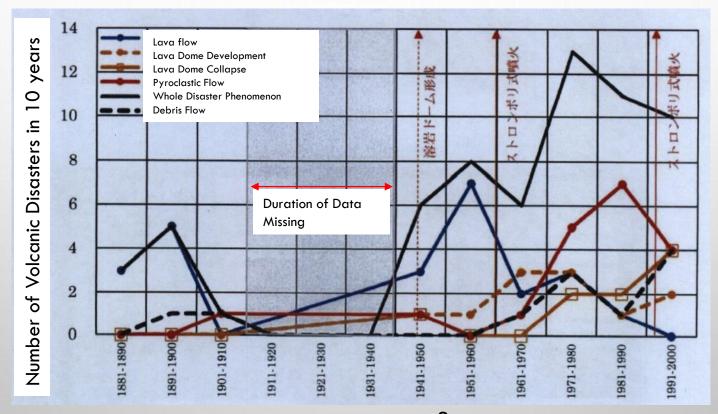
# Outline of Mt. Semeru Volcano(4)



### Crater of Mt. Semeru



**Outline of Mt. Semeru Volcano(5)** 



Source: Yachiyo Engineering Co.Ltd.

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History of Volcanic Disasters of Mt. Semeru

- On December 4, 2021 at 14:46, Mt. Semeru erupted with pyroclastic flow.
- ✓ Around 50 fatalities and 10,000 evacuees were reported.
- ✓ During the first large-scale eruption, the volcanic plume rose about 1.5 km and pyroclastic flows reached up to 17 km along the river.
- Immediately after the eruption, two villages near the crater were swallowed by the pyroclastic flow.
- ✓ Perak Bridge at Route No.3 was destroyed by Debris flow.
- ✓ Immediately after the disaster, JICA team issued Emergency Observation

Request to Sentinel Asia Secretariat, ADRC.

Status of Pyroclastic Flows (*Awan Panas*) and Debris Flows Caused by Pyroclastic Flow Deposits (*Lahar Dingin*)

Peta Kawasan Rawan Bencana Gunungapi Semeru

5km

10kn

Sedimen

https://vsi.esdm.go.id/gallery/index.php?/category/2

20kr

#### Hazard Map for Volcanic Disaster

-9-

YACHIYO



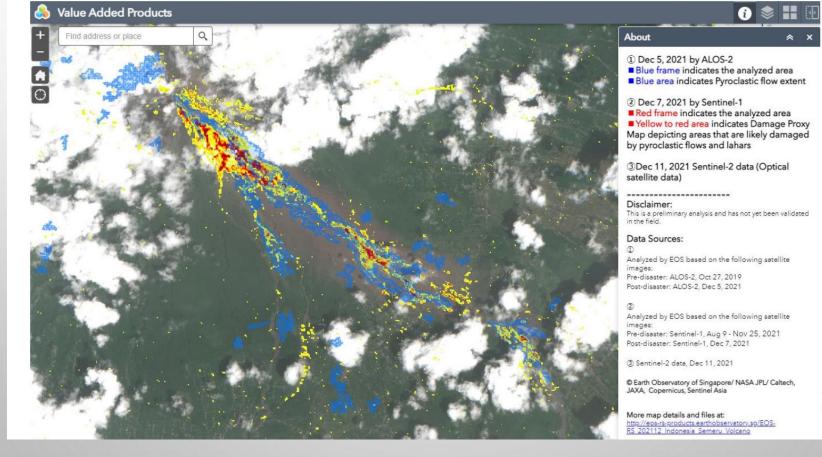
Along Rajali River10km from the summit





Perak Bridge, Route No.3(12km from the summit)

Satellite Image Analysis by Nanyang Technological University in Singapore



# jîca 🍅

Explanatory map of volcanic products by the consultant team

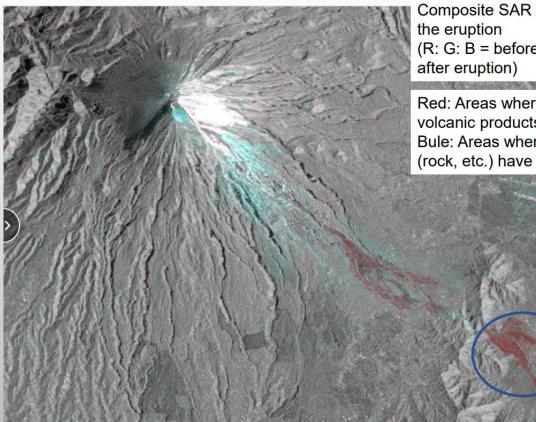


Note: The blue area is the area of topographic height change as of December 5, 2021, including pyroclastic flow deposits from the 2020 eruption. The red to yellow areas are the topographic height change areas caused by the December 4, 2021 eruption. Therefore, the major area of topographic change due to volcanic ejecta remaining at the present site is estimated to be the composite area of the blue area and the red to yellow area. The gray area is the area burned by volcanic ash and pyroclastic flow estimated from the satellite image (Sentinel2: European Satellite) of December 2021. (Source: Yachiyo Engineering Co., Ltd, EAST JAVA G.SEMERU VOLCANIC ERUPTION SITE DISASTER INVESTIGATION Ver-2)

3



Composite SAR images: before and after eruption



Composite SAR images before and after the eruption

(R: G: B = before eruption; after eruption: after eruption)

After SAR\_RGB\_2021-12-04 \$

Choose an image to visualize

Red: Areas where the ground surfaces are flattened by volcanic products. Bule: Areas where undulations of the ground surfaces

Bule: Areas where undulations of the ground surfaces (rock, etc.) have increased.

It is estimated that the river bed was flattened by the sediment (volcanic products due to pyroclastic flow and lava flood)



#### Composite SAR images: just after the eruption and 1.5 month after

Accumulated sediments (flat surfaces) were flashed by river flow, then the rocky river beds (undulation surfaces) have been appeared. Composite SAR images just after the eruption and 1.5 month after



(R: G: B = 2021-12-09: 2022-01-20: 2022-01-20)

It is estimated that the sediments (volcanic deposits) have moved from upstream to downstream. (the river beds of downstream have been flattened.)

The surfaces of river channel have flattened by sediment and/or water

There are no significant changes detected by the satellite images of the surface of the Glidlk river. (other rivers can be checked whether their surface has flattened, undulated or not)

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Surface temperature distribution estimated from satellite image

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GCOM-C Ascending(Night)

GCOM-C_Ascending(Night) GCOM-C_Descending(Day)		
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### Conclusion

- 1. Immediately after the disaster, several valuable satellite data were provided.
- 2. These data were much helpful for preparation for field survey.
- In addition of providing satellite data, advises from experts of satellite data also are helpful.
- Interpretation of satellite data are difficult for officers in the site, so dissemination of knowledge how to utilize satellite data in case of disaster are expected.