UNIVERSITAS GADJAH MADA

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Unmanned Aerial Vehicle (UAV) Utilization for Disaster Risk Reduction

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Outline

- Background
- Disaster Risk Reduction
- Method of mapping using UAV
- Application of UAV for DRR

Background

- Disasters due to both natural and human hazards
  - Over 400 million people affected by natural hazards
  - Increasing disaster event in the last decade, especially hydrometeorology disaster
  - Human caused hazards leading to disasters
- Limitations of existing approaches
  - Local maps with not accurate scale, limited use of GIS
  - Concentrate in the affected area not the source of disaster
  - Using not update satellite images
  - Mostly after disaster

The Four Priorities for Action of Disaster Risk Reduction (Sendai Framework)

- Priority 1. Understanding disaster risk
- Priority 2. Strengthening disaster risk governance to manage disaster risk
- Priority 3. Investing in disaster risk reduction for resilience
- Priority 4. Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction

Challenge to Risk Reduction & Rapid Response

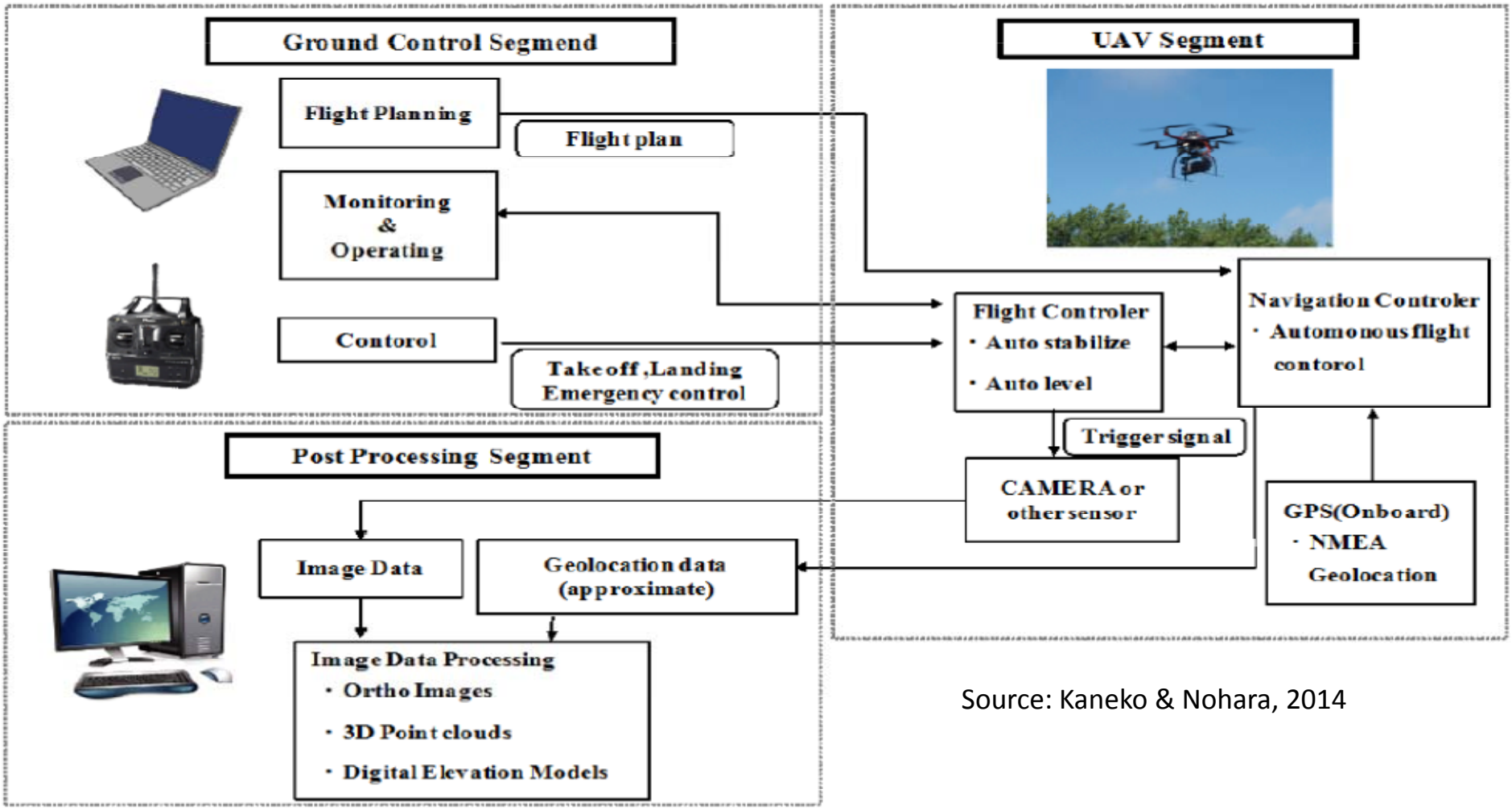
Temporal Resolution → **Very hard to be satisfied but it is a critical factor for risk reduction & rapid response.** *(satellite revisit time, the time to acquire the first image of the disaster, … …)*

Uninterrupted Monitoring → **Very difficult to be implemented in a period of days.** *(orbit limitation for satellite, tired or unbearable for Manned aircraft)*

Extreme environments → **Very dangerous.** *(poison gas, nuclear leakage, volcanic eruptions, … …)*

Source: Li, C., 2014

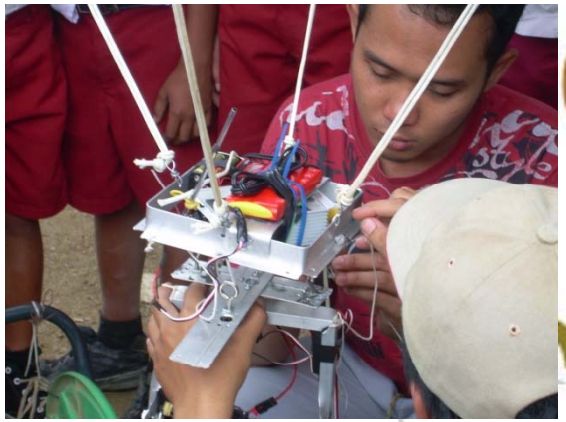
The Schematic Diagram of Mapping by UAV Method

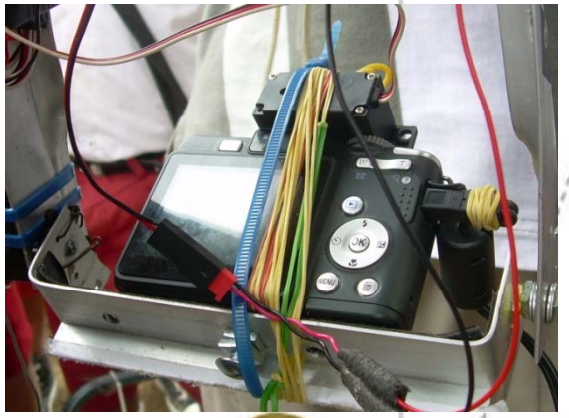


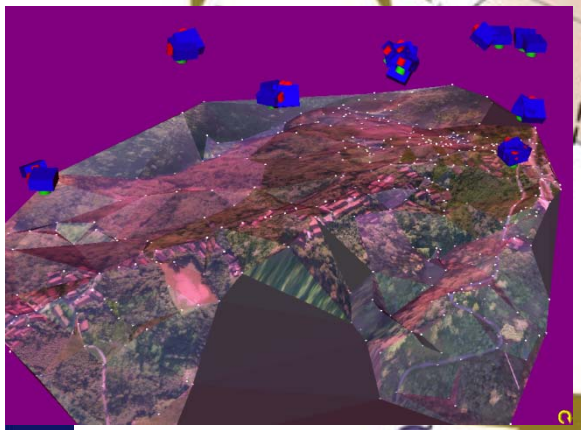
Source: Kaneko & Nohara, 2014

Tools for Aerial Photogrammetry

Digital Photogrammetry







Altitude:
150m – 300 m

Effective Ground Coverage:
120m – 250m

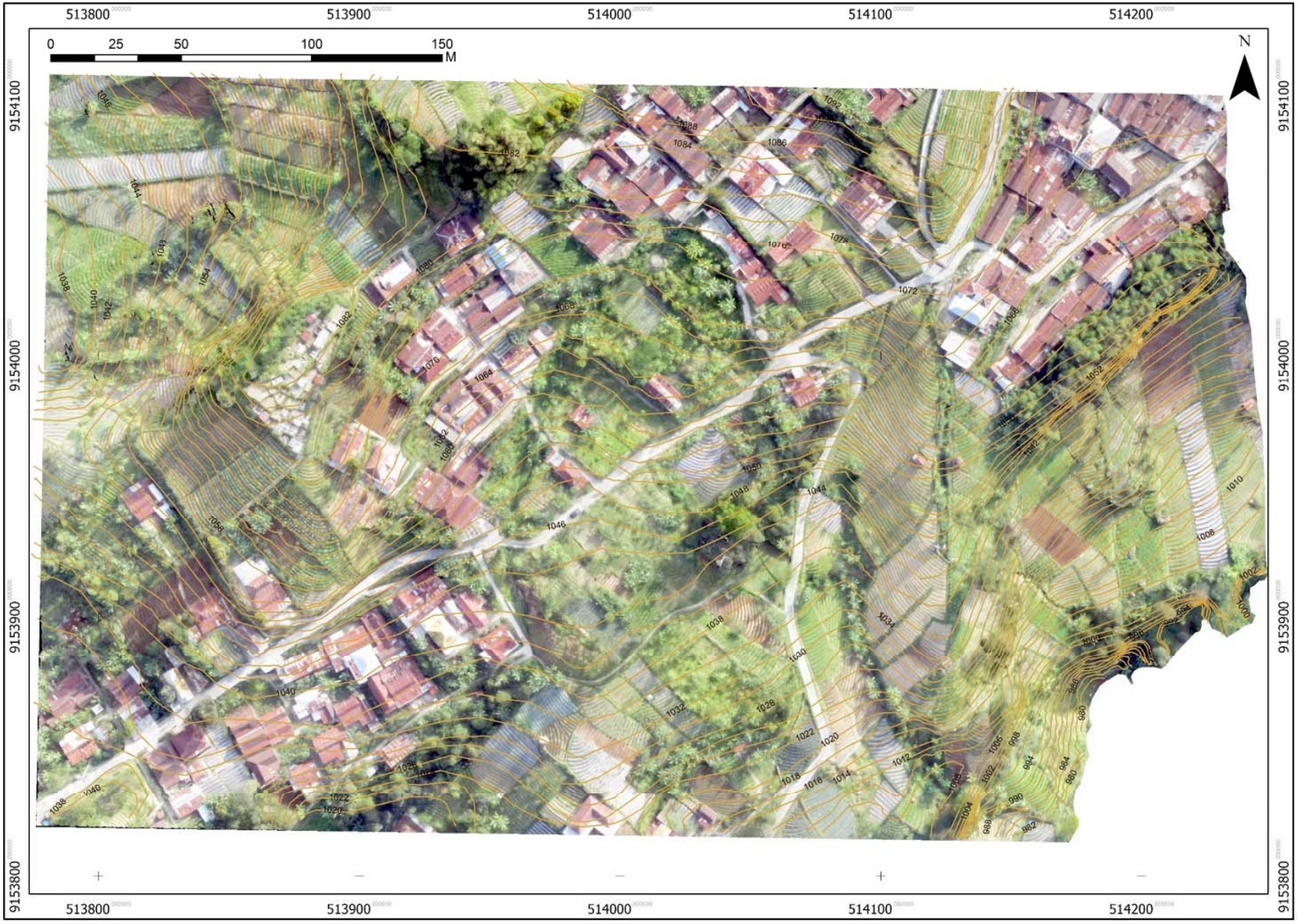
Camera:
Min 12Mpixel
With Lens Calibration Parameter

Remote camera exposure

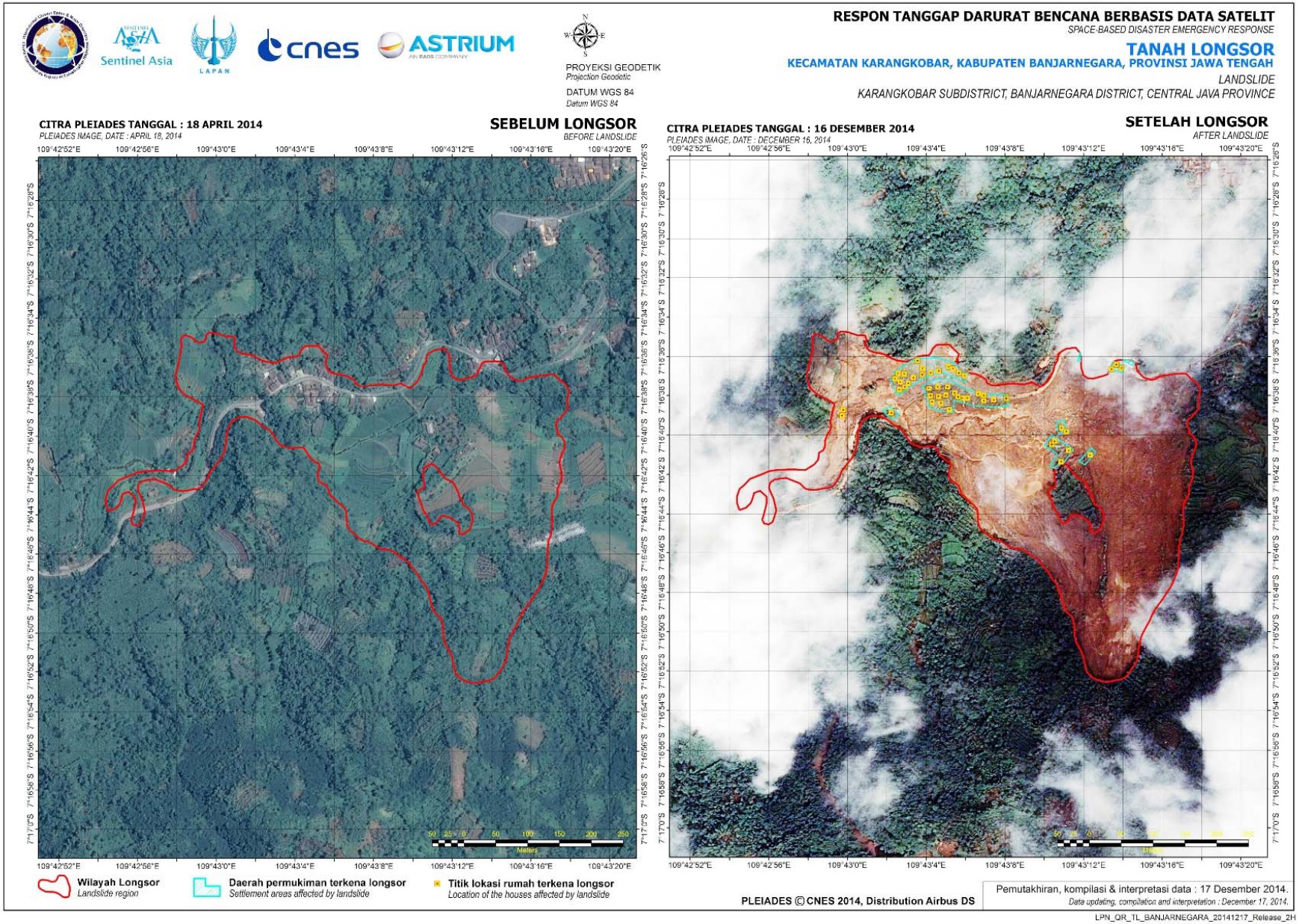
Flying Methods of UAV

Difference Images and Aerial Photos

Aerial Photo with Contour



Landslide in Banjarnegara, Central Java

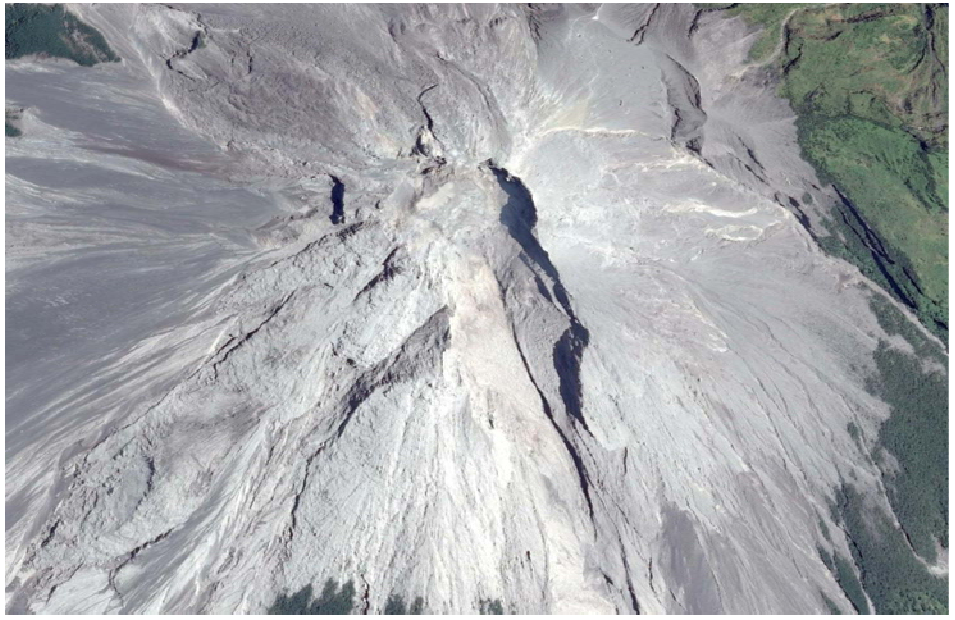


Mount Merapi Before 2010 Explosion

Mount Merapi After 2010 Explosion

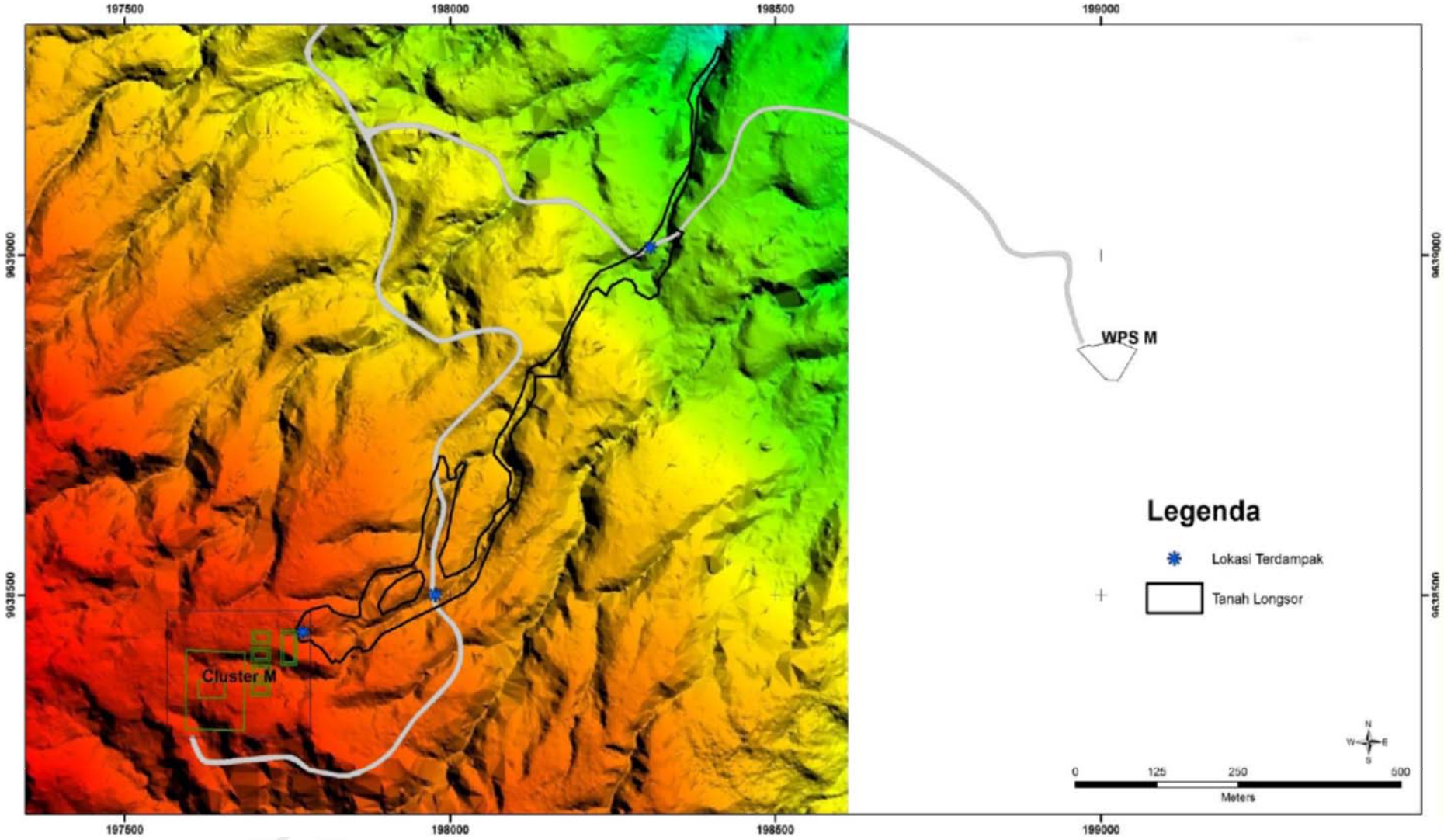
Mount Merapi 2006

Mount Merapi 2016

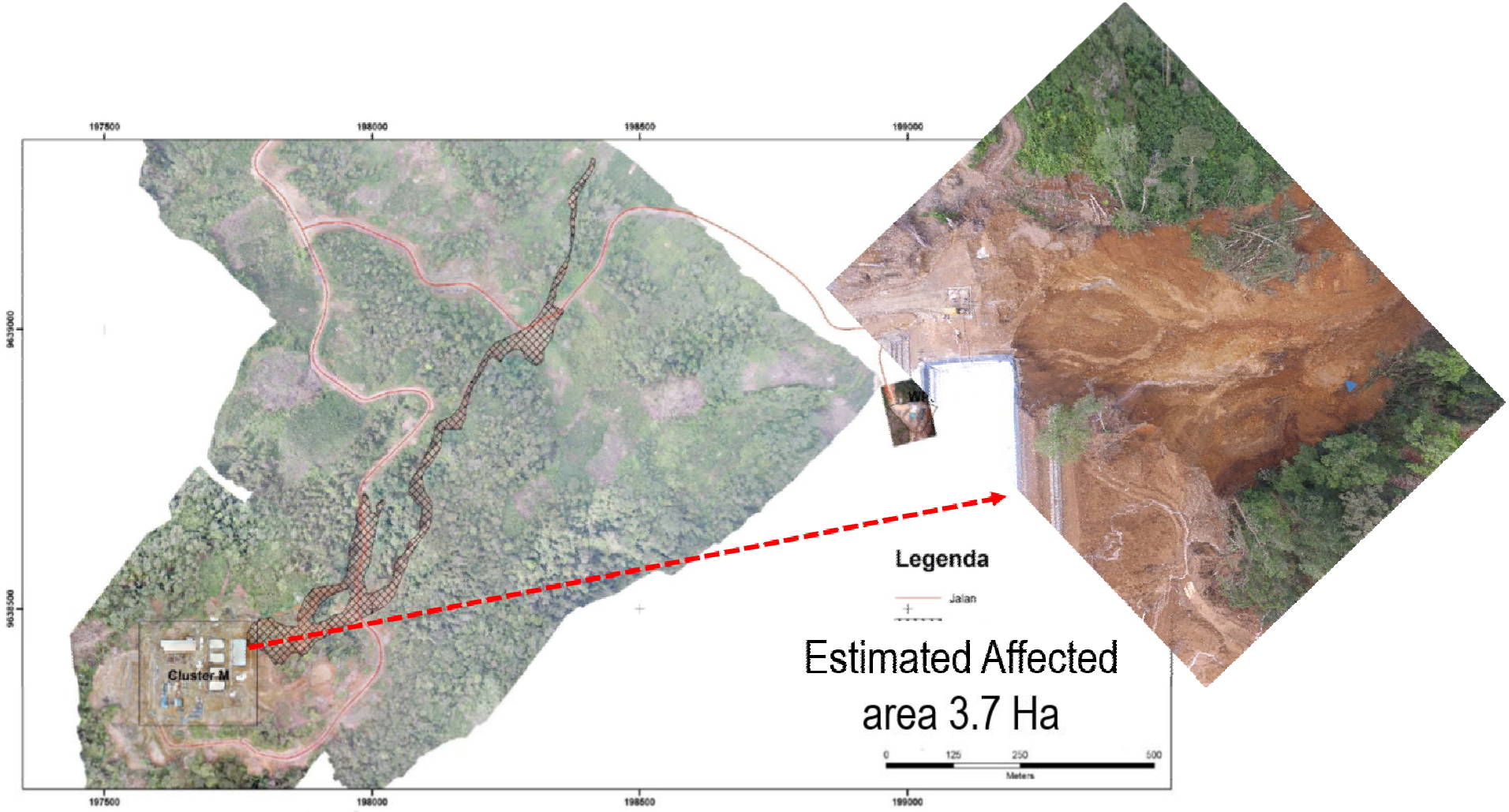


Identification of Crack Structure by UAV

Topography Condition before Debris flow



Affected Area From Debris flow



Conclusions

UAV for DRR :

- Accurate and effective to reach a remote area for potential hazard identification
- Rapid assessment and monitor continuously
- Meet time-sensitive and high resolution needs of risk assessment, emergency response and disaster relief

THANK YOU