The 29th Asia Pacific Regional Space Agency Forum ke-29 (APRSAF-29)

"Accelerating Space Economies through Regional Partnership"

Accelerating Satellite-based Data and Information for Disaster Risk Management in Indonesia

BADAN GEOLOGI

Kementerian Energi dan Sumber Daya Mineral

Jakarta, 17 September 2023

BADAN GEOLOGI
Kementerian Energi dan Sumber Daya Mineral

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Dasar Hukum: Peraturan Menteri ESDM Nomor 13 Tahun 2016
tentang Organisasi dan Tata Kerja Kementerian Energi dan Sumber Daya Mineral

ISU DAN PROGRAM STRATEGIS PEMBANGUNAN BADAN GEOLOGI

Isu Strategis Sub Sektor Geologi Dapat Dikelompokkan
Dalam 4 Pilar Pembangunan:

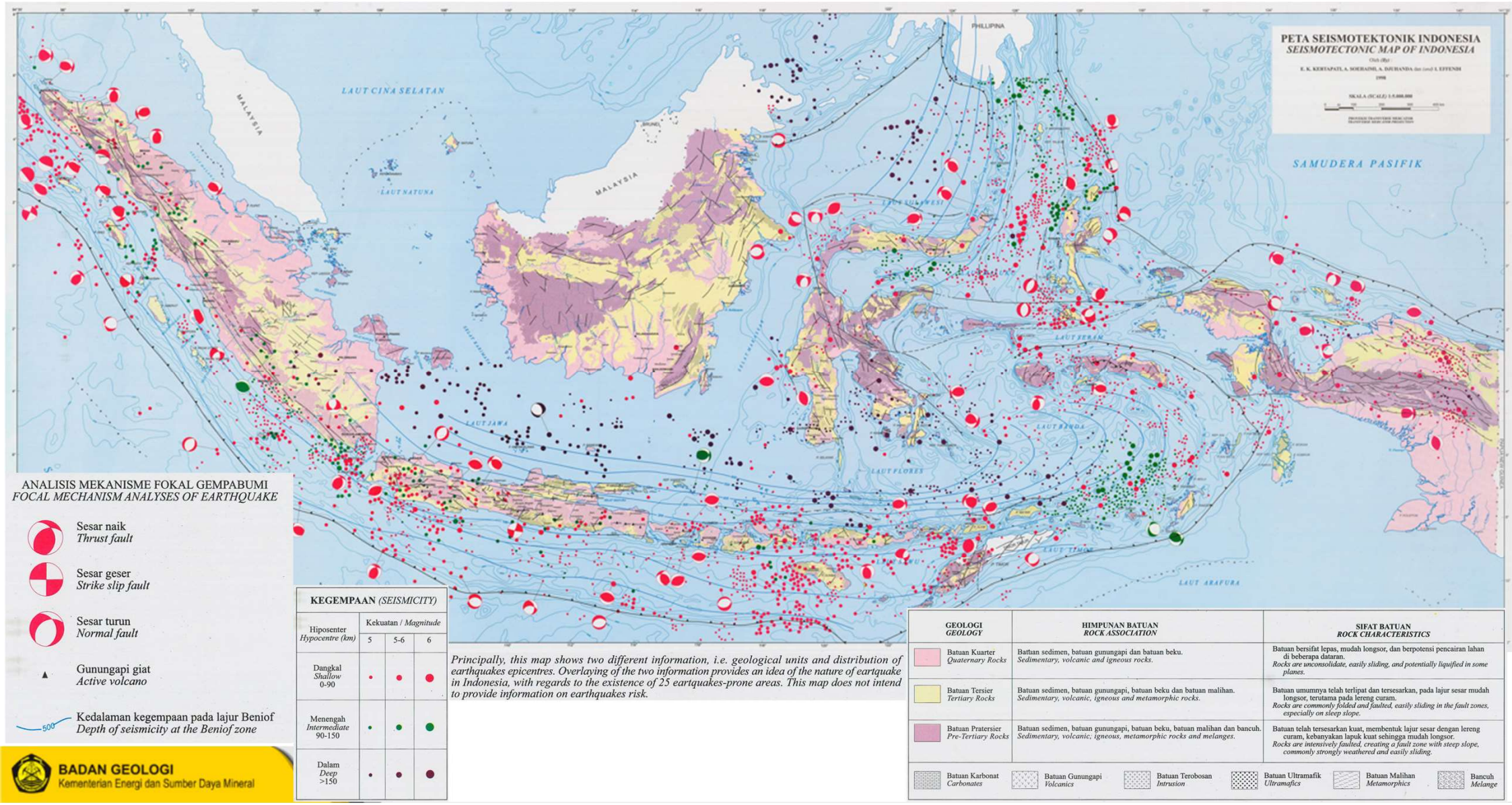
1. GEOHAZARD (Kebencanaan Geologi)
Increased risks, impacts and victims due to geological disasters

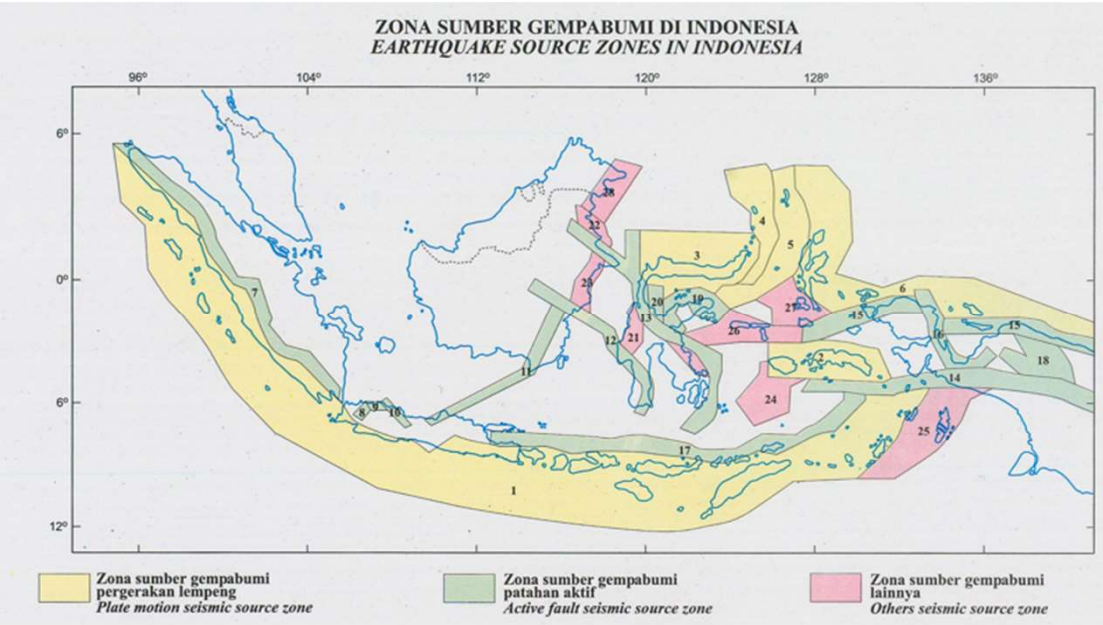
2. **GEORESOURCES** (Sumber Daya Geologi)
Energy contribution to the clean energy transition.
National energy issue and strategic minerals

3. GEOENVIRONMENT (Geologi Lingkungan)
Geological constraints in spatial planning and infrastructure development
Improved licensing and groundwater management
Geological conservation (Geological Heritage, Geopark, Nature Reserve Area
Geology and Geoheritage (KCAG), Karst Landscape Area (KBAK)

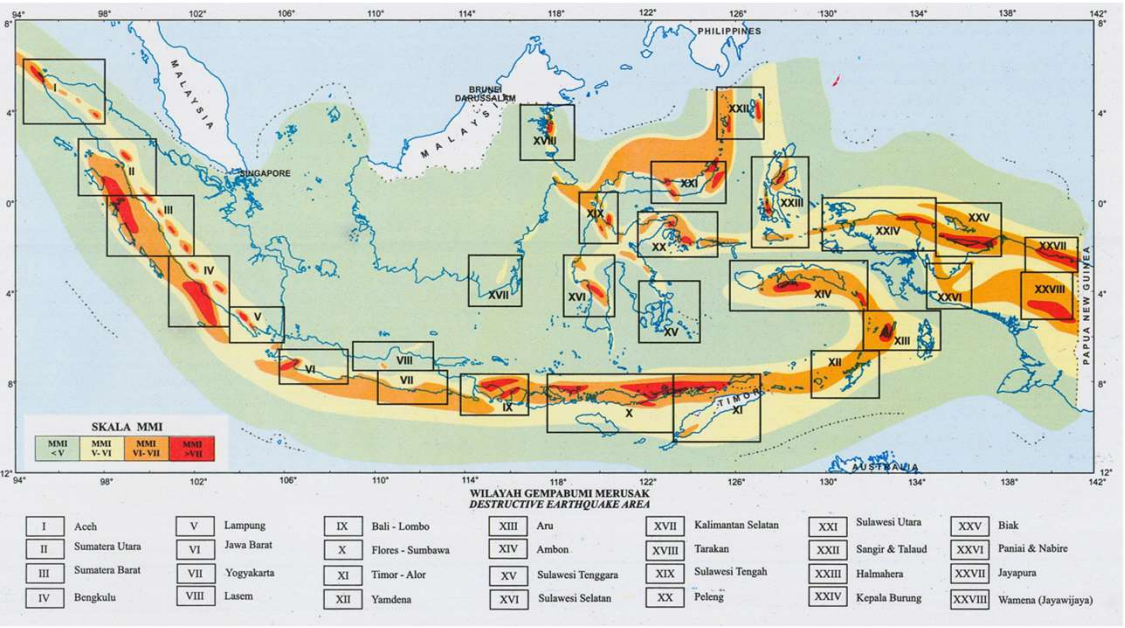
4. GEOSERVICES (Pelayanan Geologi)
Information and service data needs from stakeholders
Facilities, infrastructure and information technology
HR competency and capacity
Geological Regulations

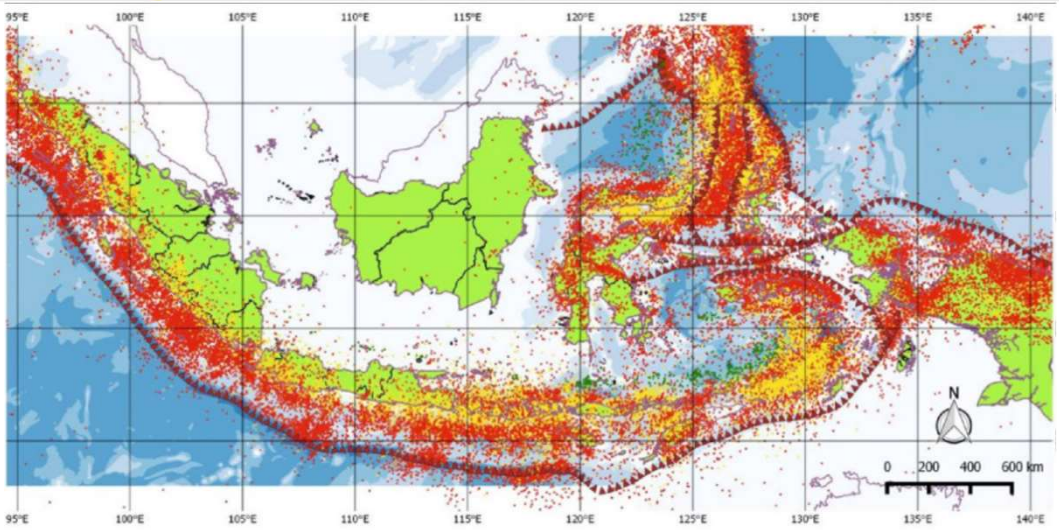
1. Potential and management of geological disasters in Indonesia





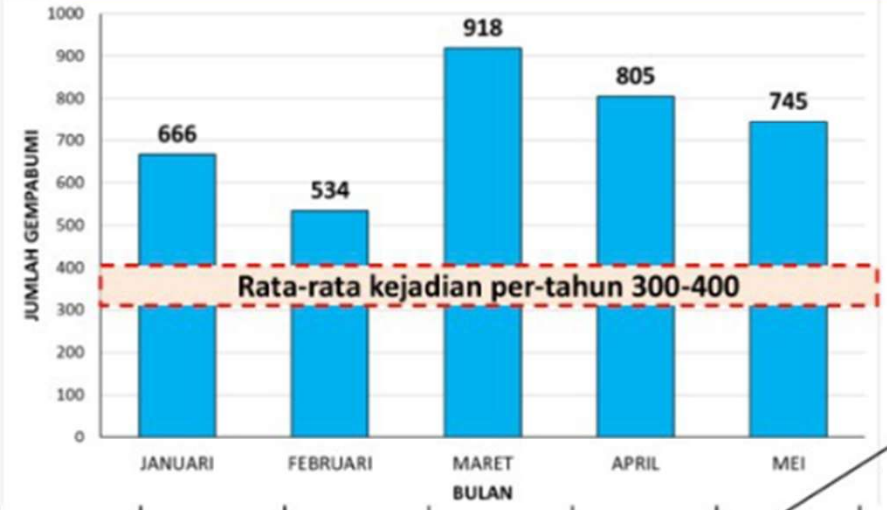
1. Zona sumber gempabumi penunjaman Jawa-Sumatera
Jawa-Sumatera subduction seismic source zone
2. Zona sumber gempabumi penunjaman Seram
Seram subduction seismic source zone
3. Zona sumber gempabumi penunjaman Sulawesi Utara
North Sulawesi subduction seismic source zone
4. Zona sumber gempabumi Sangihe
Sangihe seismic source zone
5. Zona sumber gempabumi punggungan Mayu
Mayu ridge seismic source zone
6. Zona sumber gempabumi Halmahera-Irian
Halmahera-Irian seismic source zone
7. Zona sumber gempabumi patahan Sumatera
Sumatera active fault seismic source zone
8. Zona sumber gempabumi patahan Cimandiri
Cimandiri active fault seismic source zone
9. Zona sumber gempabumi patahan Baribis
Baribis active fault seismic source zone
10. Zona sumber gempabumi patahan Bumi Ayu
Bumi Ayu active fault seismic source zone
11. Zona sumber gempabumi patahan Lasem
Lasem active fault seismic source zone
12. Zona sumber gempabumi patahan Walanae
Walanae active fault seismic source zone
13. Zona sumber gempabumi patahan Palu-Koro
Palu-koro active fault seismic source zone
14. Zona sumber gempabumi patahan Torera-Aiduna
Torera-Aiduna active fault seismic source zone
15. Zona sumber gempabumi patahan Sorong
Sorong active fault seismic source zone
16. Zona sumber gempabumi patahan Ransiki
Ransiki active fault seismic source zone
17. Zona sumber gempabumi patahan naik busur belakang Flores
Flores back arc thrust active fault seismic source zone
18. Zona sumber gempabumi patahan Membramo
Membramo active fault seismic source zone
19. Zona sumber gempabumi patahan naik Batui
Batui thrust fault seismic source zone
20. Zona sumber gempabumi patahan Poso
Poso active fault seismic source zone
21. Zona sumber gempabumi Mamuju
Mamuju seismic source zone
22. Zona sumber gempabumi cekungan Tarakan
Tarakan basin seismic source zone
23. Zona sumber gempabumi cekungan Kutai
Kutai basin seismic source zone
24. Zona sumber gempabumi fragmen Banda
Banda fragment seismic source zone
25. Zona sumber gempabumi graben Aru
Aru graben seismic source zone
26. Zona sumber gempabumi fragmen Banggai-Sula
Banggai-Sula fragment seismic source zone
27. Zona sumber gempabumi fragmen Obi
Obi fragment seismic source zone
28. Zona sumber gempabumi Sulu
Sulu seismic source zone



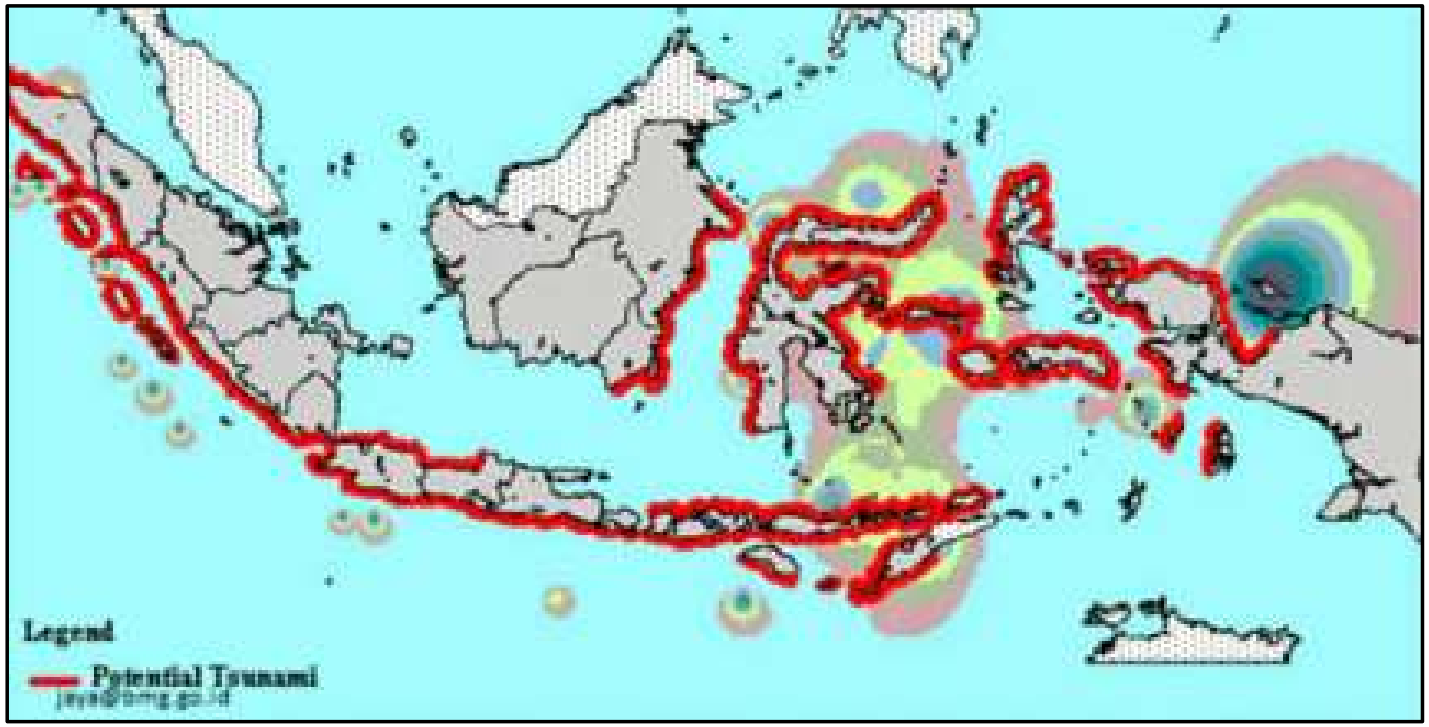


Sejak Januari 2021 rata-rata kejadian gempa di Indonesia mencapai lebih dari 600 kali per bulan (BMKG).

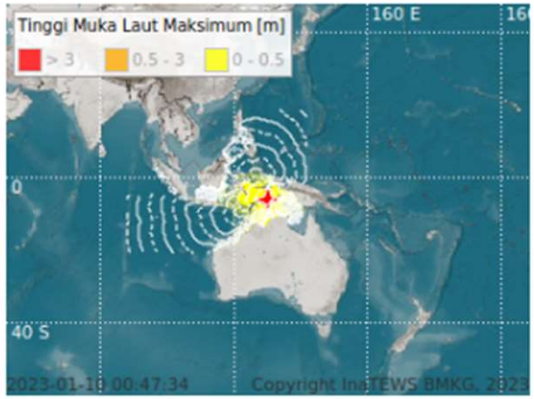
KEJADIAN GEMPABUMI INDONESIA (JANUARI-MEI 2021)



Berdasarkan data, adanya peningkatan kejadian kegempaan di wilayah Indonesia termasuk wilayah Jawa Timur, oleh karenanya perlu dilakukan kajian dan Mitigasi Bahaya Kegempaan dan Tsunami di Jawa Timur.



Peta Perkiraan Tinggi Muka Laut Maksimum



Saran dan Arahan Status Peringatan

AWAS Pemerintah Propinsi/Kab/Kota yang berada pada status "Awas" diharap memperhatikan dan segera mengarahkan masyarakat untuk melakukan evakuasi menyeluruh

SIAGA Pemerintah Propinsi/Kab/Kota yang berada pada status "Siaga" diharap memperhatikan dan segera mengarahkan masyarakat untuk melakukan evakuasi

WASPADA Pemerintah Propinsi/Kab/Kota yang berada pada status "Waspada" diharap memperhatikan dan segera mengarahkan masyarakat untuk menjauhi pantai dan tepian sungai

BMKG

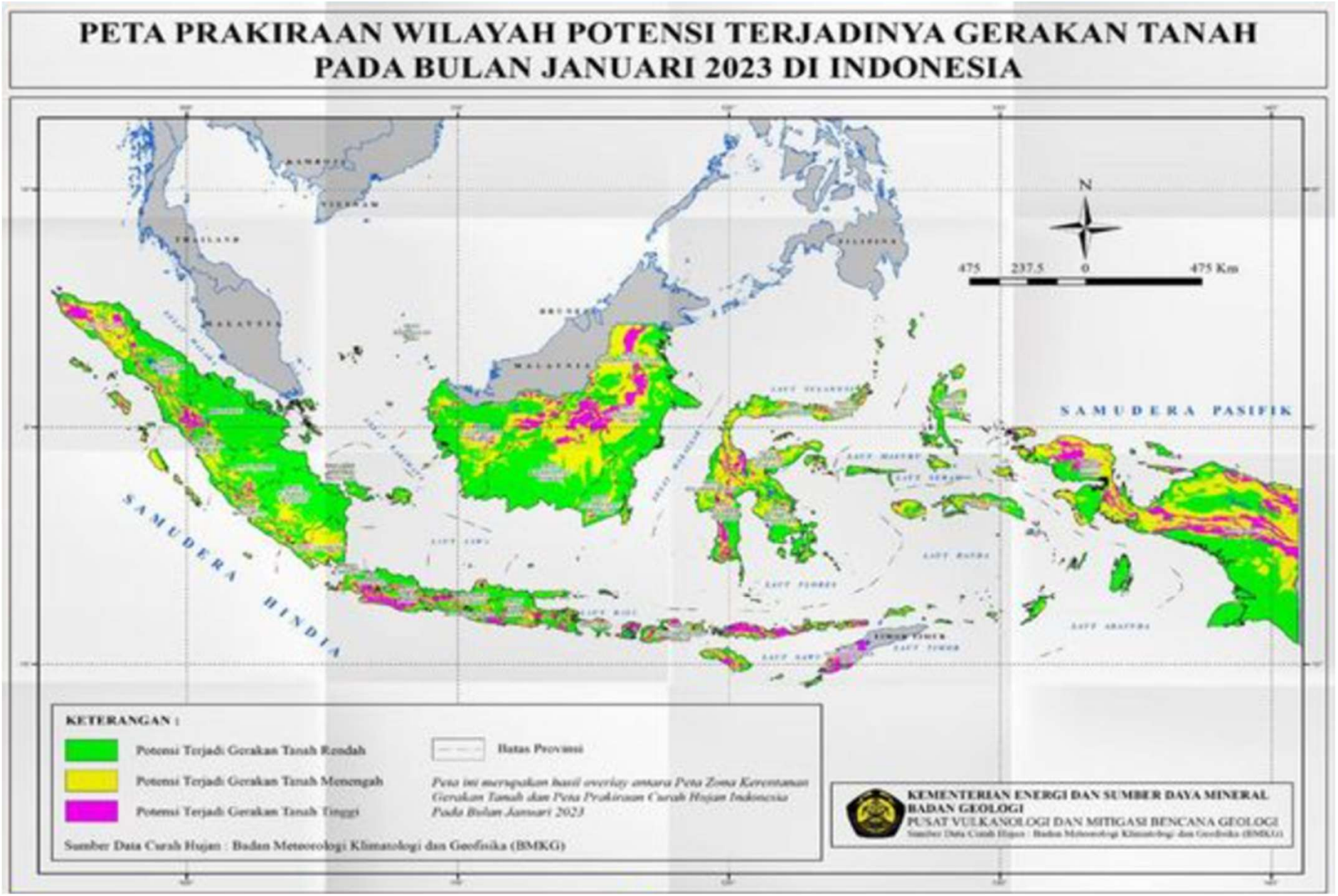
BADAN METEOROLOGI, KLIMATOLOGI, DAN GEOFISIKA

PROFIL CUACA IKLIM KUALITAS UDARA

#	Waktu Gempa	Lintang	Bujur	Magnitudo	Kedalaman	Wilayah
1	2023-04-25 03:00:57	-0.93	98.39	7.3	84 Km	177 km BaratLaut KEP-MENTAWAI-SUMBAR (Warning Tsunami PD-4)
2	2023-04-25 03:00:57	-0.93	98.39	7.3	84 Km	177 km BaratLaut KEP-MENTAWAI-SUMBAR (Warning Tsunami PD-1)
3	2023-01-10 00:47:33	-7.37	130.23	7.5	130 Km	136 km BaratLaut MALUKUTENGGARABRT (Warning Tsunami PD-4)
4	2023-01-10 00:47:34	-7.25	130.18	7.9	131 Km	148 km BaratLaut MALUKUTENGGARABRT (Warning Tsunami PD-1)

The Potential Tsunami Map is based on tsunami events which occurred since 1629. There are about 110 significant tsunami occurred in Indonesia since 1629 until 2017 and 100 tsunami caused by tectonic earthquake, 9 tsunami caused by volcanic activity in the sea and 1 tsunami caused by landslide in the sea. North of West and Central Java caused by 1883 Krakatau explosion (BMKG).

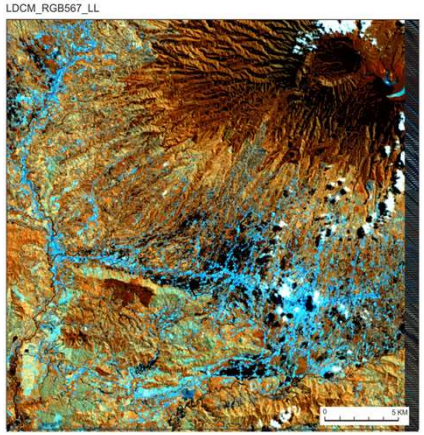
There are at least 918 locations prone to landslides in Indonesia. Every year the losses incurred due to landslides are around IDR 800 billion, while the lives threatened are around 1 million.

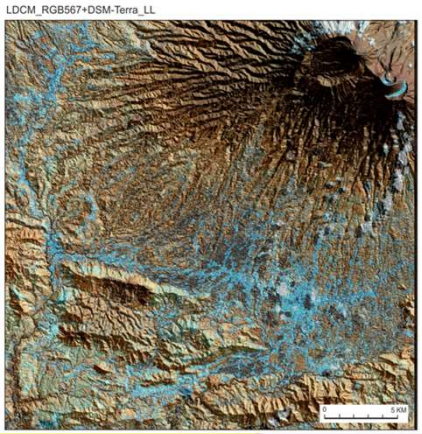


II. Experience in using remote sensing data to mitigate geological disasters in Indonesia

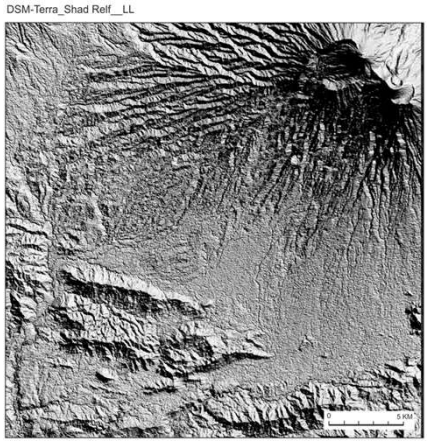
Satellite Imagery used by the Geological Agency

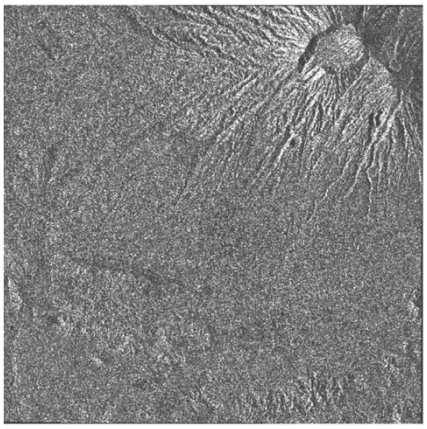
For geological mapping, monitoring volcanic eruptions, mapping ground movements and mapping areas affected by tsunamis.



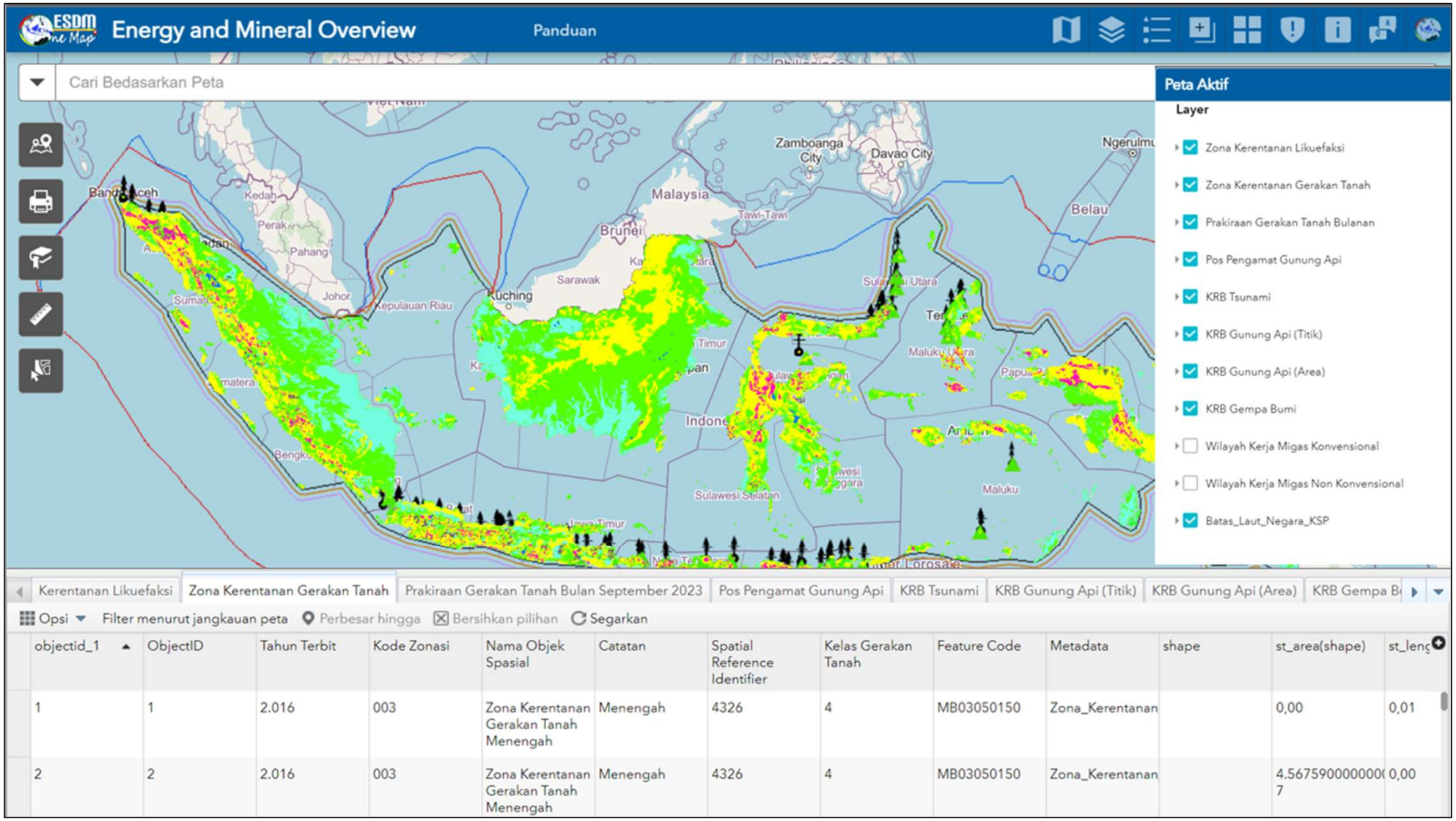


Sentinel-1 (SAR)
Sentinel-2 (Optic)
Landsat 7-9 (Optic)
SRTM (DEM)
TerraSAR-X (DSM & ORI; 2011-2012)
Radarsat-2 (DSM & ORI; 2010)
IFSAR (DSM & ORI; 2008)



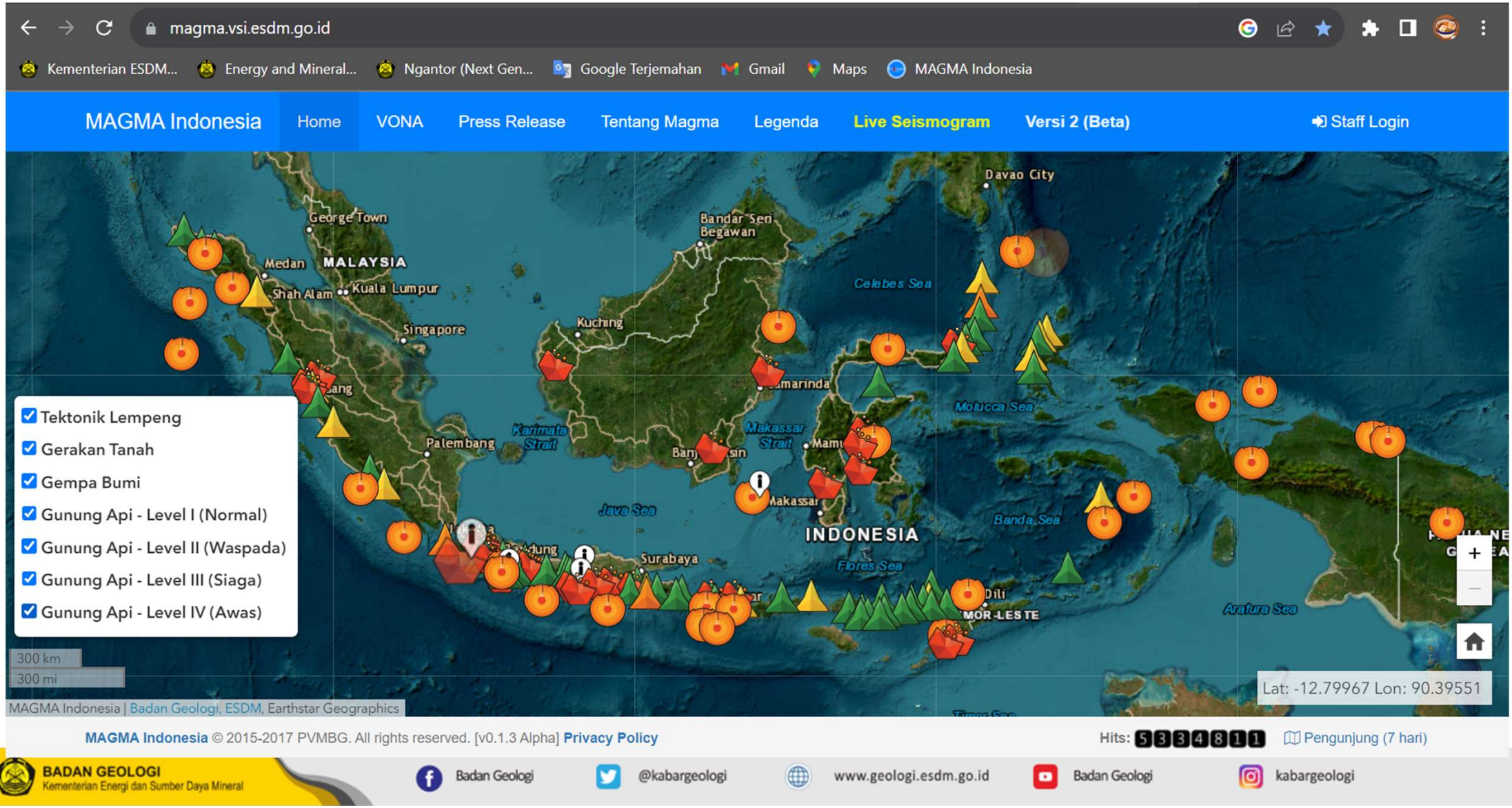


ESDM One Map (https://geoportal.esdm.go.id/)



objectid_1	ObjectID	Tahun Terbit	Kode Zonasi	Nama Objek Spasial	Catatan	Spatial Reference Identifier	Kelas Gerakan Tanah	Feature Code	Metadata	shape	st_area(shape)	st_lenç
1	1	2.016	003	Zona Kerentanan Gerakan Tanah Menengah	Menengah	4326	4	MB03050150	Zona_Kerentanan		0,00	0,01
2	2	2.016	003	Zona Kerentanan Gerakan Tanah Menengah	Menengah	4326	4	MB03050150	Zona_Kerentanan		4.567590000000 7	0,00

MAGMA Indonesia (https://magma.vsi.esdm.go.id/)

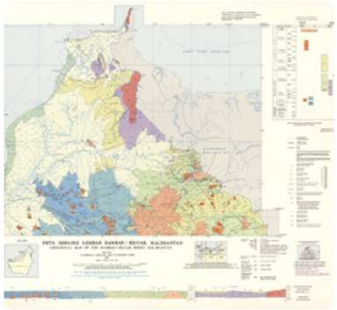


GeoMap Indonesia (https://geologi.esdm.go.id/geomap/)

geologi.esdm.go.id/geomap/pages/collection

Kementerian ESDM... | Energy and Mineral... | Ngantor (Next Gen... | MAGMA Indonesia | Tsunami Terkini | B... | Google Terjemahan

GeoMap Beranda Koleksi Peta



Peta Geologi Lembar Sambas dan Siluas, Kalimantan

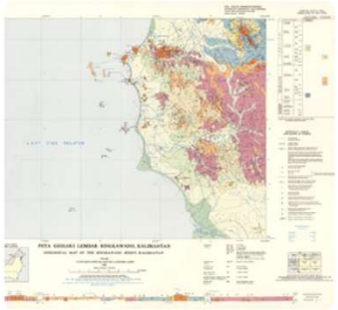
1:250.000

Pratinjau

Peta Geologi Interpretasi Citra Inderaan Jauh Lembar S.Fau, Papua Barat

1:50.000

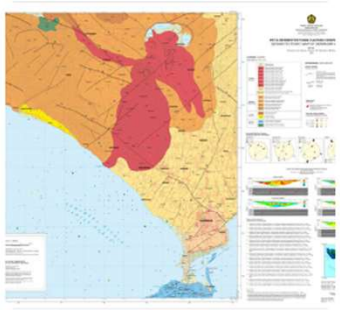
Pratinjau



Peta Geologi Lembar Singkawang, Kalimantan

1:250.000

Pratinjau



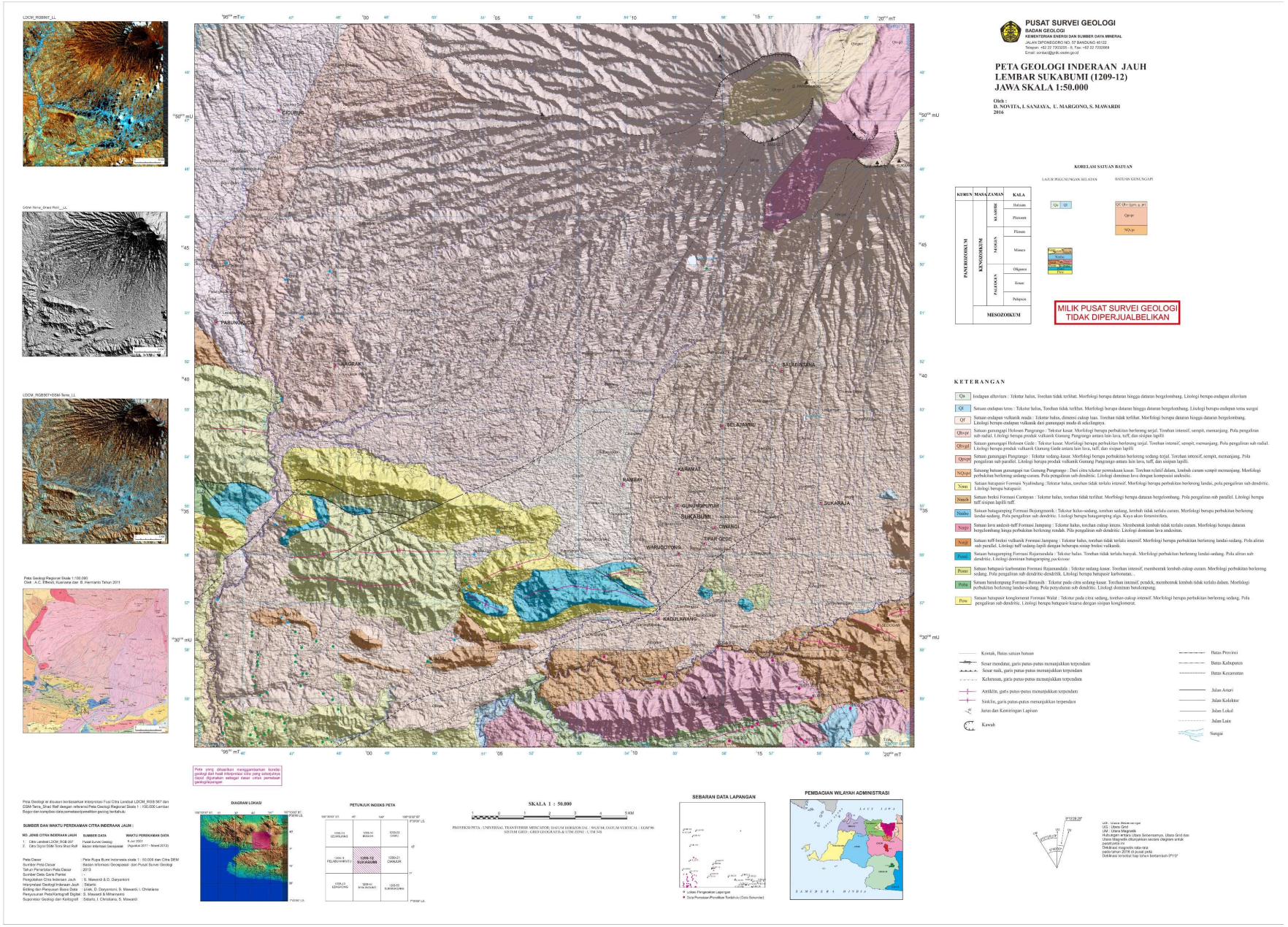
Peta Seismotektonik Daerah Denpasar, Bali

1:100.000

Pratinjau

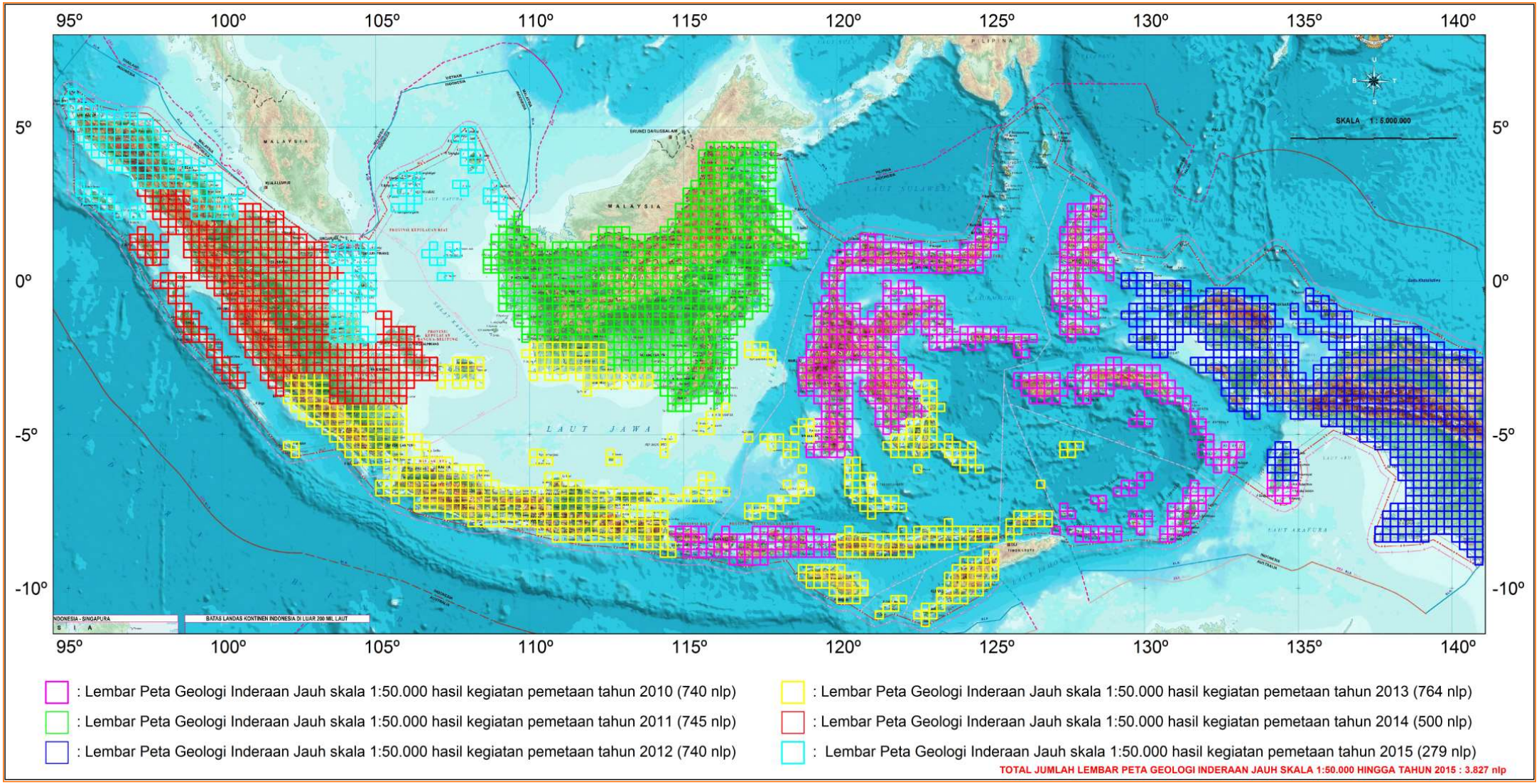
Geological map resulting from interpretation of Landsat-8 remote sensing data, Digital Surface Model and Orthorectified Radar Image TerraSar-X.

Map at a scale of 1:50,000 with reference to the Regional Geological Map and previous research results.



III. Need/expectation of remote sensing data for mitigating and managing geological disasters in Indonesia

The 1:50,000 Scale Map Index for the Republic of Indonesia has 3774 map sheet numbers



The utilization of Sentinel-1 and Sentinel-2 in geological disaster mitigation enables regular, precise, and extensive monitoring of disaster-prone areas, with expectations:

1. Easy and Fast Access: Remote sensing data can be readily and quickly accessible when needed. This may encompass access to extensive data archives, reliable data distribution platforms, and infrastructure that facilitates fast data downloads.

2. Adequate Resolution: Data is expected to have spatial and temporal resolutions that are sufficient to support accurate analysis and monitoring. High resolution is necessary for mapping damage and changes resulting from disasters.

3. Broad Area Coverage: Remote sensing data covers extensive geographic areas, allowing for the monitoring and evaluation of disaster impacts over large regions. This is crucial for swift and effective disaster response.

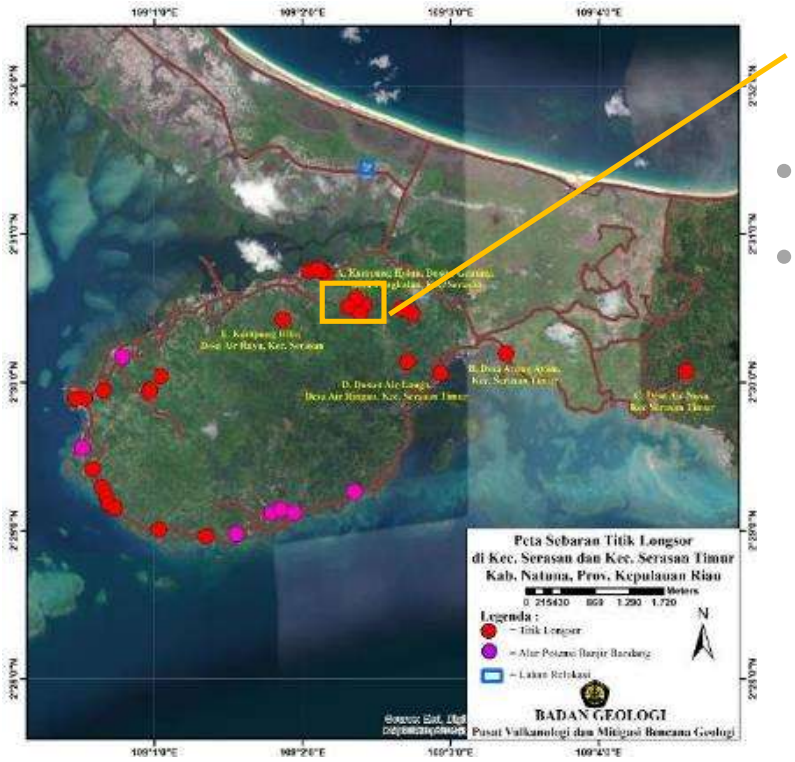
4. Diverse Data Types: Ideal remote sensing data includes various types, such as multispectral satellite imagery, radar imagery, and elevation data. The availability of diverse data types enables comprehensive monitoring.

5. **Real-time or Near-real-time:** In some cases, such as earthquakes and tsunamis, remote sensing data available in real-time or near-real-time is crucial for early warning and rapid response.
6. **Interoperability:** Remote sensing data can be integrated with other data and systems used in disaster management, such as Geographic Information Systems (GIS) and early warning systems.
7. **Open Data and Free Access:** Ideally, remote sensing data for disaster management should be available for free or at a low cost, with licenses that allow broad and flexible usage by various organizations and individuals.
8. **Support for Analysis and Processing:** In addition to raw data, there should also be support for software and analytical tools that enable the use of data in risk modeling, damage mapping, and change monitoring.
9. **Local Capacity:** Ideally, local users, including local governments and disaster management organizations, should have the capacity and skills to interpret remote sensing data and use it in disaster planning and response.
10. **Education and Awareness:** Users of remote sensing data should have an understanding of how to use it correctly. Education and public awareness about the benefits and potential of this data are also important.

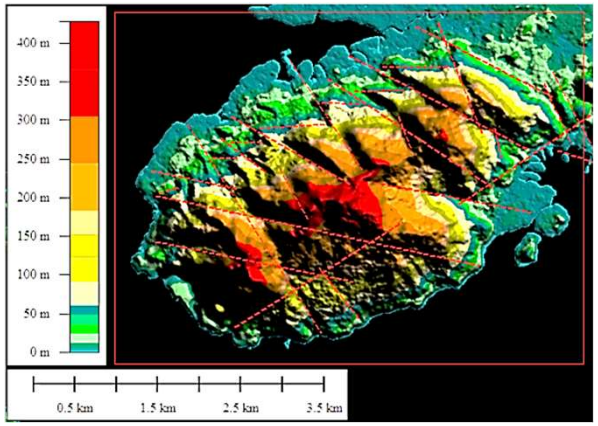
IV. Experience/expectations with international remote sensing institutions
(Sentinel Asia/Disaster Charter International/RSO UN-SPIDER BRIN)

Maret 2023

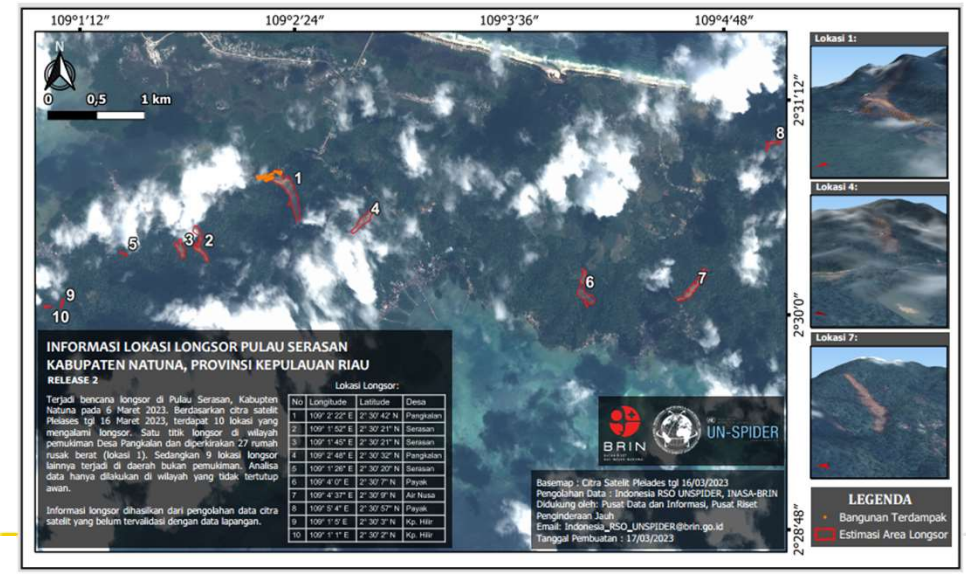
EMERGENCY RESPONSE TO LANDSLIDES ON SERASAN ISLAND, NATUNA DISTRICT, RIAU ISLANDS

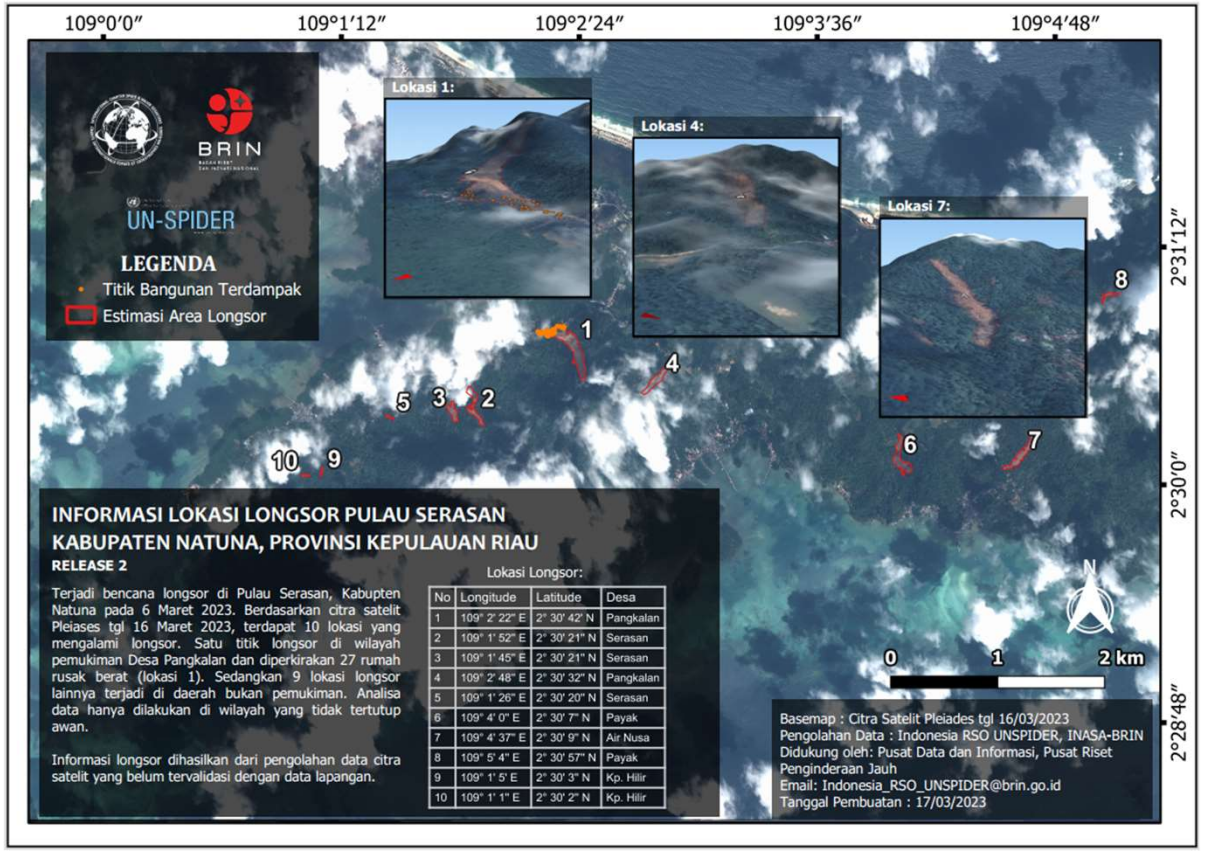


- Occurred in Genting Area, Pangkalan Village, Serasan Island which is southeast of Natuna Island at a distance of 93 nautical miles(2° 30'45" LU dan 109° 2'21" BT).
- Occurred on Monday, March 6, 2023 at **11.15 WIB**.
- Latest update from BNPB & Natuna Regency Government sd. 18 March 2023 (Close of SAR Operations):
  - 50 casualties found.
  - 4 individuals still missing.
  - 4 severe injuries.
  - 3 minor injuries.
  - 1 person is receiving medical treatment
  - 478 refugees.
  - Material losses: 147 affected houses, 1 mosque, and 1 elementary school.



Satellite image data PLEIADES 16/03/2023
Acquired after a disaster
Date: 16 Maret 2023
Data processing by: Indonesia Regional Support Office, UN-SPIDER, INASA-BRIN
Supported by: Pusat Data dan Informasi, Pusat Penginderaan Jauh





No	Longitude	Latitude	Desa
1	109° 2' 22" E	2° 30' 42" N	Pangkalan
2	109° 1' 52" E	2° 30' 21" N	Serasan
3	109° 1' 45" E	2° 30' 21" N	Serasan
4	109° 2' 48" E	2° 30' 32" N	Pangkalan
5	109° 1' 26" E	2° 30' 20" N	Serasan
6	109° 4' 0" E	2° 30' 7" N	Payak
7	109° 4' 37" E	2° 30' 9" N	Air Nusa
8	109° 5' 4" E	2° 30' 57" N	Payak
9	109° 1' 5" E	2° 30' 3" N	Kp. Hilir
10	109° 1' 1" E	2° 30' 2" N	Kp. Hilir

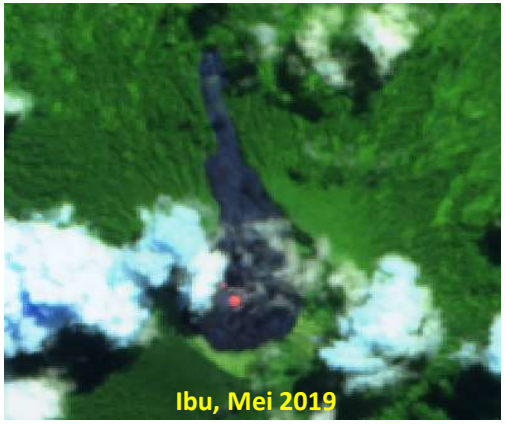
Pleiades satellite imagery from BRIN with the results of identifying landslide locations of 10 points including the incident at Kp. Genting, Pangkalan Village, Serasan Island, Natuna.

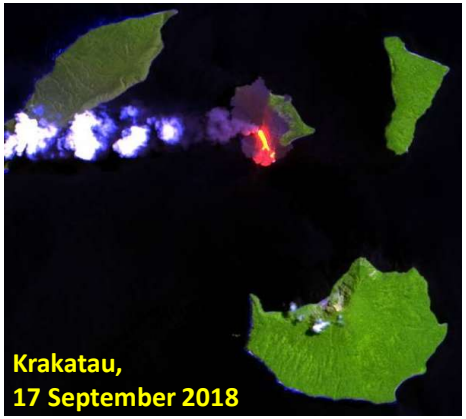
EMERGENCY RESPONSE IN SERASAN ISLAND

- The Geological Agency sent a Rapid Response Team on March 10, 2023, and conducted the following activities:

- Initiated initial coordination with BMKG (Meteorology, Climatology, and Geophysics Agency), PUPR (Public Works and Public Housing Ministry), BRIN (Research and Innovation Agency) - TMC (Technology and Monitoring Center), BNPB (National Disaster Management Agency), ATR/BPN (Agrarian and Spatial Planning Ministry), TNI/POLRI (Indonesian National Army and Police), and local government authorities.
- Conducted an investigation into the potential for landslides, geological mapping, and geohydrogeology assessment.
- Conducted a geological feasibility study of prospective relocation sites as part of disaster-mitigation-based development efforts, which includes assessing 147 houses, 1 mosque, and 1 elementary school.
- Conducted awareness and information sessions on Land Movement Disasters for government officials, community leaders, teachers, and residents in the Serasan Timur District.
- The Disaster Alert Team from PT. Putra Perkasa Abadi, under the Ministry of Energy and Mineral Resources, assisted in the search and evacuation of landslide victims, joining the Search and Rescue Operation conducted by BASARNAS (National Search and Rescue Agency), and provided logistical and medical assistance.
- The Ministry of Energy and Mineral Resources (KESDM) initiated a Charity Program and provided assistance for improving water quality and groundwater drilling through the use of pumps.

Monitoring Hot Spots using Thermal Sentinel imagery

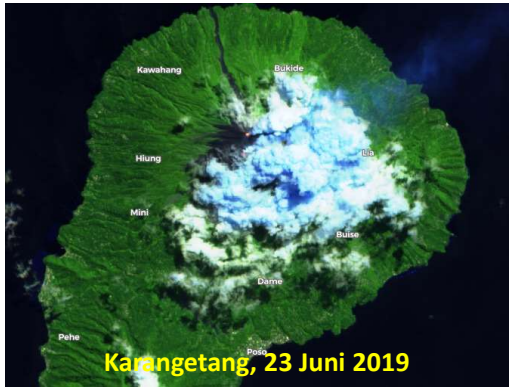

Ibu, Mei 2019


Krakatau,
17 September 2018

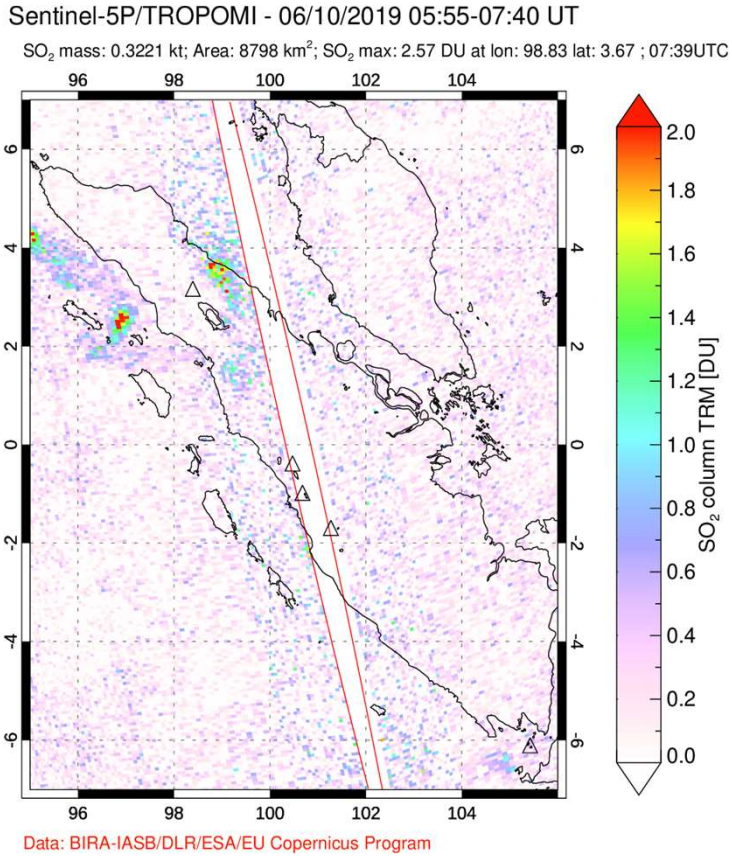

Sangeangapi, 19 Juni 2019

Semeru, 20 Juni 2019

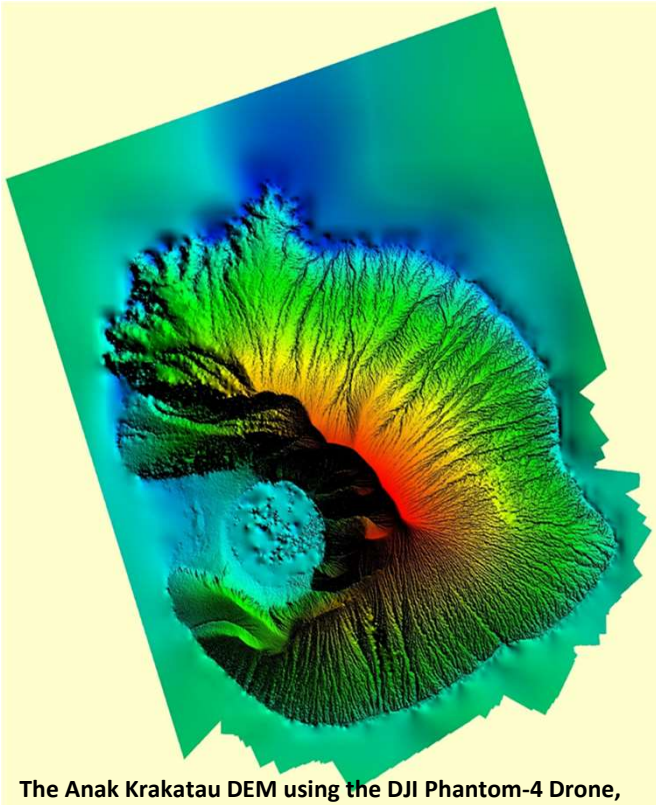

Agung, 22 Juni 2019



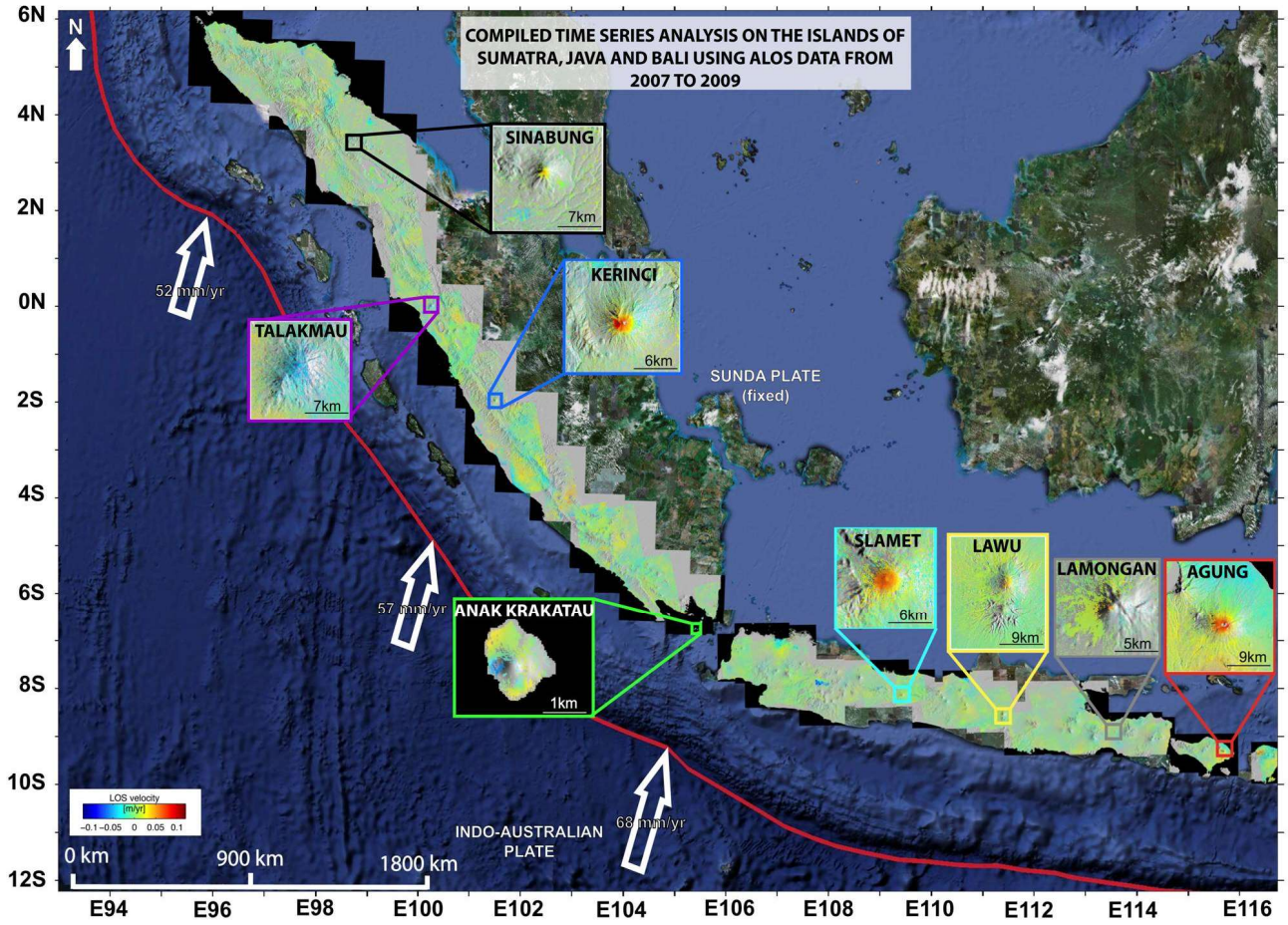
Karangetang, 23 Juni 2019



Monitoring the distribution of SO2 gas after the eruption of Mount Sinabung on June 9 2019 using the S02 Sentinel Sensor.



The Anak Krakatau DEM using the DJI Phantom-4 Drone, March 2019. This DEM can be used to model and calculate the volume of mountains or craters.



Monitoring volcanic deformation in Indonesia using SAR ALOS data for the 2007-2009 period (Estelle Chaussard and Falk Amelung, 2010)

V. Expectations, input and suggestions for Sentinel Asia in particular, or institutions related to international remote sensing in general

In response to various strategic development issues, the Geological Agency strongly supports collaboration with Sentinel Asia for the following reasons:

1.Modernization across Various aspects: Collaboration with Sentinel Asia allows for modernization across various aspects, including infrastructure, technical equipment, information, and technology, especially in the field of remote sensing. This modernization is crucial for enhancing the capabilities and efficiency of geological services.

2.Enhanced Internal and External Collaboration: Collaborating with Sentinel Asia facilitates increased internal and external collaboration and establishes close partnerships with various stakeholders. This collaboration is essential for expediting and improving the quality of services and support provided. Sentinel Asia's involvement can greatly contribute to these efforts.

3.Refinement and Strengthening of Work Programs: Working in collaboration with Sentinel Asia can help in refining and strengthening work programs and services to align with the demands and expectations of stakeholders. This ensures that the services offered are responsive to the evolving needs of the community and are delivered effectively.

In summary, partnering with Sentinel Asia supports the Geological Agency's goals of modernization, collaboration, and responsiveness to stakeholder demands, ultimately enhancing its ability to address strategic development issues and provide valuable geological services.

85 Peta Tematik

Peta tematik dalam Pelaksanaan Kebijakan Satu Peta mencakup 7 (tujuh) tema, yaitu batas wilayah, kehutanan, perencanaan ruang, sarana prasarana, perizinan dan pertanahan, sumber daya alam dan lingkungan, kawasan khusus dan transmigrasi. Ketujuh tema tersebut tersebar di 34 Provinsi yang menjadi kewenangan 19 (sembilan belas) Kementerian/Lembaga yang terlibat sebagai Walidata IGT

Sumber Daya Alam dan Lingkungan

- Peta Penutup Lahan skala 1:50.000
- Peta Air Tanah skala 1:50.000
- Peta Ketersediaan Air skala 1:250.000
- Peta Penggunaan Tanah skala 1:50.000
- Peta Lahan Gambut skala 1:50.000
- Peta Daerah Aliran Sungai (DAS) skala 1:50.000
- Peta Geologi skala 1:100.000
- Peta Kawasan Rawan Bencana Gunung Api skala 1:50.000
- Peta Kawasan Rawan Bencana Gempa Bumi skala 1:50.000
- Peta Zona Kerentanan Gerakan Tanah skala 1:50.000
- Peta Kawasan Rawan Bencana Tsunami skala 1:50.000
- Peta Hidrogeologi skala 1:100.000
- Peta Tanah Semidetail skala 1:50.000

- **Peraturan Presiden No.23 Tahun 2021 Percepatan Pelaksanaan Kebijakan Satu Peta pada Tingkat Ketelitian Peta Skala 1:50.000.**
- **Peaturan Pemerintah No.13 Tahun 2017 → Rencana Tata Ruang Wilayah Nasional**

SENTINEL Asia Disaster management

- Peta Geologi skala 1:100.000
- Peta Kawasan Rawan Bencana Gunung Api skala 1:50.000
- Peta Kawasan Rawan Bencana Gempa Bumi skala 1:50.000
- Peta Zona Kerentanan Gerakan Tanah skala 1:50.000
- Peta Kawasan Rawan Bencana Tsunami skala 1:50.000

Tim Regional Support Office Indonesia, UN-SPIDER

1:50,000 SCALE THEMATIC MAP UPDATE

Indonesia has the number of active volcanoes of 127, the most in the world and ranks first with the highest number of fatalities. Of the 127 volcanoes, only 69 are active volcanoes monitored by the PVMBG.

3774 Map Sheets (NLP) throughout the territory of the Republic of Indonesia

There are at least 918 locations prone to landslides in Indonesia. Every year the losses incurred due to landslides are around IDR 800 billion, while the lives threatened are around 1 million.

During the period 1600-2000 there were 105 tsunami events; 90 percent are caused by tectonic earthquakes.

ACCELERATION OF 1:50,000 SCALE GEOLOGICAL MAPPING OF THE INDONESIA REGION

- ❑ Presidential decree No.23 Tahun 2021 Percepatan Pelaksanaan Kebijakan Satu Peta pada Tingkat Ketelitian Peta Skala 1:50.000.
- ❑ Government regulations No.13 Tahun 2017 → Rencana Tata Ruang Wilayah Nasional

Basics for Implementing Map Acceleration----→ → →

- The need for geological maps is increasing
- Users of geological maps are increasingly widespread
- Open collaboration with stakeholders
- The development of satellite technology is increasingly rapid

- 3774 total maps throughout the Republic of Indonesia
- 200 years of conventional methods
- 61 maps are currently newly completed
- Implementing human resources are disproportionate

THREATS

- Policy changes and institutional support
- Changes to national priority programs
- Indonesia in general has geological complexity, safety, accessibility

WEAKNESS

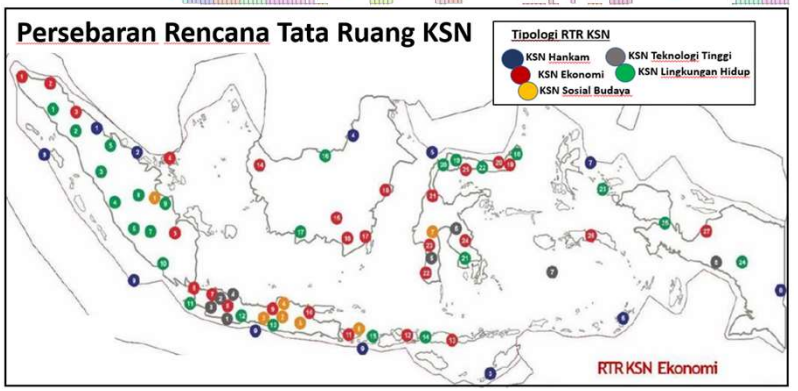
- The number of personnel currently available is disproportionate
- The number of maps to be completed is enormous
- Less focus on Mapping Location Priority Scale
- Lack of equipment support
- Time vs. time mismatch completion target

Required: ACCELERATION STRATEGY

Percepatan SIGMA

- ✓ Shorter time
- ✓ Output can increase significantly
- ✓ Doesn't require a lot of personnel
- ✓ PSG has long experience in geological mapping
- ✓ More cost effective

3774 Maps in Scale of 1:50.000



KESDM SEBAGAI WALI DATA IGT-KSP

- Peta Geologi
- Peta Patahan Aktif

ACCELERATION

- SWAKELOLA PUSAT SURVEI GEOLOGI
- KOLABORASI PERGURUAN TINGGI

Roadmap* Target and *updating
Geological Maps 1:50.000 and Active Faults Maps

Remote Sensing Geo-Map

- ❖ Identification maps elements
- ❖ Configure maps inconsistency
- ❖ Up to date satellite imageries
- ❖ Gravity and magnetic anomaly

Data Re-Interpretation

- ➢ Map validation
- ➢ Geological data acquisiton
- ➢ Field data GIS system
- ➢ Rocks sample collection

Field Survey

- ❑ collaboration,
- ❑ collection,
- ❑ assessment,
- ❑ survey planning

Geological Maps 1:50.000

→ SIGMA (Smart Integrated Geological Mapping Acceleration)

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