THE FUTURE OF
GLOBAL
DISASTER
RISK REDUCTION

Reflection on the Recommendation

“Science, Technology, and Innovation to Strengthen Disaster Resilience in Megacities Facing Catastrophic Disaster Risk:

Jakarta and Megacities in Indonesia

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2) Scientific Committee IRDR

3) Member, National Center for Earthquake Studies (PuSGeN)

4) Member, Indonesia Young Academy of Sciences

5) Founder, U-Inspire Indonesia & U-Inspire Japan

The Guardian
Int
n | Sport | Culture | Lifestyle
as Asia Australia Middle East Africa Inequality Global development

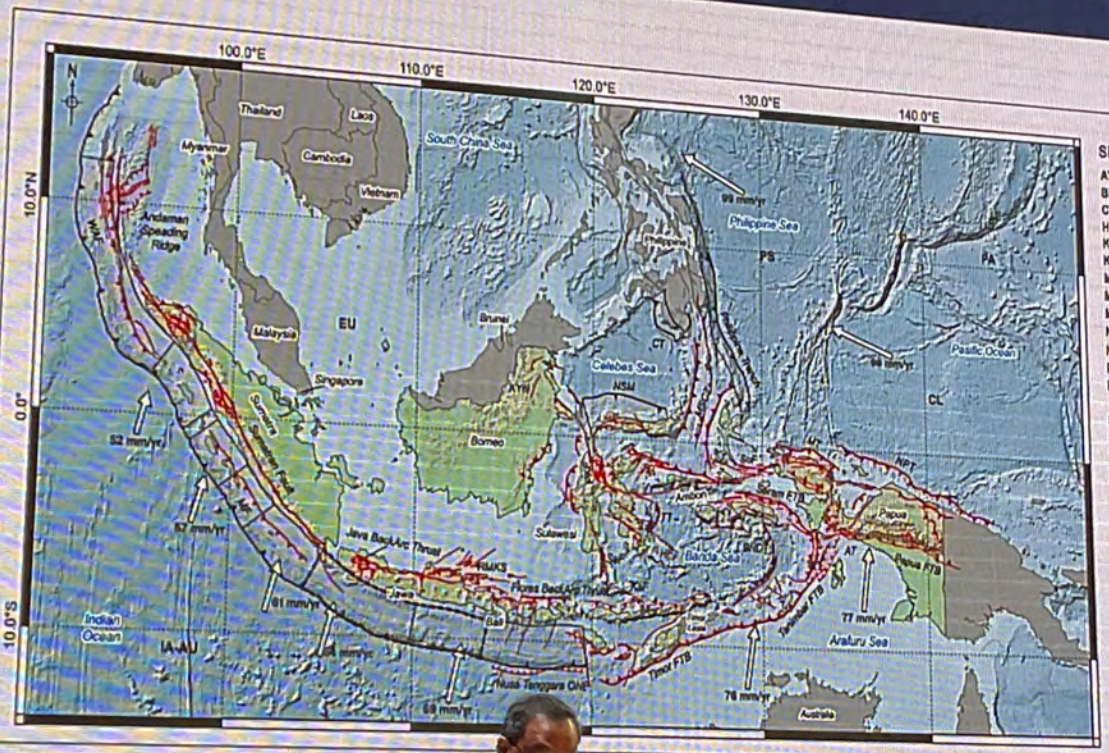
Jakarta overtakes Tokyo as world's most populous city, according to UN

The rankings were changed after the UN used new criteria to give a more accurate picture of the rapid urbanisation driving the growth of megacities

41.9 million people

PETA SUMBER DAN BAHAYA GEMPA INDONESIA TAHUN 2024

KEMENPU
SIGAP MEMBANGUN NEGERI UNTUK RAKYAT



Singkatan / *Abbreviation*

AT	Aru Through
BNDT	Banda Detachment
CT	Celebelo Trench
HF	Hamilton Fault
KaF	Kalaotoa Fault
KYN	Kayan Fault
MF	Mentawai Fault
MSCZ	Molucca Sea Collision Zone
MT	Manokwari Thrust
NSM	North Sulawesi Megathrust
NPT	North Papua Thrust
PKF	Palu-Koro Fault
RMKS	Rembang-Madura-Kangean-Sakala Fault
SeF	Selayar Fault
SoF	Sorong Fault
TT	Tolo Thrust
WAF	West Andaman Fault
CL	Carolina
IA-AU	Indo-Australia
PS	Philippine Sea
PA	Pasific
EU	Eurasia

Indonesia terletak pada pertemuan **3 Lempeng Utama Dunia** (Indo-Australia, Pasifik, Eurasia).

SESAR AKTIF

2010	2017	2024
52	273	401

SEGMEN SUMBER GEMPA SUBDUKSI

2010	2017	2024
11	13	14

PETA INI MENJADI DASAR BAGI:

- SNI (Standar Nasional Indonesia) Bangunan Gedung dan Jembatan
- Desain Bendungan dan Irigasi
- Perencanaan Jalan Nasional
- Sistem Air Minum dan Sanitasi
- Penataan Ruang Berbasis Risiko

KEMENTERIAN PEKERJAAN UMUM DAN PERUMAHAN RAKYAT
Pusat Studi Gempa Nasional
PuSGeN ©2024 PuSGeN, DBTPP, Ditjen Cipta Karya

PETA PATAHAN AKTIF INDONESIA
ACTIVE FAULT MAP OF INDONESIA

Oleh / *by* : Pusat Studi Gempa Nasional (PuSGeN) 2024

Skala / *Scale*: 0 500 1000 km

Proyeksi Peta / *Map Projection* : WGS84

Mekanisme Sesar / *Fault Mechanism*
- Sesar Naik / *Thrust Fault*
- Sesar Turun / *Normal Fault*
- Sesar Geser / *Strike-slip Fault*

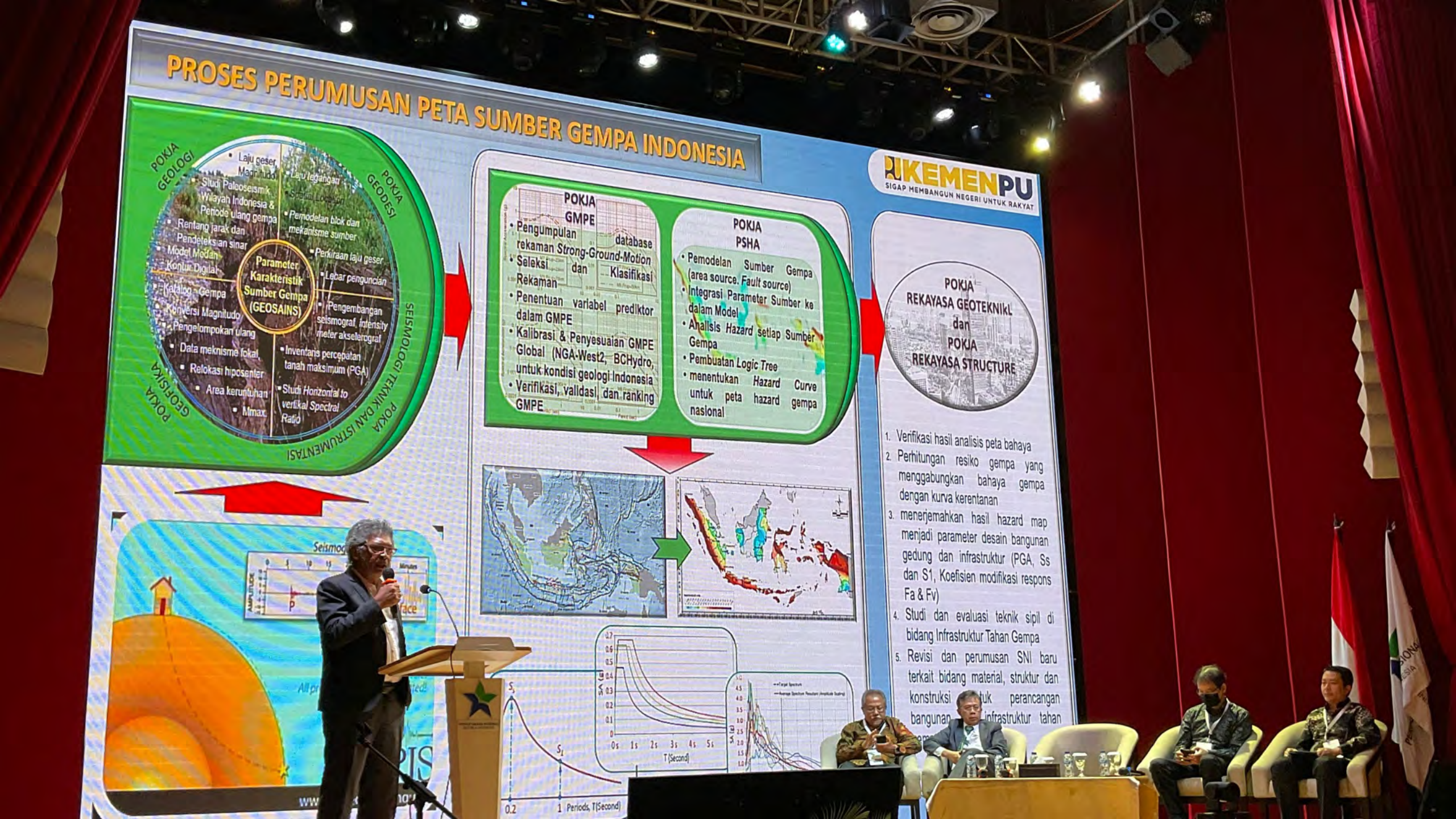
Elevasi / *Elevation* (m): -11000 0 6000

Peta Indeks / *Index Map*

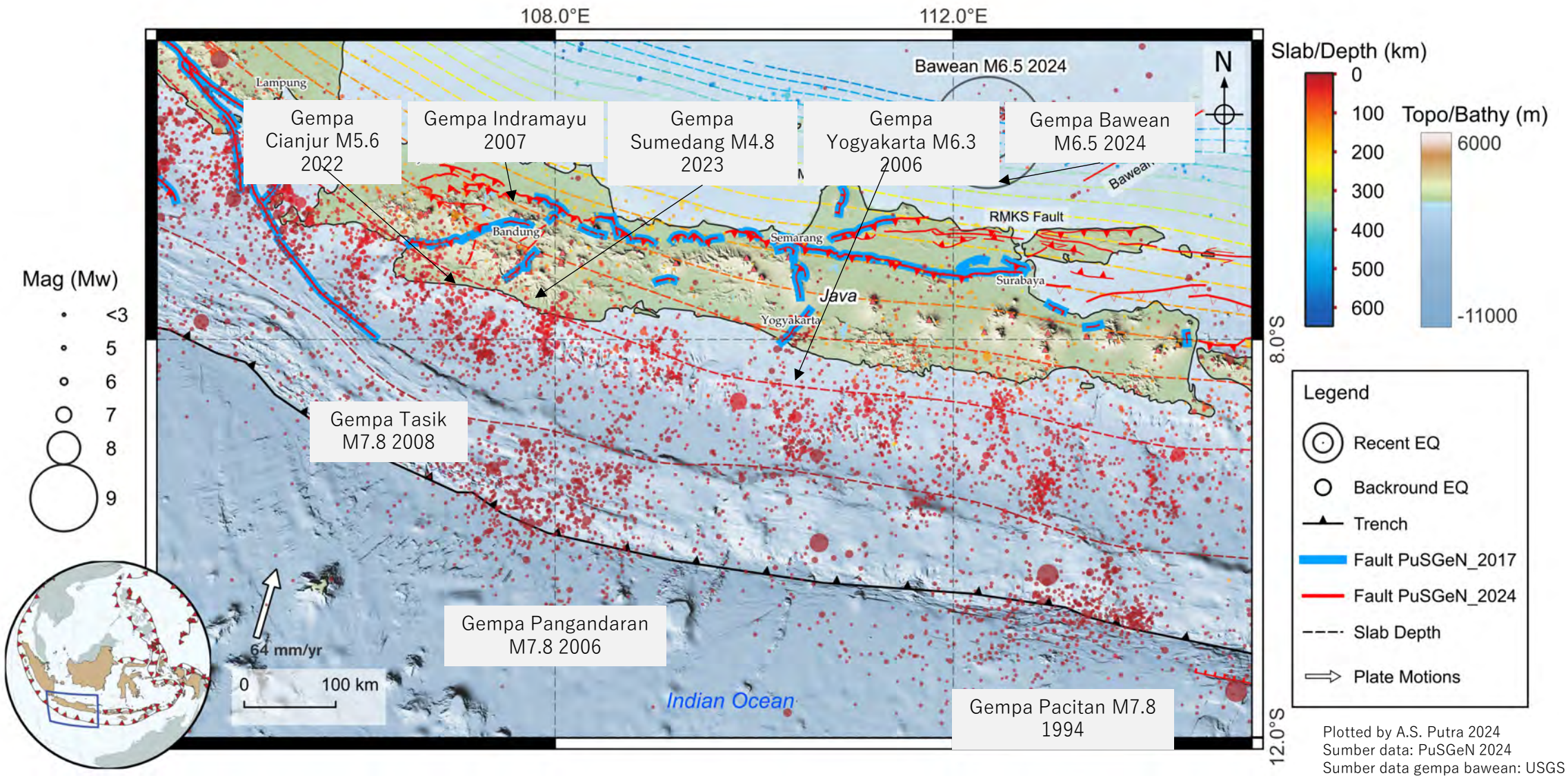
Sumber / *Sources*

Fault IA	PuSGeN 2024
Fault PH	PHIVOLCS
Megathrust	PuSGeN 2024
Plate Motions	GSRMv2.1
Topography	GMRT
Bathymetry	BIG

Sumber: Buku Peta Sumber dan Bahaya Gem...

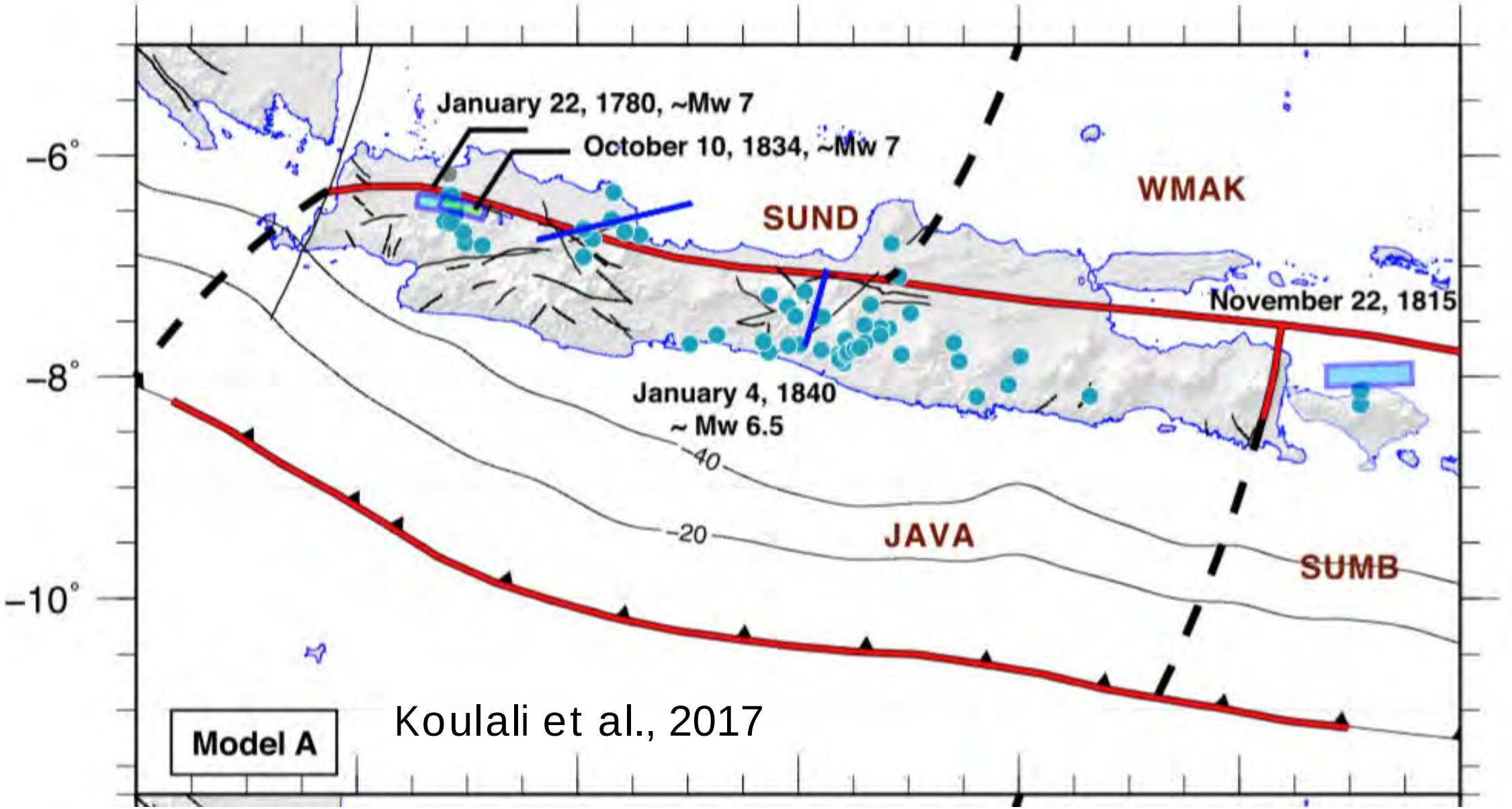

PROSES PERUMUSAN PETA SUMBER GEMPA INDONESIA
KEMENPU
SIGAP MEMBANGUN NEGERI UNTUK RAKYAT
POKJA GEOLOGI
POKJA GEODESI
POKJA GEOFISIKA
POKJA SEISMOLOGI TEKNIK DAN ISTRUMENTASI
Parameter Karakteristik Sumber Gempa (GEOSAINS)
Laju geser, Magnitudo
Studi Paleoseismik Wilayah Indonesia & Periode ulang gempa
Rentang jarak dan Pendeteksian sinar
Model Medan Kontur Digital
Katalog Gempa
Konversi Magnitudo
Pengelompokan ulang
Data meknisme fokal,
Relokasi hiposenter
Area keruntuhan
Mmax
Laju tegangan
Spatial Location
Pemodelan blok dan mekanisme sumber
Perkiraan laju geser
Lebar penguncian
Pengembangan seismograf, intensity meter akselerograf
Inventaris percepatan tanah maksimum (PGA)
Studi Horizontal to vertikal Spectral Ratio
POKJA GMPE
Pengumpulan database rekaman Strong-Ground-Motion
Seleksi dan Klasifikasi Rekaman
Penentuan variabel prediktor dalam GMPE
Kalibrasi & Penyesuaian GMPE Global (NGA-West2, BCHydro, untuk kondisi geologi Indonesia
Verifikasi, validasi, dan ranking GMPE
POKJA PSHA
Pemodelan Sumber Gempa (area source, Fault source)
Integrasi Parameter Sumber ke dalam Model
Analisis Hazard setiap Sumber Gempa
Pembuatan Logic Tree
menentukan Hazard Curve untuk peta hazard gempa nasional
POKJA REKAYASA GEOTEKNIKL dan POKJA REKAYASA STRUCTURE
1. Verifikasi hasil analisis peta bahaya
2. Perhitungan resiko gempa yang menggabungkan bahaya gempa dengan kurva kerentanan
3. menerjemahkan hasil hazard map menjadi parameter desain bangunan gedung dan infrastruktur (PGA, Ss dan S1, Koefisien modifikasi respons Fa & Fv)
4. Studi dan evaluasi teknik sipil di bidang Infrastruktur Tahan Gempa
5. Revisi dan perumusan SNI baru terkait bidang material, struktur dan konstruksi untuk perancangan bangunan infrastruktur tahan
Periods, T(Second)
T (Second)

Sesar Aktif dan kegempaan di Jawa



Plotted by A.S. Putra 2024
Sumber data: PuSGeN 2024
Sumber data gempa bawean: USGS

Sejarah Gempa di Sekitar Jakarta



Koulali et al., 2017

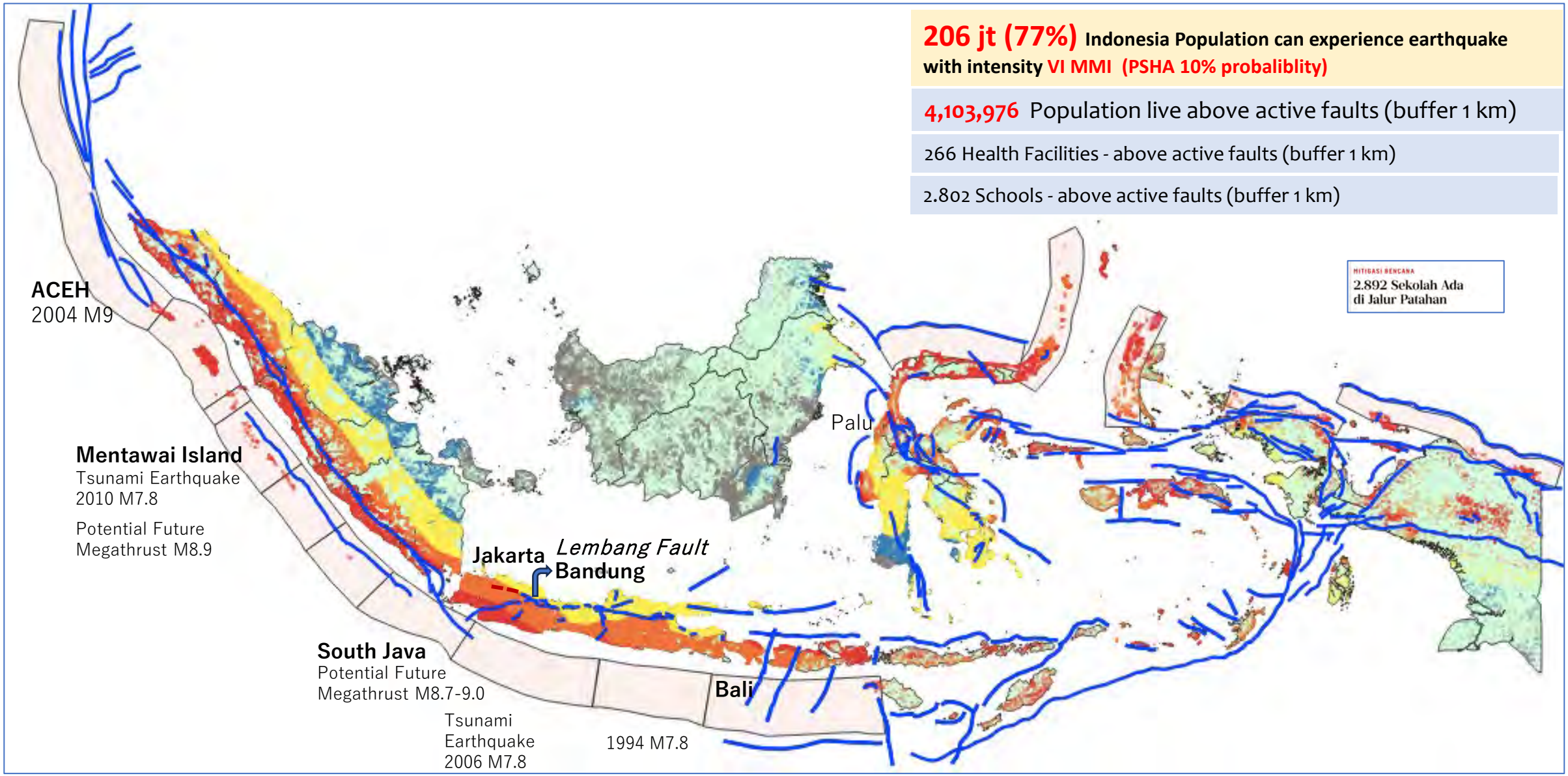
Seismic Hazard Map overlay with Population of Indonesia

206 jt (77%) **Indonesia Population can experience earthquake with intensity VI MMI (PSHA 10% probaliblity)**

4,103,976 Population live above active faults (buffer 1 km)

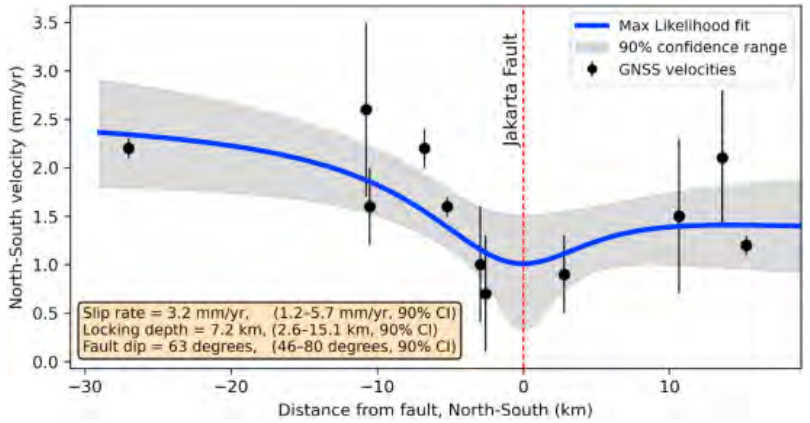
266 Health Facilities - above active faults (buffer 1 km)

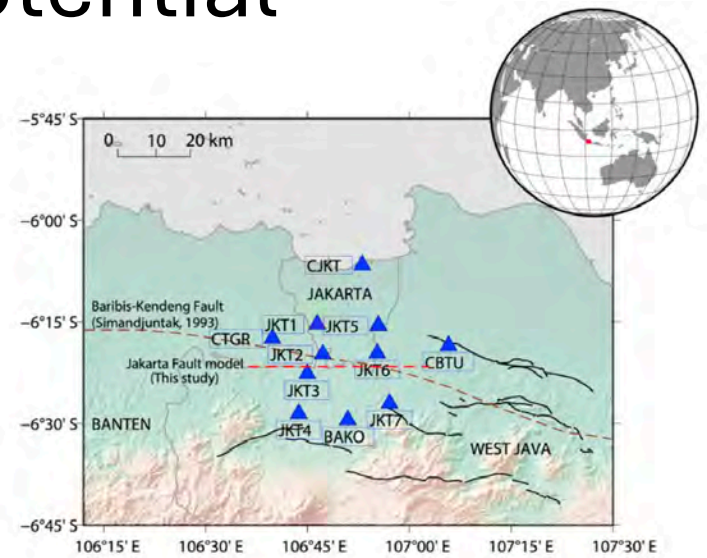
2.802 Schools - above active faults (buffer 1 km)

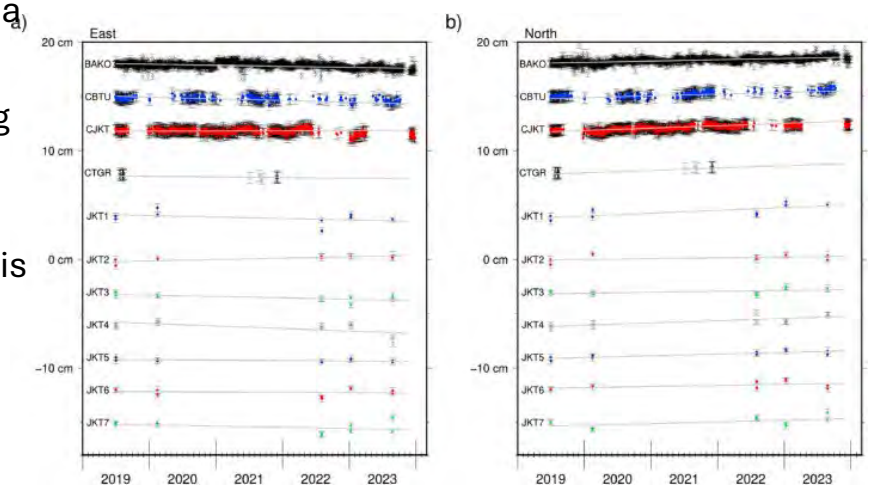


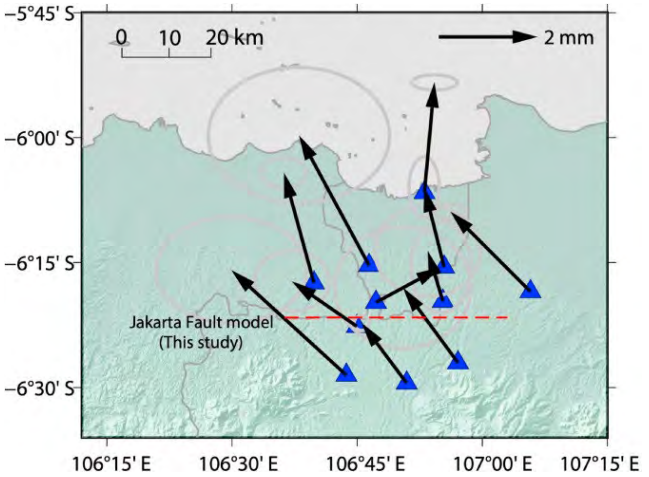
GNSS Constraints on the Jakarta Fault, Indonesia: Resolving Slip Rate and Seismic Hazard Potential

- Historically, Jakarta has experienced damaging earthquakes:
  - 5 January 1699,
  - 22 January 1780,
  - 10 October 1834 of ~Mw 7.4
- slip rate of 3.2 mm/yr,
  locking depth of 7.2 km,
  dip angle of 63°,
  confirming active deformation along the fault system.
  Assuming a fault length of 50 km and an earthquake recurrence interval of ~210 years, the next earthquake along this fault could potentially reach a magnitude between 6.49 and 6.54.
- This study highlights the ongoing deformation along the Jakarta Fault, emphasizing the need for greater attention from stakeholders.
- Given the potential severity of a seismic event of this magnitude, the implications for the Jakarta region could be catastrophic, necessitating immediate action and updated hazard assessments.







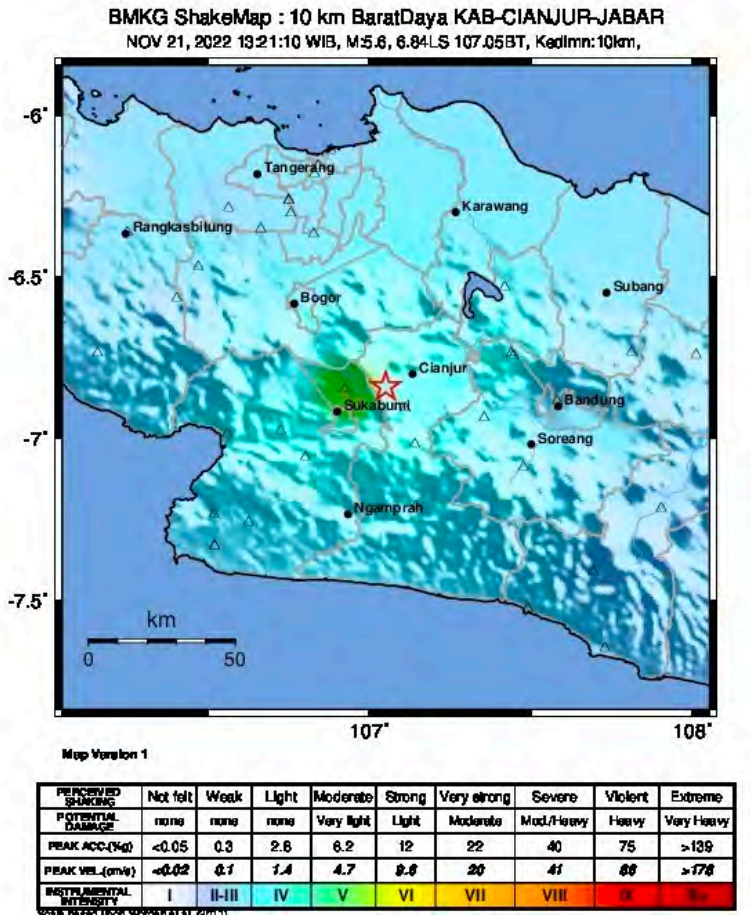


Gempa Skala M5-6

Gempa Cianjur 21 November 2022 (M5.6)

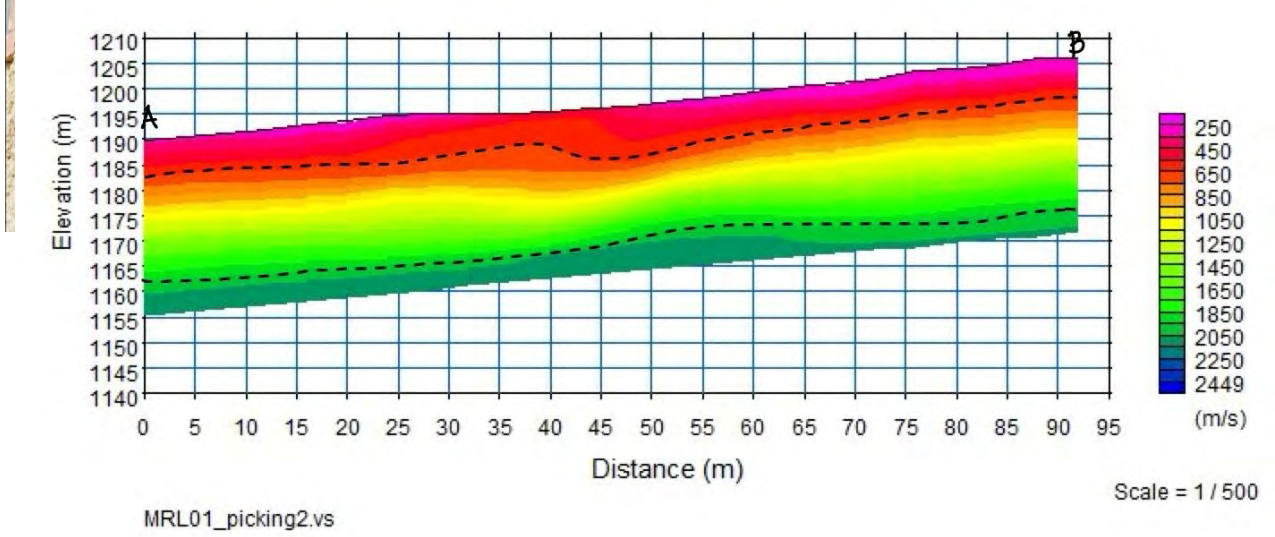
- Occurred 01:21 PM Local Time

BMKG



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	<0.02	0.1	1.4	4.7	9.6	20	41	86	>178
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

M3.3 above Lembang Fault could be damaging



DR EKBAL HUSSAIN, DR ENDRA GUNAWAN, DR N RAHMA HANIFA

Supported by BRITISH COUNCIL

Exposed: Exposure to seismic and volcanic threats in Bandung, Indonesia

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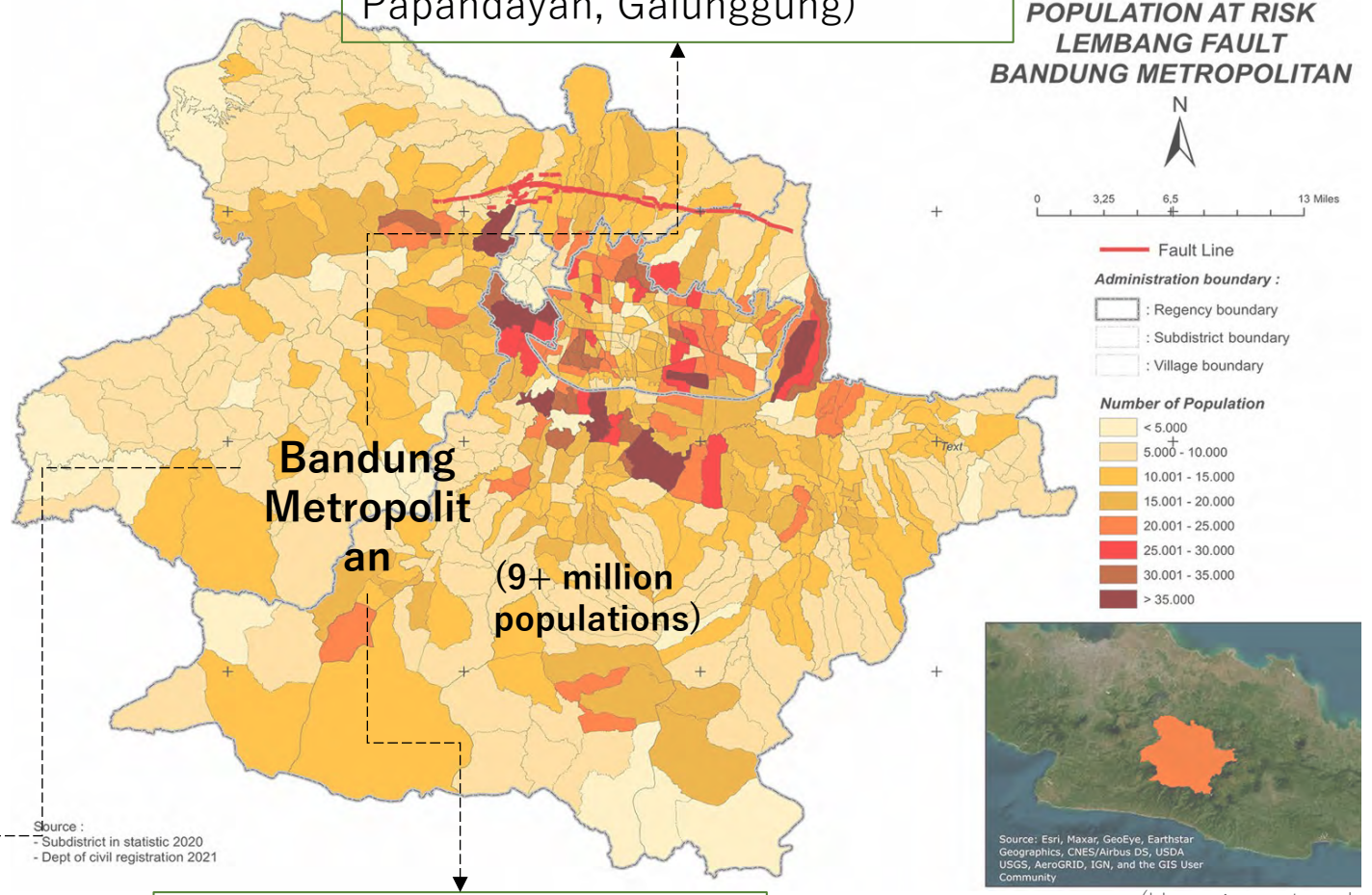
British Geological Survey
BRIN BADAN RISET DAN INOVASI NASIONAL
Resilience Development Initiative
UNIVERSITY OF LEEDS

Project Goals

- **Develop realistic & worst-case scenarios** for earthquakes, volcanic eruptions, and secondary hazards (e.g. liquefaction, landslides).
- **Identify exposed infrastructure and vulnerable population groups** in Bandung City.
- **Engage communities** to raise **awareness** and co-develop inclusive **local resilience** plans.

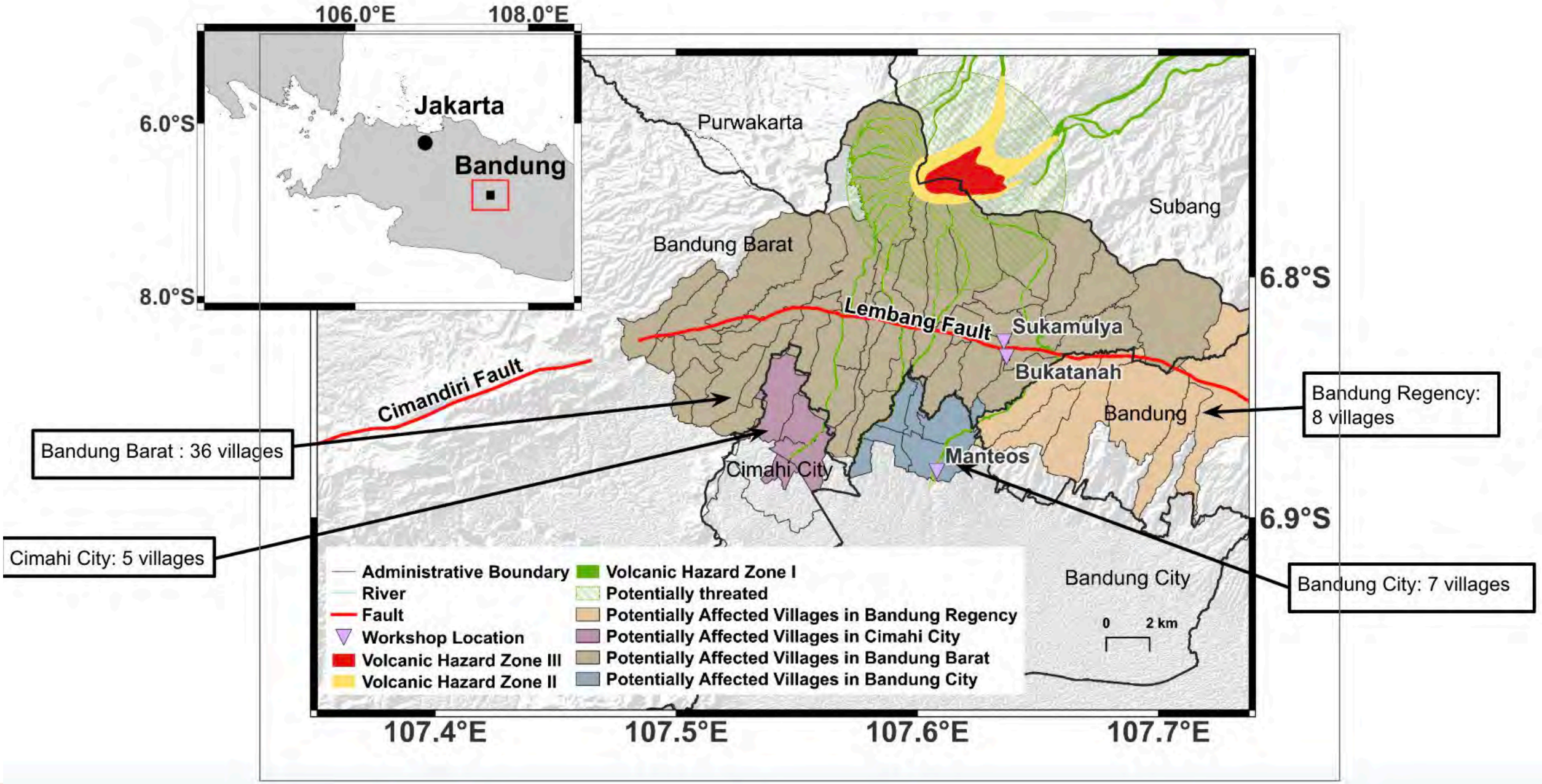
"We need scientific support to identify who and what is most at risk" — Bandung City Government.

Major threats: **Lembang Fault** and **nearby volcanoes** (Tangkuban Perahu, Guntur, Papandayan, Galunggung)



(Hussain et al., 2023)

highly vulnerable to earthquakes and volcanic eruption


106.0°E
108.0°E
6.0°S
8.0°S
Jakarta
Bandung
Purwakarta
Subang
Bandung Barat
6.8°S
Lembang Fault
Sukamulya
Bukatanah
Cimandiri Fault
Bandung
Manteos
Cimahi City
6.9°S
Bandung City
0
2 km
107.4°E
107.5°E
107.6°E
107.7°E
Administrative Boundary
River
Fault
Workshop Location
Volcanic Hazard Zone III
Volcanic Hazard Zone II
Volcanic Hazard Zone I
Potentially threated
Potentially Affected Villages in Bandung Regency
Potentially Affected Villages in Cimahi City
Potentially Affected Villages in Bandung Barat
Potentially Affected Villages in Bandung City
Bandung Barat : 36 villages
Cimahi City: 5 villages
Bandung Regency: 8 villages
Bandung City: 7 villages

Moving forward for Megacities

- More Imperative and participative efforts is required
- To be able to Advancing risk-informed development, it is important to scale-up the understanding and assessment of detail hazard, multi-hazard, cascading hazard and it's systemic associated risk
- Re-evaluating the seismic performance and multi-hazard resistant building of existing buildings and infrastructure, public infrastructures and health facilities
- Providing guideline on public health resistant and services to be able to cope during disaster
- Developing easy-to-use damage and loss assement to accommodate large scala disaster
- Increasing Disaster Risk Reduction and Disaster Resilience awareness and knowledge of leaders and citizen, rejuvenating local /traditional wisdom
- Strengthen Capacity Building and Access to Resource to accelerate development of Science, Technology and Innovation for DRR in Megacities
- Involvement of participatory approach, leveraging the role of Youth and Young Professionals, and women.
- Leveraging International collaboration for technology transfer, sharing of lesson learned and new methodologies, capacity development