

KEY RELEVANT PRIORITIES, POLICIES, AND ACTIVITIES RELATED TO TSUNAMI

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TECTONICAL SETTING OF INDONESIA



- * Located in the junction of four active tectonic plates, Indonesia is inevitably prone to tsunami
- Subduction zones with 13 megathrust segments (including Siberut M8.9, East Java M8.7, North Sulawesi M8,5, West Molucca M7,9)
- There are about 295 seismic faults had been identified, still many more had not been identified
- Indonesia is seismically active, in one year:
 - Earthquake with a various magnitude : 5.000-6.000 times
 - Earthquake M>5,0: 250-350 times
 - Destructive earthquake 8-10 times.

TSUNAMI HAZARD ZONE



Periode Tahun

INDONESIAN TSUNAMI HISTORY

The Indonesian Tsunami History from 1600-2021

- The Tsunami had been along the subduction zone of Sumatera and Java
- The eastern part of Indonesia had experienced more tsunamis
- Tsunami Mentawai 2010 (M7,7)
- Tsunami Banyuwangi 1994 (M7,8), more than 200 people died
- Tsunami Bulukumba 1820
- Tsunami Gorontalo 1938 (M7,6)



VOLCANO TSUNAMI

Potential Volcano Tsunami:

- 1. Krakatau
- 2. Tambora
- 3. Rokatenda
- 4. Teon
- 5. Gamalama
- 6. Ruang
- 7. Awu
- 8. Gamkonora
- 9. Illeweung



Indonesian non tectonical tsunami according to the historical data:

- 1. Sunda Strait Tsunami (1883, 1928, 2018)
- 2. Gamalama Tsunami (1763, 1840, 1871,)
- 3. Awu- Sangir Island Tsunami (1856)
- 4. Teon- Banda Island (1659, 1673)

Source: Soloviev and Go (1974); Wichmann (1918); Sieberg (1932); Heck (1934); Iida et al. (1967); Berninghausen (1969); NOAA; BMKG.

INDONESIAN VILLAGES PRONE TO TSUNAMI

No	Provinsi	Kerawanan Tinggi	Kerawanan Sedang	No	Provinsi	Kerawanan Tinggi	Kerawana n Sedang	BIKG BADAN METEOROLOGI KLIMATOLOGI DAN GEOFISIKA	PETA SEBARAN DESA RAWAN TSUNAMI DI INDONESIA
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Ζ	Sumatera Otara	28	169	16	Maluku Utara	62	467	Mataysta	Colden Sin
3	Sumatera Barat	51	77						Barryon
4	Bengkulu	53	90	17	Kalimantan Timur		7	Bankara a	
5	Lampung	6	95					and the second se	A second se
6	Banten	22	77	18	Kalimantan Utara		9		an Java Sea
7	DKI lakarta		2	19	Sulawesi Utara	95	376		
/	DNI Jakarta		Z	20	Gorontalo	2	58	8	
8	Jawa Barat	40	42					a.a	Arofura sea
9	Jawa Tengah		64	21	Sulawesi Tenggara	1	197	100'00'E	Course guil CERCO HOAK Inform Census (Cannor HTEE Census ing institute contractor) Horbore 130'00'E 130'00'E 140'00'E
10	DI Yogyakarta	3	25	22	Sulawesi Tengah	80	467	Sirine BMKG (52)	Ketter regan: Sease Tr Data Open Profile Sease Annuelling Open Profile Sease Annuelling Open Profile Sease Annuelling Open Profile Sease Annuelling
11	Jawa Timur	12	130	23	Sulawesi Selatan	117	168	Sirine BNPB (135) Kerawanan rendah	- bitter dear - bitt
10	D-1:		100	24	Sulawesi Barat	31	91		
12	Ball	44	109	25	Рариа	39	358		
13	NTB	70	146	26	Papua Barat	21	146		

- There 5744 villages are prone to tsunami (1013 vilages has a high level of hazard, and 4731 villages are moderate):
 - a) Saliguma, Saibi Samukop, Muara Sikabaluan (Siberut),
 - b) Kalipait (Banyuwangi)
 - c) Bunaken, Manado Tua (Bunaken)
 - d) Waitii, Waha, Tongano Barat, Mandati
 - e) Cendana, Kololio, Lebiti, Pulau Enam, Bungayo, Benteng, Bangkagi, Lembanato, Baulu (Togean) Badan Meteorologi Klimatologi dan Geofisika

Tsunami Modelling



Tsunami Modelling West Sumatera, M8.9

- Mentawai: ETH 25-27 m, ETA 1-4 minutes
- South Banyuwangi: ETH 24-27 m, ETA 21-24 minutes
- East Banyuwangi: ETH 4-7m, ETA 45-48 minutes
- Bunaken: ETH 0-5-3 m, ETA 25-30 minutes

Tsunami Modelling East Java, M8,7



Tsunami Modelling North Sulawesi, M8,2



Indonesia Tsunami Early Warning System: Presidential Decree no 93/2019



PROGRESSIVE DEVELOPMENT OF SEISMOGRAPH NETWORK

DEVELOPMENT OF SEISMOGRAPH NETWORK

■ <2018 ■ 2019 ■ 2020 ■ 2021 ■ 2022





 83 seismometers are on going process to be deployed until next year.



Seismic data from international data sharing to improve quality of earthquake parameter.

Integrating Sea Level Monitoring into InaTNT







- Sea level monitoring network to make sure whether tsunami has generated or not.
- Whole sea level data is integrated in InaTNT system, which managed by BMKG

INSTALLATION SEA LEVEL OBSERVATION AT SUNDA STRAIT





 The lesson learnt from Non Seismic Tsunami event at Sunda Strait in 2018 by installing sea level observation (IDSL) surrounding GAK.

 This activity was supported by KKP, BAKTI, PVMBG and DISNAV HUBLA

DEVELOP SOP FOR ATYPICAL TSUNAMI AT GAK



End

- a) BMKG and Geological Agency (Ministry of ESDM) develop new SOP for monitoring Gunung Anak Krakatau (GAK) activities
- b) The SOP will be triggered by the increase activity of the Volcanic Eruption, rely on the PVMBG information
- c) BMKG will disseminate tsunami warning (Bulletin 3), if sea level anomaly is detected

REAL TIME EARTHQUAKE INFORMATION AND TSUNAMI WARNING



- There are 425 Warning Receiver Systems (WRS) New Generation
- WRS were installed at BPBD Mentawai, BPBD Banyuwangi, BPBD • Tojo Una Una, BPBD Manggarai Barat, BPBD Kep. Selayar, SAR Manado, and SAR Wakatobi

installed at LDMO, SAR, Media.

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DEVELOPING THE TSUNAMI HAZARD MAP

• The tsunami hazard map was based on the inundation modelling of worse earthquake scenario

- The Earthquake scenario was provided by PUSGEN
- BMKG developed more than 85 maps of 15 provinces
- The map shows the hazard zone, safe zone, and the land mark point of interesting, and interesting location



Tanjung Benoa Tsunami Hazard Map



Number of Tsunami Hazard maps had been developed

Νο	Province	Number of Maps
1	Aceh	5
2	Sumut	5
3	Sumbar	8
4	Bengkulu	4
5	Lampung	8
6	Banten	13
7	Jabar	5
8	Jateng	4
9	Yogya	3
10	Jatim	10
11	Bali	6
12	NTB	1
13	Maluku	6
14	Maluku Utara	1
15	Papua	6

Tsunami Hazard Map Books

Badan Meteorologi Klimatologi dan Geofisika

INVOLVING LOCAL COMMUNITIES AND GOVERNMENT TO VERIFY THE TSUNAMI HAZARD MAP





The Head of BMKG Verified the tsunami hazard map with

The local government









Involving the communities to verify the tsunami hazard map





- The local government and communities were invited to verify the tsunami hazard map
- Assessing the evacuation facilities
- Giving a recommendation to the local government for tsunami evacuation plan based on the tsunami hazard map

SEKOLAH LAPANG GEMPA (SLG)/ EARTHQUAKE FIELD SCHOOL



- Outreach activity (ToT) in the tsunami prone area
- The SLG had been conducted since 2015 including:
 - Waktobi, 2019
 - -Banyuwangi, 2019
 - -Labuan Bajo, 2021
- in 2023, the SLG will be conducted in 23 locations







Badan Meteorologi Klimatologi dan Geofisika

THE COMMUNITY EDUCATION ACTIVITIES OF SEKOLAH LAPANG GEMPA (SLG) ON CONTRIBUTING TO THE DEVELOPMENT OF TSUNAMI READY COMMUNITY

- The SLG (Earthquake Field School) is a capacity building activity to enhance local government and community awareness and response
- LDMO, Community, Army, stakeholders related to the disaster management and reponse, School, community, private sector are involved.
- The scope of the SLG:
 - 1. Field Survey and advocating the implementation of the 12 indicators
 - 2. TOT Workshop of the SLG
 - 3. School Exercise
- 114 tsunami prone areas had been trained by conducting the SLG.
- 9 Communities are advocated to get IOC-UNESCO tsunami ready recognition





Advocacy of the compliance of the 12 indicators

Discussion on the development of community emergency response team



PILOTING THE UNESCO-IOC RECOGNITION OF TSUNAMI READY COMMUNITIES





TR Recognition Tanjung Benoa, Tambakrejo, Glagah



TR Recognition Panggarangan



The National Recognition of

Purus and Lolong Belanti in

Padang



Tsunami Simulation to implement Airport Tsunami Ready

- 1. In 2021, BMKG starts to advocate the implementation the 12 indicators of Tsunami Ready indicators
- 2. Indonesia Piloting UNESCO IOC Tsunami Ready Recognition of 9 (nine) communities.
- 3. Implementing the Tsunami Ready into 2 Critical infrastructures (YIA Airport and Ngurah Rai Airport)

TSUNAMI READY BANDARA INTERNATIONAL YOGYAKARTA













Table Top Exercise followed by the Biennial Tsunami Exercise of the IOWave 2020 and Tsunami Drill

SLG-TR in 2023

- In 2023, BMKG will conduct SLG-TR in 23 locations prone to tsunami.
- In 2023, will propose Tsunami Ready Recognition for:
 - 1. Cilacap
 - 2. Pacitan
 - 3.Bantul
 - 4. Pelabuhan Ratu
 - 5. Lhokseumawe
 - 6. Buleleng



No	Lokasi	Provinsi	UPT Pelaksana	Wilayah
1	Lhokseumawe	Aceh	Stageof Aceh Besar	
2	Pelabuhan Ratu	Jawa Barat	Balai II	
3	Kebumen	Jawa Tengah	Stageof Banjarnegara	Barat (5 Lokasi)
4	Bantul	DI Yogyakarta	Stageof Yogya	
5	Pacitan	Jawa Timur	Stageof Nganjuk	1
6	Buleleng	Bali	Stageof Denpasar	
7	Bima	NTB	Stageof Mataram	1
8	Sumba Tengah	NTT	Stageof Sumba Timur	1
9	Kutai Timur	Kalimantan Timur	Stageof Balikpapan	Toronh (0) alas
10	Polewali Mandar	Sulawesi Barat	Stageof Gowa	Tengan (8 Lokasi
11	Bolaang Mongondo	Sulawesi Utara	Stagoef Manado	1
12	Buol	Sulawesi Tengah	Stageof Palu	1
13	Buton	Sulawesi Tenggara	Stageof Kendari	1

No	Lokasi	Provinsi	UPT Pelaksana	Wilayah	
14	Tual	Maluku	Stageof Saumlaki	-	
15	Seram Barat	Maluku	Stageof Ambon		
16	Jailolo	Maluku Utara	Stageof Ternate	Timur (10 Lokasi)	
17	Sula	Maluku Utara	Stageof Ternate		
18	Supiori	Papua	Balai V		
19	Waropen	Papua	Stageof Nabire		
20	Mimika	Papua	Stageof Jayapura		
21	Kaimana	Papua Barat	Stageof Sorong		
22	Teluk Wondama	Papua Barat	Stageof Sorong		
23	Manokwari Selatan	Papua Barat	Balai V		

Future Activities

- Enhance seismic network and dissemination system
- Expanding the Tsunami Ready Recognition program
- Contributing to develop Tsunami Hazard Map
- Engage University to be apart of Tsunami Ready Recognition
- 23 locations of SLG in 2023



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Image: Second systemImage: Second systemJl. Angkasa 1 No.2 Kemayoran Jakarta Pusat, Indonesiawww.bmkg.go.id

Thank you