



BMKG

INDONESIAN TSUNAMI EARLY WARNING SYSTEM (INATEWS) CURRENT STATUS

**Dr. Karyono
Suci Dewi Anugrah**

**National Report
Agency for Meteorology Climatology and Geophysics (BMKG)**

[ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation
System in the South China Sea Region - online session
28-30 September 2021](#)



OUTLINE



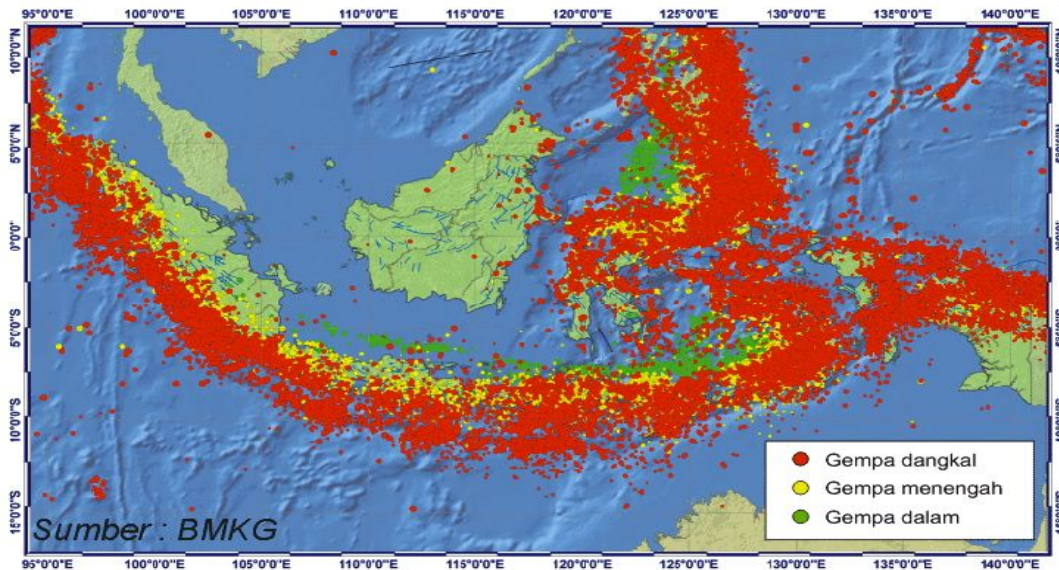
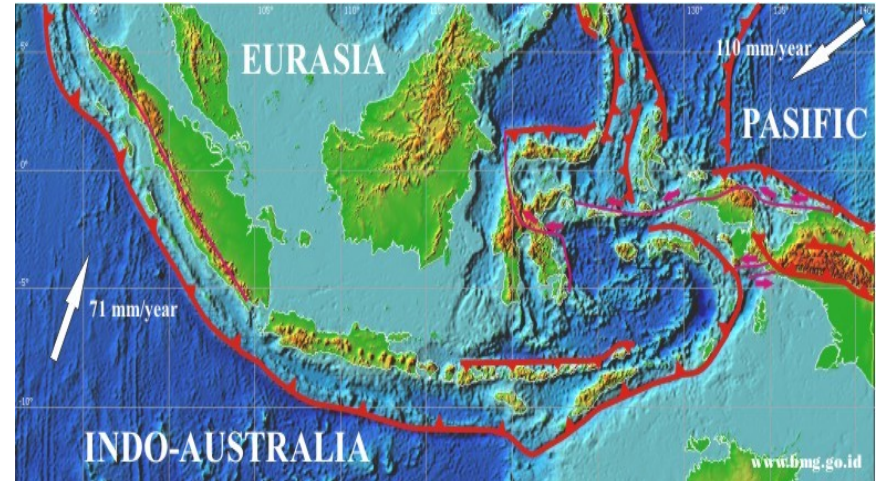
1. Background
2. Monitoring System
3. Processing System
4. Dissemination System
5. Indonesia Responsibility in Global area
6. Capacity building

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EARTHQUAKE AND TSUNAMI THREAT IN INDONESIA

Indonesia Region is a Part of
“Ring of Fire”

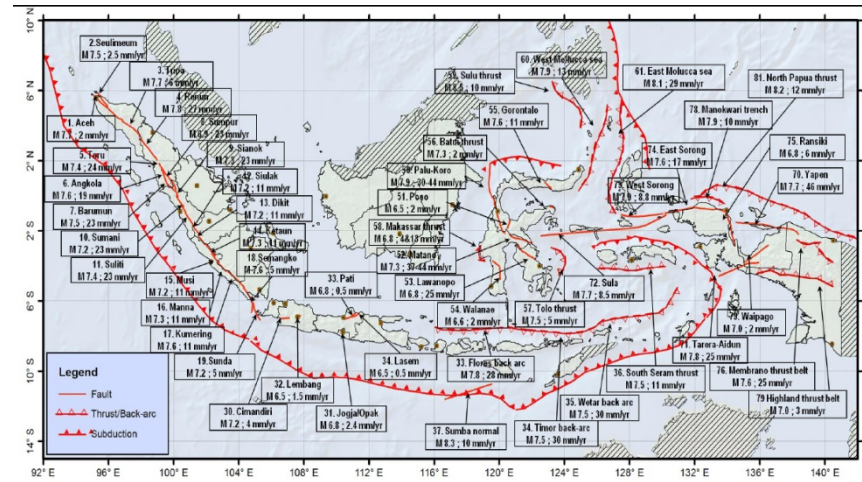
- Indonesia is one of a very seismic active region in the world



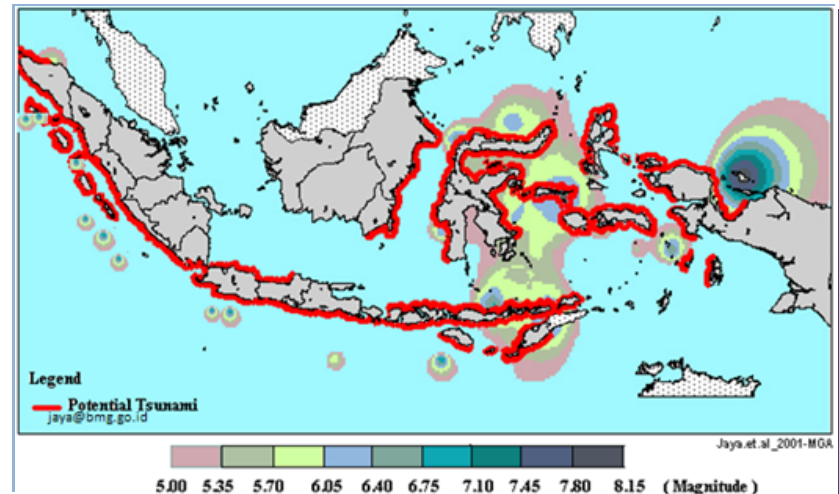
Seismicity of Indonesia
(1900 – 2021)

EARTHQUAKE AND TSUNAMI THREAT IN INDONESIA

- 295 active faults and 5 active subduction zone:**
 1. Sunda Subduction,
 2. Banda subduction,
 3. North Sulawesi Subduction,
 4. Molucca Sea Subduction and
 5. North Papua Subduction



- 46% of Indonesia coastal length is prone to tsunami



ESTABLISHMENT OF INATEWS INDONESIA TSUNAMI EARLY WARNING SYSTEM

Inaugurated on November 11, 2008



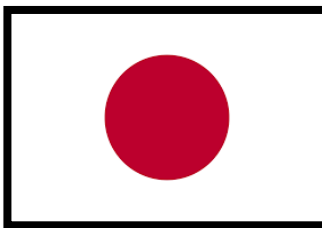
- The main product of InaTEWS is **Earthquake Info and Tsunami Warning**
- Required to disseminate Earthquake Information and Tsunami Warning within **5 minutes** after the earthquake occurred



Indonesia Tsunami Early Warning System Goal's:

Timely detection of earthquake event and provide tsunami warning to the responsible-institutions and people.

Proper response of communities to reduce and minimize the impacts of disaster.



MENTERI KOORDINATOR BIDANG KESEJAHTERAAN RAKYAT
REPUBLIK INDONESIA

KEPUTUSAN
MENTERI KOORDINATOR BIDANG KESEJAHTERAAN RAKYAT REPUBLIK INDONESIA
SELAKU
KETUA HARIAN BAKORNAS PB
Nomor : 21 /KEP/MENKO/KESRA/IX/2006

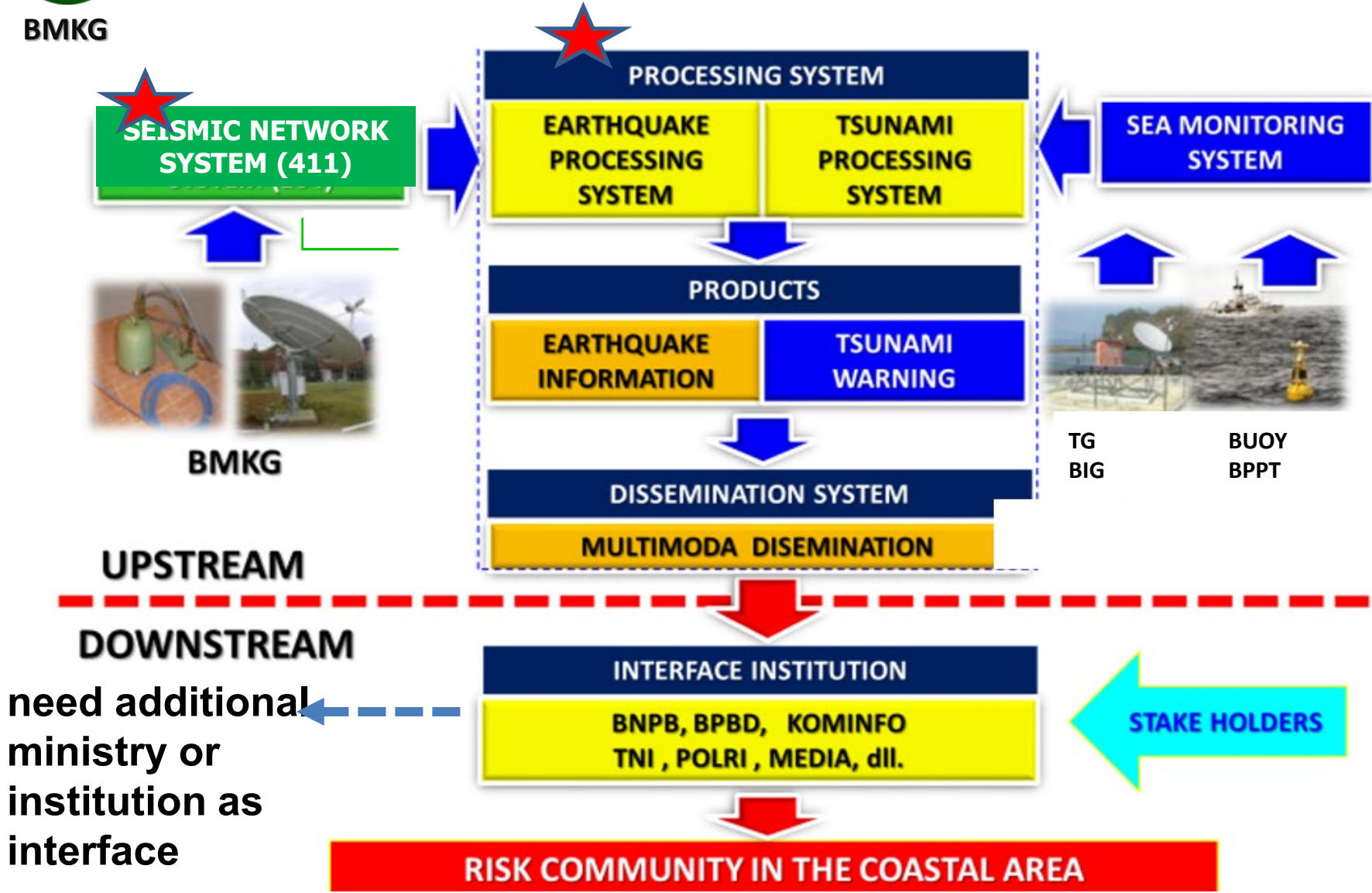
TENTANG

PENUNJUKAN LEMBAGA PEMERINTAH SEBAGAI *FOCAL POINT* DAN PEMBENTUKAN
TIM PENGEMBANGAN SISTEM PERINGATAN DINI TSUNAMI DI INDONESIA

MENTERI KOORDINATOR BIDANG KESEJAHTERAAN RAKYAT
SELAKU KETUA HARIAN BAKORNAS PB

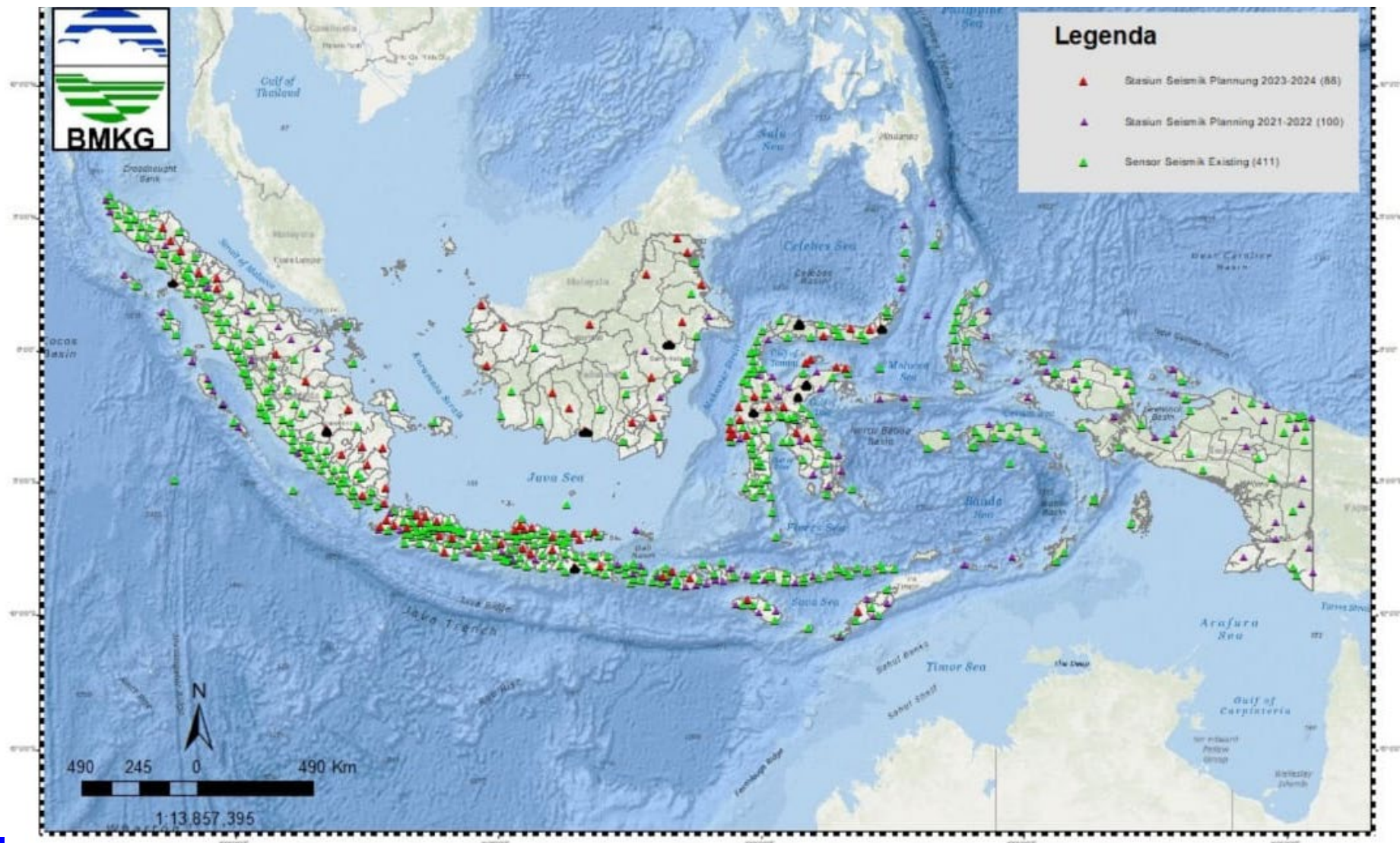
- Menimbang :
- a. bahwa sebagian besar wilayah Indonesia rawan akan terjadinya bencana gempa bumi dan tsunami;
 - b. bahwa bencana gempa bumi dan tsunami yang terjadi di Nanggroe Aceh Darussalam dan Sumatera Utara serta Jawa Barat telah menyadarkan tentang pentingnya dikembangkan Sistem Peringatan Dini Tsunami di Indonesia;
 - c. bahwa untuk mengembangkan sistem tersebut, Menteri Negara Riset dan Teknologi telah mengkoordinasikan berbagai lembaga dalam menyusun skenario besar Sistem Peringatan Dini Tsunami;
 - d. bahwa untuk melaksanakan program tersebut, perlu dibentuk lembaga pemerintah yang menjadi *Focal Point* Komponen Sistem Peringatan Dini Tsunami dan dibentuk Tim Pengembangan Sistem Peringatan Dini Tsunami di Indonesia dengan Keputusan Menteri Koordinator Bidang Kesejahteraan Rakyat.
- Mengingat :
- 1. Undang-undang Nomor 18 Tahun 2002 Tentang Sistem Nasional Penelitian, Pengembangan, dan Penerapan Ilmu Pengetahuan dan Teknologi;
 - 2. Undang-undang Nomor 32 tahun 2004 tentang Pemerintahan Daerah sebagaimana telah diubah dengan Undang-Undang Nomor 8 tahun 2005;
 - 3. Peraturan Presiden Nomor 9 Tahun 2005 Tentang Kedudukan, Tugas, Fungsi, Susunan Organisasi dan Tata Kerja Menteri Negara, sebagaimana telah diubah terakhir dengan Peraturan Presiden Nomor 62 Tahun 2005;
 - 4. Keputusan Presiden RI Nomor 20/P tahun 2005;
 - 5. Instruksi Presiden Nomor 4 Tahun 2003 tentang Pengkoordinasian Perumusan dan Pelaksanaan Kebijakan Strategis Pembangunan Nasional Ilmu Pengetahuan dan Teknologi.

1. Background
2. **Monitoring System**
3. Processing System
4. Dissemination System
5. Indonesia Responsibility in Global area
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INATEWS SEISMIC MONITORING NETWORK (CODE IA)

411 SEISMIC STATIONS UNTIL SEP 2021





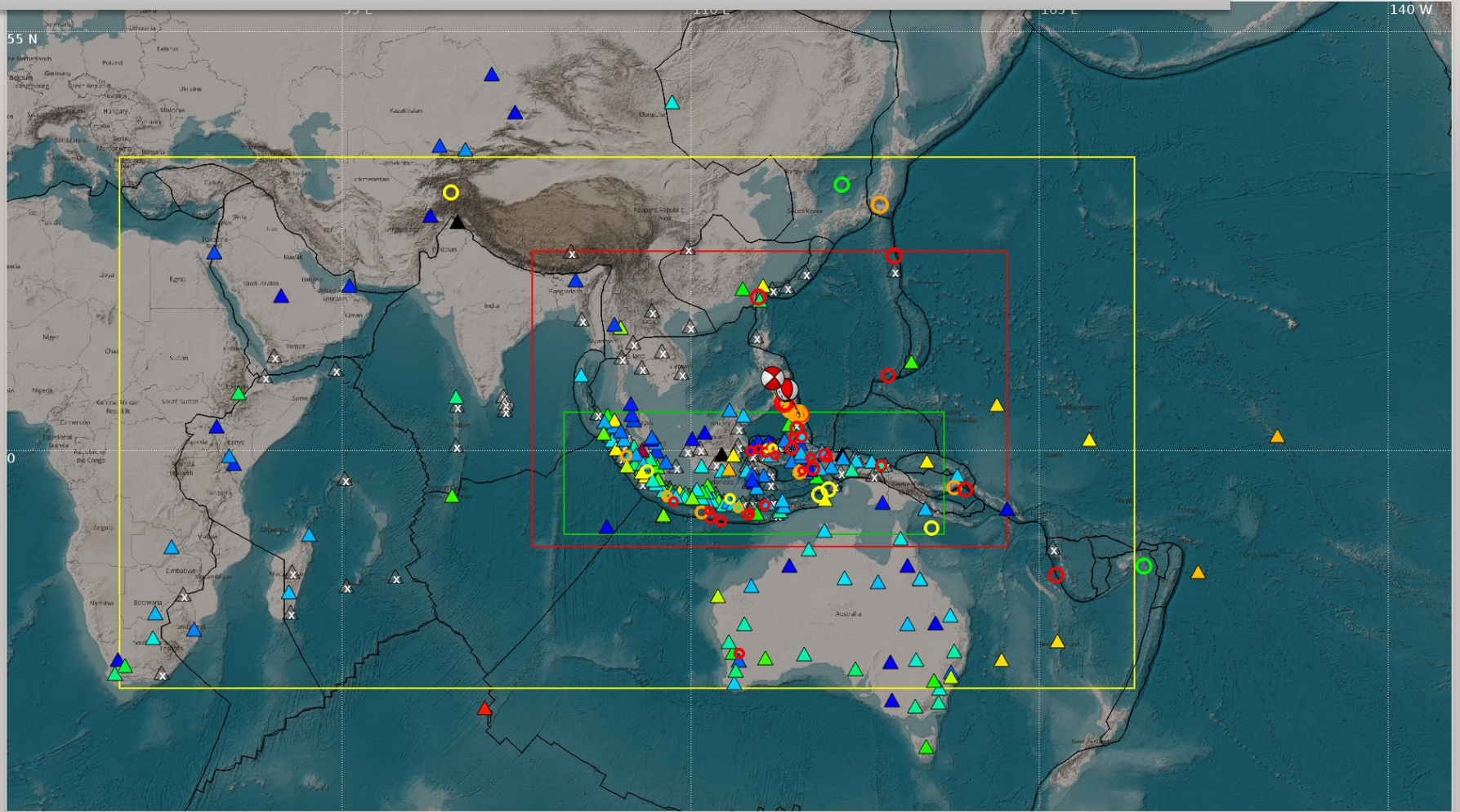
PMKG

InaTEWS Seismic Monitoring Network



INDONESIAN : 411 STATIONS

SITES FROM OTHER COUNTRIES : 200 STATIONS



Germany (GFZ)

- 21 seismic stations
- Technical capacity building

Japan

- 20 seismic stations
- Technical capacity building

China (GEA)

- 14 seismic stations
- Technical capacity building

CTBTO

- 6 seismic stations
- Technical capacity building

USA

- Technical capacity building

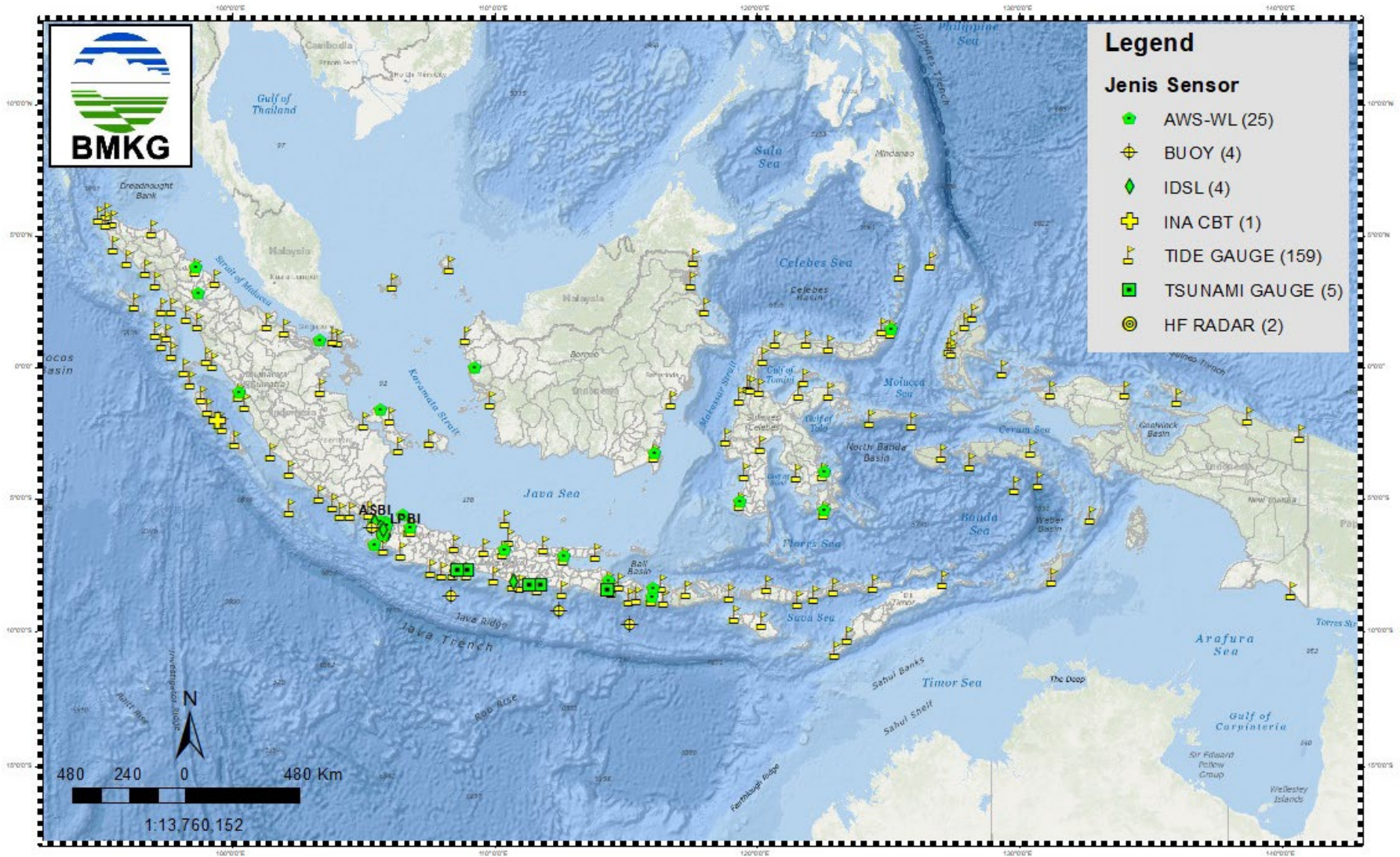
Australia

- Technical capacity building



BMKG

SEA LEVEL MONITORING NETWORK USED BY INATEWS



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1. Seismic Processing
 - Seiscomp3 server
 - Seiscomp3 client
2. Tsunami Processing
 - Toast application



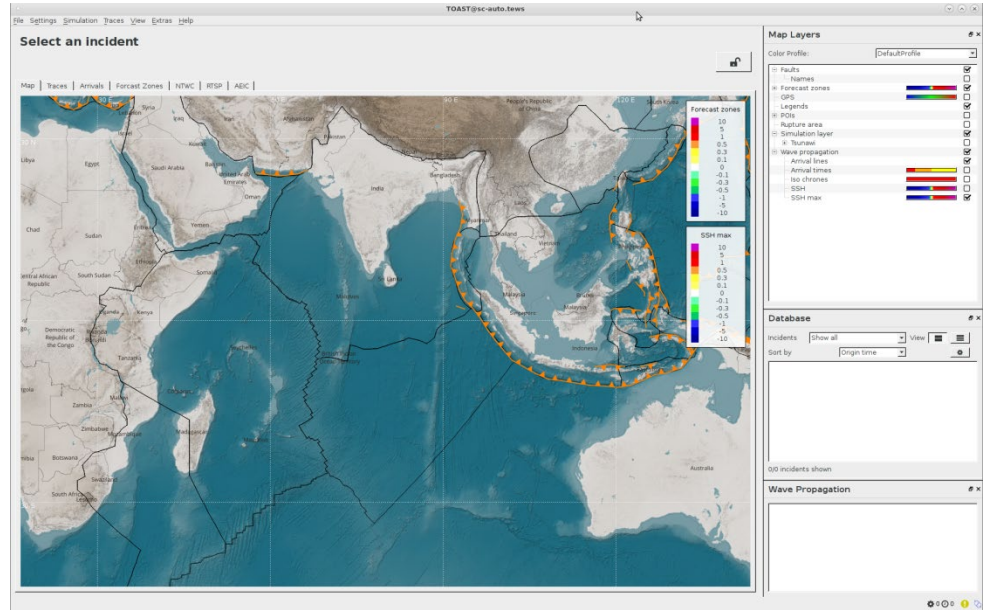
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PROCESSING SYSTEM



TOAST (Tsunami Observation And Simulation Terminal) Using real time simulation and pre-calculated tsunami DTB

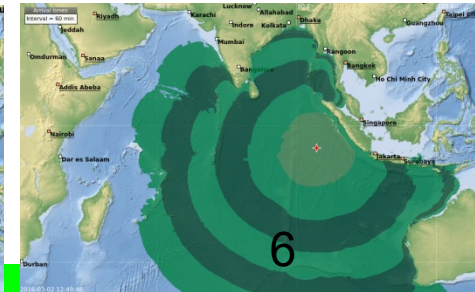
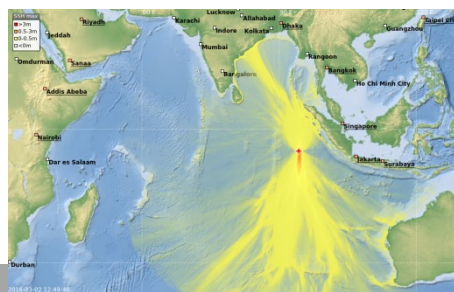
Seiscomp 3 – Eq Analysis



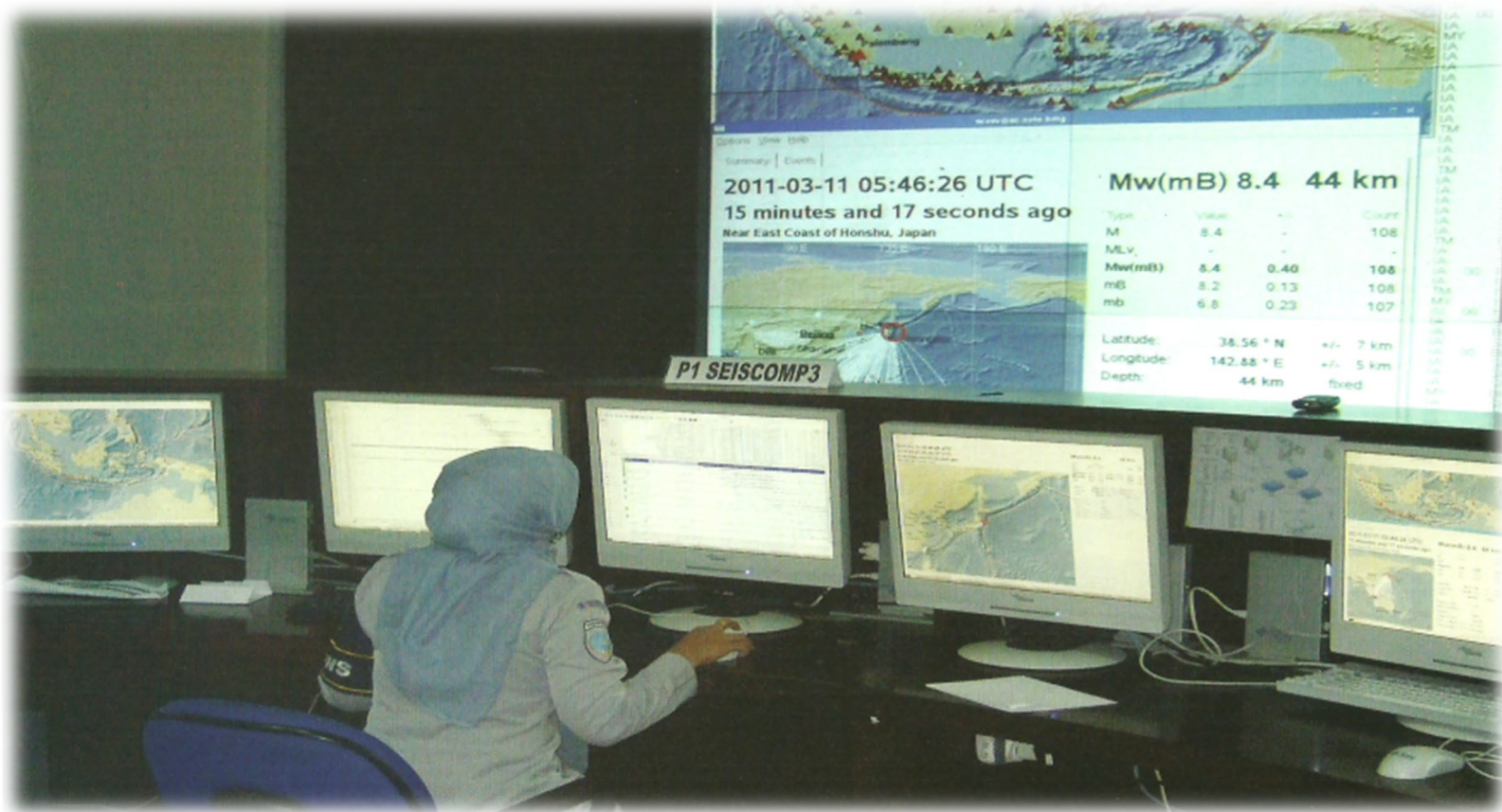
Earthquake
Information

Tsunami Warning

- Origin Time
- Magnitude
- Depth
- Location

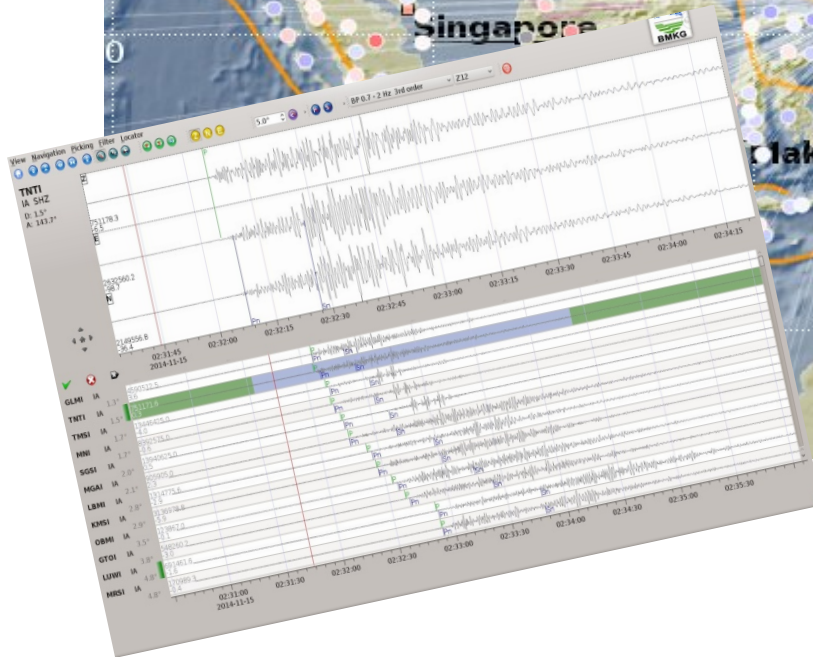


SEISMIC PROCESSING



**AUTOMATIC AND MANUAL REVIEW BY OPERATOR ON DUTY
IN OPERATIONAL ROOM**

Northern Molucca Sea



M 7.2
Northern Molucca Sea
Depth 59 km

1.96° N 126.49° E



MLv	6.9 (18)
mb	6.7 (127)
mB	7.2 (126)
Mw(mB)	7.2 (126)
Mwp	6.8 (121)
Mw(Mwp)	7.0 (121)
M	7.1 (127)

Phases: **180**

RMS Res.: 1.4



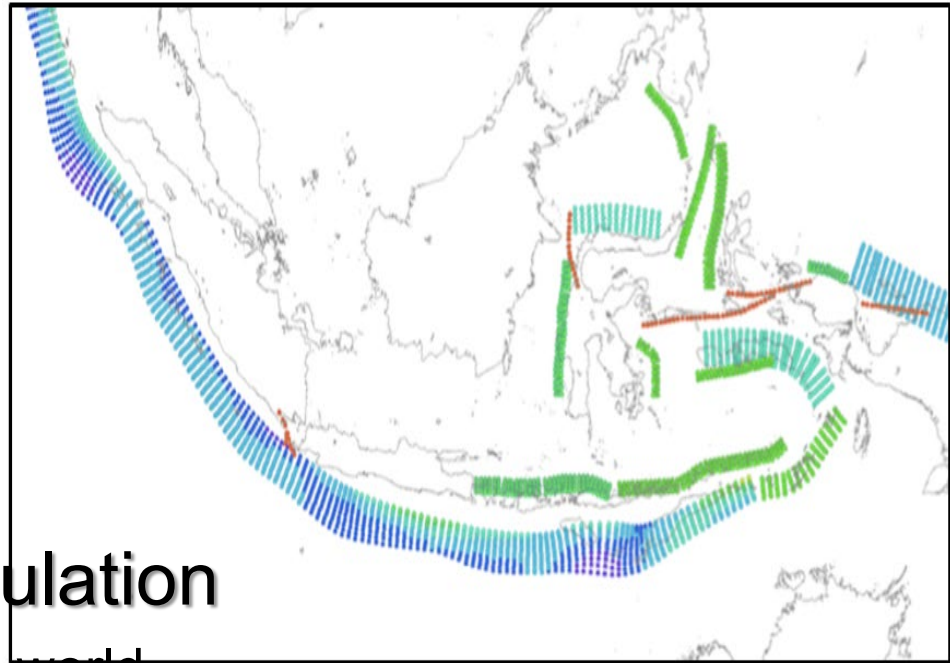
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TSUNAMI PROCESSING



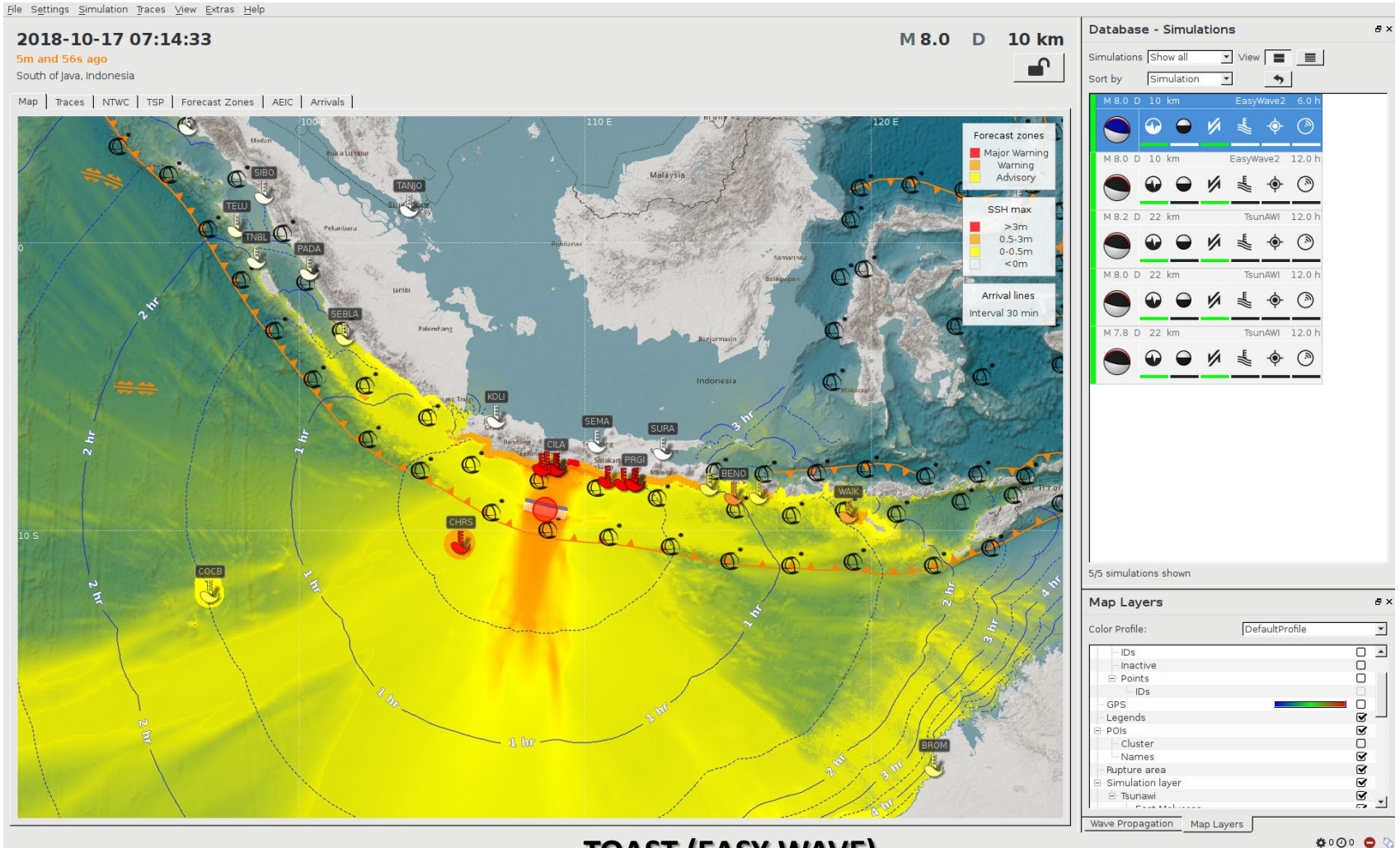
Pre-calculated Tsunami Database (Tsunawi)

- Until 2021, InaTEWS has 20.000 Tsunami Scenarios to complete the previous scenario, which only consists of 4580 scenario tsunami.
- Achievement of tsunami database is to improve the capability in issued the tsunami warning in all area of Indonesia.



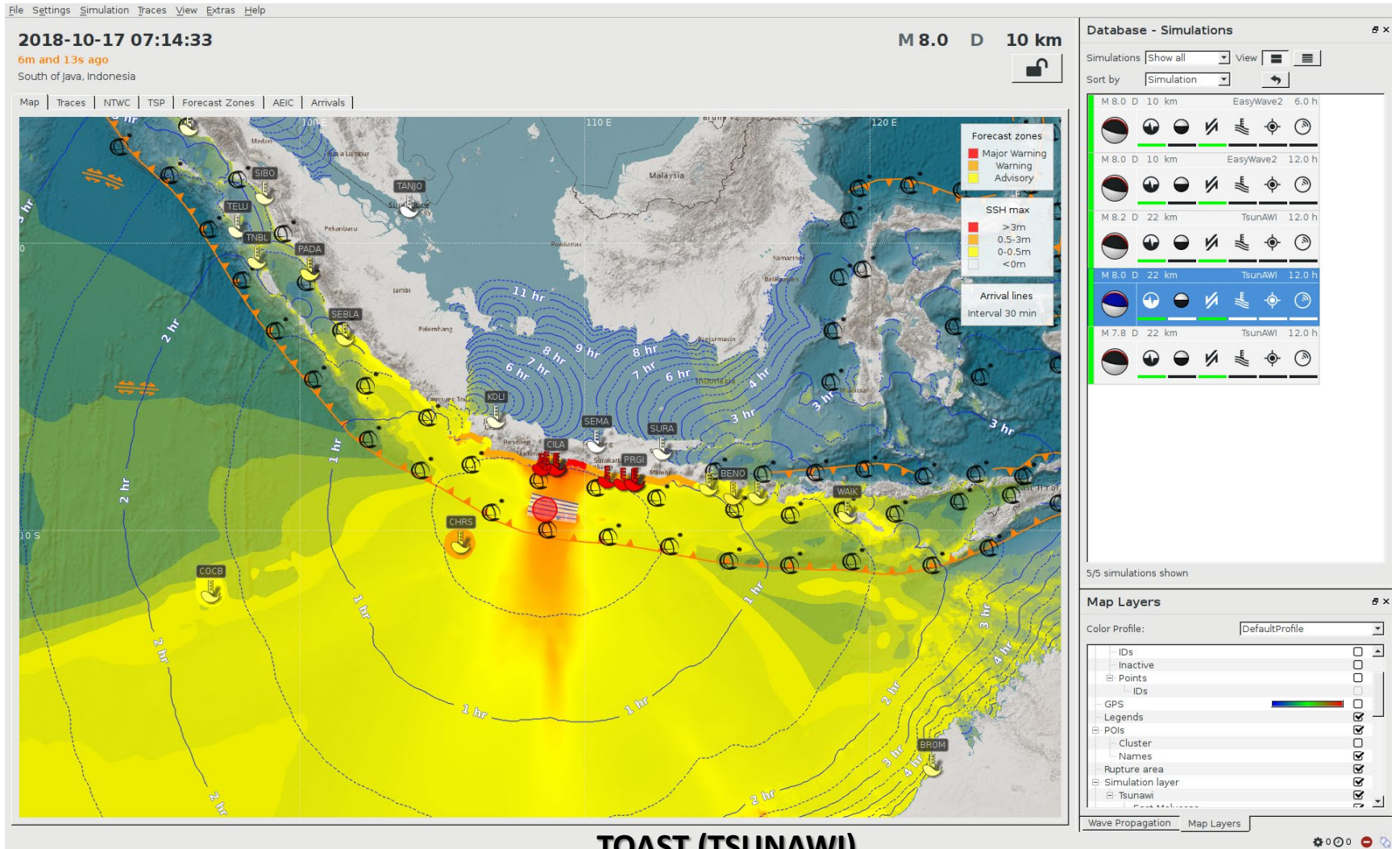
On fly or real time simulation

- Applicable for all area in the world



TOAST (EASY WAVE)

TSUNAMI PROCESSING



TOAST (TSUNAWI)

PROCESSING SYSTEM

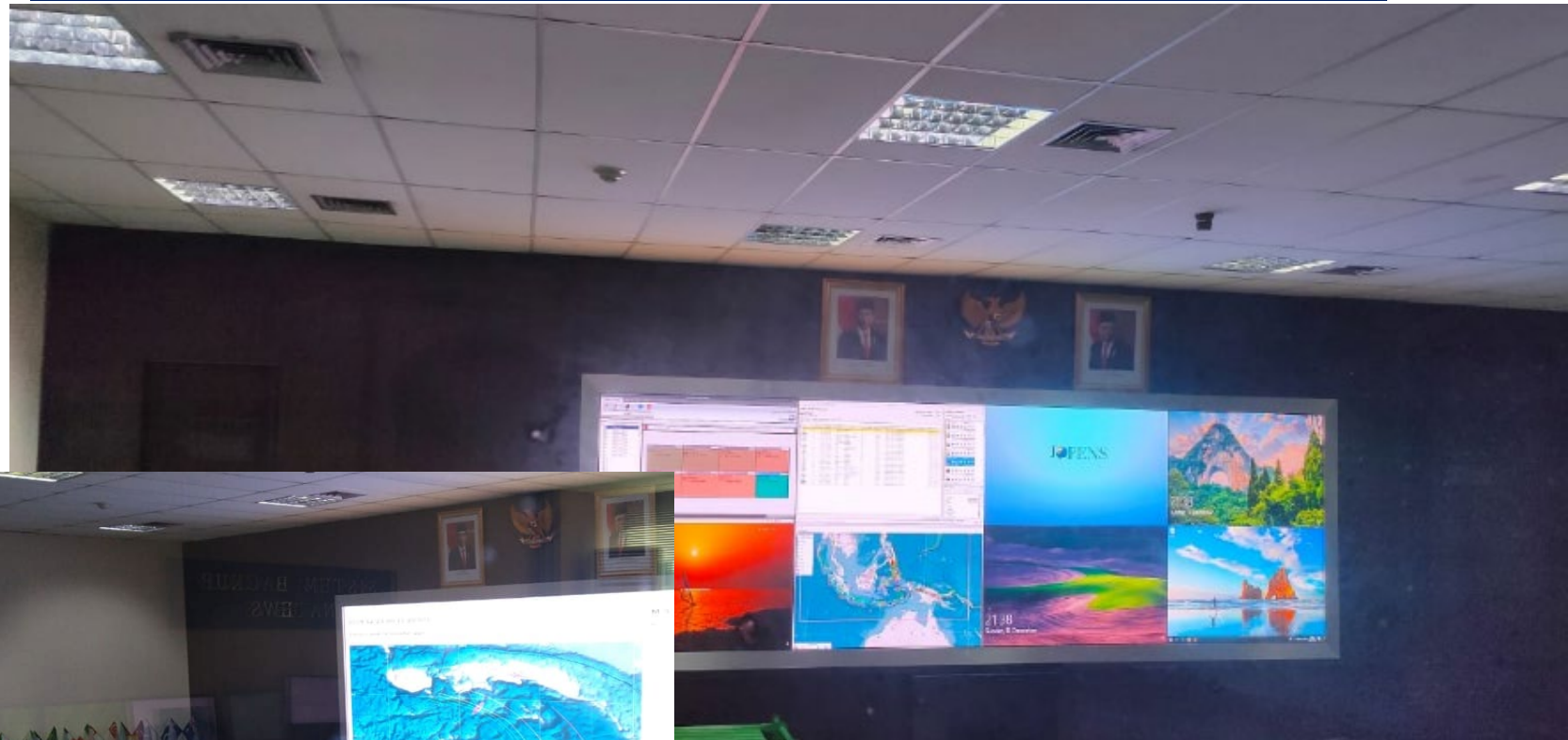
1. InaTEWS Main system in Jakarta
2. Backup system in Regional office Bali
3. Training system

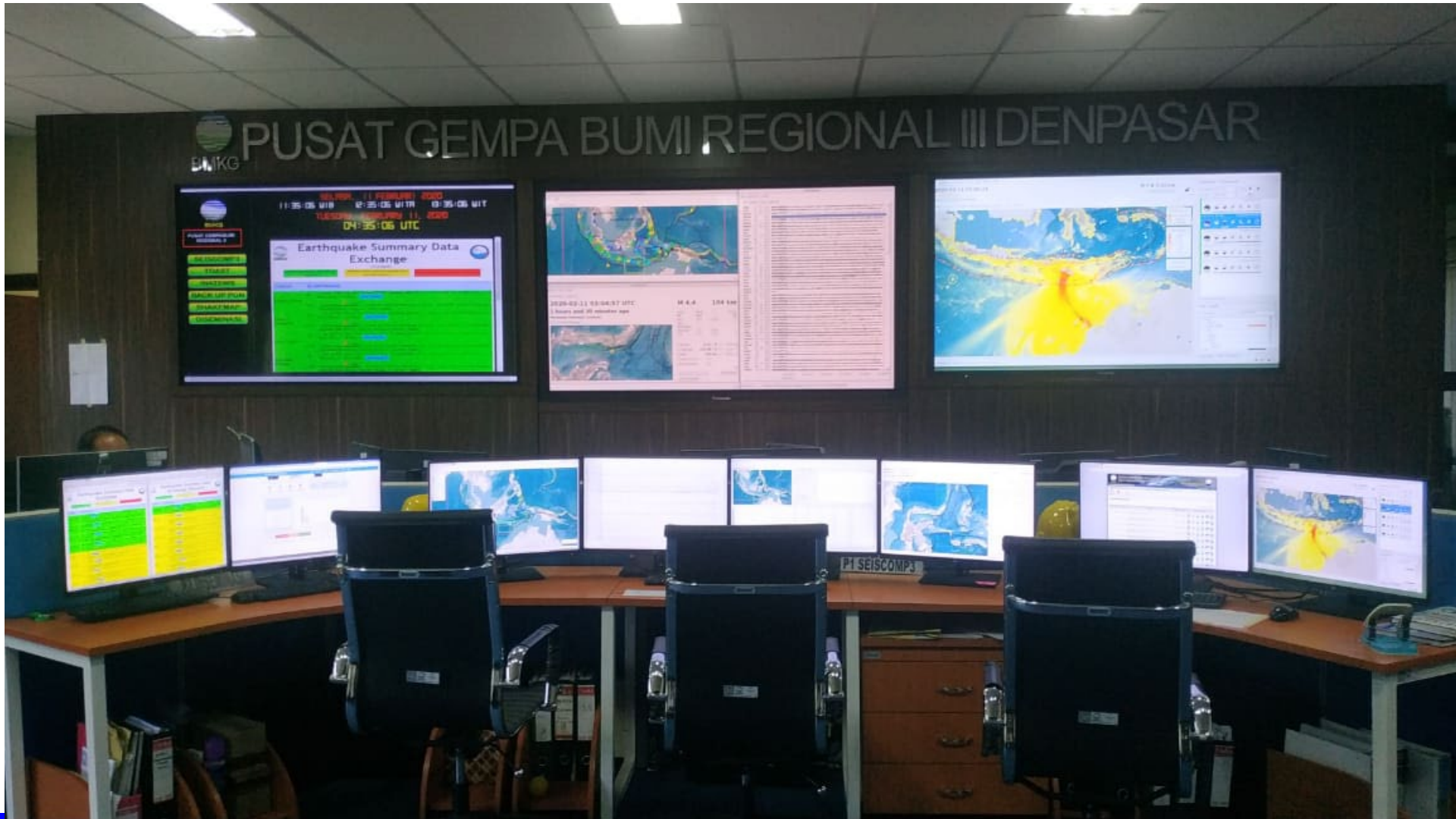


InTEWS Operational Building



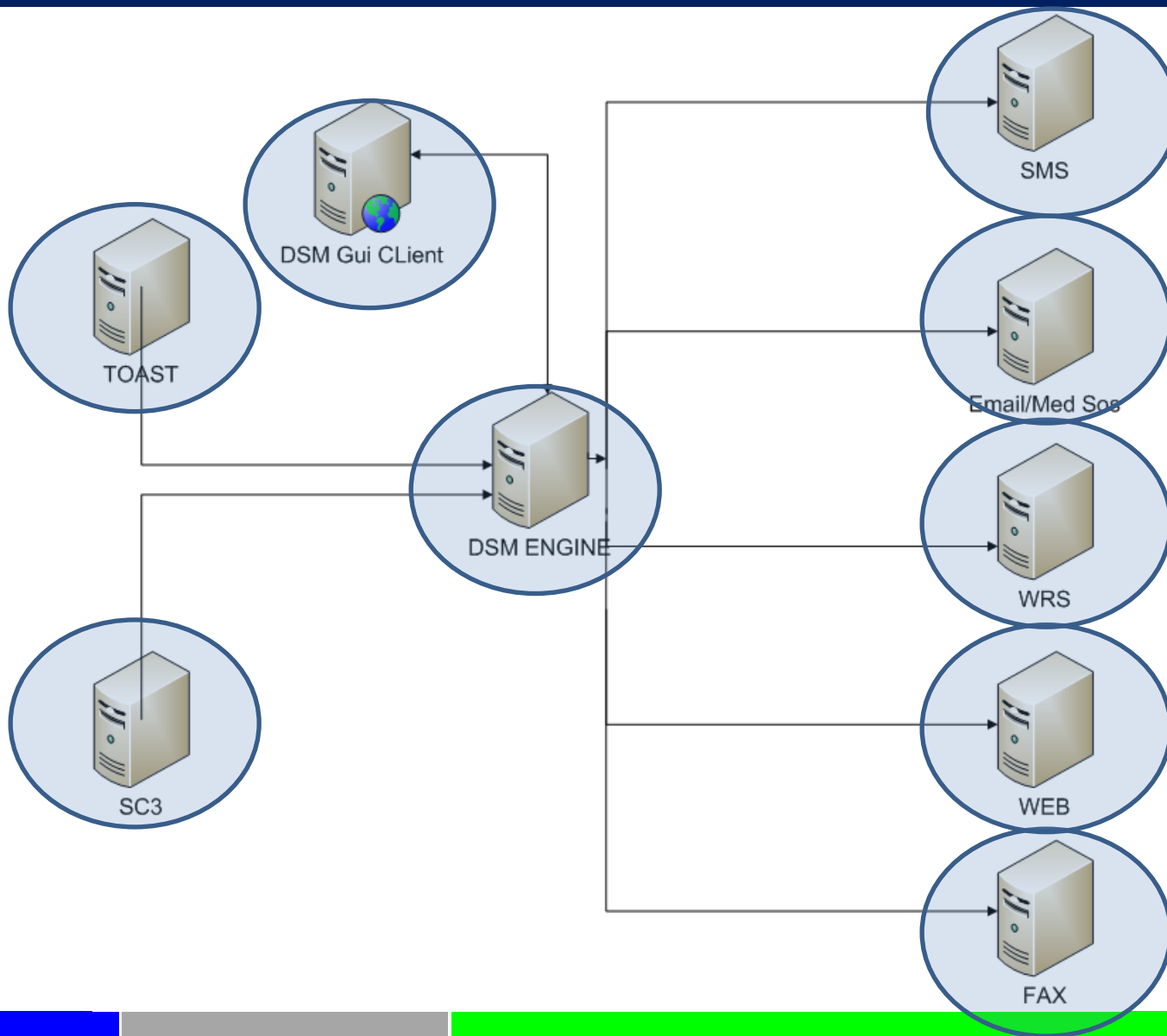
INATEWS MAIN SYSTEM - JAKARTA



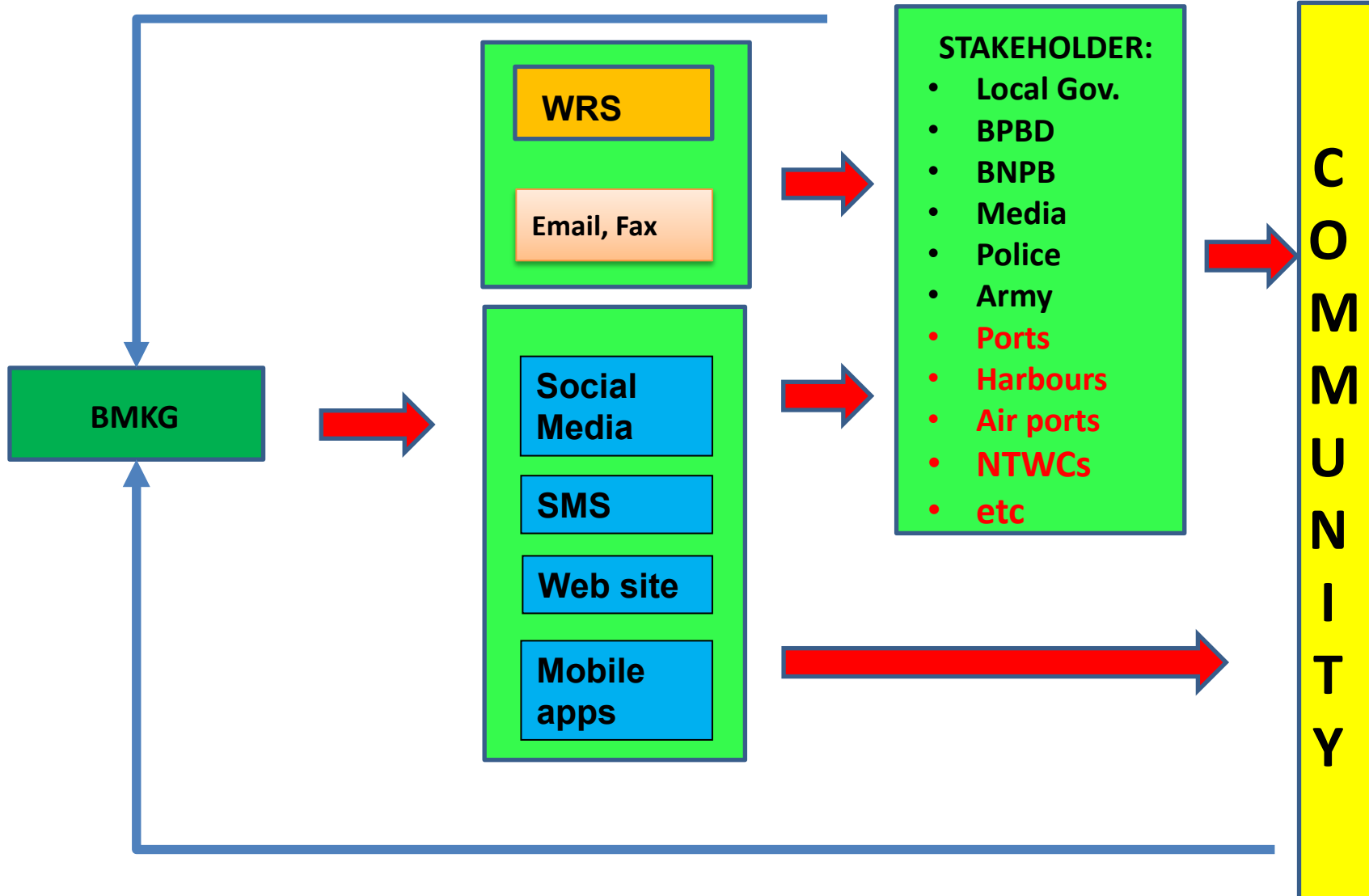


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DISSEMINATION FLOWCHART



Warning Chain InaTEWS





SMS



GSM → SMS

WARNING RECEIVER SYSTEM

FACSIMILE



MULTIMODE DISSEMINATION

INFO GEMPABUMI MAGNITUDO **5,1** SR

Tanggal : 10-Feb-15 06:32:48 WIB

Lokasi:
4.15 LS - 132.56 BT
(139 km Tenggara
FAKFAK-
PAPUABRT)

Kedalaman:
10 Km

Sumber Informasi: InaTEWS BMKG

**TIDAK BERPOTENSI
TSUNAMI**

Television
Radio and
media on
line, Loc
DMO

SOCIAL NETWORKS

Badan Meteorologi, Klimatologi, dan Geofisika

Informasi Cuaca • Informasi Hidro • Kualitas Udara • Gempabumi & Tsunami • IT & Sarana Telemo •

Tanda Waktu
Selasa, 10 Februari 2015
21:39:51 WIB
Tuesday, February 10, 2015
14:39:51 UTC

Banner Layanan
Anda Membaca Data dan Informasi
GEMPABUMI
Pusat Databank

Media
Minggu, 08 Februari 2015
BMKG Menuju Wilayah Bebas Korupsi

Berita Foto
PACIFIC WAVE TSUNAMI EXERCISE
Selama Rahu (K2) Dalam rangka mengukuhkan BOP NTC nasional
Pusat Meteorologi, Klimatologi, dan Geofisika

SIRENS

Sumatera Barat: 6 sirens
Bengkulu: 2 sirens
Lampung: 1 siren
DIY: 1 siren
East Java: 1 siren
Gorontalo: 2 sirens
North-Sulawesi: 2 sirens
NTB: 6 sirens
NTT: 1 siren
Manohewi: 1 siren
Jayapura: 1 siren

Existing : 34
Plan : 13

→ 52

MOBILE APPLICATION

WRS – BMKG



WRS – AEIC



WRS – TSP INDONESIA



EXAMPLE MOBILE APPS MESSAGE CONTENT MOBILE BASED WARNING RECEIVER SYSTEM

Gempa Berpotensi Tsunami



28 Sep 2018
17:02:44 WIB (2 bulan yang lalu)

P.D. Tsunami 1

7.7 Magnitudo
10 km Kedalaman
0.18 LS
119.85 BT

Peringatan Dini Tsunami untuk wilayah: SULBAR, SULTENG, Gempa Mag:7.7, 28-Sep-18 17:02:44 WIB, Lok:0.18 LS, 119.85 BT (27 km TimurLaut DONGGALA-SULTENG), Kedlmn:10 Km ::BMKG

Beranda Gempabumi Umpan Balik Tentang

Peta Perkiraan Tinggi Muka Laut Maksimum



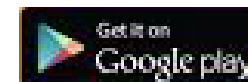
Daerah yang berpotensi tsunami

Provinsi	Kota/Kabupaten	Status Peringatan
Sulteng	Toli-Toli	SIAGA
Sulteng	Buol	WASPADA
Gorontalo	Gorontalo Bagian Utara	WASPADA
Sulut	Bolaangmongondow Bagian Utara	WASPADA

Beranda Gempabumi Tentang

Development of dissemination system, **WRS 4.0**, where the tsunami early warning will be received by the smartphone user with maps and more informative texts, fast and massive.

This application can be downloaded from Google Play and App Store





42% 10:10



Real-time Earthquakes (beta)



Map

Last 30 Events



Disclaimer: Unless revised by a geophysicist, automatically determined earthquake locations may be erroneous!

M 4.7

Stat
201
Dep
Sun

M 5.4

Stat
201
Dep
Ton

M 4.8

Stat
201
Dep

Stat

201

Dep

Sun

Stat

201

Dep

Ton

Stat

201

Dep

Samar, Philippines



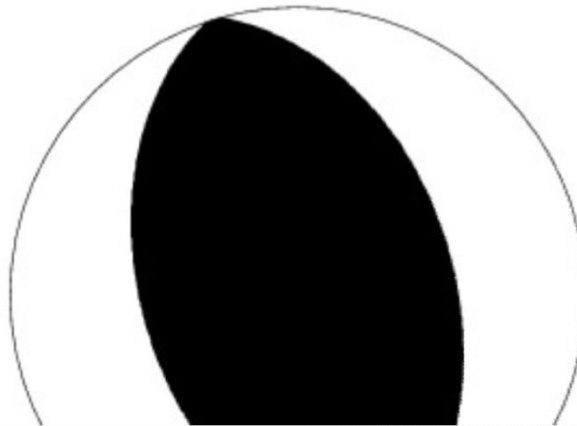
Earthquakes



About

Available

Focal Mechanism



Earthquakes

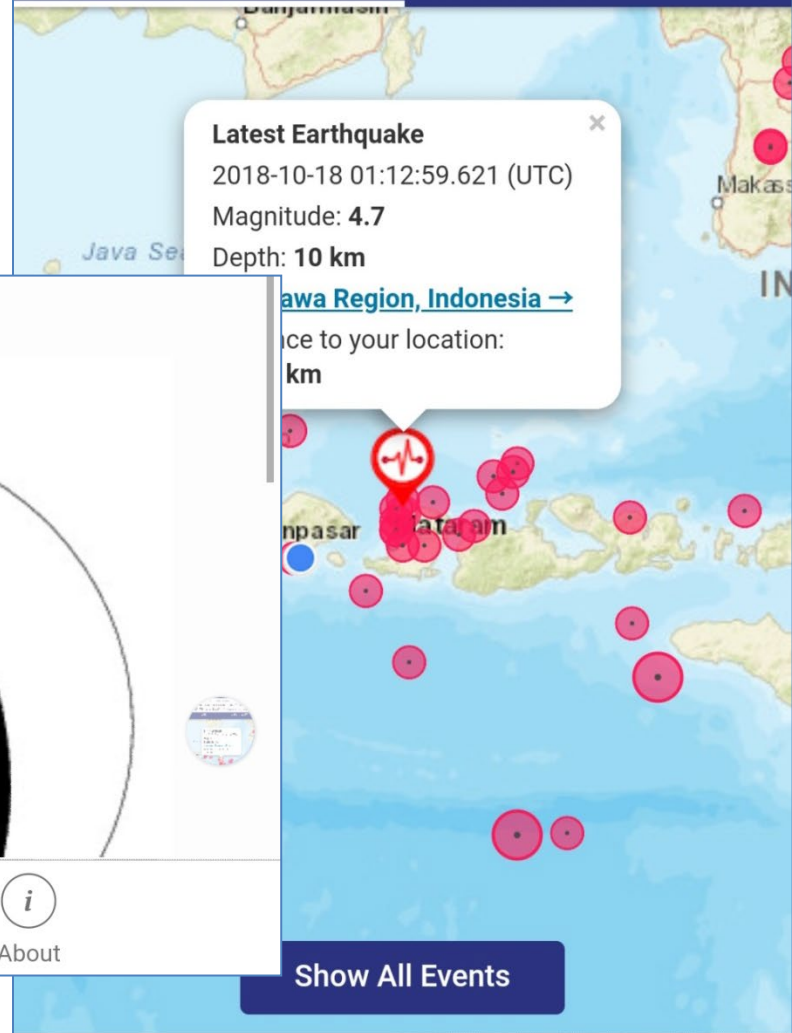


About



Map

Last 30 Events



Earthquakes



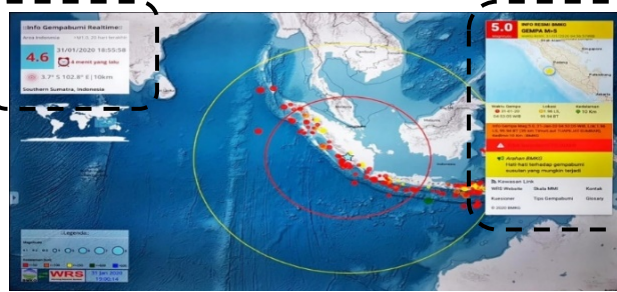
About

Show All Events

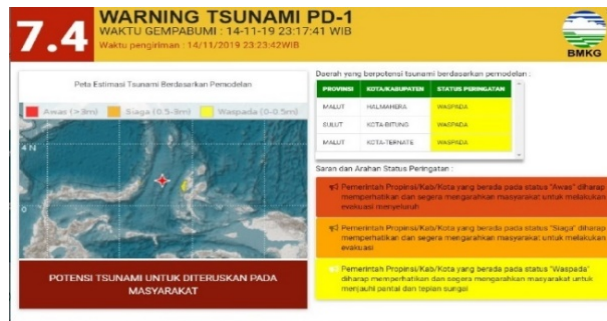
WARNING RECEIVER SYSTEM NEW GENERATION (WRS NewGen)



Realtime earthquake information



Earthquake information based on the SOP ($M \geq 5.0$), and felt earthquake



Smart Display WRS NewGen

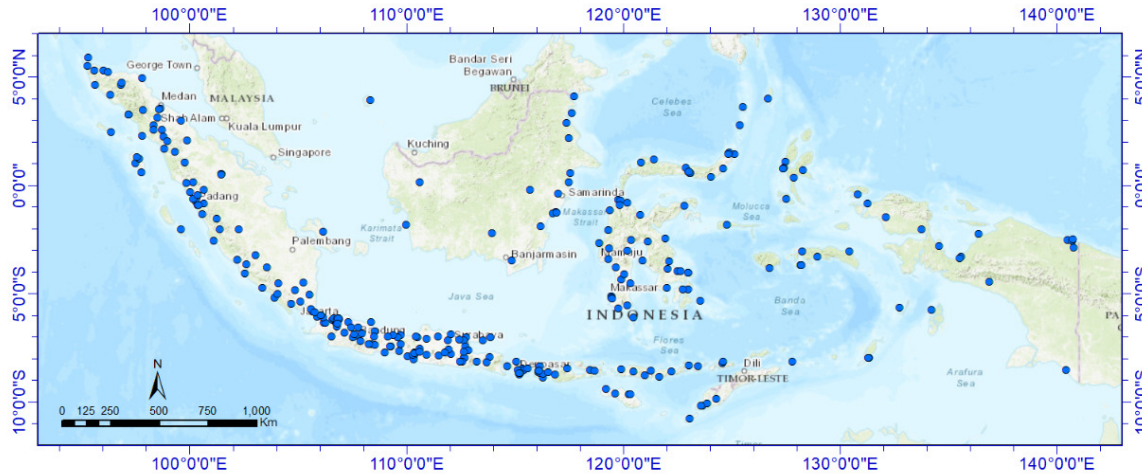
Feature of the WRS NewGen:

- Sound of alarm when earthquake occurred
- Realtime earthquake information
- Earthquake information and tsunami warning based on the SOP
- SMS forwarding
- Earthquake information and tsunami warning on screen
- Historical data in the last of 20 days



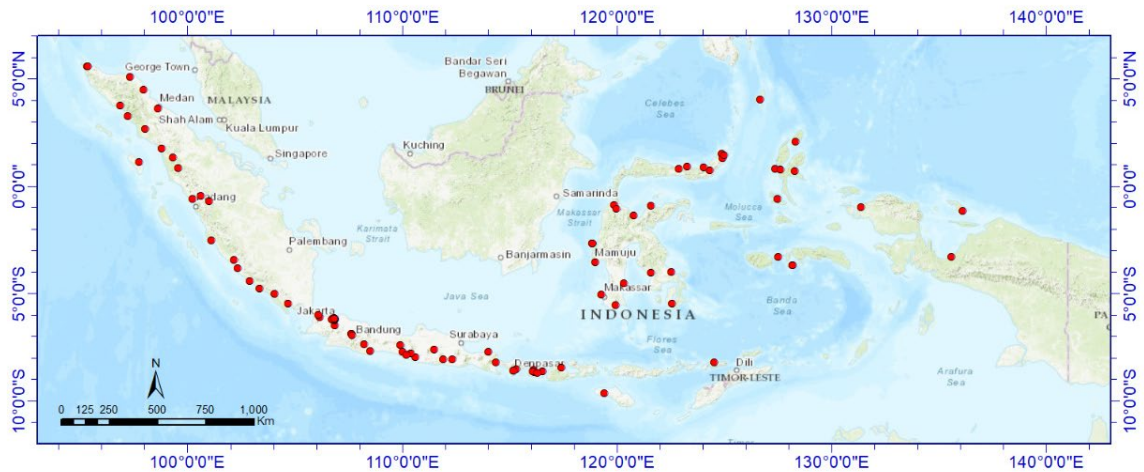
WARNING RECEIVER SYSTEM NEW GENERATION (WRS NEWGEN)

PETA LOKASI WRS NEW GENERATION 2020



In 2020, WRS NewGen had been installed at 315 locations

100 WRS NewGen are installed in 2021



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INDONESIA RESPONSIBILITY IN GLOBAL AREA

- a) Indonesia as Tsunami Service Provider (Indian Ocean)
- b) Indonesia as ASEAN Earthquake Information Center
- c) Indonesia as NTWC of IO area
- d) Indonesia as NTWC of Pacific area
- e) Indonesia as NTWC of SCS area

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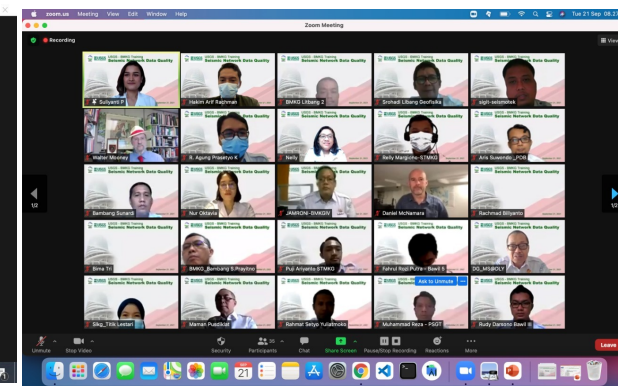
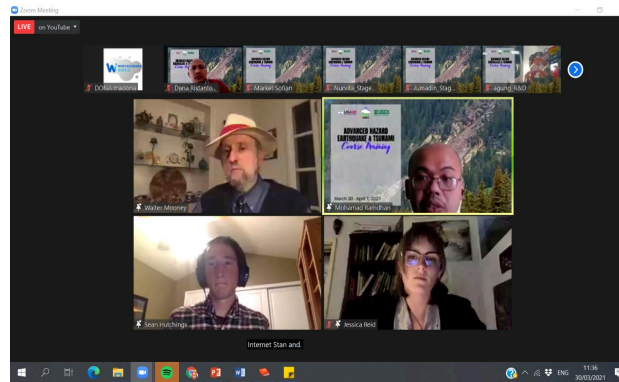
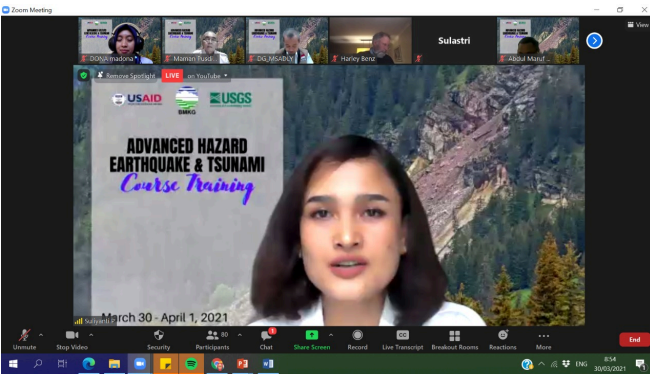
CAPACITY BUILDING

- Formal degree and training for Staff
- Outreach Activities (INDONESIAN TSUNAMI READY)



GRADUATE PROGRAM AND TRAINING FOR NTWC OPERATORS

MASTER		DOCTORAL	
Indonesia	Study abroad	Indonesia	Study abroad
	2 (IISEE Japan)	6	1 (China)



Training Program for Operators

1. Online training of Advance Hazard Earthquake and Tsunami Course
2. Online training on Seismic Network Data Quality

Experts from USGS were invited to give the lectures session for The NTWC Operators

THE INDONESIAN TSUNAMI READY

12 Indicators IOC- UNESCO Tsunami Ready Community

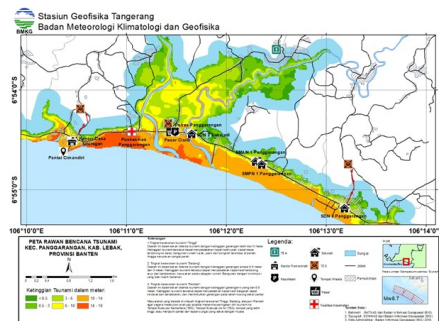
1. Have designated and mapped tsunami hazard zones
2. To develop an initial estimate of the number of people that live in the tsunami hazard zone
3. Have a public display of tsunami information
4. Develop an inventory of available economic, infrastructural, political, and social resources to reduce tsunami risk at the community level
5. Produce easily understood tsunami evacuation map as determined to be appropriate by local authorities in collaboration with communities
6. Development and distribution of outreach and public education materials
7. Hold at least three outreach or education activities annually
8. Conduct biennial tsunami community exercise
9. Have a tsunami Emergency Operation Plan (EOP) for the community
10. Have the capacity to manage emergency response operations during a tsunami
11. Have redundant and reliable means to receive 24 hours official tsunami alerts
12. Have redundant and reliable means to disseminate 24 hours official tsunami alerts to the public

•Indonesia Tsunami Ready (InaTR) is an outreach program of community capacity building by examining and implementing 12 indicators of Unesco-IOC Tsunami Ready Community. The InaTR is conducted in the following ways:

1. Field Survey and advocacy to fulfill the 12 indicators;
2. Two days intensive Workshop of Indonesian Tsunami Ready to evaluate and finalize all the indicators;
3. Tsunami Drill for school through BMKG Goes to School;

•The InaTR has been included in our national priority program by the Ministry of National Development Planning Agency (BAPPENAS)

•30 Communities are planed to be participated in 2021



Developing Tsunami Hazard Map

Group Discussion in developing Tsunami Evacuation Map

30 LOCATIONS OF INDONESIAN TSUNAMI READY COMMUNITIES IN 2021



THANK YOU

BADAN METEOROLOGI KLIMATOLOGI DAN GEOFISIKA



**JL. ANGKASA I NO. 2 KEMAYORAN
JAKARTA PUSAT – INDONESIA 10720**

<https://inatews.bmkg.go.id>, <https://www.bmkg.go.id>