TSP Indonesia Report on Service Updates

Center for Earthquake and Tsunami, BMKG

ICG/IOTWMS Working Group 2
on Tsunami Detection, Warning, and Dissemination
5 - 6 April 2023

United Nations Educational, Scientific and Cultural Organization
Intergovernmental Oceanographic Commission

Outline:

1. TSP Indonesia Performance 2022 and 2023
2. TSP Indonesia development since last ICG
3. TSP Indonesia development and innovation plans

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1. TSP Indonesia Performance 2022 and 2023

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TSP Indonesia Performance 2022 (*Jan – Dec*)

During 2022, TSP Indonesia has issued 25 events for both inside (4) and outside (21) IO region.

	Service Level 1 EQ Bulletins					Service Level 2 Threat / No Threat Bulletins		
TSP	**KPI 1** **ET First EQ Bull** **Target: 10 mins (% met)**	**KPI 2** **POD IO EQs GE M6.8** **Target: 100%**	**KPI 3** **EQ Mag** **Target: 0.3 (% met)**	**KPI 4** **EQ Depth** **Target: 30 km (% met)**	**KPI 5** **EQ Location** **Target: 30 km (% met)**	**KPI 6** **ET First Threat Bull** **Target: 20 mins (% met)**	**KPI 7** **POD Tsunami Waves** **Target: 100%**	**KPI 8** **Tsunami Height Accuracy** **Target: Factor of 2**
Indonesia	**10.39 (68%)**	**(100%)**	**0.20 (80%)**	**26.78 (72%)**	**26.91 (72%)**	**33 (0%)**	**n/a**	**n/a**

Meets Target	Near Target	Misses Target

NOTES

KPI 6:
Indonesia issued 3 events No Threat Bulletin.

KPI 7,8: No events caused threat-level tsunami waves.

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TSP Indonesia Performance 2023 (*Jan – Apr*)

During Jan-Apr 2023, TSP Indonesia has issued 8 events for both inside (3) and outside (5) IO region.

	Service Level 1 EQ Bulletins					Service Level 2 Threat / No Threat Bulletins		
TSP	**KPI 1** **ET First EQ Bull** **Target: 10 mins (% met)**	**KPI 2** **POD IO EQs GE M6.8** **Target: 100%**	**KPI 3** **EQ Mag** **Target: 0.3 (% met)**	**KPI 4** **EQ Depth** **Target: 30 km (% met)**	**KPI 5** **EQ Location** **Target: 30 km (% met)**	**KPI 6** **ET First Threat Bull** **Target: 20 mins (% met)**	**KPI 7** **POD Tsunami Waves** **Target: 100%**	**KPI 8** **Tsunami Height Accuracy** **Target: Factor of 2**
Indonesia	**14.9 (75%)**	**(100%)**	**0.28 (63%)**	**29.43 (63%)**	**33.87 (75%)**	**n/a**	**n/a**	**n/a**

Meets Target	Near Target	Misses Target

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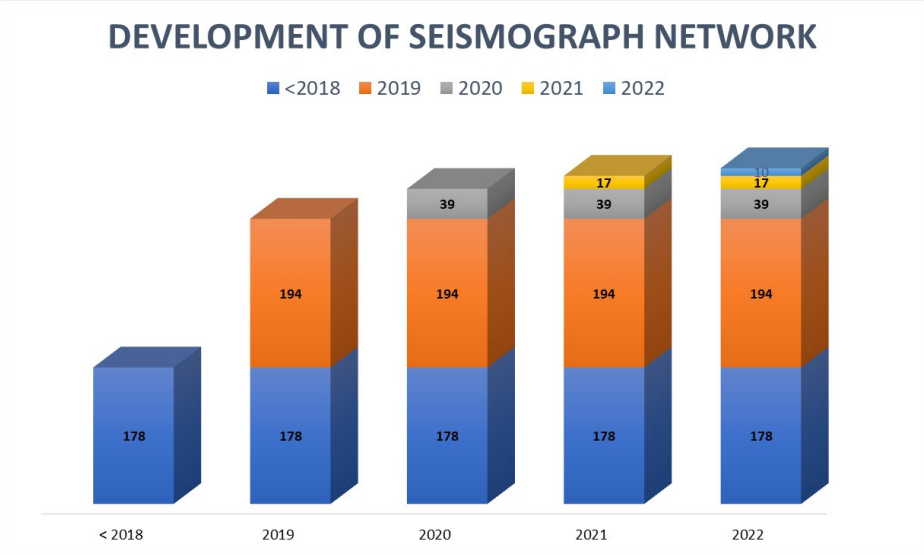
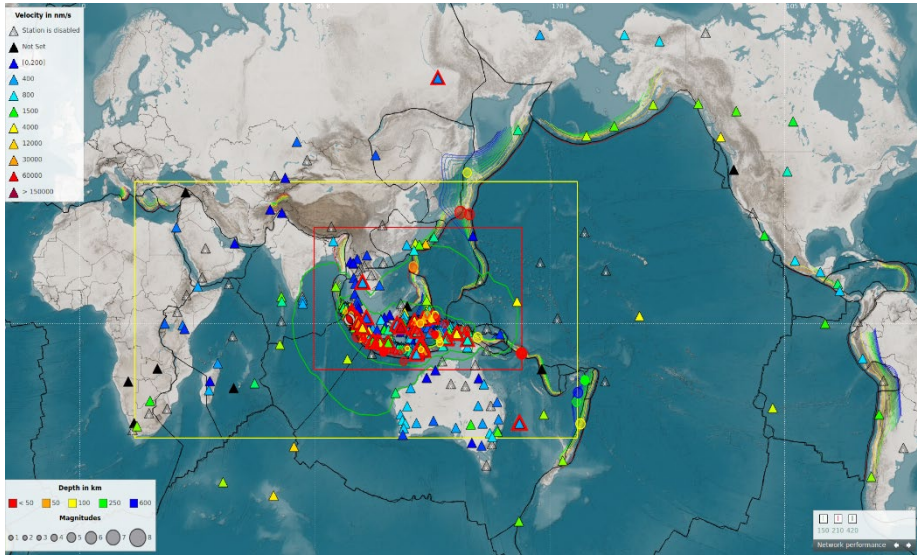
2. TSP Indonesia development since last ICG

Deployed 10 new seismic stations (2022).





YEAR	<2018	2019	2020	2021	2022	TOTAL
ΣSEISMOGRAPH	178	194	39	17	10	438

Until 2022, 438 broadband seismometers have been deployed.

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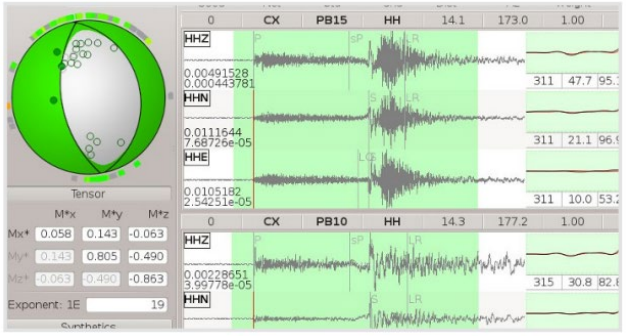
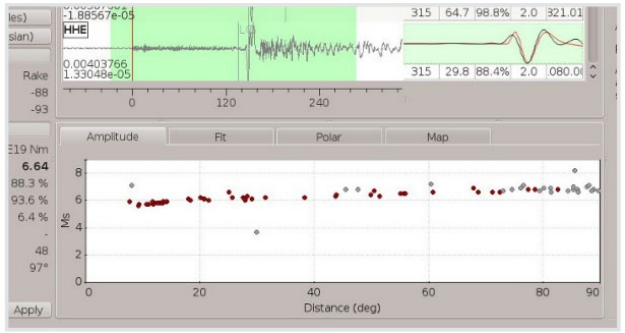
Upgraded the TSP Earthquake Processing System (2022)

Seiscomp Earthquake Processing System version 5

Moment Tensor Analysis

Rapid automatic and interactive moment tensor determination.





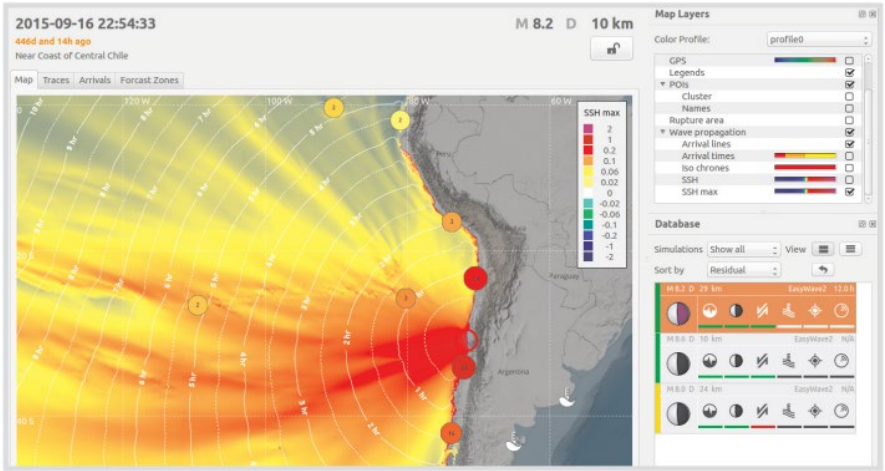
Allows operators interactive, easy guiding of the inversion by checking observed and synthetic waveforms, selecting data and time windows and by adjusting the important control parameters such as filtering, weighting schemes, source location or earth models.

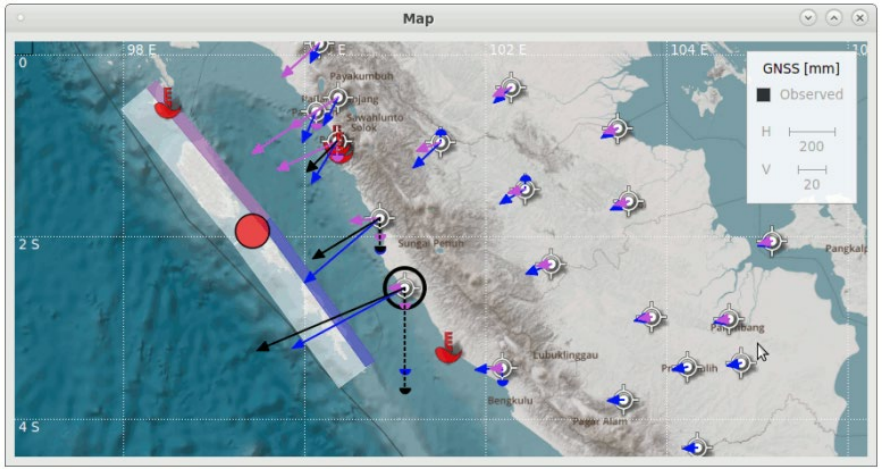
provides multiple options to select or unselect data interactively based on data-dependent features. The features include amplitudes, fit, azimuth and distance, P-wave polarity or geographical location on the map.

Automatic calculation of 3D centroid locations. Full control on cenroid depth search through the depth iteration panel.

Upgraded the TSP Tsunami Processing System (2022)

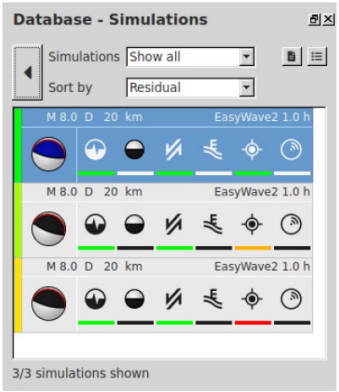
TOAST (Tsunami Observation and Simulation Terminal)





- Direct connectitity to Seiscomp processing system.
- Automatic reception of earthquake parameters.
- Calculation of SSH, SSHMax, isochrones, arrival times, coastal wave heights.
- Calculation of warning levels for forecast zones.
- Automatic and interactive rupture generation.
- GPU based “on the fly” simulation (Easywave Modelling).
- Pre-Calculated simulation databases (TsunAWI Modelling).
- Wors-case scenario aggregation.
- Integration of oceanographic and GNSS sensor data
- Template-based bulletin generation.

Trial implementation of TOAST GNSS displacement functionality . Displacements are received by messaging or imported from XML.



A GNSS residual is computed by comparing these displacements with those computed by simulations like EasyWave. It can be used as additional ranking information for the scenarios.

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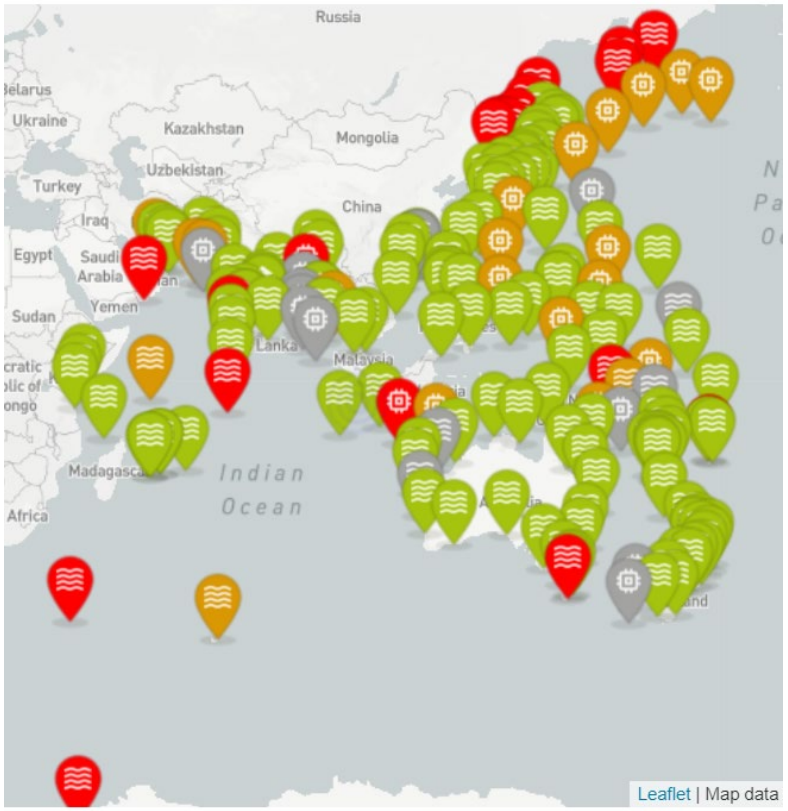
Improvement the capacity of Indonesia Tsunami Non-Tectonic Monitoring System (InaTNT) for Indian Ocean coverage



Domestic Water Level Sensors

NO	NETWORK	TOTAL	OWNER
1	**AWS Water Level**	35	BMKG
2	**Tsunami Gauge**	5	BMKG
3	**Tide Gauge 1**	237	BIG
4	**Tide Gauge 2 (RT)**	34	BIG
5	**IDSL**	11	KKP/BRIN
6	**Buoy**	7	BPPT/BRIN
7	**CBT**	2	BPPT/BRIN
	TOTAL	**331**	

International Water Level Sensors

NO	NETWORK	TOTAL	OWNER
1	**Dart Buoy NOAA**	33	NOAA
2	**Tide Gauge IOC**	165	IOC
3	**Tide Gauge INCOIS (India)**	7	INCOIS
	TOTAL	**205**	

PTWC Tide Tools Algorithm adaptation for marigram quality enhancement:

- Spike removal using median filter
- De-tide correction using TTide prediction model

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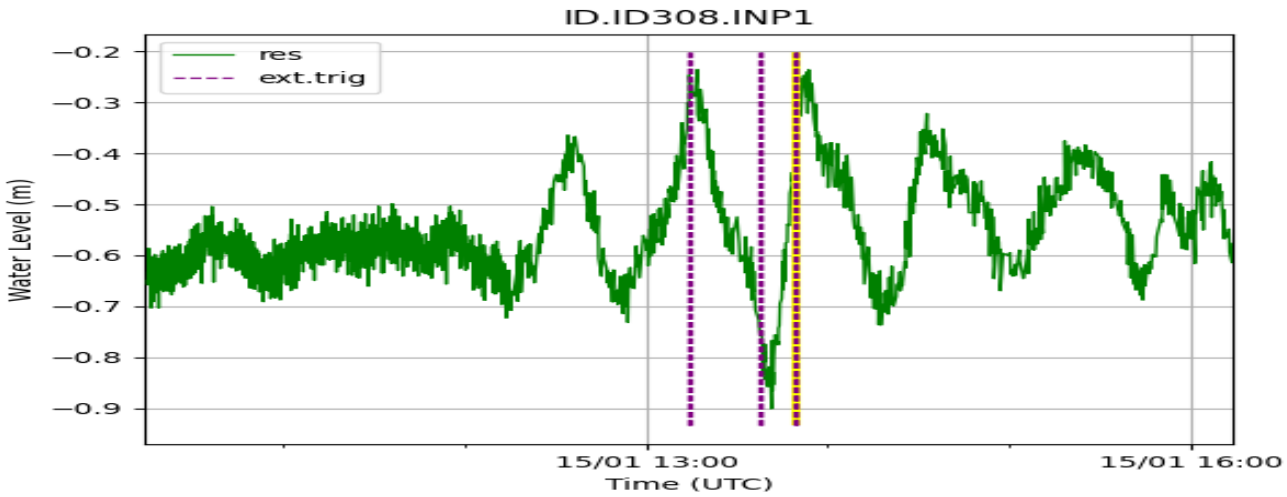
DETECTED METEOTSUNAMI / RISSAGA PHENOMENON FROM 15 JANUARY 2022 HUNGA TONGA VOLCANIC ERUPTION BLAST IN INATNT SYSTEM

Total rows loaded: 10

	TRIGTIME	CHANNEL	WH	STATUS	RCV_TIME
1	2022-01-15 13:14:02	ID.ID308.INP1	2.35289788246155	Anomaly alert at 2022-01-15 13:14:02 UTC with waveheight 2.35 m (Alert Level : 5.0), please check it	2022-01-18 02:52:16
2	2022-01-15 13:14:14	ID.ID308.INP1	2.41590595245361	Anomaly alert at 2022-01-15 13:14:14 UTC with waveheight 2.42 m (Alert Level : 7.0), please check it	2022-01-18 02:52:16
3	2022-01-15 13:14:50	ID.ID308.INP1	2.38521909713745	Anomaly alert at 2022-01-15 13:14:50 UTC with waveheight 2.39 m (Alert Level : 10.0), please check i	2022-01-18 02:52:16
4	2022-01-15 13:37:26	ID.ID308.INP1	1.85812497138977	Anomaly alert at 2022-01-15 13:37:26 UTC with waveheight 1.86 m (Alert Level : 2.0), please check it	2022-01-18 02:52:17
5	2022-01-15 13:37:44	ID.ID308.INP1	1.84495401382446	Anomaly alert at 2022-01-15 13:37:44 UTC with waveheight 1.84 m (Alert Level : 5.0), please check it	2022-01-18 02:52:17
6	2022-01-15 13:38:14	ID.ID308.INP1	1.85065996646881	Anomaly alert at 2022-01-15 13:38:14 UTC with waveheight 1.85 m (Alert Level : 10.0), please check i	2022-01-18 02:52:17
7	2022-01-15 13:49:02	ID.ID308.INP1	2.16072297096252	Anomaly alert at 2022-01-15 13:49:02 UTC with waveheight 2.16 m (Alert Level : 3.0), please check it	2022-01-18 02:52:18
8	2022-01-15 13:49:14	ID.ID308.INP1	2.16184091567993	Anomaly alert at 2022-01-15 13:49:14 UTC with waveheight 2.16 m (Alert Level : 5.0), please check it	2022-01-18 02:52:18
9	2022-01-15 13:49:32	ID.ID308.INP1	2.22066688537598	Anomaly alert at 2022-01-15 13:49:32 UTC with waveheight 2.22 m (Alert Level : 8.0), please check it	2022-01-18 02:52:18
10	2022-01-15 13:49:50	ID.ID308.INP1	2.21634793281555	Anomaly alert at 2022-01-15 13:49:50 UTC with waveheight 2.22 m (Alert Level : 10.0), please check i	2022-01-18 02:52:18



The small tsunami was detected caused by the atmospheric disturbance in IDSL Sensor in Prigi, East Java

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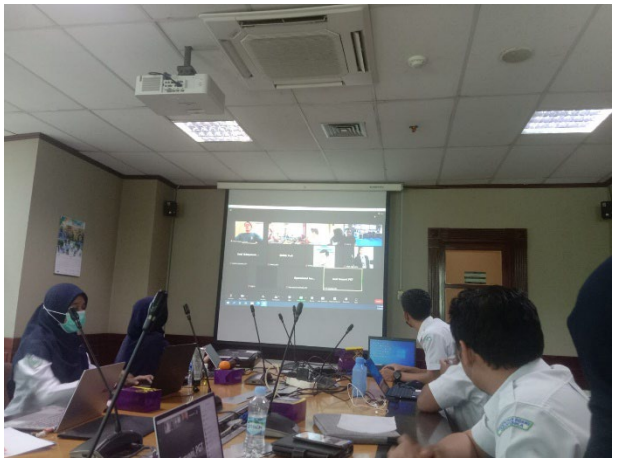
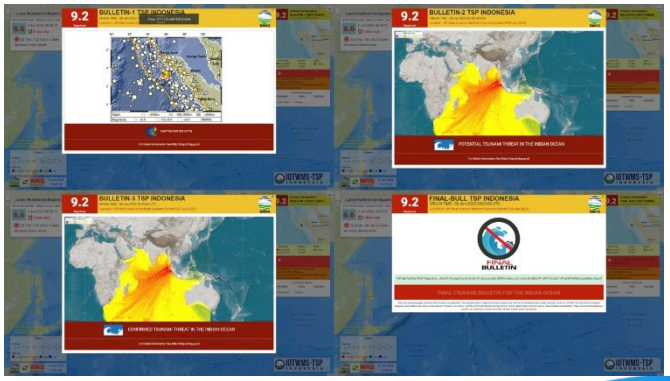
Participation on the regular IOTWMS communication test in 2021 and 2022.



Preparation Coordination Execution



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Establishment of National Consortium to support InaTEWS

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National Consortium board of supervisors

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Continuing the contribution of WRS-TSP Indonesia as a real-time system to alert NTWCs.

WRS-TSP Indonesia can be accessed by any web browser.

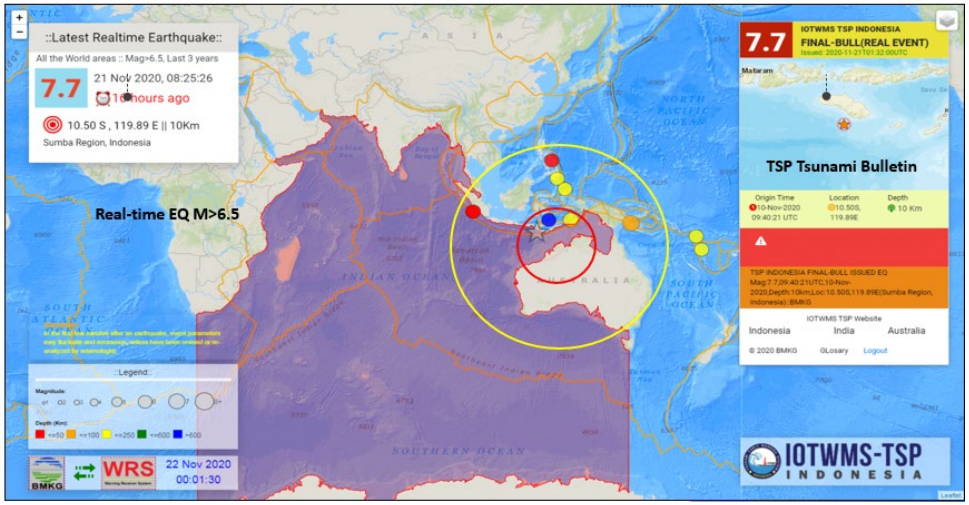
WRS is directly connected to the processing and dissemination system of TSP Indonesia (located at BMKG headquarters in Jakarta).

The user guide is available at https://oceanexpert.org/document/30448.

FEATURES

WRS-TSP INDONESIA

- Text2voice Sound Alert (when new information available)
- Real time Earthquake Information (M>6.5) with visualization of time propagation of P and S wave
- TSP Tsunami Bulletin with popup window
- Historical events on TSP web sites.
- Cloud web base d application
- User password protected access



WRS-TSP Indonesia (stands for Warning Receiver System of TSP Indonesia) is the real-time system to receive tsunami bulletin using a recommended set of hardware such as a large or **smart display**. WRS-TSP connected online to the processing and dissemination system of TSP Indonesia at BMKG head quarter Jakarta.

WRS-TSP ensures NTWCs of the Indian Ocean Countries **keep informed tsunami bulletin** timely and properly.

NTWCs could immediately take further essential actions right after they received the tsunami bulletin.

Earthquake ⇨ TSP INDONESIA ⇨ WRS-TSP INDONESIA

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PILOTING THE INTERNATIONAL RECOGNITION OF INDONESIAN TSUNAMI READY

Indonesia Piloting UNESCO IOC Tsunami Ready Recognition of 9 (nine) communities. BMKG starts to advocate the implementation the 12 indicators of Tsunami Ready indicators

Advocacy of the compliance of the 12 indicators

Discussion on the development of community emergency response team and emergency plan

The inaguration of Tsunami Ready Recognition of Tanjung Benoa community

- 4 communities had been recognized as a Unesco/IOC Tsunami Ready Communities (Tj Benoa, Tambakrejo, Glagah, and Panggarangan)
- 3 Communities in Process to be recognized (Pangandaran, Kemadang and Kuta Mandalika)
- 2 Communities just got recognition for the national level (Purus and Lolong Belant

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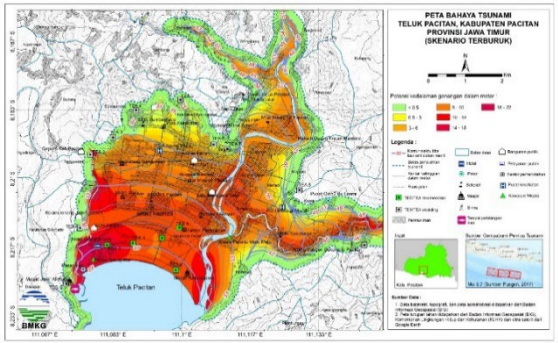
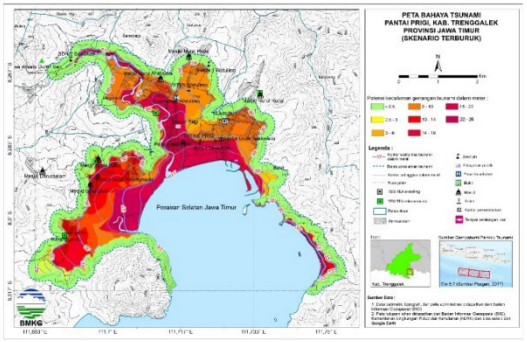
MAPPING TSUNAMI HAZARD POTENTIAL



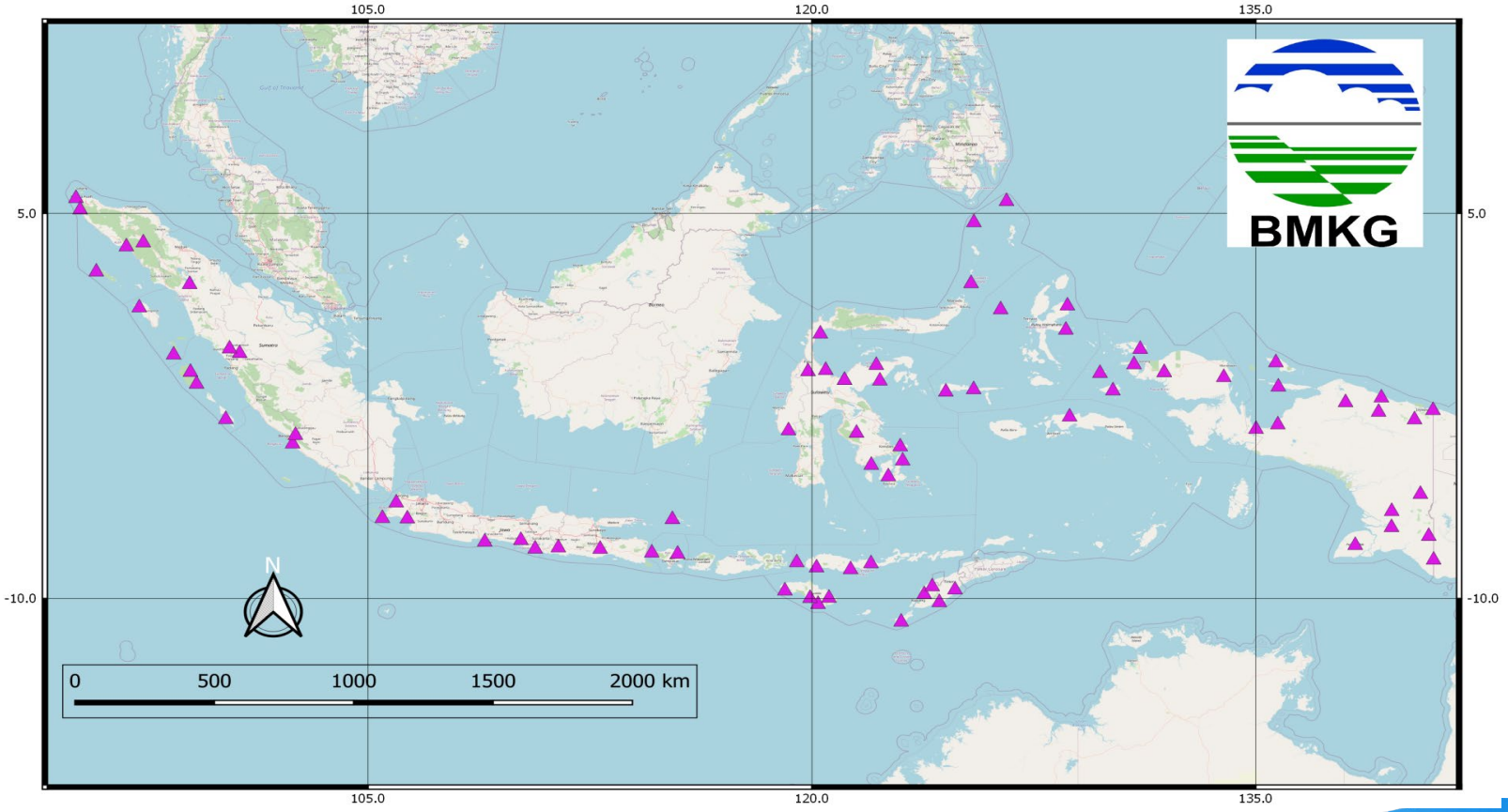


Tsunami Hazard maps and 2 books of Tsunami hazard maps compilation

- **BMKG has developed more than 100 tsunami hazard maps and tsunami evacuation maps from 15 provinces in Indonesia**

3. TSP Indonesia Development and innovation Plans

- **The installation of 83 new seismic stations will begin in April 2023.**



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3. TSP Indonesia Development and innovation Plans

- Upgrade the seismic stations
- Update the TSP User Guide
- Strengthening the development of Indonesia Tsunami Non-Tectonic monitoring system for IO area.
- Development InaTEWS impact base real time system supported by national consortium
- Continue Research on characterization related atypical tsunami event

Thank you