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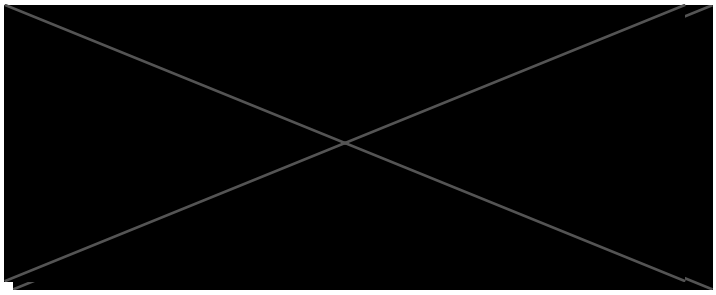
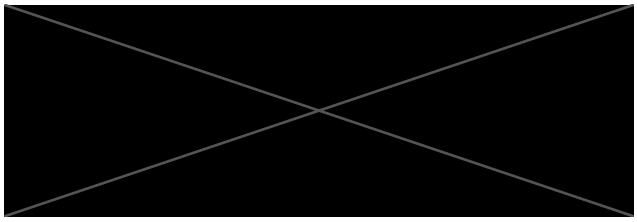
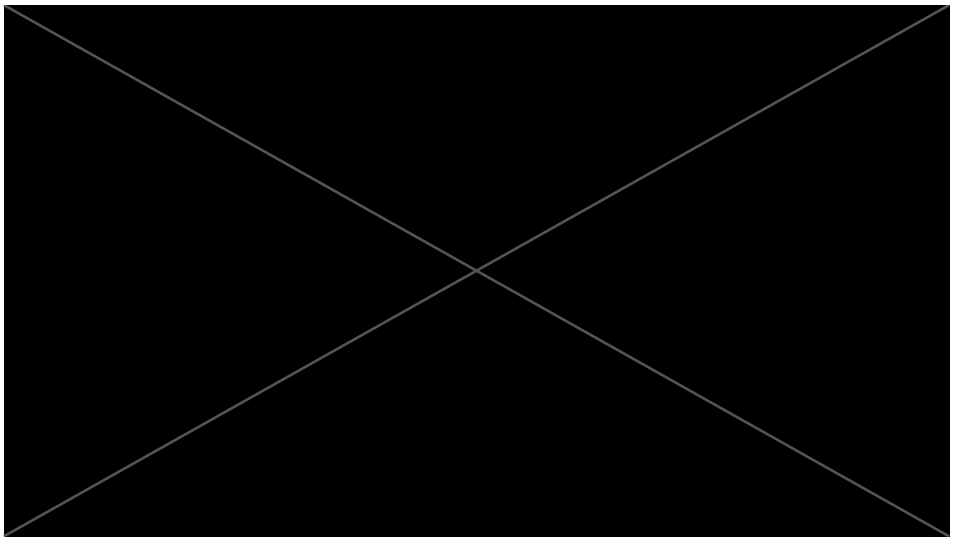


Name	:	Dr. Mohd Hisham bin Mohd Anip
Organization	:	Malaysian Meteorological Department
Postal Address	:	Jalan Sultan, 46667 Petaling Jaya, Malaysia
Email Address	:	hisham@met.gov.my

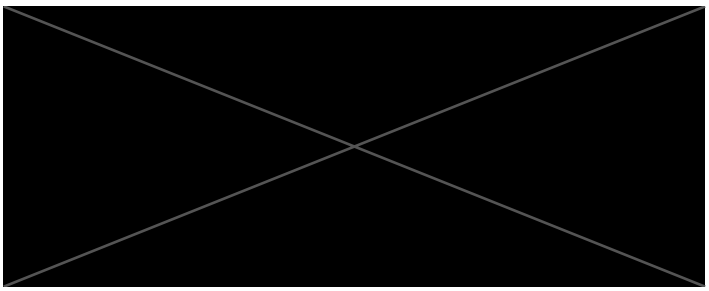


2.0 ICG/PTWS Tsunami Warning Focal Point (TWFP)



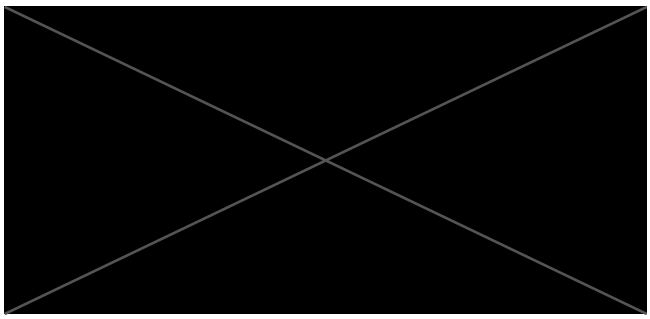
Tsunami Warning Focal Point (TWFP) 24x7 point of contact

Name of Office	:	National Weather and Geophysics Operations Centre



3.0 Tsunami Advisor

Name	:	Dr. Chai Mui Fatt
Position	:	Principal Assistant Director
Postal Address	:	Malaysian Meteorological Department Jalan Sultan, 46667 Petaling Jaya, Malaysia
Email Address	:	chai@met.gov.my



4.0 Tsunami Standard Operating Procedures for a Local and Distance Tsunami

On 26 December 2004, Malaysia was hit by a tsunami that originated from an 9.3 Mw earthquake that occurred off the West Coast of Northern Sumatera, Indonesia. The tsunami hit the coastal areas of the northern Peninsula Malaysia such as Kuala Muda, Kedah, Penang and Langkawi Island. This devastating event triggered the Government of Malaysia and mandated the **Malaysian Meteorological Department (MET Malaysia)** to establish the **Malaysian National Tsunami Early Warning Centre (MNTEWC).** The MNTEWC is tasked to provide the tsunami early warning that will affect Malaysia in a timely

and effective manner within **8 minutes** after the detection of an undersea earthquake occurrence at the Indian Ocean, South China Sea, Sulu Sea or the Pacific Ocean.

The tsunami early warning centre operates on a 24**/7** basis to continuously monitor any earthquake activities locally or regionally that have tsunamigenic potential using data from Malaysia Seismic Network and Global Seismic Network. In the event of an earthquake, our centre immediately determines the hypocentre, magnitude and the depth of an earthquake using SeisComP. Then the tsunami simulation and risk are being evaluated by using **Tsunami Observation and Simulation Terminal (TOAST)**. The tsunami early warning operator will then issue either earthquake information bulletin or tsunami warning/advisory depending on the criteria as shown in **Table 1**.

Earthquake information bulletin or tsunami warning/advisory will then be disseminated to the National Disaster Management Agency (NADMA) and local authorities for mitigation actions using various media such as text messages, facsimile, websites and social media. NADMA together with governors of municipalities are responsible for evacuation of residents following the tsunami warning or advisory issues by MET Malaysia. In the event of a tsunami, a tsunami siren located along the coastal states of Malaysia will be triggered and continuous monitoring of sea level change using National Sea Level Network or Global Sea Level Observing System (GLOSS). Continuous data will then be fed to TOAST in order to update the propagation, height and arrival time of tsunami waves. The warning will then be terminated when MET Malaysia concludes that the dangerous situation has been over, namely, when the tsunami attenuates and the observed height becomes lower. The workflow for the process of monitoring earthquake and tsunami is shown in **Figure 1**.

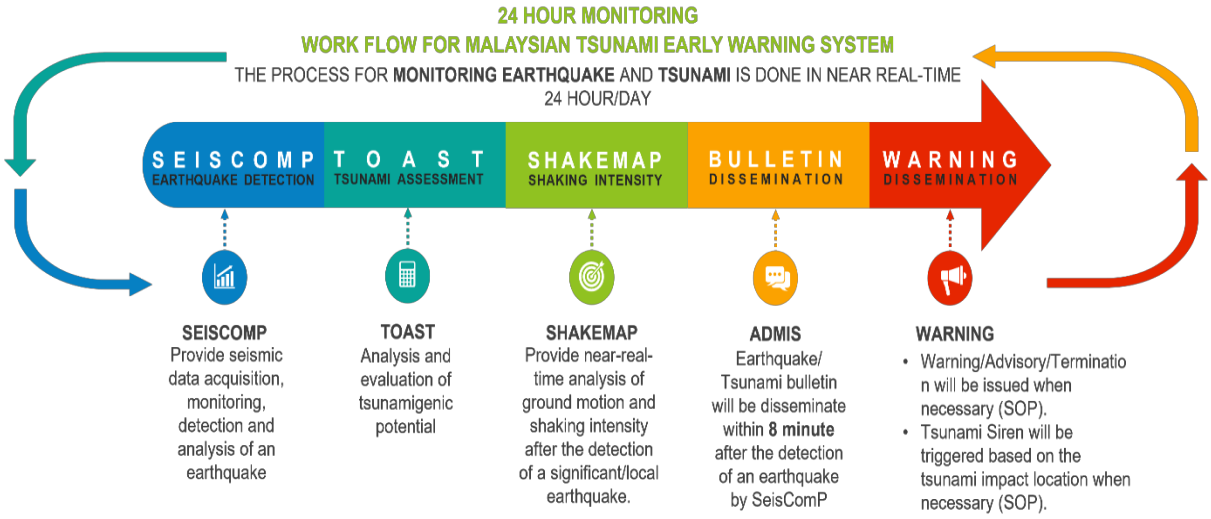


Figure 1: Workflow for Malaysian Tsunami Early Warning Systems

Table 1: Criteria of Tsunami Advisory/Warning Issuance

Location	Criteria of Tsunami Advisory/Warning Issuance			
	Depth (km)	Magnitude (M)	Tsunami height (metre, m) at coastal area of Malaysia	Type of warning
South China Sea, Sulu Sea, Celebes Sea, Indian Ocean (Andaman & Nicobar) Makassar Strait, Java Sea, Flores Sea and Banda Sea	< 100 km	M ≥7.5	≥ 0.5 m	Tsunami Warning
		6.5 ≤ M < 7.5	< 0.5 m	Tsunami Advisory
Out of the above area		M > 7.9	≥ 0.5 m	Tsunami Warning
			<0.5 m	Tsunami Advisory

5.0 National Seismic Network

Malaysia is affected by both local and regional earthquakes due to its location surrounding the ring of fire and several active faults located in the country. Seismic monitoring in Malaysia started in 1979 with six (6) short period Seismic stations under the UNDP-UNESCO Regional Seismological Network. The recent development of the National Seismic Network sees the continuous expansion of the network consisting of 36 Broadband Stations, 6 Short Period Stations and 36 Strong Motion Stations to make a total of 80 Seismic Stations as shown in **Figure 2**.

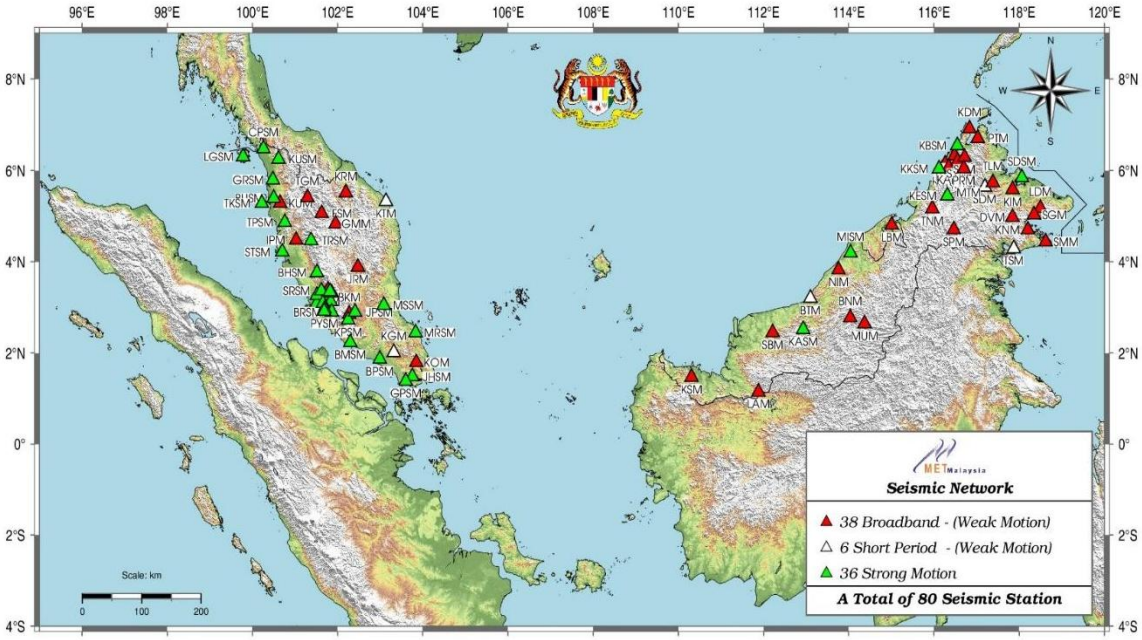


Figure 2: Malaysian National Seismic Network

As part of our commitment to support global earthquake monitoring, MET Malaysia provides seismic data sharing via IRIS DMC or direct access using our public seedlink server. Any inquiries regarding seismic data exchange should be directed to the Director General of MET Malaysia. Detail location for seismic station is shown in **Table 2**.

Table 2: List of National Seismic Network

No	Code	Location	Description	Operational Status
1	FRM	Kepong	Short Period	Active
2	KGM	Kluang	Short Period	Active
3	KTM	Kuala Terengganu	Short Period	Active
4	SDM	Sandakan (Telupid)	Short Period	Active
5	TSM	Tawau	Short Period	Active
6	BTM	Bintulu	Short Period	Active
7	KUM	Kulim	Broadband	Active
8	IPM	Ipoh	Broadband	Active
9	KKM	Kota Kinabalu (Lawa Mandau)	Broadband	Active
10	SBM	Sibu	Broadband	Active
11	KSM	Kuching	Broadband	Active
12	JRM	Jerantut	Broadband	Active
13	SPM	Sapulut	Broadband	Active
14	BNM	Bakun	Broadband	Active
15	KDM	Kudat	Broadband	Active
16	KOM	Kota Tinggi	Broadband	Active
17	LDM	Lahad Datu	Broadband	Active
18	TGM	Temenggor	Broadband	Active
19	BKM	Batu Kikir (Kuala Pilah)	Broadband	Active
20	*KRM*	*Kuala Krai*	*Broadband*	*Discontinue*
21	RAM	Ranau	Broadband	Active
22	DVM	Danum Valley	Broadband	Active
23	SMM	Semporna	Broadband	Active
24	LAM	Batang Ai (Lubuk Antu)	Broadband	Active
25	MUM	Murum	Broadband	Active
26	TLM	Beluran	Broadband	Active
27	MTM	Matupang	Broadband	Active
28	TNM	Tenom	Broadband	Active
29	SGM	Segama	Broadband	Active
30	KNM	Kunak	Broadband	Active
31	TPM	Tamparuli	Broadband	Active
32	KPM	Kinabalu Park	Broadband	Active

No	Code	Location	Description	Operational Status
33	KIM	Kinabatangan	Broadband	Active
34	WRM	Wario	Broadband	Active
35	KAM	Kaung	Broadband	Active
36	SYM	Sayap	Broadband	Active
37	SRM	Serinsim	Broadband	Active
38	PTM	Pitas	Broadband	Active
39	PRM	Poring	Broadband	Active
40	FSM	Desa Kencana Felda Sahabat	Broadband	Active
41	GTM	Aminuddin Baki Goh Tong Jaya	Broadband	Active
42	GMM	Gua Musang	Broadband	Active
43	NIM	Niah	Broadband	Active
44	LBM	Limbang	Broadband	Active
45	CPSM	Chuping	Strong Motion	Active
46	GRSM	Gurun	Strong Motion	Active
47	LGSM	Langkawi	Strong Motion	Active
48	KUSM	Kuala Nerang	Strong Motion	Active
49	BUSM	Bukit Mertajam	Strong Motion	Active
50	TKSM	Teluk Kumbar	Strong Motion	Active
51	BHSM	Behrang	Strong Motion	Active
52	TPSM	Taiping	Strong Motion	Active
53	STSM	Setiawan	Strong Motion	Active
54	BKSM	Pusat Sains Bukit Kiara	Strong Motion	Active
55	SASM	Bukit Cerakah Shah Alam	Strong Motion	Active
56	UYSM	Empangan Batu Ulu Yam	Strong Motion	Active
57	KNSM	Mardi Kundang	Strong Motion	Active
58	SRSM	Pusat Serenti Serendah	Strong Motion	Active
59	DTSM	IKBN Dusun Tua	Strong Motion	Active
60	BRSM	Kolej Mara Beranang	Strong Motion	Active
61	BGSM	Bukit Gasing Petaling Jaya	Strong Motion	Active
62	PJSM	Wetland	Strong Motion	Active
63	KPSM	Kuala Pilah	Strong Motion	Active

No	Code	Location	Description	Operational Status
64	JPSM	Jempol	Strong Motion	Active
65	BMSM	Bukit Katil	Strong Motion	Active
66	BPSM	Batu Pahat	Strong Motion	Active
67	JHSM	Johor Bahru	Strong Motion	Active
68	GPSM	Gelang Patah	Strong Motion	Active
69	MRSM	Mersing	Strong Motion	Active
70	JBSM	Balai Polis Janda Baik	Strong Motion	Active
71	TRSM	Tanah Rata Cameron Highland	Strong Motion	Active
72	MSSM	Muadzam Shah	Strong Motion	Active
73	KKSM	Kota Kinabalu (UMS)	Strong Motion	Active
74	KESM	Keningau	Strong Motion	Active
75	SDSM	Sandakan (Bukit Cina)	Strong Motion	Active
76	KBSM	Kota Belud	Strong Motion	Active
77	MISM	Miri	Strong Motion	Active
78	KASM	Kapit	Strong Motion	Active
79	PYSM	Perbadanan Putrajaya	Strong Motion	Active
80	BTSM	Bukit Tinggi	Strong Motion	Active

6.0 National Sea Level Network

The Sea Level Network database consists of sea level gauges that are located within the South China Sea and the Strait of Malacca. The database is intended to include all near real-time sea level observation. The data has been checked for accuracy and completeness via consultation with national and global network operators. Communication of all the tide gauges are using Very Small Aperture Terminal (VSAT) to make sure the stability in receiving and transmitting the data every minute. MET Malaysia currently has 25 tide gauges stations located all over Malaysia as depicted in **Figure 3**. The location of the Malaysia Level Stations which are equipped with Pressure Level Sensor and Radar Level Sensor listed in **Table 3**.

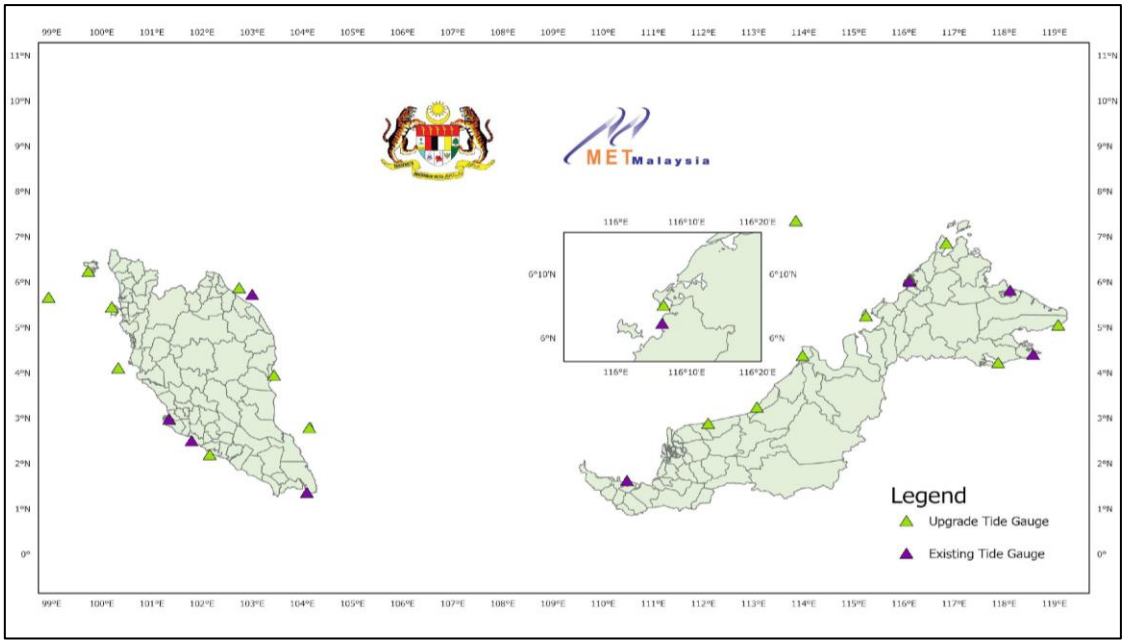


Figure 3: Location of National Sea Level Network

Table 3: List of National Sea Level Network

STATE	LOCATION	
Kedah	1	Awana Porto Malai, Langkawi
Perak	2	Bagan Datuk
	3	TLDM Pulau Jarak
Pulau Pinang	4	USM CEMACS, Pulau Pinang
Selangor	5	TLDM Pusat Hidrografi Nasional (PHN) Klang
Negeri Sembilan	6	Port Dickson Ferry Terminal
Melaka	7	Melaka Marine Park, Pulau Undan
Johor	8	TLDM Tanjung Pengelih, Johor
Pahang	9	Pulau Tioman
	10	TLDM Tanjung Gelang
Terengganu	11	Terengganu Marine Park, Pulau Perhentian
	12	Terengganu Marine Park Pulau Redang
Sarawak	13	APMM Muara Tebas
	14	JUPEM Miri
	15	Bintulu Port
	16	LKIM Kuala Oyai, Mukah
Sabah	17	Tawau Port
	18	Kudat Port
	19	Felda Sahabat, Lahad Datu
	20	UMS Kota Kinabalu
	21	TLDM Teluk Sepanggar, Kota Kinabalu
	22	TLDM Semporna

STATE	LOCATION	
	23	TLDM Sandakan
	24	TLDM Pulau Layang-Layang
W.P. Labuan	25	Labuan Port

7.0 National Tsunami Siren Network

In 2006, as part of the end-to-end warning system, MET Malaysia began the installation of 23 tsunami sirens at strategic coastal area locations based on tsunami risk assessment. Tsunami sirens act as a mechanism to warn the public along coastal areas in the event of a tsunami. In 2013, additional 30 tsunami sirens were installed to improve tsunami warning dissemination. Based on the reports by NADMA, the sound propagation of existing tsunami sirens should be increased to a distance of 2km and in 11th Malaysian Plan, 30 units of tsunami siren were installed with a sound propagation of up to 2km depending on topography. The tsunami sirens are intended to be used as a warning when a distant tsunami approaches the shoreline. The primary focus of the sirens is to warn those who are outside in the inundation zone or those who are on the beach.

In 2023, MET Malaysia installed the 3rd phase of the upgraded tsunami siren. The tsunami sirens are intended to be used as a warning when a distant tsunami approaches the shoreline. The primary focus of the sirens is to warn those who are outside in the inundation zone or those who are on the beach. The total of 83 units of tsunami siren is depicted in **Figure 4** and listed in **Table 4**.

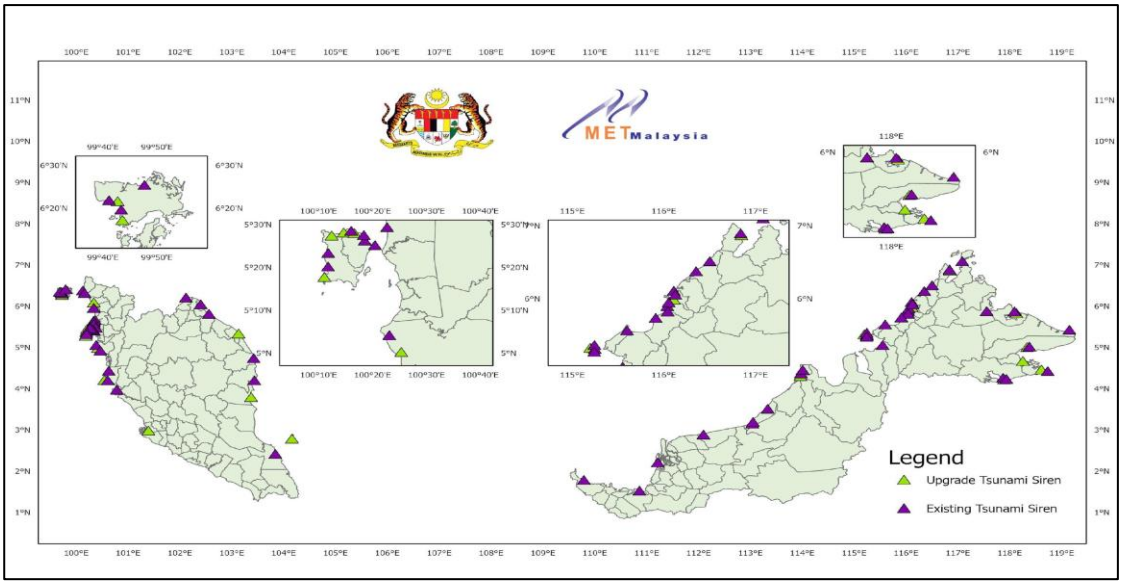


Figure 4: Location of National Tsunami Siren Network

Table 4: List of Location of National Tsunami Siren Network

STATE	LOCATION	
PERLIS	1	**Kuala Perlis** Hotel Putra Brasmana
	2	**Kg. Sungai Baru** Masjid Ameer Fawwaz
	3	**Padang Mat Sirat** Pusat Latihan Polis Langkawi
	4	**Telaga Harbour** Telaga Harbour Park
	5	**Pantai Pasir Hitam** Medan Niaga P. Pasir Hitam
	6	**Tanjung Dawai** Balai Polis Tanjung Dawai

STATE	LOCATION	
KEDAH	7	**Pantai Cenang** Langgura Baron Resort
	8	**Kuala Teriang** Perikanan Kuala Teriang
	9	**Kuala Kedah** Marina Harbour ZMKH
	10	**Kota Kuala Muda** Masjid
	11	**Kuala Sala** Lembaga Kemajuan Ikan(LKIM)
	12	**Kuala Muda** Persatuan Nelayan LKIM Kuala Muda Kg Tepi Sungai
	13	**Pulau Sayak** Fish Research Institute, Kg. Pulau Sayak
	14	**Sungai Yu** Surau Al-Ibramsah, Kg. Sungai Yu
PULAU PINANG	15	**Kuala Muda, Penaga** Masjid Hidayah
	16	**Bagan Belat, Butterworth** Masjid Jamek
	17	**Kota Lama** Lot Pakir Dewan Sri Pinang
	18	**Persiaran Gurney** Kaw. Medan Makan
	19	**Tanjung Tokong** Balai Polis
	20	**Miami Beach** Kompleks Makanan
	21	**Kuala Sungai Pinang**
	22	**Kuala Sungai Burung** Pintu Masuk Ke 2 Taman Negara
	23	**Pasir Panjang** BTN
	24	**Teluk Bahang** LKIM
	25	**Batu Feringgi** Masjid
	26	**Tanjung Bungah** Masjid
SELANGOR	27	**Pantai Remis Kuala Selangor** Medan Selera Pantai Remis
	28	**Tanjung Piandang** Dewan JKKK

STATE	LOCATION	
PERAK	29	**Pantai Remis** Pejabat Perikanan Daerah
	30	**Bagan Datoh** Jabatan Laut Wilayah Utara
	31	**Lumut** TLDM
	32	**Kuala Kurau** Kg. Nelayan
	33	**Pulau Pangkor** Teluk Nipah
	34	**Kuala Gula** Masjid Al-Taufiqiah
PAHANG	35	**Kuantan** Pantai Baluk
	36	**Pulau Tioman** Jeti Kargo, Jabatan Laut
TERENGGANU	37	**Dungun** Rumah Daerah Dungun
	38	**Kemaman** Pejabat Perikanan Daerah
	39	**Kuala Terengganu** Pusat Perkembangan Perikanan
	40	**Besut** Pejabat Perikanan Daerah
LABUAN	41	**Labuan** Balai Bomba & Penyelamat Layangan
	42	**Kerupang** Masjid Al-Muttakin, Kg. Kerupang
	43	**Temiang** Masjid Al-Muzakirullah, Kg. Lubuk Temiang
	44	**Perbadanan** Menara Perbadanan Labuan
SARAWAK	45	**Bintulu** Ibu Pejabat Polis Marin Bintulu
	46	**Mukah** Kompleks LKIM, Mukah
	47	**Miri** Pantai Luak Bay Esplanade
	48	**Sematan** Pusat Perikanan Sematan
	49	**Sebuyu** Masjid An Nur, Kampung Tebulu
	50	**Belawai** Pejabat Dearah Tanjung Manis

STATE	LOCATION	
	51	**Bintulu (BDA)** Bintulu Development Authority (BDA)
	52	**Samalaju** Samalaju
	53	**Miri Central Park** Miri Central Park
	54	**Lutong** Lutong
SABAH	55	**Tawau 1** Kg. Batu Keramat
	56	**Tawau Batu Keramat** Masjid Al- Khauthar
	57	**Kunak** Balai Polis Kunak
	58	**Lahad Datu (FAMA)** Pejabat FAMA Daerah
	59	**Lahad Datu** IPD Lahad Datu
	60	**Pulau Bum Bum** Masjid Dul Naim
	61	**Tambisan** Balai Polis Tambisan
	62	**Semporna** Polis Marin Wilayah 4
	63	**Sandakan Tinosa 2** Masjid Kg.Tinosa 2
	64	**Sandakan** Masjid Daerah
	65	**Kudat** Pejabat Kesihatan
	66	**Pulau Banggi** Balai Polis Pulau Banggi
	67	**Kota Kinabalu** Masjid Bandaraya
	68	**Kota Belud** Pondok Polis Kuala Abai
	69	**Tuaran** Nexus Karambunai Resort
	70	**Putatan** Balai Cerap Al-Biruni
	71	**Tanjung Aru** Masjid Al-Kauthar
	72	**Sabah Port** Masjid Al-Ikhwan

STATE	LOCATION	
	73	**Kinarut** Masjid Puncak Taqwa
	74	**Papar** Masjid Raudhatul Ilmiyyah, Kampong Kuala
	75	**Kudat (IPD)** Ibu Pejabata Polis Daerah Kudat
	76	**Kota Belud (Masjid Mustapah)** Masjid Imam Hj. Mustapah
	77	**Kuala Penyu** Balai Polis Kuala Penyu
	78	**Sipitang** Ibu Pejabat Polis Sipitang
	79	**Tawau (JKR)** Pejabat Jabatan Kerja Raya (JKR)
	80	**Beluran (IPD)** Ibu Pejabat Polis Dearah Beluran
KELANTAN	81	**Tumpat** Pantai Geting
	82	**Bachok** Padang Istiadat Bachok
JOHOR	83	**Mersing** Menara Tanjung

8.0 Information on Tsunami occurrences

In December 2004, Malaysia was also affected by tsunami Aceh as depicted in **Figure 5**. It is because of the location of the country close to the most two seismically active plate boundaries which is the inter-plate boundary between the Indo-Australian and Eurasian Plates on the west and inter-plate boundary between Eurasian and Philippine Plates on the east. These plates are depicted in **Figure 6**.

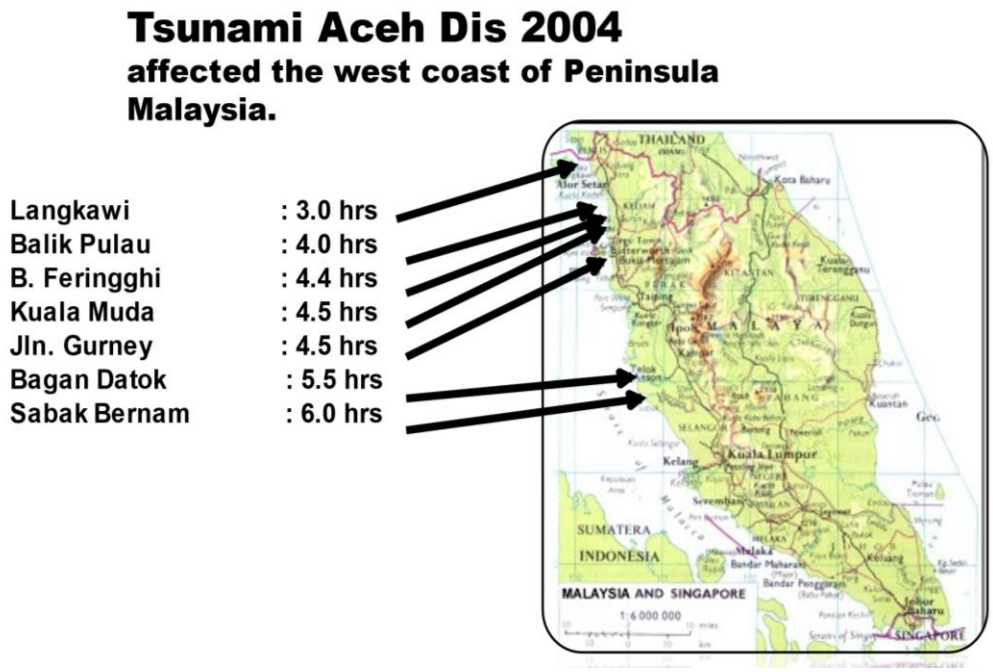


Figure 5: Tsunami Aceh December 2004 Impact area in Malaysia

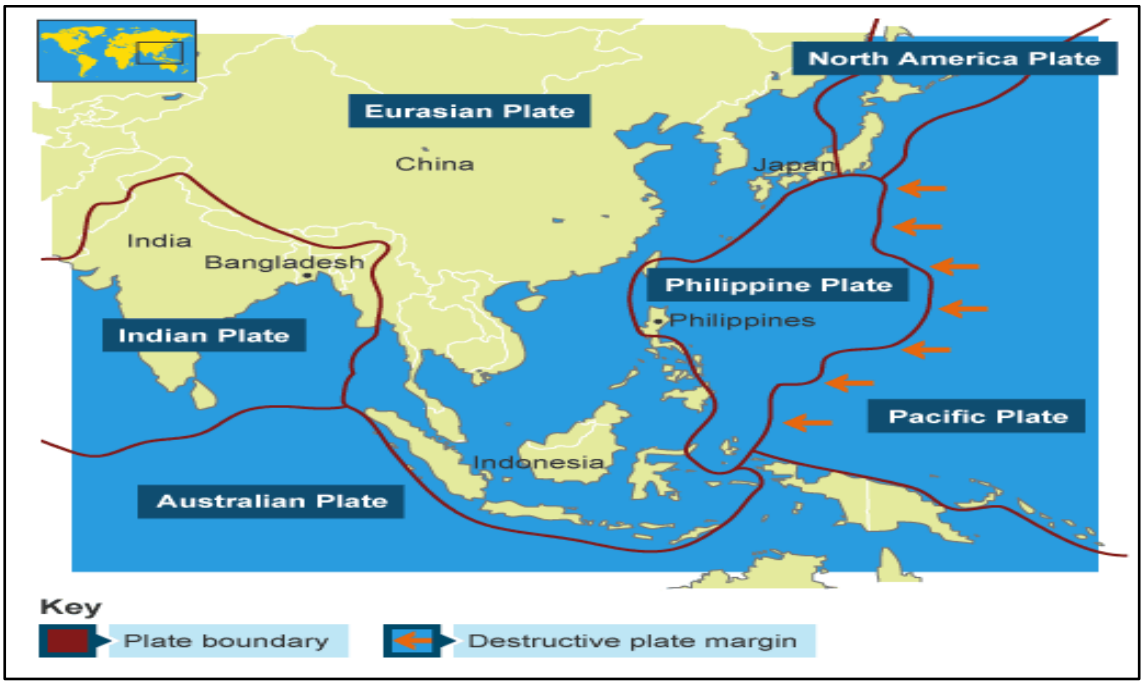


Figure 6: Map of plate boundaries

Significant progress has been made in the implementation of an end-to-end Tsunami Early Warning System in Malaysia. The Government of Malaysia had allocated RM19 million for the establishment of a National Tsunami Early

Warning System since 2005 after the tsunami Aceh. The activities, which include the enhancement of Malaysia's seismic network, tide gauges and tsunami siren. The network of tidal gauges was installed in the high-risk areas to obtain additional data and information of the sea condition. Tsunami sirens were installed along the coastlines to warn the coastal communities. Various communications were used to disseminate information to the disaster management agencies and media which include the SMS, facsimile, media social etc.

9.0 Public Awareness

- Public awareness campaigns have been carried out at tsunami high risk areas since **2006**. The awareness campaigns also include extreme weather awareness and are held at various locations throughout Malaysia.
- The objectives of the public awareness campaign are to promote, educate and prepare the public with knowledge about hazard, risk, discipline, morale and spirit toward empowering the awareness and preparedness in the event of Extreme Weather, Earthquake and Tsunami. It is also for the purpose to disseminate hazard and risk information about the extreme weather, earthquake and tsunami to government agencies and local authority related to NADMA and to promote the cooperation between NADMA with the other related response agencies with regard to the Malaysia National Tsunami Early Warning System Operation.
- Tsunami drills and public awareness that have been carried out are listed in **Table 5**.

Table 5: List of Tsunami Drill and Public Awareness Campaign by MET Malaysia

Year	Tsunami Drill (Physical)		Public Awareness Campaign (Physical)		Public Awareness Campaign (Online)	
	Series	Total Participant	Series	Total Participant	Series	Total Engagement
2006	1	2,000	0	0	-	
2007	1	1,000	5	480		
2008	0	0	15	2,169		
2009	1	1,000	13	2,694		
2010	0	0	3	438		
2011	4	2,500	5	793		
2012	2	1,480	7	1,208		
2013	2	1,372	7	1,014		
2014	2	1,674	8	1,488		
2015	0	0	6	1,159		
2016	1	1,200	2	1,550		
2017	2	1,150	2	1,150		
2018	2	5,200	4	3,129		
2019	1	1,200	10	2,900		
2020	0	0	-		12	7,997
2021	0	0			13	22,918
2022	0	0			7	6,930
2023	1	388	5	579	3	38,206
2024	1	100	7	1,261	6	27,299
TOTAL	**21**	**20,264**	**99**	**22,012**	**41**	**103,350**

10.0 Web sites (URLs) of tsunami related web sites

- http://mygempa.met.gov.my/docroot/view/index.php
- MET Malaysia website: www.met.gov.my
- NADMA disaster portal: https://portalbencana.nadma.gov.my/

11.0 Summary plans of future tsunami warning and mitigation system improvements

As part of our continuous effort to improve earthquake and tsunami early warning, MET Malaysia under the 11th Malaysian Plan from 2020-2022 started a comprehensive effort to improve existing command center to provide better services for tsunami early warning. Together with this improvement, a new seismic processing and data acquisition SeisComP 5 were installed along with Tsunami Observation and Simulation Terminal (TOAST) system to provide on-the-fly simulation of tsunami propagation as part of tsunami assessment and risk. The introduction of the TOAST system enables MET Malaysia to provide better understanding of tsunami risk and comparisons with real-time sea level observation. In addition to these plans, 3 seismic stations, 8 tidal gauge stations and 30 tsunami sirens were installed. Currently under the 12th Malaysian Plan from 2024 until 2025, 1 unit of New Seismic Station will be deployed, 3 seismic stations will be relocated, 2 seismic stations will receive new instrument upgrades,17 tidal gauge stations and 23 tsunami sirens will be upgraded.

12.0 Executive Summary

- The Malaysian Meteorological Department (MET Malaysia) is responsible for the operation of the earthquake monitoring system and tsunami early warning centre.
- MET Malaysia disseminates earthquake information within 8 minutes from the time of detection of an earthquake event.
- A tsunami warning is issued once all information has been verified that there is a tsunami threat to the Malaysia coast via the various channels.
- Public awareness programmes and activities are an integral part of the National Tsunami Early Warning System and conducted in close cooperation with the National Disaster Management Agency (NADMA) and MET Malaysia.

13.0 Narrative

- MET Malaysia is currently operating 80 seismic sensor (strong motion and weak motion) stations throughout Malaysia.

- MET Malaysia has installed the weak motion seismic sensor, with priority given to the western and central part of Peninsular Malaysia and central (Ranau District) and eastern part of Sabah (Tawau, Semporna and Lahad Datu Districts). Peninsular Malaysia experiences stronger ground shaking compared to other areas; therefore, it is an urgent need to increase the weak motion seismic sensor in those areas.
- Under the 12th Malaysian Plan, 3 units of seismic stations (1 unit of weak motion in Peninsular Malaysia and 2 units of weak motion in Sarawak), 8 units of tide gauge and 30 units of tsunami siren were installed.
- Malaysia currently has 80 Seismic Stations. The Seismic Stations in Malaysia were installed in a few phases as listed in **Table 3**.

Table 6: Timeline for Malaysian National Seismic Networks

YEAR	No. of Seismic Station
2003-2008	
2013	
2014-2022	
TOTAL NUMBER	

- For coastal monitoring, currently MET Malaysia is operating 25 units of tide gauges that have been installed in 3 phases as listed in **Table 7**.

Table 7: Timeline for Malaysian National Tidal Gauge Networks

YEAR	No. of Tide Gauge Station
2006	
2013	
2021-2022	
TOTAL	

- For the dissemination of tsunami warning, various communication methods are used to disseminate information to the public such as siren, SMS, facsimile, media social etc.
- There were 3 phases of installation of tsunami sirens as listed in **Table 8**.

Table 8: Timeline for Malaysian National Tsunami Siren Network

YEAR	No. of Tsunami Siren
2006	
2013	
2021-2022	
TOTAL	

Date: Name: