

**JMA/WMO WORKSHOP ON EFFECTIVE TROPICAL CYCLONE WARNING
IN SOUTHEAST ASIA**

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**TROPICAL CYCLONE, ROUGH SEAS AND SEVERE WEATHER MONITORING AND EARLY
WARNING SYSTEM IN MALAYSIA**

by

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1. Tropical Cyclone Monitoring, Analysis and Forecasting

1.1 Tropical Cyclone Monitoring

1.1.1 Tropical Cyclogenesis Monitoring

The Malaysian Meteorological Department (MetMalaysia) monitors potential TCs based on analysis of satellite imageries (MTSAT, FY, ASCAT), wind charts, NWP products and information from tropical cyclone monitoring centres such as RSMC Tokyo-Typhoon Center, JTWC and RSMC Tropical Cyclones New Delhi. A TC Warning is issued for tropical depression/tropical storm/typhoon in the Malaysian Exclusive Economic Zone (EEZ) or if the TC is forecast to enter Malaysia EEZ within 24 hours. A TC Advisory is issued for TCs outside the Malaysian EEZ but within the area bounded by 0-30°N and 90-130°E.

1.1.2 Tropical Depression (TD) Warnings

TD Advisories are normally posted on The MetMalaysia's web page. TD Warnings and TD Advisories (for TDs which are significant enough) are disseminated to the disaster management agencies via short message system (SMS), facsimile and telephone calls while the public can access the TD Advisories/Warnings through various communication channels such as the Internet, social media (Facebook and Twitter), live media broadcast and the print media. The MetMalaysia also uses notice boards and red flags in several coastal locations to alert the community at risk on strong winds and rough seas.

The MetMalaysia also participates in the WMO's SWIdget Project, which is a widget that allows users to obtain local severe weather warnings issued by official weather services. The following advisories/warnings issued by the MetMalaysia are accessible through SWIdget:

- i) Heavy Rain/Thunderstorm Warning
- ii) Strong Winds and Rough Seas Warning
- iii) Tropical Cyclone and Storm Advisory/Warning

1.1.3 Challenges, Needs and Improvement Plans

It would be beneficial if RSMC could also display tropical depression information on its web site. Presently only information about tropical cyclone of tropical storm strength or greater are displayed. By having such product, MetMalaysia would be able to monitor the system closely and its impact on the weather and sea condition in Malaysian waters.

1.2 Tropical Cyclone Analysis

1.2.1 Parameters and Methods

Parameter	Time (UTC)	Methods	Other sources
Position and maximum sustainable wind	On Adhoc basis	MTSAT and FY imageries are used in conjunction with ASCAT imageries to identify the position and maximum sustainable wind.	RSMC Tokyo-Typhoon Center, JTWC and RSMC Tropical Cyclones New Delhi.

1.2.2 Challenges, Needs and Improvement Plans

MetMalaysia requires more training on Dvorak TC intensity estimation technique to enable it to monitor closely the TC activities in its area of responsibility.

1.3 Tropical Cyclone Forecasting

1.3.1 Parameter and Method

Parameter	Issuance Time (UTC)	Lead time (hours)	Methods
Track, central pressure, maximum sustainable wind, strong wind areas.	On adhoc basis	3	MetMalaysia refers to RSMC Tokyo-Typhoon Center, JTWC and RSMC Tropical Cyclones New Delhi for TC forecasts.

1.3.2 Challenges, Needs and Improvement Plans

MetMalaysia would like to acquire a Tropical Cyclone Information Processing System.

1.4 Tropical Cyclone Products

1.4.1 TC Products

Tropical Depression Advisory

Issued at 02:56PM 09 December 2012

Stage : Tropical Depression.

Time of Observation : 2.00 pm, 9 December 2012.

Location : Latitude 18.0 North; Longitude 120.0 East; approximately 391 km North-Northwest of Manila, Philippines.

Movement : Southeastwards slowly.

Distance from nearest town: Approximately 1,281 km North-Northeast of Kudat, Sabah.

Threat to Malaysia :

These conditions may cause thunderstorms activities, strong winds and rough seas over waters off Sarawak (Miri), Labuan FT, Sabah (Interior, West coast and Kudat), Condore, Reef North, Layang-layang, Palawan and Sulu.

1.4.2 Challenges, Needs and Improvement Plans

Better graphical products i.e. based on GIS, GoogleEarth

1.5 Computing Platform and Software

Linux servers and customised software.

2 Numerical Weather Prediction Status for Effective Warning

2.1 NWP in Operational Use

Model	Domain (square degree)	Resolution (horizontal & vertical)	Initial Time	Forecast Range (hours)	Run by (own/foreign centers)
MMD-WRF	85 – 135°E and 20°S – 30°N 98 – 121.5°E and	36,12,4 km 30 vertical	00,12 UTC	72	Own

	1.8°S – 12°N 99°E – 105.5°E and 1°N – 8°N and 109 – 120.5°E and 0.5°N – 8.5°N	levels			
MMD-MM5	85 – 135°E and 20°S – 30°N 98 – 121.5°E and 1.8°S – 12°N 99°E – 105.5°E and 1°N – 8°N and	36,12,4 km 23 half sigma levels	00,12 UTC	72	Own
MMD-HRM	98°E– 121.5°E and 1.8°S – 12°N	60 vertical levels	00,12 UTC	72	Own

2.2 Application Techniques of NWP Products for Operational Forecasts

In situ and remote sensing observation are utilized in conjunction with the high resolution NWP outputs to produce forecasts. For very short-range (0-6 hrs) forecasts, in situ and remote sensing observation are given more weightage. For forecasts beyond 6 hours, NWP outputs are usually more reliable.

2.3 Challenges, Needs and Improvement Plans

Forecasts accuracies need to be improved. There is an urgent need for the weather advisories/warnings to be issued earlier i.e. at least 4-7 days before the heavy rainfall episode.

3. Storm Surge

Storm Surge Information is included in The Strong Winds and Rough Seas Advisory/Warning. The storm surge information is based on outputs from JMA Storm Surge Model operated by MetMalaysia. The details of the model is as follows:

Model	Domain and resolution	Forecast Range (hours)	Frequency	Considered factors (Tide/ensemble/inundation, etc.)
JMA Storm Surge	0°-25°N, 90°-125°E, resolution 1'x1'	192	Twice daily	-

4. Effective Warnings

4.1 Emergency Response for TC Disasters

4.1.1 Legal Framework for TC Disaster Management

In Malaysia, the National Security Council (NSC) is the principal policy making and coordinating body for disaster management. The NSC coordinates and plans all activities related to preparedness, prevention, response/relief operations and recovery/rehabilitation of disaster management. The National Security council Directive No. 20 (NSC No. 20): The Policy and Mechanism for National Disaster Management is the main guideline for disaster management in Malaysia. The directive prescribes the mechanism on the management of disasters including the responsibilities and functions of related agencies under an integrated emergency management system. This is achieved through the establishment of the Disaster Management Committee at three different levels (federal, state and district levels) pending the severity of the disaster. At the Federal level, this committee is chaired by the Minister appointed by the Prime Minister. The directive is supported by other Standard Operating Procedures which outline the mechanism as well as roles and responsibility of various agencies for specific disasters including TC disasters.

THE ROLE AND DUTY OF MAJOR RESCUE AGENCIES AND SECONDARY RESCUE AGENCIES IN HANDLING DISASTER ON SCENE

MAJOR RESCUE AGENCIES

A: SPECIAL MALAYSIA DISASTER ASSISTANCE AND RESCUE TEAM (SMART)

1. To search and rescue victims in any disaster which need the help of special skill, expertise, tools and equipment.

B: ROYAL MALAYSIA POLICE (PDRM)

1. To inform the relevant agencies of the occurrence of the disaster.
2. To coordinate disaster operation at the scene of incident with other agencies.
3. To establish Control Post On Scene.
4. To control and cordon special areas at the sight of incident.
5. To search and rescue lives and properties.
6. To control movement at the scene of disaster.
7. To carry out investigation on the disaster.
8. To protect unclaimed properties and to trace their owner.
9. To help in protecting lives/properties.
10. To collect and protect information and exhibits for the use of investigation/ litigation.
11. To give air transport service through the PDRM Air Unit whenever necessary.

C: MALAYSIAN FIRE AND RESCUE DEPARTMENT (JBPM)

1. To search and rescue victims.
2. To prevent incident from being spread by fighting the fire, control any chemical leakage and other dangerous situation.
3. To collect information and study the risk in order to advice the police on evacuation step.
4. To cooperate with the police in establishing operation border/zone(inner cordon) around the proper place of incident to enable JBPM carry out surveillance and control operation.
5. To ensure the security of workers involved in rescue operation.
6. To take into account the incident effect on environment and take action to reduce the effect of incident.
7. To cooperate with incident medical officer and other medical officer and the ambulance in helping the victims who need such help and removing patients from place of incident.
8. To support the police in searching killed victims.
9. To carry out investigation whenever necessary and prepare report and evidence.
10. Always being ready at the proper place of incident to ensure that the situation is safe and under control.

D: MALAYSIAN ARMED FORCES (ATM)

1. To support by offering services of members from all ranks during disaster.
2. To support in providing transportation vehicles for land, air or sea at all levels of disaster.
3. To assist with preparing machinery equipment facilities to be used in relation to disaster at all levels.
4. To provide skilled services, such as experts in explosive, engineering, communication and any form of aid if necessary.
5. To assist with construction works if needed to facilitate the operation during a disaster.
6. To provide divers services.
7. To carry out search and rescue operation based on necessity during a disaster.
8. To prepare Air Ambulance as first aid and to evacuate victims.
9. To provide liaison officers at all levels.
10. To offer emergency relief services when ATM is the first agency to reach the place of incident and will only hand over the responsibility when official authority on disaster arrived to continue works according to the issued directive.

E: EMERGENCY MEDICAL SERVICES

I. Emergency and Rescue Services

1. To offer skilled services on emergency treatment in rescue operation hand in hand with rescue workers from other agencies. .
2. To give emergency treatment service to the trapped victims.
3. To provide ambulance, pre-hospital and transport services.

II. Medical Depot Service

1. To provide emergency treatment service to victims and rescuers.
2. To give forensic services including identification, morgue and evidence documentation.
3. To give medical supply.
4. To give health services and to control infections disease.
5. To give psychological services, such as post trauma disorder, psychotherapy, counselling and debriefing.

F: ATOMIC ENERGY LICENSING BOARD (LPTA)

1. To control and prevent radioactive materials from spreading.
2. To provide trained staff and skill services at scene of incident to manage and coordinate technical matters in aspect of atomic power, such as to monitor radiation and to clear radioactive agent.
3. To provide all related equipment for search and rescue works in a nuclear and radiology accident.
4. To carry out investigation and prepare report in relation to nuclear and radiology accident which occurred.
5. To collect and protect information, evidences and exhibits in connection with nuclear and radiology accident occurred.
6. To evaluate the accident and collect information in order to advise Disaster Operation Commander so that evacuation steps could be taken.
7. To advise workers in security aspects of radiation protect before and during the search and rescue operation.
8. To evaluate whether Malaysia Nuclear Agency services is needed and to get such service when necessary.
9. To evaluate whether International Atomic Energy Agency (IAEA) services is needed and to get such service when necessary.

SUPPORTING RESCUE AGENCY

A: CIVIL DEFENCE DEPARTMENT

1. Assisting in operations to save life and property.
2. Assisting in preparation and maintenance of evacuation centres and provision of food for the victims.
3. Assisting in providing first aid service to the victims, if necessary.

THE ROLE AND DUTY OF RELIEF AND REHABILITATION AGENCIES AND VOLUNTARY BODIES IN THE WORKDS OF RELIEF AND REHABILITATION ON SCENE

A: PUBLIC WORKS DEPARTMENT (JKR)

1. Providing stores, transport and work force from JKR to do the jobs of cleaning up the scene of incident and transportation.
2. Providing temporary shelter as canopy or tent.
3. Supplying water and to raise water pressure at places where such services are needed(where water supply is under the supervision of JKR/Water Supply Department(JBA).
4. Providing technical and skill services in the fields of forensic, geotechnics, structures and etc. as in landslide or structure failure cases.

B: SOCIAL WELFARE DEPARTMENT

1. Prepare and maintain the evacuation centres.
2. To make an arrangement and distributing food, clothings and other necessities.
3. To carry out registration on the victim for the purpose of rehabilitation.
4. To offer guidance, advice/counselling to victims.

C: MALAYSIAN PEOPLE VOLUNTARY ALLIANCE (RELA)

1. To assist with the evacuation of victims.
2. To assist with preparing /distributing food to victims/duty officers.
3. To assist with providing places of evacuation.
4. To assist with distributing of clothes and other necessity to the victims.
5. To assist with crowd control at the scene of incident.
6. To assist with traffic control.
7. To assist with the construction of control centres.

D: TENAGA NASIONAL BERHAD (TNB)

1. To assure the continuous supply of safe energy at the scene of incident in order to smoothen the search and rescue operation.
2. To ensure the electrical power should be supplied again as soon as the situation is back to normal.
3. To stop the electric supply at the area of incident temporarily for security reasons.
4. To provide with lights and electrical equipment during search and rescue operation at the scene of incident.
5. To supply with electricity through a mobile generator temporarily during search and rescue operation.
6. To offer counselling services, needed at the scene of incident.
7. To provide extra manpower (if necessary).

E: MALAYSIA NATIONAL TELECOMMUNICATIONS AGENCY (STMB)

1. To ensure that telephone and telecommunication services, maintenance and control are not interrupted throughout the time when disaster management and search and rescue operation is being carried out.
2. To extend telephone direct line/self-circuit services needed by Disaster Operation Room.
3. To provide other telecommunication services needed for the operation by the relevant agencies.
4. To place enough officers and staffs to give counselling services and maintenance services on the telecommunication lines and other equipment being used.

F: MALAYSIA RED CRESCENT SOCIETY (PBSM)

1. To assist the Social Welfare Department with maintaining evacuation centres, cooking and serving food, distributing clothes, blankets and doing registration and rehabilitation works for the victims.
2. To assist other agencies with rescuing and evacuating victims.
3. To assist Emergency medical Service (Hospital) with offering first aid and other emergency relief and health care at the evacuation centres.

G: ST. JOHN AMBULANCE MALAYSIA

1. To assist with humanitarian works, including emergency medical services and emergency aid to the disaster victims.
2. To assist with giving emergency aid to the disaster victims together with the other agencies.

4.1.2 Emergency Response Mechanism

Through the National Security Council Directive No. 20, the disaster management is controlled in accordance with the type of disaster and the following elements:

1. Level I Disaster

Local incident which are controllable and with no potentiality of spreading out. It is not complex and could cause only a small damage to life and property. This form of disaster would not be a jeopardy to local daily activity on a large scale. The District Level Authority is capable of controlling such incident through district level agencies without or with a limited assistance from outside.

2. Level II Disaster

More serious incident covers a wide area or has exceeding two (2) districts and has a potential to spread out. Possibly would cause death and damage to a large number of properties. The incident also affects public daily activities. Being more complex than Level I Disaster and difficult in aspect of search and rescue. Need to and could be able to be controlled by State Level Authority with or without limited help from outside.

3. Level III Disaster

Any incident caused by Level III Disaster is more complex in nature or affecting a wide area or more than two states. Need to and could be able to be handled by Central Authority with or without foreign help.

The classification or assessment is done by the district level authority or state level authority or central authority which decides on its management procedure or to suggest that a higher authority takes over the control of the disaster management activities.

To ensure any disaster incident are being managed according to its level, the Disaster Management Committee has to form the following:

1. District Disaster Management Committee (JPBD) for Level I Disaster;
2. State Disaster Management Committee (JPBN) for Level II Disaster; and
3. Central Disaster Management Committee (JPBP) for Level III Disaster.

Relief operation or action procedure in overcoming the disaster at every stage by the government authority level is as below:

A. District Level

1. Any disaster incident at early stage should be managed by the relevant agencies using the facilities and resources at District Level Management.
2. On receiving a disaster report, District Police Officer Chief and District Fire Brigade Chief should take appropriate steps by the help from main rescue agencies and supporting agencies and other organization and voluntary bodies responsible in giving aid and rehabilitation to disaster victims. District Police Officer Chief and District Fire Brigade Chief would be commander and deputy commander of disaster operation respectively.
3. District Disaster Management Committee (JPBD) which is headed by District Officer should be mobilized to ensure all activities of search and rescue operation, taking over and preparation of facilities and machinery and other emergency aid, i.e. food and treatment could be executed and managed in good order and fully coordinated.
4. JPBD Chairman together with the commander and deputy commander would assess the disaster to know the level of the disaster and ability of local agencies at District Level in handling it. After assessment is done and early step is taken, but it is found that the disaster could not be handled at District Level or needs assistance from State Level, JPBD should inform State Disaster Management Committee (JPBN) to get prompt assistance and taking over the disaster management.

B. State Level

1. The whole management and control of Level II Disaster will be taken over by the State Level Authority or by mobilizing certain sources under the state control. State Police Chief and Director of State Fire Brigade will be a commander and deputy commander of disaster operation respectively at this stage.
2. JPBN headed by State Secretary should be mobilized to ascertain that all disaster management run smoothly and coordinated. For Federal Territory of Kuala Lumpur, the chairman of JPBN is the mayor while for Federal Territory of Labuan is the Director of Administration Federal Territory, Labuan.
3. JPBN on advice by Disaster Operation Commander shall decide on capability rescue agencies to handle disaster incident as needed, so JPBN should inform Central Disaster Management Committee (JPBP) immediately through a fixed information and communication channel.

C. Central Level

1. When the disaster administration taken over by Central Level (Level III Disaster), all related agencies and sources including search and rescue team, emergency aid and etc. at District and State level shall be combined to face disaster that occurred under JPBP. The Director of Internal Security and Public Order, Royal Malaysia Police (PDRM) and Deputy Chief Director of operation, JBPM respectively will be the commander and deputy commander of disaster operation.
2. JPBP headed by a minister appointed by the prime minister should be mobilized to ensure that all aspect in relation to policy and decision in search and rescue operation and etc. is carry out in a professional and effective manner.

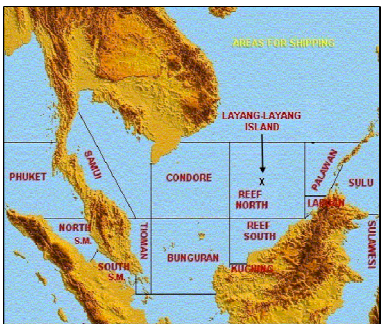
4.1.3 Organs Responsible for Warnings and Evacuation Orders

Severe Weather Phenomena	Organs responsible for Warnings	Organs responsible for Evacuation Orders
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Tropical Cyclone	The Malaysian Meteorological Department	The National Security Council of Malaysia
Heavy Rain	The Malaysian Meteorological Department	The National Security Council of Malaysia
Strong Wind	The Malaysian Meteorological Department	The National Security Council of Malaysia
River Flood	The Department of Irrigation and Drainage, Malaysia	The National Security Council of Malaysia
Storm Surge	The Malaysian Meteorological Department	The National Security Council of Malaysia

4.2 Warnings/Advisories for Severe Weather Phenomena

4.2.1 Tropical Cyclone

Warnings/Advisories and corresponding emergency responses	Please refer to ATTACHMENT 1 .
Potential Disaster Risks	Heavy rainfall, flash floods, strong winds and rough seas.
Target (warning areas)	Marine regions under MetMalaysia responsibility for issuing sea state conditions. 
Meteorological variables/indices used for criteria/thresholds for warnings/advisories	Rainfall intensity, wind speed and wave height.
Criteria/Thresholds	<p>A TC Warning is issued for tropical depression/tropical storm/typhoon in the Malaysian Exclusive Economic Zone (EEZ) or if the TC is forecast to enter Malaysia EEZ within 24 hours. A TC Advisory is issued for TCs outside the Malaysian EEZ but within the area bounded by 0-30°N and 90-130°E.</p> <p>There are two categories of TC warning namely Orange and Red.</p> <p>i. Orange : Tropical depression is in the Malaysian EEZ or is going to enter the Malaysian EEZ within 24 hours</p>

	ii. Red : Tropical storm / typhoon is in the Malaysian EEZ or is going to enter the Malaysian EEZ within 24 hours
Contents of Warning/Advisory Message	Time and date of warning/advisory issuance, TC stage, time of observation, location, movement, distance from nearest town and potential disaster risks to Malaysia.
Sample Warning/Advisory Message	<p style="text-align: center;">Tropical Depression Advisory Issued at 05:55AM 03 January 2013</p> <p>Stage : Tropical Depression.</p> <p>Time of Observation: 5.00 am, 3rd January 2013.</p> <p>Location: Latitude 8.3 North; Longitude 124.4 East; approximately 123 km Southeast of Mindanao, Philippines.</p> <p>Movement: Westwards at estimated speed of 45 kmph.</p> <p>Distant from nearest town: Approximately 783 km Northeast of Semporna, Sabah.</p> <p>Threat to Malaysia: These conditions may cause strong winds and rough seas over waters off Sulu Sea.</p>

4.2.2 Heavy Rain

Warnings/Advisories and corresponding emergency responses	Please refer to ATTACHMENT 1 .
Potential Disaster Risks	Floods over low-lying areas.
Target (warning areas)	District.

Meteorological variables/indices used for criteria/thresholds for warnings/advisories	Rainfall intensity.
Criteria/Thresholds	<p>There are three categories of heavy rain warning/advisory due to TCs that is Yellow, Orange and Red.</p> <ul style="list-style-type: none"> i. Yellow (Advisory): Moderate rains with strong winds expected in the next 1- 2 days to come. ii. Orange (Warning): Moderate rainfall with intensity $2.5 \leq i < 10.0$ mm / hr (which is intensifying) and with strong winds are occurring or expected to occur in less than 24 hours. iii. Red (Warning): Heavy rainfall with intensity ≥ 10.0 mm / hr and with strong winds are occurring or expected to occur within the next few hours.
Contents of Warning/Advisory Message	Warning/advisory stage (Yellow, Orange, Red), date and time of issuance, TC location, wind speed over affected areas, associated severe weather phenomena, warning/advisory affected areas, duration of occurrence and potential disaster risks.
Sample Warning/Advisory Message	<p style="text-align: center;"><u>Heavy Rain Warning</u> <u>(Orange Stage)</u></p> <p>Issued at : 09:31AM, 03 January 2013</p> <p>A Tropical Depression is observed at 8.3 North, 124.4 East with wind speed between 50-60 kmph. In conjunction to that, widespread thunderstorms are expected to occur over the states of Sabah: Divisions of Sandakan (Beluran, Kinabatangan and Sandakan Districts), Tawau (Lahad Datu District) and Kudat (Pitas, Kudat and Kota Marudu Districts) from tonight, 3rd January 2013 until Friday, 4th January 2013.</p> <p>This condition will cause floods over low-lying areas and strong winds.</p>

4.2.3 Strong Wind

Warnings/Advisories and corresponding emergency responses	Please refer to ATTACHMENT 1 .
Potential Disaster Risks	Dangerous for small boats, ferry services, fishing, recreational activities, sea sports, shipping, coastal activities and workers on oil platforms.

Target (warning areas)	Marine regions under MetMalaysia responsibility for issuing sea state conditions.
Meteorological variables/indices used for criteria/thresholds for warnings/advisories	Wind speed and wave height.
Criteria/Thresholds	<p>There are three categories of strong wind warning/advisory due to TCs that is First, Second and Third category.</p> <ul style="list-style-type: none"> i. First Category: Strong winds with speeds up to 50 kmph and rough seas with wave height up to 3.5 m. ii. Second Category: Strong winds with speeds up to 60 kmph and rough seas with wave height up to 4.5 m. iii. Third Category: Strong winds with speeds exceeding 60 kmph and rough seas with wave height exceeding 4.5 m.
Contents of Warning/Advisory Message	Warning/advisory stage (First, Second or Third category), date and time of issuance, TC information, associated severe weather phenomena, wind speed & wave height over affected areas, warning/advisory affected areas, duration of occurrence and potential disaster risks.
Sample Warning/Advisory Message	<p style="text-align: center;"><u>THIRD CATEGORY WARNING</u> WARNING ON STRONG WINDS AND ROUGH SEAS</p> <p>Updated:</p> <p>Tropical Depression is located at Latitude 8.3 N and Longitude 124.4 E, at 5:00 am, 3rd January 2013, approximately 783 km Northeast of Semporna, Sabah and moved Westwards with estimated speed of 45 km/h.</p> <p>STRONG WINDS AND ROUGH SEAS (THIRD CATEGORY) -Update</p> <p>Strong Northeasterly winds over 60 kmph with waves more than 5.5 metres occurring over the waters off Kelantan, Terengganu, Samui, Condore, Reef North, Layang-Layang & Palawan are expected to continue until Friday, 4th January 2013.</p> <p>In addition, the coastal areas of Kelantan & Terengganu are vulnerable to sea level rise. This condition is expected to continue until Friday, 4th January 2013.</p> <p>This condition of strong winds and rough seas is dangerous to all coastal and shipping activities including workers on oil platform.</p> <p style="text-align: right;"><i>Updated on 03 January 2013, at 07:46AM</i></p>

4.2.4 River Flood

Warnings/Advisories and corresponding emergency responses	Flood warnings are disseminated via SMS(people in a particular area,disaster management agencies), web site(http://infobanjir.water.gov.my/), sirens. No river flood warning associated with tropical cyclones was ever issued.
Potential Disaster Risks	/Floods.
Target (warning areas)	Housing area/District.
Meteorological variables/indices used for criteria/thresholds for warnings/advisories	Rainfall amount and rates.
Criteria/Thresholds	-
Contents of Warning/Advisory Message	-
Sample Warning/Advisory Message	-

4.2.5 Storm Surge

Warnings/Advisories and corresponding emergency responses	Storm surge warnings are not issued separately but the possible impact is included in the Strong Winds and Rough Seas Advisory/Warning.
Potential Disaster Risks	Coastal areas are vulnerable to sea level rise.
Target (warning areas)	State.
Meteorological variables/indices used for criteria/thresholds for warnings/advisories	-
Criteria/Thresholds	-
Contents of Warning/Advisory Message	-
Sample Warning/Advisory Message	-

4.3 Supporting Meteorological Information for Warning/Advisory Messages

Name of Information	Potential Disaster Risks	Target (areas)	Issuance (update) Time	Contents
-				

4.4 Institutional Coordination

4.4.1 Coordination with Disaster Management Authorities

Warning Coordination	Meetings, seminars, workshops and awareness programmes are held regularly to discuss about enhancement of our services with regard to warnings and advisories.
Needs from Disaster Management Authorities	Disaster management authorities should only refer to warnings and advisories issued by MetMalaysia and not from other sources. Information from unofficial sources such as from social media, SMS and The Internet have been known to cause problems.

4.4.2 Partnership and Coordination with Media

Warning Coordination	The MetMalaysia has a mini studio where the weather reports are broadcasted live four times daily. Advisories/warnings are also broadcasted through TV crawlers, news(TV, Radio, printed, electronic) and interview sessions.
Needs from Media	Our local media provide us with a lot of coverage regarding warnings/advisories to the public. There is a need to set up a TV channel fully dedicated to broadcasting information such as weather forecasts/warnings.

4.5 Challenges (and Future Plan)

During festive seasons and significant events the exchange of information through telecommunication systems is disrupted due to the huge load/demand. Due to relatively small number of disasters, disaster awareness is rather low compared to other countries. Disaster awareness will be carried out annually with emphasis on the communities at risk. Communication of the warning message via SMS and Internet(Whatsapp group) are gaining in popularity.

ATTACHMENT 1

WARNINGS/ADVISORIES ISSUED BY METMALAYSIA FOR TROPICAL CYCLONES AS WELL AS ASSOCIATED SEVERE WEATHER PHENOMENA IN 2013

No.	Tropical Cyclone Name	Category	Date		Total No. of TC Warnings/Advisories	Total No. of Heavy Rain Warnings/Advisories (due to TC)	Total No. of Strong Wind and Rough Seas Warnings/Advisories (due to TC)
			Start	End			
1	SONAMU	Depression	01/01/2013	03/01/2013	50	1	40
		Tropical Storm	03/01/2013	04/01/2013			
		Severe Tropical Storm	05/01/2013	06/01/2013			
		Tropical Storm	06/01/2013	07/01/2013			
2	MINDANAO	Depression	08/01/2013	10/01/2013	NIL	NIL	NIL
		Depression	18/02/2013	21/02/2013			
3	SHANSHAN	Tropical Storm	22/02/2013	23/02/2013	27	NIL	22
		Depression	23/02/2013	23/02/2013			
4	YAGI	Depression	06/06/2013	08/06/2013	7	NIL	NIL
		Tropical Storm	08/06/2013	12/06/2013			
		Depression	12/06/2013	12/06/2013			
5	LEEPI	Depression	16/06/2013	17/06/2013	30	NIL	26
		Tropical Storm	18/06/2013	20/06/2013			
6	BEBINCA	Depression	19/06/2013	20/06/2013	27	NIL	27
		Tropical Storm	21/06/2013	24/06/2013			
		Depression	24/06/2013	24/06/2013			
7	RUMBIA	Depression	27/06/2013	28/06/2013	35	NIL	4
		Tropical Storm	28/06/2013	01/07/2013			
		Severe Tropical Storm	01/07/2013	01/07/2013			
		Tropical Storm	01/07/2013	02/07/2013			
8	SOULIK	Depression	02/07/2013	02/07/2013	24	NIL	NIL
		Depression	07/07/2013	07/07/2013			
		Tropical Storm	08/07/2013	08/07/2013			
		Severe Tropical Storm	08/07/2013	08/07/2013			
		Typhoon	09/07/2013	12/07/2013			
9	CIMARON	Tropical Storm	13/07/2013	13/07/2013	20	NIL	10
		Depression	14/07/2013	14/07/2013			
		Depression	15/07/2013	16/07/2013			
10	JEBI	Depression	17/07/2013	18/07/2013	49	NIL	28
		Tropical Storm	18/07/2013	18/07/2013			
		Depression	28/07/2013	30/07/2013			
		Tropical Storm	31/07/2013	02/08/2013			
11	MANGKHUT	Severe Tropical Storm	02/08/2013	02/08/2013	26	NIL	4
		Tropical Storm	02/08/2013	03/08/2013			
		Depression	03/08/2013	03/08/2013			
		Depression	05/08/2013	06/08/2013			
12	UTOR	Tropical Storm	06/08/2013	07/08/2013	48	NIL	37
		Depression	08/08/2013	08/08/2013			
		Depression	08/08/2013	09/08/2013			
		Tropical Storm	09/08/2013	10/08/2013			
		Typhoon	10/08/2013	14/08/2013			
13	TRAMI	Severe Tropical Storm	14/08/2013	14/08/2013	51	NIL	52
		Tropical Storm	14/08/2013	15/08/2013			
		Depression	15/08/2013	16/08/2013			
		Depression	16/08/2013	17/08/2013			
		Tropical Storm	18/08/2013	19/08/2013			
14	KONG-REY	Severe Tropical Storm	19/08/2013	22/08/2013	42	NIL	8
		Tropical Storm	22/08/2013	22/08/2013			
		Depression	22/08/2013	22/08/2013			
		Depression	25/08/2013	26/08/2013			
15	TORAJI	Tropical Storm	26/08/2013	27/08/2013	21	NIL	NIL
		Severe Tropical Storm	28/08/2013	28/08/2013			
		Tropical Storm	29/08/2013	30/08/2013			
		Depression	31/08/2013	01/09/2013			
16	MAN-YI	Tropical Storm	01/09/2013	02/09/2013	NIL	NIL	NIL
		Depression	03/09/2013	04/09/2013			
		Tropical Storm	10/09/2013	12/09/2013			
		Severe Tropical Storm	12/09/2013	13/09/2013			
17	USAGI	Tropical Storm	14/09/2013	16/09/2013	55	NIL	46
		Depression	16/09/2013	16/09/2013			
		Tropical Storm	16/09/2013	17/09/2013			
		Severe Tropical Storm	18/09/2013	18/09/2013			
18	PABUK	Typhoon	18/09/2013	22/09/2013	8	NIL	NIL
		Tropical Storm	22/09/2013	23/09/2013			
		Depression	23/09/2013	23/09/2013			
		Depression	25/09/2013	26/09/2013			
19	WUTIP	Tropical Storm	27/09/2013	27/09/2013	45	NIL	43
		Severe Tropical Storm	27/09/2013	27/09/2013			
		Tropical Storm	28/09/2013	28/09/2013			
		Typhoon	28/09/2013	30/09/2013			
20	SEPAT	Severe Tropical Storm	30/09/2013	30/09/2013	NIL	NIL	NIL
		Tropical Storm	30/09/2013	30/09/2013			
		Depression	01/10/2013	01/10/2013			
		Depression	29/09/2013	29/09/2013			
21	FITOW	Tropical Storm	30/09/2013	02/10/2013	40	NIL	36
		Depression	02/10/2013	03/10/2013			
		Tropical Storm	04/10/2013	04/10/2013			
		Typhoon	04/10/2013	06/10/2013			
22	DANAS	Severe Tropical Storm	06/10/2013	06/10/2013	12	NIL	11
		Tropical Storm	07/10/2013	07/10/2013			
		Depression	01/10/2013	04/10/2013			
		Tropical Storm	04/10/2013	05/10/2013			
23	NARI	Severe Tropical Storm	05/10/2013	05/10/2013	52	NIL	47
		Typhoon	05/10/2013	08/10/2013			
		Severe Tropical Storm	08/10/2013	08/10/2013			
		Tropical Storm	08/10/2013	08/10/2013			
24	WIPHA	Depression	08/10/2013	09/10/2013	NIL	NIL	NIL
		Tropical Storm	09/10/2013	10/10/2013			
		Severe Tropical Storm	10/10/2013	10/10/2013			
		Typhoon	10/10/2013	14/10/2013			
25	FRANCISCO	Tropical Storm	15/10/2013	15/10/2013	2	NIL	NIL
		Depression	15/10/2013	15/10/2013			
		Tropical Storm	08/10/2013	10/10/2013			
		Depression	10/10/2013	11/10/2013			
26	LEKIMA	Severe Tropical Storm	11/10/2013	12/10/2013	NIL	NIL	NIL
		Typhoon	12/10/2013	16/10/2013			
		Depression	15/10/2013	16/10/2013			
		Tropical Storm	16/10/2013	16/10/2013			
27	KROSA	Severe Tropical Storm	16/10/2013	17/10/2013	45	NIL	11
		Typhoon	17/10/2013	24/10/2013			
		Severe Tropical Storm	24/10/2013	26/10/2013			
		Tropical Storm	20/10/2013	21/10/2013			
28	HAIYAN	Typhoon	21/10/2013	21/10/2013	NIL	NIL	NIL
		Depression	27/10/2013	29/10/2013			
		Tropical Storm	29/10/2013	30/10/2013			
		Severe Tropical Storm	30/10/2013	30/10/2013			
29	PODUL	Typhoon	31/10/2013	2/11/2013	30	NIL	NIL
		Severe Tropical Storm	31/10/2013	3/11/2013			
		Tropical Storm	3/11/2013	4/11/2013			
		Depression	4/11/2013	4/11/2013			
30	HAIYAN	Depression	3/11/2013	3/11/2013	49	NIL	45
		Tropical Storm	4/11/2013	4/11/2013			
		Severe Tropical Storm	5/11/2013	6/11/2013			
		Typhoon	5/11/2013	10/11/2013			
31	PODUL	Severe Tropical Storm	11/11/2013	11/11/2013	30	NIL	NIL
		Tropical Storm	11/11/2013	11/11/2013			
		Depression	11/11/2013	11/11/2013			
		Typhoon	9/11/2013	14/11/2013			
32	PODUL	Tropical Storm	14/11/2013	14/11/2013	30	NIL	NIL
		Depression	15/11/2013	16/11/2013			