MEMBER REPORT

ESCAP/WMO Typhoon Committee
43rd Session

17 – 22 January 2011
Jeju Island, Republic of Korea

(MALAYSIA)

SUMMARY OF TYPHOON COMMITTEE REPORT 2010

I. Meteorology

Overall fourteen typhoons and tropical storms (tropical storm intensity or higher) developed over the western Pacific, South China Sea and the Philippines region from Mac to October in 2010. This number is much lower than the average value of 25.4 recorded for 58 years from 1951 to 2008. The total number of typhoons and tropical storms being 14 is also much lower than the 21 recorded for 2009 in the same region as mentioned above.

Local convective processes at selected meteorological stations in Northern Peninsular Malaysia, coastal Sarawak and Sabah were enhanced during those events. Based upon the climatology of the Malaysian region, convective activity due to migration of typhoons and tropical storms in the Philippine region and South China Sea enhances convective activity to a greater extent over Northern Peninsular Malaysia compared to East Malaysia. Nevertheless this year, heavier rainfall influenced by the typhoons and tropical storms were observed in East Malaysia compared to Peninsular Malaysia. Rainfall amounts of more than 50mm/day were recorded in many meteorological stations in East Malaysia compared to 20 to 30 mm/day for stations in Peninsular Malaysia. Additionally, maximum rainfall recordings related to typhoon and tropical storm related events amounting to 80 to 90 mm/day were observed in Sibu, Miri and Labuan. These 3 meteorological stations are all located in East Malaysia.

No typhoon or tropical storm warnings were issued by the Malaysian Meteorological Department (MMD), as none of the typhoons or tropical storms were close enough to warrant such a issuance of warning. Migration of typhoons and tropical storms across the Philippines and South China Sea regions usually strengthen the 850hPa westerlies from the Indian Ocean. In October this year, migration of Typhoon Megi in the Philippines region had strengthened the westerlies across the Straits of Malacca, thereby intensifying the haze dispersion from the Straits of Malacca to the South China Sea across Peninsular Malaysia.

Major hardware and software improvements and upgrades were done to the existing conventional radar station network. Upgrades were done on all the existing conventional radar stations to convert them to Doppler radar stations. The Doppler radar stations together with an additional deployment of 108 automatic weather stations throughout the country enable a more accurate representation of positions and intensity of occurring heavy weather events. The Bogus Data Assimilation (BDA) Typhoon Bogussing Scheme of the Shanghai Typhoon institute was successfully implemented on an operational basis in December 2009 to improve the cyclone vortex representation in the Mesoscale Model 5 numerical weather prediction system at MMD. Initial tests of this BDA Typhoon Bogussing Scheme displayed an improvement of track forecasts for the typhoons and tropical storms considered.

Development of the Malaysian Integrated Forecasting System (MIFS) at MMD was completed in 2010. The MIFS has the ability to send alerts based on predefined criteria such as the maximum wind speed and position of tropical cyclones. Various meteorological and marine products available in the MIFS are distributed real time through the internal web to Regional Forecast Offices throughout the country. These products are essential for purposes of weather monitoring and issuance of weather forecasts and warnings. The internal web is also made available to all external agencies involved in disaster management.

Attending training sessions in numerical weather prediction and wave modelling at reputed institutions are regular efforts. The objective is to improve the technical knowledge of MMD officers involved in those fields. As of November 2009 up to November 2010 three officers have been involved in numerical modelling training at other meteorological institutions. The meteorological institutes involved were the National Center for Atmospheric Research (NCAR), Korea Meteorological Administration (KMA) and Deutscher Wetteredienst (DWD). Additionally two meteorological officers from the MMD were sent to to attend the Asia Pacific Typhoon Workshop in Manila and the Typhoon Committee Roving Seminar in Thailand in 2010. Three research studies directly related to tropical cyclone impacts in Malaysia were conducted by the Research Division in MMD in 2010.

II. Hydrology

To date, the Department of Irrigation and Drainage (DID) has installed and operated 525 telemetric stations in 38 river basins. Additionally, 670 manual river gauges, 1013 stick gauges and 182 flood warning boards have been set up in flood prone areas to provide crucial information during the flood season. Operations of 395 automatic flood-warning sirens are an integral part of the local flood warning system being operated.

An Integrated Flood Forecasting and River Monitoring System (IFFRM) for the Klang Valley inclusive of a flood modelling system is nearing completion. Included in the infrastructure networks which have been completed are 88 new telemetric systems. An Integrated Flood Forecasting and Warning System for the Muda River Basin in Northern Peninsular Malaysia is also being developed simultaneously. This includes developing a radar rainfall analyzer and integrator for Malaysia (RAIM), which feeds information to a real- time flood forecasting system which is already in place in 13 river basins throughout the country. Upon completion, this project will be extended to the Kelantan, Pahang and Johor river basin. On another note, flood forecasting models in the Johor, Muar and Batu Pahat river basins are being upgraded to the real-time computerized HEC-HMS model.

To further improve the efficiency of flood forecasting in Malaysia DID has also embarked on the Atmospheric Model-Based Rainfall & Flood Forecasting System (AMRFF) project. Upon completion, this project will be able to provide a sufficient lead time for flood management in the Pahang, Kelantan and Johor River Basins. The Stormwater Management and Road Tunnel Project (SMART) in Kuala Lumpur which was completed in July 2007 had successfully reduced flooding incidences in the Kuala Lumpur City Centre. It had successfully managed to divert potential flood waters from the city centre during many severe weather events.

Eight courses and conferences was also organised throughout the country by DID in 2010. Critical areas such as storm water management, flood forecasting and warning and flood mitigation were covered during these courses and conferences.

III. Disaster Prevention and Preparedness (DPP)

State of the art technology alone will not suffice to mitigate the impacts of massive flooding if coordination of flood preparation and flood evacuation procedures are not in place. The National Security Council (NSC) plays a pivotal role here in coordinating the usages of meteorological and hydrological information available for relieve efforts. To facilitate management of disasters, the NSC is given the task to coordinate efforts among the various agencies involved in disaster management. The National Security Council Directive No. 20: *The Policy and Mechanism on National Disaster and Relief Management* was established on 11 May 1997 for this purpose. Given the various degrees of uncertainties and complexities involved in each disaster, it is relevant to review and upgrade Directive No. 20 to make it more robust in meeting the ever growing threat of disasters.

Ensuring effective communication between the NSC, collaborating agencies and the affected population for any given disaster is pivotal for any Search and Rescue (SAR) and evacuation operation to proceed as effective as possible. Setting up of an Emergency Command Centre (ECC), establishment of the Malaysian Emergency Response System (MERS 999), Government Integrated Radio Network (GIRN) and Fixed Line Alert System (FLAS) are crucial efforts undertaken to ensure effective communication in the face of any impending disaster.

Once victims of impending disasters such as flooding are already safely brought to the relieve centres, the Department of Social Welfare is responsible for providing their necessities throughout their wait at the relieve centres until the danger has subsided. These necessities include food, clothing, guidance and counselling. In 2009, the Department of Social Welfare had identified 4,744 relief centres which can accommodate up to 1.3 million disaster victims at any particular time. The department had also conducted 31 training sessions for 3,239 people (1,750 social workers and 1,489 volunteers) in 2009. Given the necessity to relocate and deploy SAR assets in a strategic location or storage facility, the Central Store was established at the Defence Supplies Depot in Sungai Buloh. This storage facility is managed jointly by the NSC, Armed Forces, Department of Social Welfare and the Royal Malaysian Police.

In an effort to strengthen the resilience of victims affected by natural disasters, the government had established the National Disaster Relief Trust Fund (NDRF) to alleviate the financial burden of the victims to a certain extent. In 2005, the NDRF was changed from a normal fund to a trust fund to include contributions from the general public and private sector.

Instilling disaster risk awareness among the public is a necessary feature of precautionary measures undertaken to reduce mortality rate due to natural disasters. MMD in collaboration with the Ministry of Education and Ministry of Science Technology and Innovation had organized a total of 98 awareness programmes in regard to extreme weather and its impact in various schools, hospitals and universities throughout the country.

Regional cooperation is a necessary feature in monitoring and preparing mitigation measures related to various large-scale weather phenomena affecting the South East Asian region. At the regional level, Malaysia is an active member of the Association of South East Asia Nations (ASEAN) and is a member of the ASEAN Committee on Disaster Management (ACDM).

The ASEAN Agreement on Disaster Management and Emergency Response (AADMER) was in force from the 24^{th} of December 2009 onwards. In line with the Agreement above, member countries are called upon to designate National Focal Points and competent authorities to coordinate regional Humanitarian Assistance and Disaster Relief Operations (HADR) and to support the establishment of ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre) and ASEAN Standby Arrangements for Disaster Relief and Emergency Response (SASOP). Malaysia had participated in the Fourth Asian Ministerial Conference on Disaster Risk Reduction (4^{th} AMCDRR) which took place at the Republic of Korea in October 2010. The main theme of the conference was “Climate Change Adaptation through Disaster Risk Reduction”. Malaysia had also contributed more than USD 2 million in terms of cash money and necessary supplies to help victims of the flooding in Pakistan in 2010.

CONTENTS

I Overview of tropical cyclones which have affected/impacted Member's area since the last Typhoon Committee Session

1. Meteorological Assessment

From 1st of March 2010 to 31st of October 2010, 7 typhoons and 7 tropical storms had developed in regions from the Western Pacific, Philippines and to the South China Sea. The total number of 14 typhoons and tropical storms this year is much lower than the average value of 25.4 per year recorded for the period from 1951 to 2008. This value is also lower than the total number of 21 obtained for last year. The typhoons and tropical storms observed this year are as listed in **Table 1.** Details regarding their lifetimes, region of formation and maximum wind speeds attained are also included. Typhoons and tropical storms having relatively more impacts on the Malaysian weather, especially in rainfall are listed in bold. One (1) tropical storm had developed over the South China Sea region, three (3) over the Philippines region and the remaining ten (10) over the Western Pacific region.

The number of typhoon and tropical storm advisories issued by the Malaysian Meteorological Department in regard to the above-mentioned typhoons and tropical storms are given in **Table 2**. Starting and ending dates of the typhoon and tropical storm advisories are also indicated. Tracks of the typhoons and tropical storms that were relatively closer to the Malaysia region are as shown in **Figure 1**. No typhoon or tropical storm warnings were issued by the Malaysian Meteorological Department, as none of the typhoons or tropical storms was close enough to directly or indirectly cause significant loss of life and properties.

The impacts of tropical storms and typhoons over the Malaysia region are restricted to rainfall events and severe gusting due to the tail effects of the tropical storms and typhoons. These tail effects are generally responsible for enhancing the afternoon convective weather over the Malaysia region, especially in the northern Peninsular Malaysia, Sabah and coastal Sarawak. Due to the presence of the typhoons and tropical storms in the South China Sea and the Philippines regions, the resulting southwesterly wind flow over the Malaysia region to a certain extent does influence the rainfall pattern on the western coast of East Malaysia and the northern Peninsular Malaysia. The satellite imageries of the rain cloud clusters over the Malaysia region associated with the tail effects of the typhoons and tropical storms are as shown in **Figure 2.** These imageries were obtained from the infrared channel of the MTSAT – 1R geostationary satellite. The other typhoons and tropical storms which are not shown in **Figure 1** and **Figure 2** are located too far away to have any significant impact on Malaysia.

Rainfall events due to the tail effects of typhoons and tropical storms are also depicted with daily rainfall charts of selected meteorological stations in northern Peninsular Malaysia and East Malaysia. The daily rainfall charts for the months of March to October 2010 are as shown in **Figures 3a** to **3h**. Large spatial variation associated with rainfall may result in some of the selected stations not showing significant rainfall, although the satellite imageries may indicate so.

From the satellite imageries (**Figure 2**) and rainfall charts (**Figures 3a** to **3h)**, it was found that the rain cloud bands associated with the typhoons and tropical storms are generally more intense in northern Peninsular Malaysia as compared to that of the East Malaysia. Nevertheless, there are exceptions as depicted in the case of Tropical Storm Meranti. The satellite imageries and the rainfall charts (**Figures 3e** and **3f**) clearly shown much more significant rain clouds and rainfall amounts respectively, for coastal Sabah and Sarawak as compared to those in Peninsular Malaysia. For the northern Peninsular Malaysia, rain cloud bands are generally more clearly established in the northwestern region as compared to the northeastern region during the presence of typhoons and tropical storms in the South China Sea and Philippines regions.

Based upon satellite imageries in **Figure 2** and rainfall data in **Figure 3**, Typhoons Conson and Chanthu and Tropical Storm Meranti had more significant impacts in term of weather in Peninsular Malaysia and East Malaysia. Large rainfall amounts were recorded during Typhoon Conson and Tropical Storm Meranti events. Rainfall amounts of more than 50mm/day were recorded in many meteorological stations in East Malaysia. For Peninsular Malaysia, the average rainfall amount of most meteorological stations was only 20 to 30 mm/day during the events. Maximum rainfall amount of 80-90 mm/day were recorded in Sibu during the Typhoon Conson event and in Miri and Labuan during the Tropical Storm Meranti event.

On the 19-20 October 2010, there was a severe haze event over the southern Peninsular Malaysia region due to the passage of Typhoon Megi over the South China Sea (**Figure 4a**). The passage of Typhoon Megi over the South China Sea led to the changing of wind direction from northerly to southwesterly flow which brought the haze to the southern state of Peninsular Malaysia (**Figure 4b**). **Figure 4c** shows the observed visibility at the Principal Meteorological Stations in Johor during the period.

Table 1 List of Typhoons and Tropical Storms, Maximum Wind and Date of their Birth and Death from 1st March to 31st October 2010.

No.	Tropical Cyclone Name (2009)	Class (JTWC)	Birth Date	Death Date	Max Wind (knots)
1	*Omais	Tropical Storm	24/03/2010	26/03/2010	35
2	***Conson**	Typhoon	12/07/2010	18/07/2010	70
3	#**Chanthu**	Typhoon	19/07/2010	23/07/2010	70
4	*Dianmu	Tropical Storm	08/08/2010	12/08/2010	55
5	@Mindulle	Tropical Storm	23/08/2010	25/08/2010	45
6	#Lionrock	Tropical Storm	28/08/2010	02/09/2010	50
7	*Kompasu	Typhoon	29/08/2010	02/09/2010	80
8	*Namtheun	Tropical Storm	30/08/2010	31/08/2010	40
9	*Malou	Tropical Storm	03/09/2010	08/09/2010	50
10	#**Meranti**	Tropical Storm	09/09/2010	10/09/2010	45
11	*Fanapi	Typhoon	15/09/2010	20/09/2010	95
12	*Malakas	Typhoon	21/09/2010	25/09/2010	75
13	*Megi	Typhoon	13/10/2010	23/10/2010	125
14	*Chaba	Typhoon	24/10/2010	30/10/2010	90

Remarks:

1. Tropical cyclones that formed over

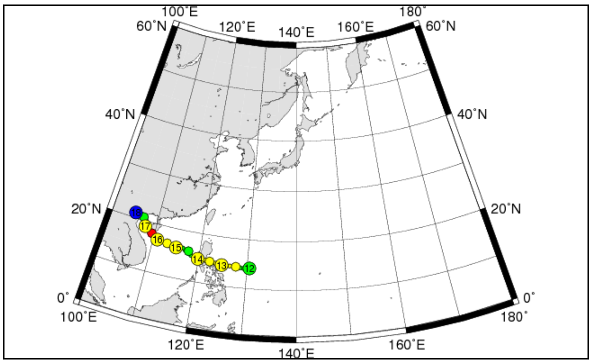
   * West Pacific Ocean (10 cases)
   \# Philippines region (3 cases)
   @ South China Sea region (1 case)

2. Tropical cyclones that have impacts on the weather in Malaysia are in **bold**.

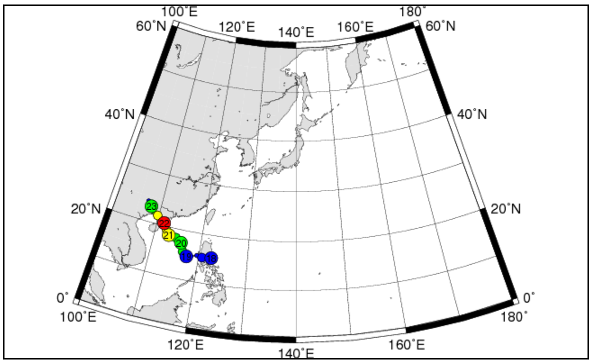
3. JTWC: Joint Typhoon Warning Centre

Table 2 Number of Tropical Cyclone Advisories Issued from 1st March 2010 to 31st October 2010

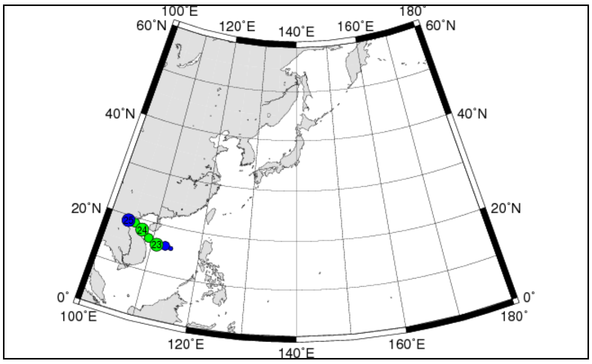
No.	Name	Category	Advisories Issued	Start Date		End Date
1	Conson	Typhoon	7	12/07/2010	-	18/07/2010
		Storm	3			
2	Chanthu	Typhoon	2	19/07/2010	-	23/07/2010
		Storm	10			
3	Mindulle	Storm	6	23/08/2010	-	25/08/2010
4	Lionrock	Storm	18	28/08/2010	-	02/09/2010
5	Meranti	Storm	3	09/09/2010	-	10/09/2010
6	Fanapi	Typhoon	14	15/09/2010	-	20/10/2010
		Storm	5			
7	Megi	Typhoon	28	13/10/2009	-	23/10/2009
8	Chaba	Typhoon	11	24/10/2009	-	30/11/2009
		Storm	6			



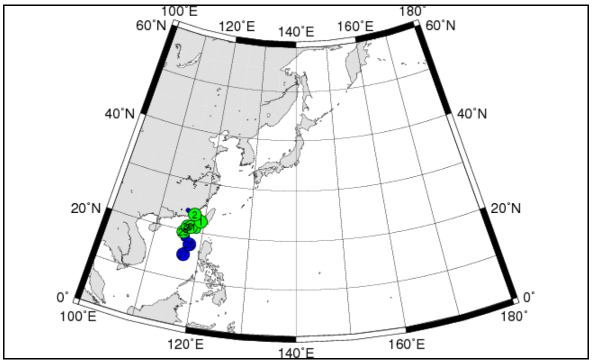
CONSON



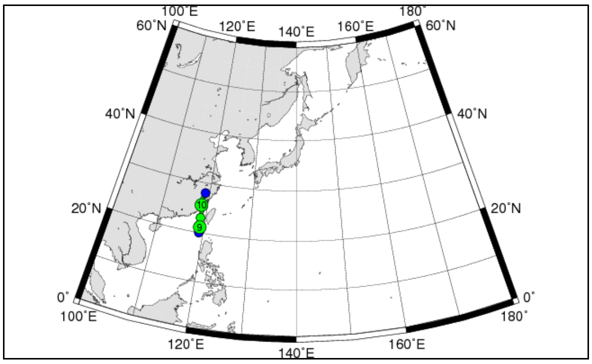
CHANTHU



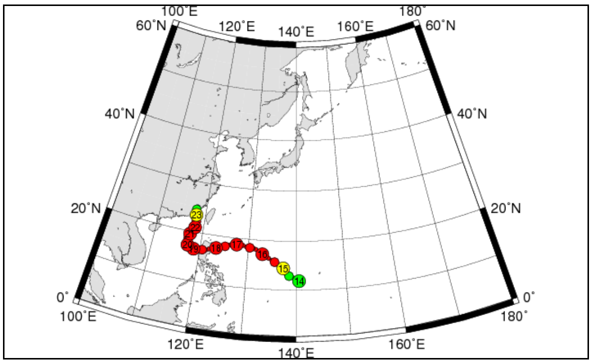
MINDULLE



LIONROCK

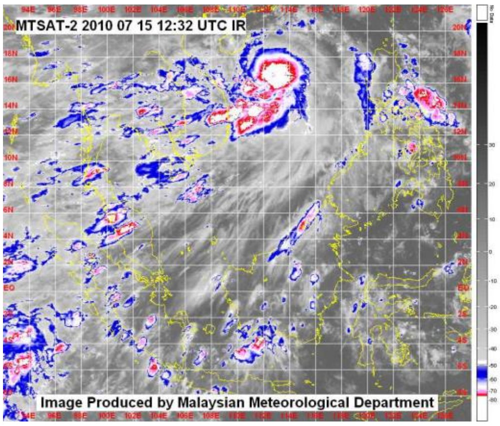


MERANTI

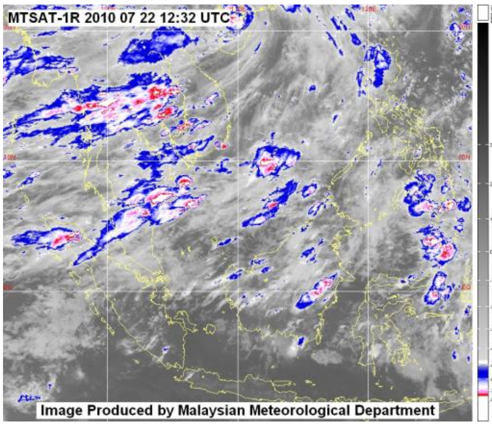


MEGI

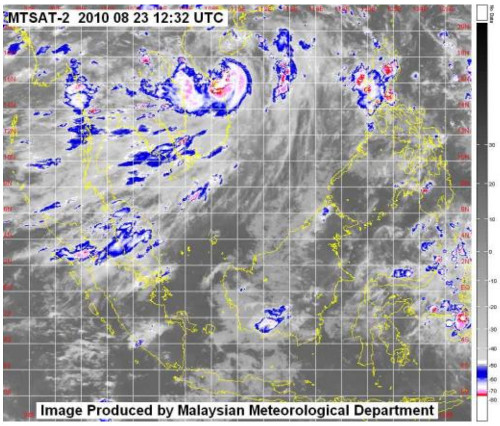
Figure 1 Tracks of the six (6) tropical storms and cyclones closest to Malaysia from 1 March 2010 to 31 October 2010. The number in the circle represents the date of occurrence of the tropical storms and cyclones.



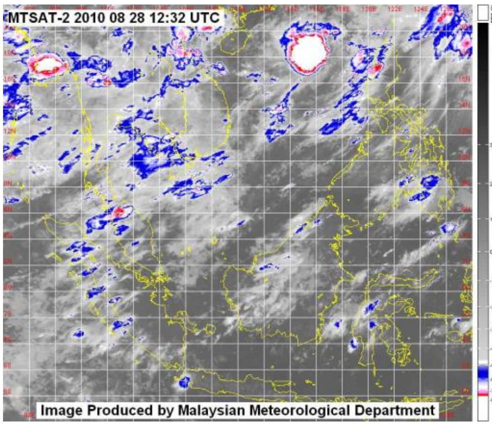
CONSON



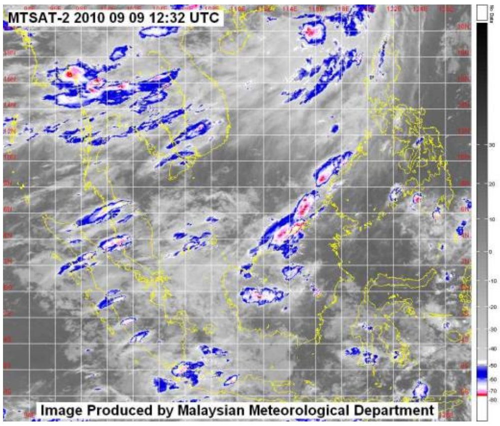
CHANTHU



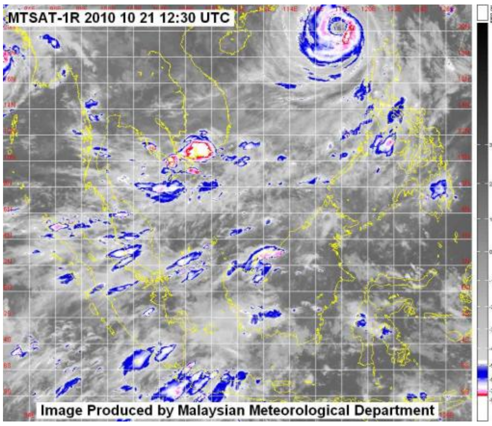
MINDULLE



LIONROCK



MERANTI



MEGI

Figure 2 MTSAT – 1R satellite imageries showing the rain cloud clusters associated with some of the selected tropical storms and cyclones over the Malaysia region from 1 March 2010 to 31 October 2010.

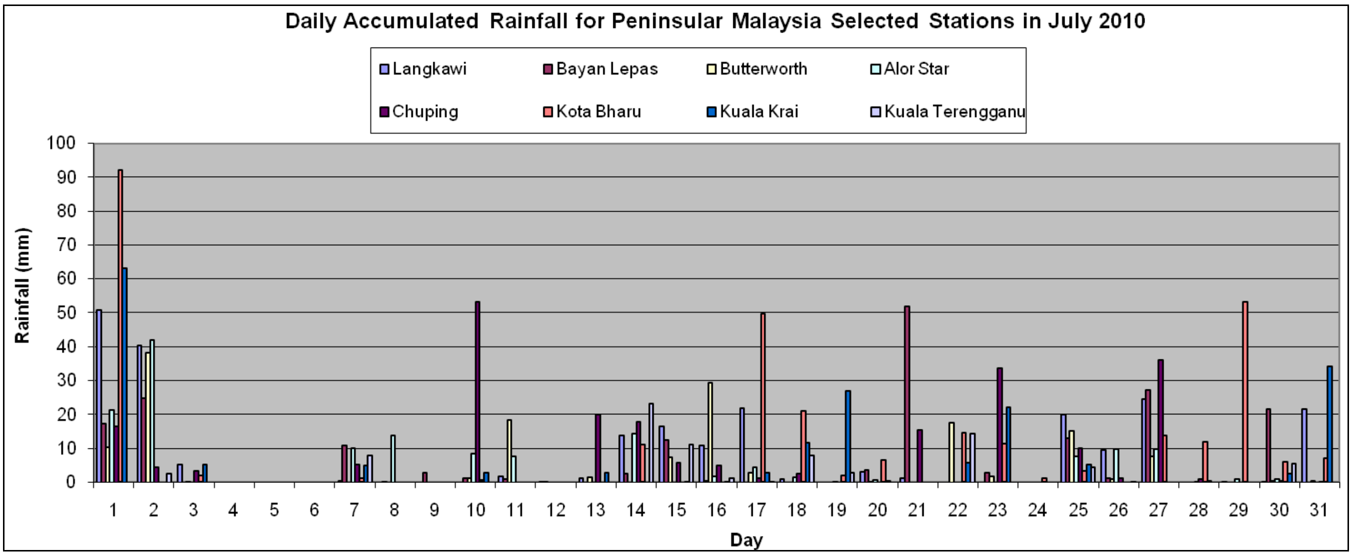


Figure 3a Daily rainfall chart of selected meteorological stations in Peninsular Malaysia for July 2010: Typhoon Conson (12/07/10 - 18/07/10) and Typhoon Chanthu (19/07/10 – 23/07/10)

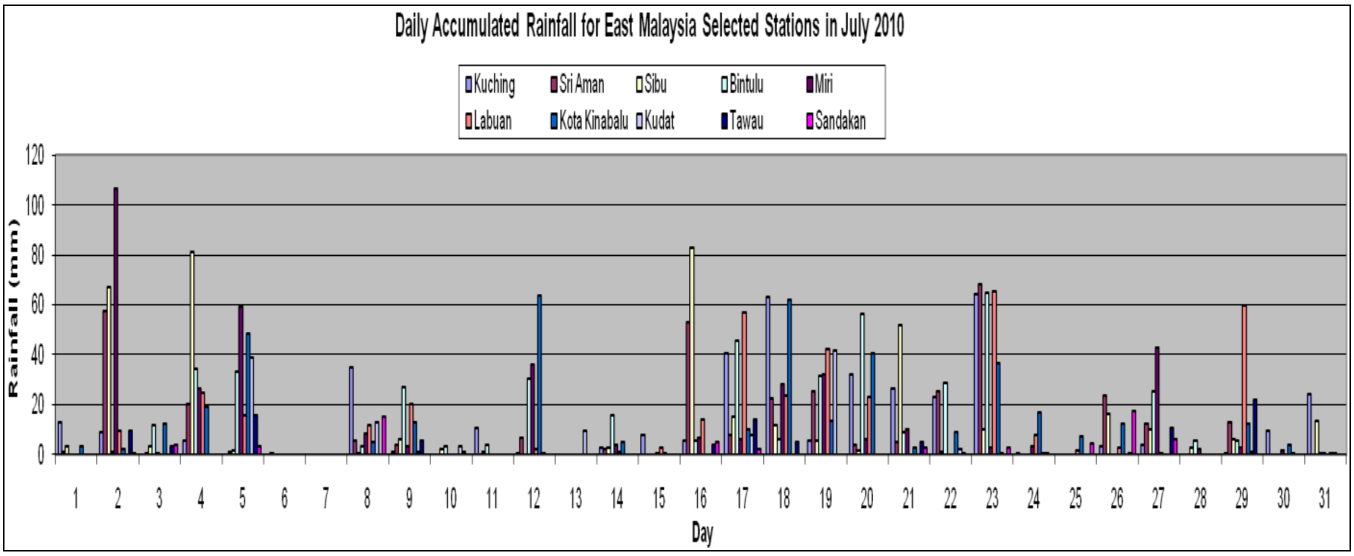


Figure 3b Daily rainfall chart of selected meteorological stations in East Malaysia for July 2010: Typhoon Conson (12/07/10 - 18/07/10) and Typhoon Chanthu (19/07/10 – 23/07/10)

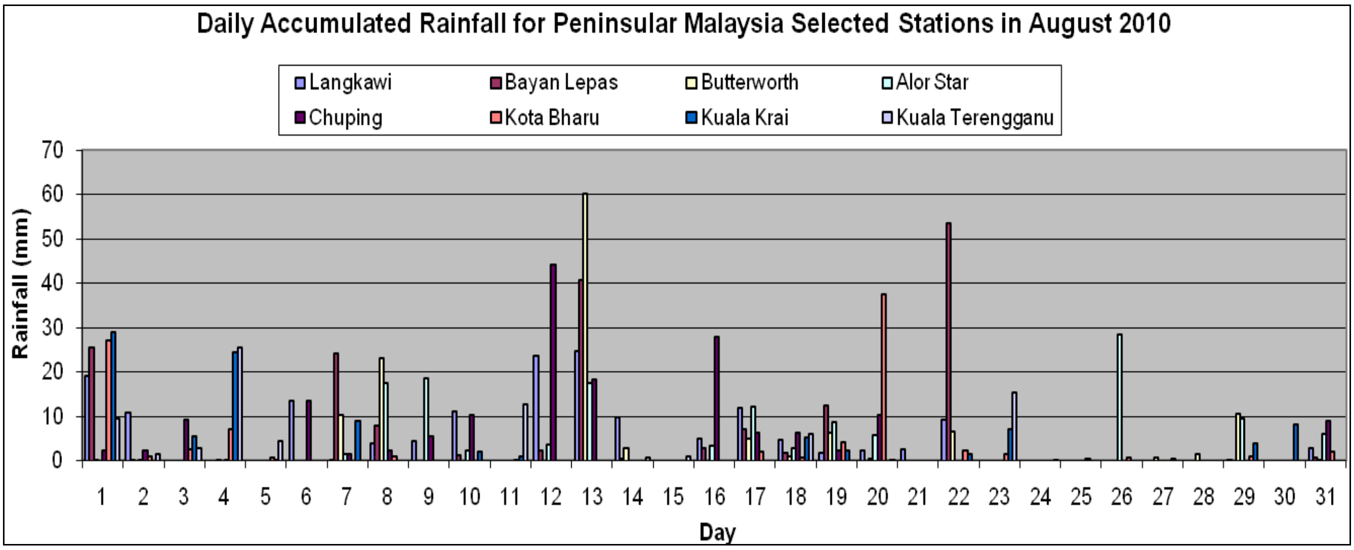


Figure 3c Daily rainfall chart of selected meteorological stations in Peninsular Malaysia for August 2010: Tropical Storm Mindulle (23/08/10 – 25//08/10) and Tropical Storm Lionrock (28/08/10 – 02/09/10)

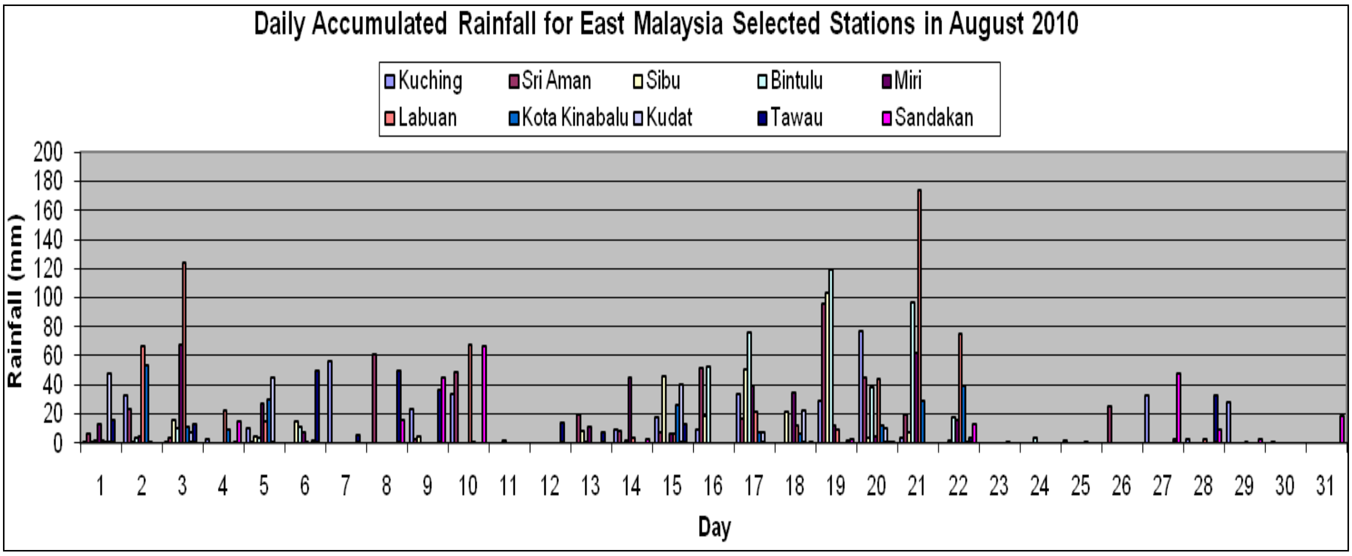


Figure 3d Daily rainfall chart of selected meteorological stations in East Malaysia for August 2010: Tropical Storm Lionrock (28/08/10 – 02/09/10)

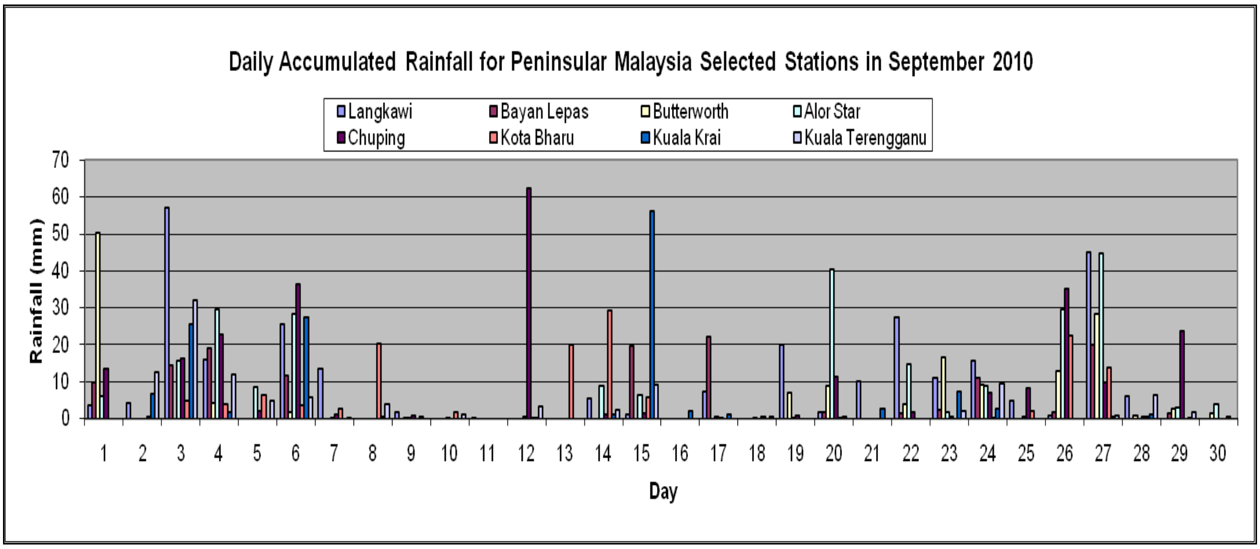


Figure 3e Daily rainfall chart of selected meteorological stations in Peninsular Malaysia for September 2010: Tropical Storm Meranti (09/09/10 - 10/09/09).

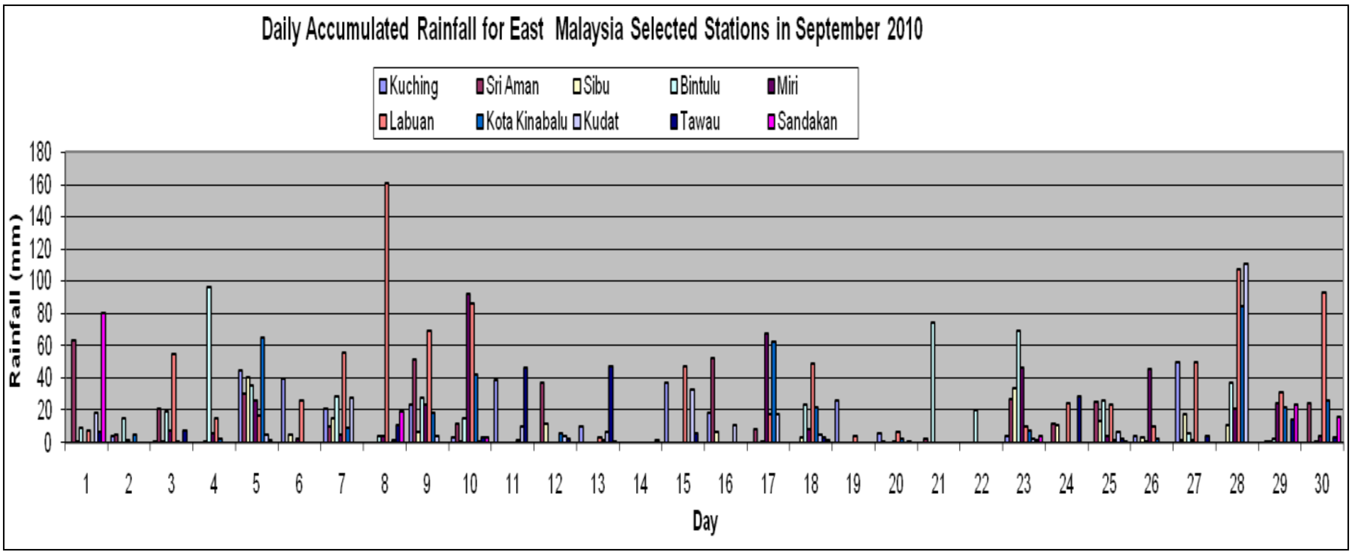


Figure 3f Daily rainfall chart of selected meteorological stations in East Malaysia for September 2010: Tropical Storm Meranti (09/09/10 - 10/09/09)

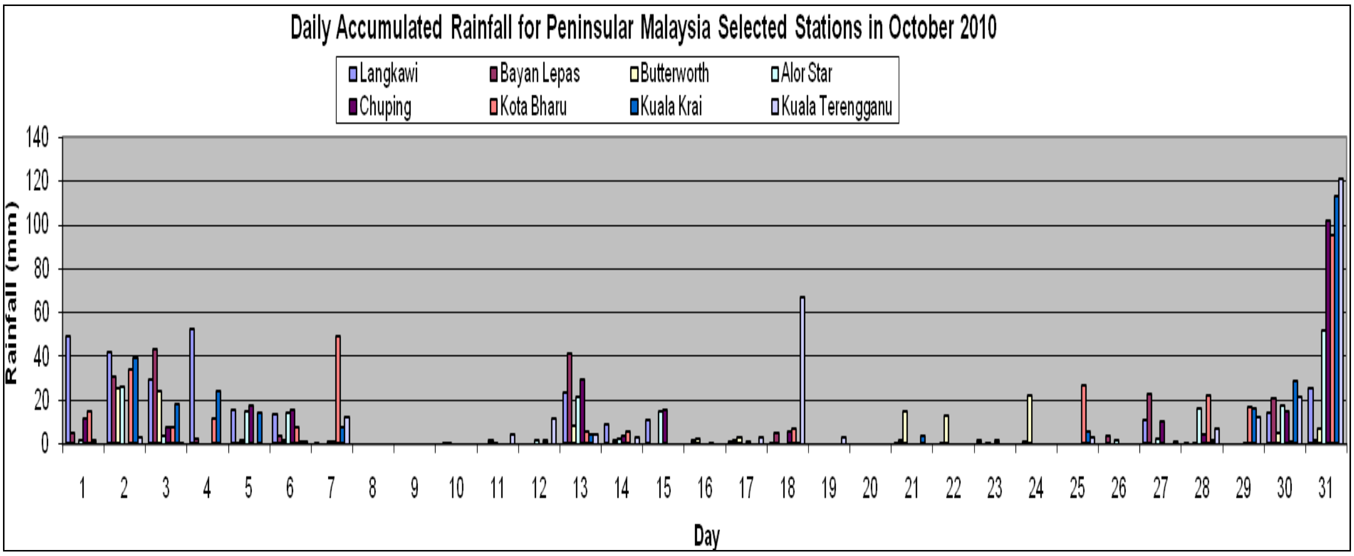


Figure 3g Daily rainfall chart of selected meteorological stations in Peninsular Malaysia for October 2010: Typhoon Megi (13/10/10 - 23/10/10).

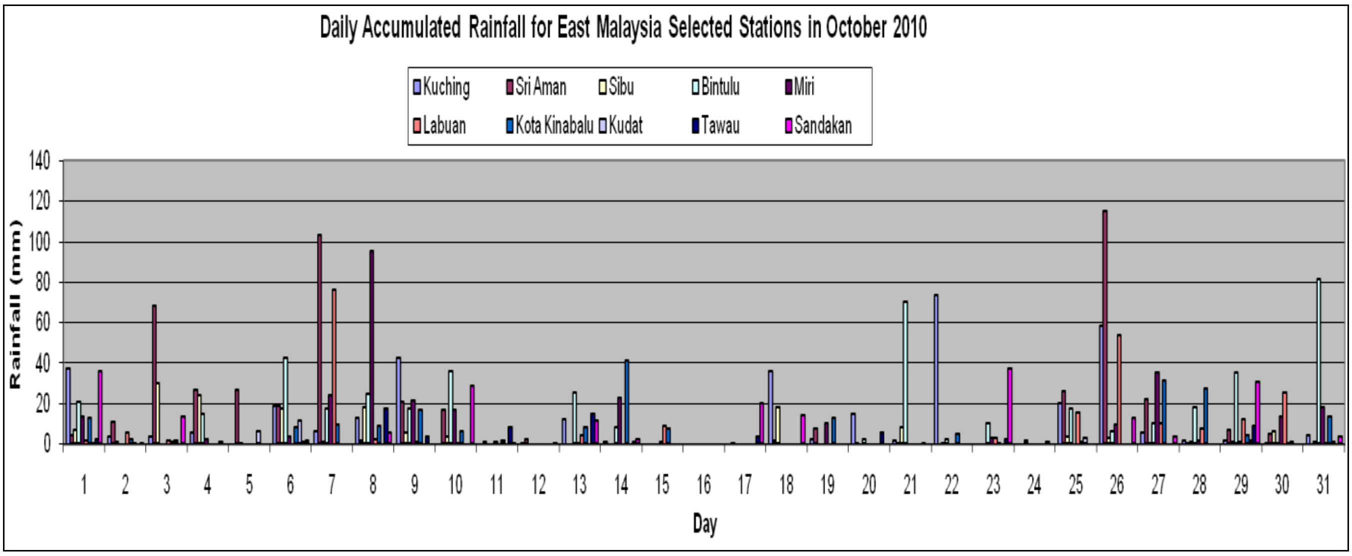


Figure 3h Daily rainfall chart of selected meteorological stations in East Malaysia for October 2010: Typhoon Megi (13/10/10 - 23/10/10)

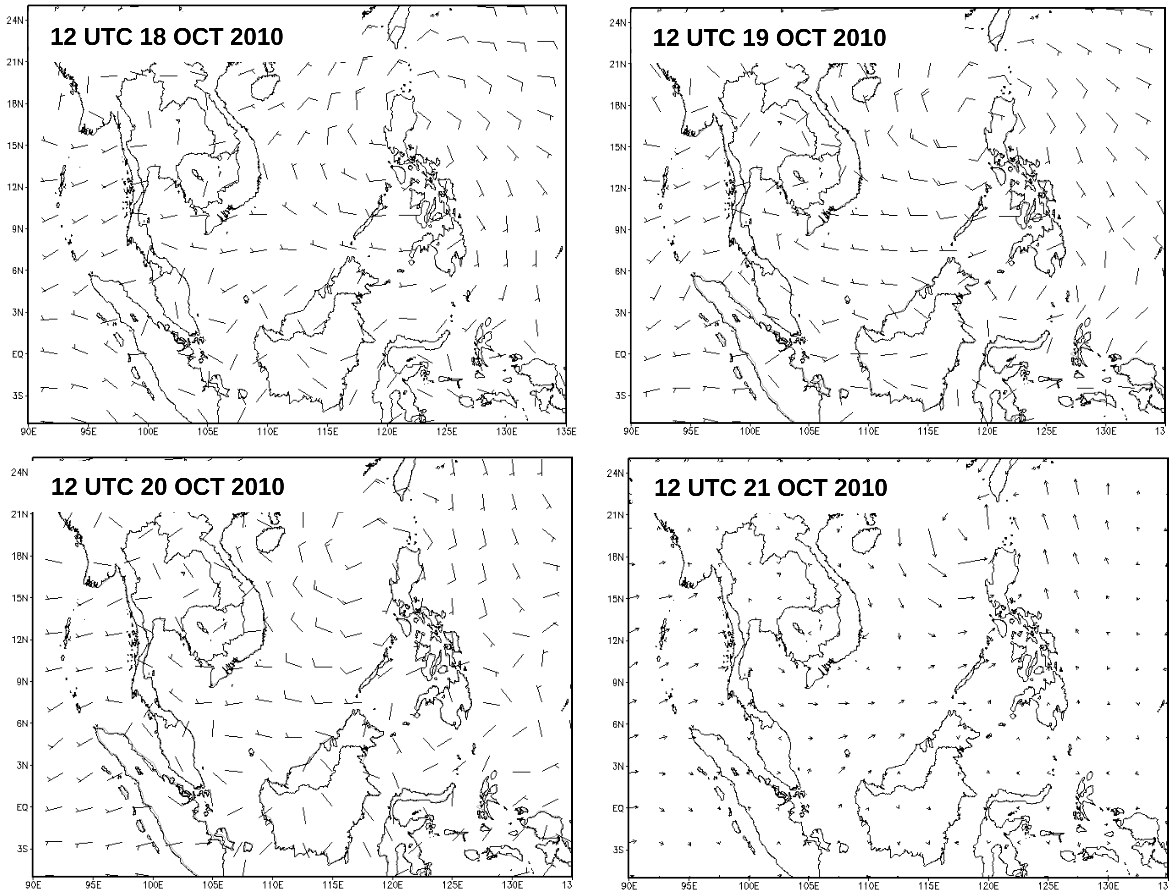


Figure 4a Surface wind charts from the Japanese Reanalysis dataset showing wind pattern during the passage of Typhoon Megi

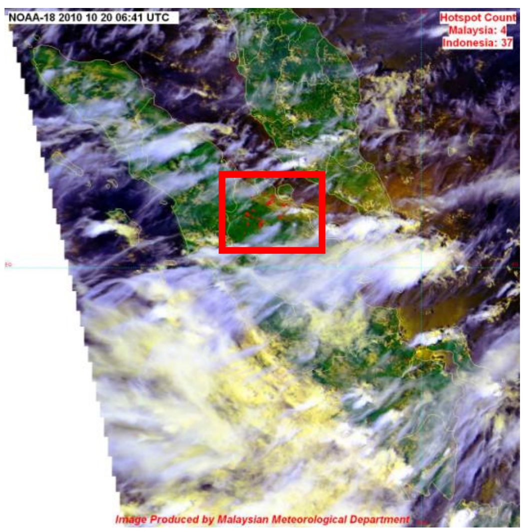


Figure 4b NOAA-18 satellite imagery showing hotspot count on 20 October 2010

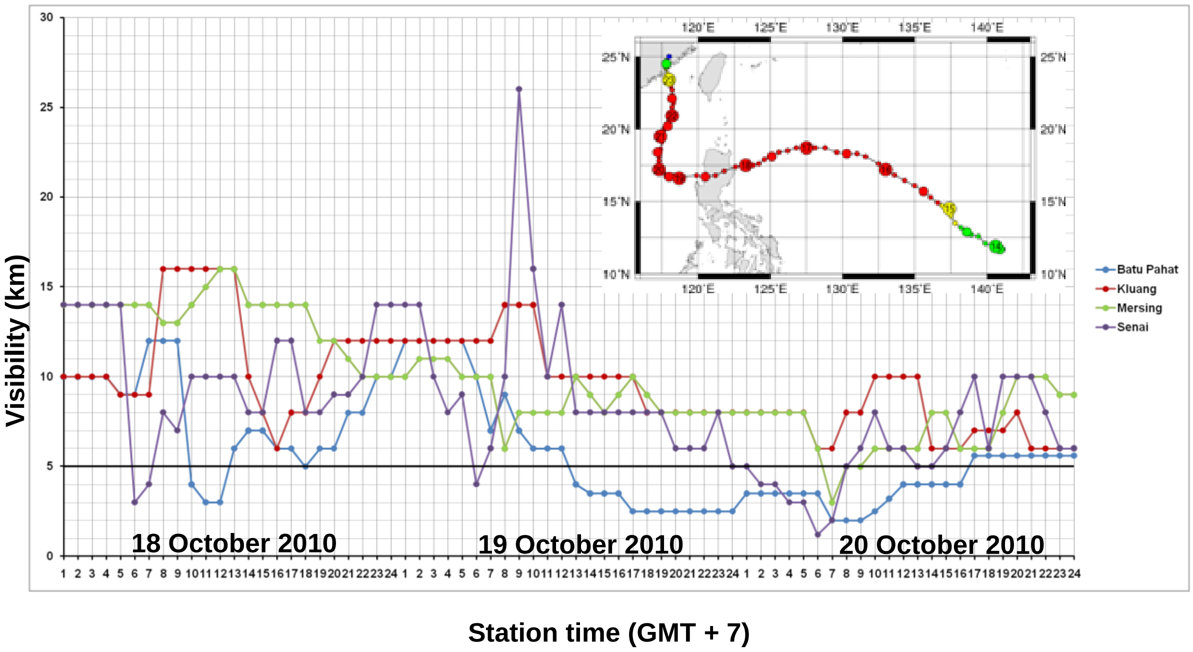


Figure 4c Observed visibility at the Principal Meteorological Stations in Johor

2. Hydrological Assessment

During the 2009 North-East Monsoon season, the northern, western and eastern regions of the Peninsular Malaysia namely Kedah, Penang, Perak, Kelantan, Terengganu, and Pahang states experienced severe floods due to prolonged heavy rainfall events. The states of Kelantan and Terengganu receive 3 periods of heavy rainfall, specifically during the first week of November, third week of November and during the first week of December 2009. Meanwhile, the states of Sabah and Sarawak, which were located in East Malaysia, received the North-East monsoon rainfall from December 2009 and extended until February 2010. **Table 3** shows the summary of flood events during 2009 North-East Monsoon season.

Table 3 Summary of flood events during 2009 North-East Monsoon season

State/River Basin	Period of Rainfall	Date of Peak Flood (2009)	Average Rainfall (mm)	Highest Recorded Daily Rainfall (mm)	Estimated Area of Flood Extent (Hectare)
Padang Terap River, Kedah	7 -12 Nov 2009	Nov 7 / 19.17m @ Kuala Nerang	101	125	14,000
Golok River, Kelantan	5 – 12 Nov 2009	Nov 7 / 18.06m @ Kusial	125	358	20,000
Besut River, Terengganu	21 – 28 Nov 2009	Nov 22 / 9.55m @ Jambatan Jerteh	316	339	18,000

The estimated cost of flood damages is RM 65 million. Approximately 50,000 people were evacuated and given shelter in flood relief centres in the states of Kedah, Perak, Pahang, Terengganu and Kelantan. The death toll during this monsoon season was nine persons. The worst affected areas were areas along the major rivers such as the Kelantan River, Golok River and Besut River.

II Summary of progress in Key Result Areas

1. Reduced Loss of Life from Typhoon-related Disasters.

1.1 Meteorological Achievements/Results

Radar System Upgrade

As part of the 9th Malaysia Plan, major upgrades were carried out to the radar station network operated by the Malaysian Meteorological Department (MMD). Up to 2009, only one (1) of the radar stations operated by the MMD is a Doppler radar. In 2010, the remaining ten (10) conventional radars were upgraded to Doppler radars. The RAPIC BOM systems of the conventional radars were replaced by the IRIS SIGNET VAISAL system. A new radar station was also constructed in Miri, Sarawak.

With the present upgraded radar stations, each of them will be able to function at two operation modes. One is the fixed operation mode, during which scans are done using 4 vertical levels and up to a range of 500km. The temporal resolution for this fixed mode is 10 minutes. The other mode is during which scans are done using 16 vertical levels and therefore of a lower range up to 300km. The temporal resolution of this higher horizontal resolution mode is 30 minutes.

1.2 Hydrological Achievements/Results

Improvement of Facilities

The Department of Irrigation and Drainage (DID) to date has installed and operated about 525 telemetric stations in 38 river basins. In addition to that, 670 manual river gauges, 1013 stick gauges and 182 flood warning boards have been set up in flood prone areas so as to provide additional information during the flood season. As part of the local flood warning system, about 395 automatic flood warning sirens are being operated.

An Integrated Flood Forecasting and River Monitoring System (iFFRM) for the Klang Valley are being developed. For this system, 88 new telemetric stations and infrastructure networks will be installed together with a flood modelling system that include both hydrometeorology and hydrodynamic. To date, infrastructure networks have been completed, while the progress for modelling has reached 90%.

An Integrated Flood Forecasting and Warning System for Muda River Basin are being developed. The objective is to develop a radar rainfall analyzer and integrator for Muda River and a real-time flood forecasting system. To date, the progress is 40%.

As reported previously, Stormwater Management and Road Tunnel Project (SMART), Kuala Lumpur had been completed in July 2007. Since then, SMART had successfully diverted flood water from entering Kuala Lumpur City Centre.

1.3 Research, Training, and Other Achievements/Results

Atmospheric Model-Based Rainfall & Flood Forecasting System (AMRFF)

To improve the efficiency of flood forecasting in Malaysia, DID has embarked on the Atmospheric Model-Based Rainfall & Flood Forecasting System (AMRFF) project. This project is to be completed by November 2010. At present, the progress of the project is 60%.

This project has two objectives:

1. To develop real-time flood forecasting based on Atmospheric Model-based Rainfall and Flood Forecasting (AMRFF) System for providing a real-time flood warning and emergency responses in a convenient lead-time to the Pahang, Kelantan and Johor River Basins.

2. To develop radar rainfall analyzer and integrator for Malaysia (RAIM) to estimate rainfall distribution and the rainfall magnitude forecast in the Pahang, Kelantan and Johor River Basins.

On The Job Training (OJT)

The fourth OJT was held from the 12 July until 6 August 2010 at the DID office (Hydrology and Water Resources Division), Kuala Lumpur, Malaysia. The programme was arranged for 20 days to cover all the modules that have been planned by the Department. Upon successful completion of the on-the-job training programme, participants would be able to:

i. Gain knowledge, appreciation and experience on the use of the Tank Model for flood forecasting

ii. Configure a flood forecasting model based on the Tank Model for a selected catchments in the participant's country

iii. Calibrate the Tank Model and preparing the model for operational use in the participant's respective organisation

iv. Develop an error correction module for the Tank Model to enhance forecast accuracy

v. Develop expertise in writing simple macros (Microsoft Excel) to automate model computations – a skill which can be used to customize the model and further enhance the model in the future

The fourth OJT was attended by 18 participants, comprising 15 engineers from the Department of Meteorology and Hydrology Lao PDR, Ministry of Water Resources of China and Ministry of Water Resources and Environment Vietnam and 3 Typhoon Committee (TC) representatives. This programme consists of 11 elements as shown in **Table 4**.

Table 4: The OJT programme schedule

No	***Training Programme***	***Type***	***Date***	***Week***	***No. of days***
1	Flood forecasting using the tank model	Lecture	12 July 2010	1	1
2	MS Excel Macros	Lecture			2
3	Configuring the Tank Model	OJT			2
4	Data quality checking and processing	OJT	19 July 2010	2	2
5	Catchment parameters – calibration of model (1)	OJT			1
6	Development of Excel macros for automating model computations	OJT		2	1
7	Fine tuning model – adjustment of flood simulation to improve forecasts – calibration of model (2)	OJT		2	1
8	Site visit to Malaysian Meteorological Department and SMART Tunnel	Site Visit	29 July 2010	3	1
9	Lecture on telemetry and SCADA, Integrating with SCADA/Telemetry System and preparing the model for real-time flood forecasting, dissemination of flood forecast	OJT	30 July 2010	3	1
10	Enhancements to model – adapting model to changes and additional modules (Fill-in Matrix/Rating Curve)	Lecture	2 August 2010	4	3
11	Reports/Discussion	-	5 August 2010	4	2
	Total No. of Days				20

2. Minimized Typhoon-related Social and Economic Impacts.

2.1 Meteorological Achievements/Results

Automatic Weather System Upgrade

Under the 9th Malaysia Plan, the Automatic Weather Station (AWS) project is expected to be completed in 2010. Under this project a further 108 AWS were added to the existing network of AWS. A higher density of AWS data made available through this system would help immensely in continuous monitoring of the weather conditions.

2.2 Hydrological Achievements/Results

Flood Forecasting and Warning (Operation)

Flood forecasting operations were carried out during the flood seasons by the respective DID state offices with technical assistance from the National Flood Forecasting Centre at DID Head Quarters. The river basins which have been provided with forecasting models are summarized in **Table 5**.

Some of the flood forecasting models have been revised in order to improve their performance. Flood forecasting models for Johor River, Muar River and Batu Pahat River are currently being revised using the real-time computerized HEC-HMS model.

Table 5 The river basins with forecasting models.

River Basin	Catchments Area (km^2)	Number of Forecasting Point	Forecasting Model
1. Muda River	4,300	2	Stage Regression
2. Perak River	14,700	3	Stage Regression
3. Muar River	6,600	2	Linear Transfer Function
4. Batu Pahat River	2,600	2	Stage Correlation
5. Johor River	3,250	2	Regression Model
6. Pahang River	29,300	3	Linear Transfer Function and Stage Regression (back-up)
7. Kuantan River	2,025	1	Tank Model
8. Besut River	1,240	1	Stage Regression
9. Kelantan River	13,100	2	Tank Model and Stage Regression (back-up)
10. Golok River	2,175	1	Stage Regression
11. Sadong River	3,640	1	Linear Transfer Function
12. Kinabatangan River	17,000	1	Linear Transfer Function
13. Klang River	1280	5	Flood Watch

3. Improved Typhoon-related Disaster Risk Management in Various Sectors

3.1 Disaster Prevention and Preparedness Achievements/ Results

Malaysia is geographically located just outside the ‘Pacific Rim of Fire” and is generally free from severe natural disasters such as earthquake and volcanic eruption. Although Malaysia is spared from the threats of severe natural disasters and calamities, Malaysia is nonetheless affected by other natural disasters especially monsoonal flood, landslide, severe haze, and strong storm surges during the monsoon season.

Hardware and/or Software Progress

3.1.1 **Emergency Command Centre (ECC)**

The Emergency Command Centre has been approved during the Mid-Term Review of the Ninth Malaysia Five-Year Plan. The Government of Malaysia through the National Security Council has agreed to start the development of the centre by early next year in 2011.

3.1.2 **Malaysian Emergency Response System (MERS 999)**

The establishment of a single emergency number "999" for the entire nation will make it easier for the public to contact emergency service providers, namely the police, ambulance, fire station and civil defence rescue units. With the new system, specially-trained service professionals form the 999 Emergency Call Service Centre would handle all emergency calls and reroute them to respective emergency service providers, complete with digital data on the type of emergency and location.

The 999 emergency number is free of charge and any emergency call will be answered and vetted within 10 seconds. All 999 call centres are connected to the agencies through a virtual private network. The telephone number and location of callers will be identified through automatic number identification and automatic location identification with the help and sharing of information between telecommunication service providers.

3.1.3 **Government Integrated Radio Network (GIRN)**

A Government Integrated Radio Network (GIRN) project was introduced to provide secure digital trunk radio system between the various Government agencies in Malaysia as a study showed that there are currently more than 12 radio networks used by the various agencies. The introduction of the GIRN project preserves the autonomy and freedom of the various agencies while providing a unified network of shared infrastructures.

GIRN will certify that every agency's network would be physically and virtually separated. Every agency would manage the equipments and assets on its own. It can utilise and manage the network using its own and unique command and control policy. The network is virtually separated by using different System Number for each agency. In case of emergency or disaster, all agencies communicate in one single radio channel. GIRN is targeted to cover 95% of Malaysia's populated land and areas extending 10 nautical miles from the shoreline.

3.1.4 **Fixed Line Alert System (FLAS)**

The Fixed Line Alert System (FLAS) or Disaster Alert System (DAS) will enable the Government, specifically the National Security Council and the Malaysian Meteorological Department to disseminate early warning messages to selected communities who subscribe to fixed line telephone when a disaster occurs. When the system is triggered, pre-recorded emergency voice messages on the early warning of potential catastrophic disasters such as tsunami will be broadcasted immediately to Telekom Malaysia's fixed line subscribers.

3.2 Implications on Operational Progress

3.2.1 **Disaster Management and Relief Committee**

For the year 2010, Minister at the Prime Minister's Department, as the Chairman of the National Disaster Management and Relief Committee, chaired two flood disaster preparation and mitigation meetings to assess the level of preparedness among disaster management agencies in emergency response, recovery and rehabilitation for the flood victims.

Similar preparation and mitigation meetings are also held at the respective state and district levels. The committee is responsible to evaluate a situation and to determine the level and scope of disaster; to formulate plan of action; to determine the capability in handling disaster and the need to request for assistance whether from within or outside the country.

3.2.2 Reviewing the Directive No. 20 of the National Security Council (NSC)

To facilitate the management of disasters, NSC is tasked to coordinate efforts among the various agencies involved in disaster management. The National Security Council Directive No. 20: *The Policy and Mechanism on National Disaster and Relief Management* was established on 11 May 1997 to provide inter-agency coordination in disaster management.

Due to the uncertainty and complexity of disasters, measures are taken to review and upgrade Directive No. 20 to ensure that it remains relevant and up to date in meeting these challenges. The NSC is taking steps by having meetings at regular intervals with related agencies to conduct the review exercise.

The Department of Social Welfare has 4 main tasks as stipulated in the Standard Operational Procedures (SOP) under the Directive as follows:

i. Management of evacuation centers;

ii. Assistance in the form of food, clothing and other necessities including family disaster kit;

iii. Registration of victim; and

iv. Guidance and counseling

The Department of Social Welfare which is in charge of preparing the relief centers, food supply and registration of disaster victims will identify suitable potential relief centers in the whole country. At the same time the department also has to establish good networking with food suppliers at strategic places. On top of that, the depots for food and other necessities storage at the zone level such as north, south, east and central of Peninsular Malaysia were established. For the year 2009, the department had identified 4,744 relief centres which can accommodate 1.3 millions disaster victims at a time.

In term of training for social workers and volunteers, the department had conducted 31 training sessions for 3,239 people (1,750 social workers and 1,489 volunteers) in 2009. The objectives of these trainings are to provide knowledge and skills for officers and volunteers to work professionally in helping the disaster victims. On top of that, the Department of Social Welfare also continued to assist the families who are seriously affected by disaster in order to help them to return to their normal daily life. This is considered as a long-term intervention or management process.

3.2.3 National Disaster Relief Trust Fund (NDRF)

National Disaster Relief Trust Fund was changed from a normal fund to a trust fund in 2005 to enable the general public and the private sector to contribute in assisting disaster victims. Financial sources for the fund comprise of both annual budget allocation from the government and contributions from the public and private sectors. The types of financial assistance provided are for the following eventualities:

i. loss of income;

ii. damaged/demolished house;

iii. agricultural damage;

iv. livestock and aquaculture damage; and

v. burial cost for fatalities due to disasters

The trust fund is administered in accordance with a letter of trust which is subjected to Section 10 of the Financial Procedure Act 1957. The letter allows the usage of the trust fund for extending financial aid and relief supplies to foreign countries affected by disasters.

In the year 2010, Malaysia has contributed more than USD 2 million in terms of cash money, medicines, medical equipments, tents and daily necessities to help victims of the great flood in Pakistan.

3.2.4 Central Store

During the National Disaster Management and Relief Committee Meeting No. 1/2006 on 5 January 2006, the Prime Minister of Malaysia, as chairman of the committee highlighted the need to relocate and deploy search and rescue (SAR) assets in a strategic location / storage facility.

At the National Disaster Management and Relief Committee meeting No. 1/2007, the Prime Minister requested that a centralised store for SAR utilities and equipments should be established. This storage facility is managed together by the National Security Council, the Armed Forces, the Welfare Department and the Royal Malaysia Police.

The establishment of this facility at the Defense Supplies Depot in Sungai Buloh allows centralised procurement of the much needed assets and equipments for disaster relief operations such as rescue boats, mobile toilets and heavy trucks as required at the local level all across Malaysia. These assets are managed by state offices of the National Security Council and coordinated in their deployment via the role of the NSC as secretariat for the Disaster Management and Relief Committee at the district and state levels respectively.

3.3 Regional Cooperation Achievements/Results

3.3.1 Regional Cooperation

At the regional level, Malaysia is an active member of the Association of South East Asia Nations (ASEAN) and is a member of the ASEAN Committee on Disaster Management (ACDM). In ensuring cooperation among Member States, the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) was signed on 26 July 2005. The agreement has entered into force on 24 December 2009.

In line with the Agreement, States are called upon to designate National Focal Points and competent authorities to coordinate regional Humanitarian Assistance and Disaster Relief Operations (HADR), to support the establishment of ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre) as well the ASEAN Standby Arrangements for Disaster Relief and Emergency Response (SASOP). The standby arrangements require Malaysia to earmark assets on voluntary basis to be shared with other Member States who are in need of assistance.

3.3.2 Fourth Asian Ministerial Conference on Disaster Risk Reduction

Malaysia participated in the Fourth Asian Ministerial Conference on Disaster Risk Reduction (4^{th} AMCDRR) which took place at Incheon, Republic of Korea from 25 – 28 October 2010 with the main theme "Climate Change Adaptation through Disaster Risk Reduction". Malaysia's participation in the said conference was deemed important to the country as it is a continuation of Malaysia's initiatives through the hosting of the previous 3^{rd} AMCDRR.

4. Strengthened Resilience of Communities to Typhoon-related Disasters.

4.1 Hydrological Achievements/Results

Technical Advancement

The Infobanjir website (http://infobanjir.water.gov.my) continues to be enhanced and improved in terms of IT technology, hardware, procurement and network expansion as well as its contents to meet the customer's requirement. It has recently included rainfall isohyet maps where users can monitor and assess the severity of rainfall of the previous events. It has also included the improvement of on-line flood reporting in order to expedite the dissemination of the flood reports to the top management level.

The active on-going projects carried out by DID are as follows:

i. Flood Diversion (Keruh Diversion, Gombak Diversion etc.)
ii. Retention Pond (Sri Johor, Taman Desa, Batu, Jinjang etc.)
iii. 1.8 km stretch of Sg. Kerayong

4.2 Research, Training, and Other Achievements/Results

Enhancement of Public Education and Awareness

To instill disaster risk reduction awareness among the public, various initiatives were introduced. These include awareness programmes for disasters such as landslides, tsunami, and floods by the MMD, Ministry of Education and Ministry of Science, Technology and Inovation. These initiatives were conducted in schools, universities and hospitals.

MMD in collaboration with the Ministry of Education had organized a total of 95 awareness programmes in regard to extreme weather and its impact in various schools and universities throughout the country. Out of the 95 awareness programmes conducted by the MMD, 48 public education and awareness programmes were conducted by the Regional Offices, 44 by the Training Division and 3 by the Geophysics and Tsunami Division. The Ministry of Science, Technology and Innovation had also carried out 3 such awareness programmes at the national level.

5. Improved Capacity to Generate and Provide Accurate, Timely, and understandable Information on Typhoon-related Threats.

5.1 Meteorological Achievements/Results

The Shanghai Typhoon Institute's Bogus Data Assimilation (BDA) Typhoon Bogussing Scheme was successfully implemented on an operational basis in December 2009 to improve the cyclone vortex representation in the MM5 model at MMD. In the BDA scheme, bogus sea level pressure data are ingested as an observation field based on the Fujita's formula, and all model fields will be adjusted accordingly under the constraints of the MM5 model. Tropical cyclone analysis data from CMA are used to update the cyclone's central pressure, maximum wind speed and location. Currently, the bogussing scheme is configured for the Southeast Asian domain from 90°E to 130°E and 0°N to 20°N. The bogussing scheme will be turned on whenever a tropical cyclone with central pressure of less than 1000 hPa is located within the domain.

The MM5 with the BDA Typhoon Bogussing Scheme has performed well during the passages of Chantu, Dianmu, Mindulle and Megi over the South China Sea in 2010. The tracks of these tropical cyclones were more accurately predicted compared to the MM5 model without the bogussing scheme. More verification of track forecasts is being conducted and further research in cyclone intensity and structural changes, landfall processes, ensemble prediction techniques of cyclone tracks and assimilation of non-conventional data (radar and satellite) will be undertaken in the near future to improve the bogussing scheme's performance.

5.2 Research, Training, and Other Achievements/Results

Research and Training

An officer from MMD was sent to attend the Asia Pacific Typhoon Workshop in Manila, Philippines on 27 – 28 Jan and another officer attended the Typhoon Committee Roving Seminar in Ubon Ratchathani, Thailand on 30 Nov – 3 Dec 2010.

Current research activities at the MMD Research Division include three studies which are related directly to tropical cyclones. The three studies are:

i. The Impact of Tropical Cyclones in the Western Pacific Ocean and South China Sea on the Rainfall in Malaysia.

ii. The Impact of Tropical Cyclones in the Bay of Bengal on the Rainfall in Peninsular Malaysia.

iii. Influence of Tropical Cyclones in the Western Pacific Ocean and South China Sea on the Tropospheric Circulation and Weather Pattern over the Asian Monsoon Region during the Pre-monsoon, Monsoon and Post-monsoon Seasons.

The first two of the papers are completed and the third is in the drafting stage.

The courses, seminars and conferences related to flood and hydrology organized by DID during the year are as follows:

i. One-day Seminar on R&D in Hydrology, Kuala Lumpur, 18 January 2010

ii. Course on Hydrological Application, Sarawak, 5 May 2010

iii. Course on Flood Operation, Sarawak, 6 May 2010

iv. National Conference on Hydrology and Environment, Batu Pahat, 23-24 June 2010

v. “4th On The Job Training (OJT)”, DID Kuala Lumpur, 12 July – 6 August 2010

vi. Course on Flood Forecasting and Warning System, Kelantan, 20 - 22 July 2010

vii. Course on Flood Management, Sarawak, 27 – 29 July 2010

viii. 4th International Course on Flood Mitigation and Storm water Management 2010, DID Kuala Lumpur, 4 – 22 Oct 2010

5.3 Information and Communication Technology (ICT)

The MMD ICT Division has upgraded the Computer Message Switching System (CMSS) and start using the new system from August 2010. This new system is used to manage transmission of meteorological data and information locally and internationally that include Global Telecommunication System (GTS) and Aeronautical Fixed Telecommunication Network (AFTN) messages.

The development of the Malaysian Integrated Forecasting System (MIFS) is expected to be completed by November 2010. This system comprises of visualization and product generation systems and internal web. The visualization and product generation systems are able to generate various meteorological and marine products including observations from the land surface stations, marine, upper air, radars, satellites and also the forecast products from various numerical weather prediction models. This system is capable to give an alert based on predefined criteria like maximum wind speed and position of tropical cyclone in certain area.

Most of these products are distributed through internal web to forecast offices to help MMD’s staff monitoring the weather and issuing weather forecasts and warnings to the public and clients. This internal web is also opened to external agencies that involved in disaster management to enable them to obtain information that are related to weather in real time.

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