MEMBER REPORT

ESCAP/WMO Typhoon Committee

12th Integrated Workshop

(MALAYSIA)

29 October 2017 – 3 November 2017

Jeju, Republic of Korea

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I. Overview of tropical cyclones which have affected/impacted Malaysia in 2017

1. Meteorological Assessment (highlighting forecasting issues/impacts)

In total eleven typhoons and eleven tropical storms (tropical storm intensity or higher) developed over the western Pacific Ocean, the Philippines region, and the South China Sea from January to October 2017. Two typhoons and nine tropical storm developed in July 2017 followed by three typhoons and three tropical storm in August 2017. It was very active in July this year as compared last year. The observed typhoons and tropical storms are listed along with details regarding their lifetimes, regions of formation, starting and ending dates as well as their highest wind speeds in Table 1.

Two typhoons and five tropical storms, respectively, warranted the issuance of strong wind/rough sea warnings over marine regions under the responsibility of the Malaysian Meteorological Department (MMD). The map of Malaysia territorial waters and the trajectories of the six typhoons or tropical storms closest to Malaysia are illustrated in **Figure 1a and Figure 1b** below. **Table 2** recounts the number of warnings issued by MMD for each typhoon and tropical storm. However, none of these typhoons or tropical storms was close enough to directly or indirectly cause significant loss of neither life nor properties within Malaysia.

The impacts of typhoons and tropical storms over the Malaysian region were restricted to rainfall events and gusting due to the tail effect of the typhoons and tropical storms. The tail effect is generally responsible for enhancing afternoon convective weather over Malaysia, especially in northern Peninsular Malaysia, Sabah and coastal Sarawak. The satellite imageries of rain cloud clusters centered upon the Malaysian region during the transits of typhoon or tropical storms close to Malaysia are shown in **Figure 2**. The images were derived from the HIMAWARI-8 Infrared Grey Scale channel. 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.

Figure 3 illustrates the wind flow at 1000hPa atmospheric pressure level during the transits of typhoons or tropical storms closest to Malaysia. The charts were derived from the Global Forecast System (GFS) analysis. Daily rainfall graphs of chosen meteorological stations in the Peninsular and east Malaysia were usedto depict rainfall events induced by the tail effect of typhoons and tropical storms. Monthly

rainfall charts in June, July, August and September 2017 covering the typhoon or tropical storm events affecting the country are shown in **Figures 4a to 4j**.

Qualitative analysis of **Figure 2** (satellite imageries) as well as **Figures 4a to 4j** (daily rainfall charts) revealed rain cloud bands associated with typhoons and tropical storms over Malaysia. However, the rainfall charts of August 2017 **(Figures 4e to 4f)** clearly showed a wet period over the north and the east coast of Peninsular Malaysiaas well as in East Malaysia. The enhanced rainfall intensity happened over the same time as tropical storm Pakhar.

The satellite imageries in **Figure 2**, also displayed the tail effect of Tropical Storms Merbok, Talas and Pakhar; and Typhoon Doksuriand Lan over Malaysia. Subsequent examination of rainfall charts in **Figures 4g to 4h** showed a spike in daily rainfall over selected stations in the north of Peninsular Malaysia along with the west coast of East Malaysia during the event of typhoon Doksuri.

Recently, Typhoon Lan had causedheavy rainfall with strong winds over eastern and northern parts ofSabah as well as Federal Territory of Labuan had caused flooding over certain areas in Kudat and Kota Belud, Sabah. **Figure 4j** showed a spike in daily rainfall over selected stations in the East Malaysia during the event. Nevertheless, typhoons and tropical storms are not the only factors contributing to heavy rainfall in Malaysia. There are cases whereby severe rainfall occurred during typhoon events but may not be associated with it.

Table 1: List of typhoons and tropical storms with JTWC classification, date of birth and death and maximum wind from January until October 2017

No.	Tropical Cyclone	JTWC Classification	Date		Max Wind (knots)
			Birth	Death	
1.	MUIFA*	Tropical Storm	25/04/2017	27/04/2017	35
2.	MERBOK@	Tropical Storm	11/06/2017	13/06/2017	55
3.	NANMADOL#	Tropical Storm	02/07/2017	05/07/2017	55
4.	TALAS@	Tropical Storm	15/07/2017	17/07/2017	50
5.	NORU*	Typhoon	21/07/2017	08/08/2017	100
6.	KULAP!	Tropical Storm	21/07/2017	25/07/2107	40
7.	ROKE#	Tropical Storm	22/07/2017	23/07/2017	35
8.	SONCA@	Tropical Storm	23/07/2017	25/07/2017	35
9.	NESAT#	Typhoon	26/07/2017	30/07/2017	80
10.	HAITANG@	Tropical Storm	29/07/2017	31/07/2017	45
11.	NALGAE*	Tropical Storm	02/08/2017	06/08/2017	45
12.	BANYAN*	Typhoon	11/08/2017	17/08/2017	75
13.	HATO#	Typhoon	20/08/2017	24/08/2017	80
14.	PAKHAR#	Tropical Storm	24/08/2017	27/08/2017	55
15.	SANVU*	Typhoon	28/08/2017	03/09/2017	80
16.	MAWAR#	Typhoon	31/08/2017	04/09/2017	50
17.	GUCHOL#	Typhoon	06/09/2017	06/09/2017	35
18.	TALIM*	Typhoon	09/09/2017	15/09/2017	95
19.	DOKSURI#	Typhoon	12/09/2017	15/09/2017	80
20.	KHANUN*	Typhoon	12/10/2017	16/10/2017	80
21.	LAN#	Typhoon	15/10/2017	22/10/2017	95
22.	SAOLA*	Tropical Storm	24/10/2017	29/10/2017	

Remarks:

1. Number of tropical cyclones originated from:

*	Western Pacific Ocean region:	8
!	Central Pacific region:	1
#	Phillipines region:	9
@	South China Sea region:	4

2. JTWC: Joint Typhoon Warning Centre

Table 2: Tropical Cyclone Advisories and Warnings Issued by MMD from January to until October 2017

No.	Tropical Cyclone	JTWC Classification	Date		Total No. Strong Wind / Rouh Seas Warnings due to Tropical Cyclones (area affected)
			Birth	Death	
1.	MERBOK@	Tropical Storm	11/06/2017	13/06/2017	11(Selangor, Negeri Sembilan, Malacca, Sarawak (Mukah&Rejang) and Sabah (Sandakan &Tawau), Condore, Reef South, Reef North, Layang-layang and Sulawesi)
2.	TALAS@	Tropical Storm	15/07/2017	17/07/2017	18 (Phuket, Samui, Condore, Reef North, Layang-Layang and Palawan)
3.	SONCA@	Tropical Storm	23/07/2017	25/07/2017	17 (Phuket, Reef North, Layang-Layang and Palawan)
4.	NESAT#	Typhoon	26/07/2017	30/07/2017	26 (Phuket, Reef North, Layang-Layang and Palawan)
5.	HAITANG@	Tropical Storm	29/07/2017	31/07/2017	7 (Phuket, Reef North, Layang-Layang and Palawan)
6.	HATO#	Typhoon	20/08/2017	24/08/2017	5 (Reef North, Palawan, Labuan and Sulu)
7.	PAKHAR#	Tropical Storm	24/08/2017	27/08/2017	17 (Northern Straits of Malacca, Condore& Labuan)
8.	MAWAR#	Typhoon	31/08/2017	04/09/2017	5 (Straits of Malacca & Reef South)
9.	DOKSURI#	Typhoon	12/09/2017	15/09/2017	26 (Phuket, Straits of Malacca, Kuching, Reef South and Labuan)
10.	KHANUN*	Typhoon	12/10/2017	16/10/2017	8 (Condore, Reef North, Layang-layang, Reef South, Labuan dan Palawan)
11.	LAN#	Typhoon	15/10/2017	22/10/2017	9 (Condore, Reef North, Layang-layang, Reef South, Labuan dan

					Palawan)

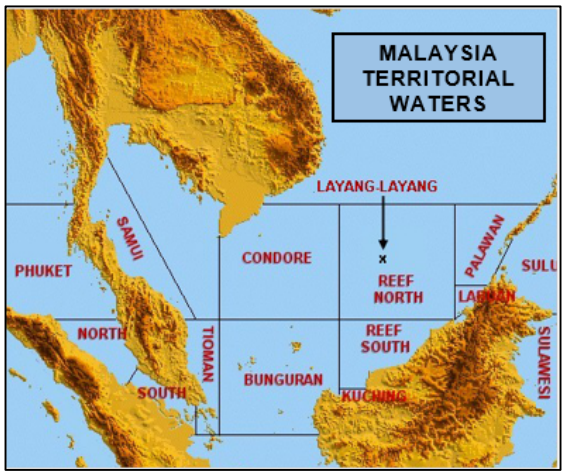
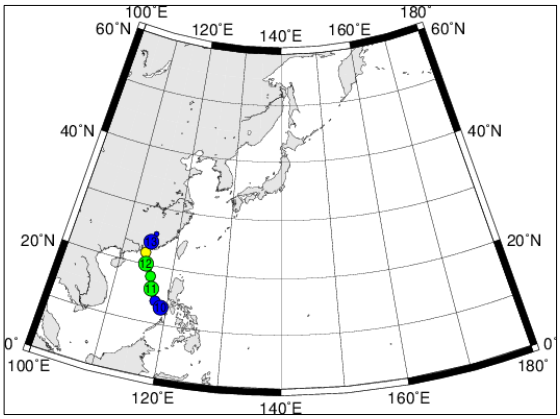
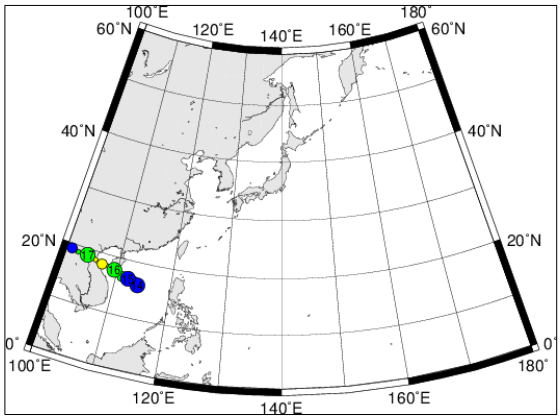


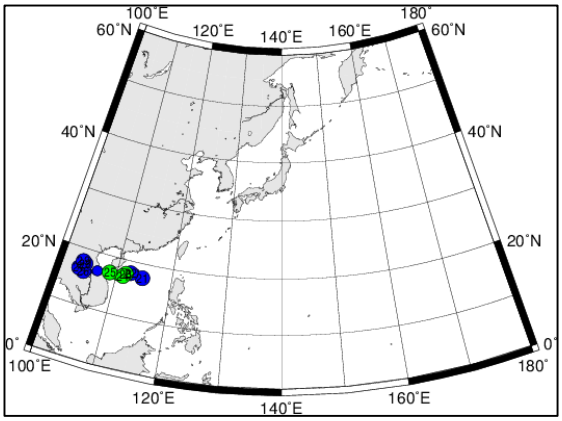
Figure 1a: Map of Malaysia territorial waters



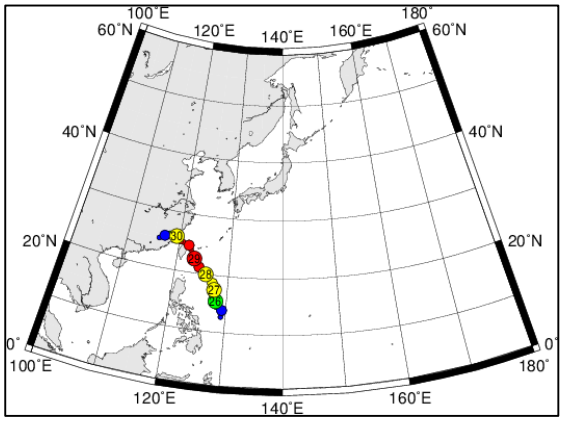
MERBOK



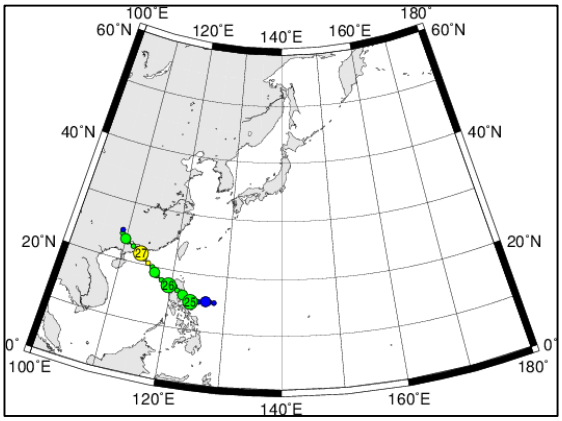
TALAS



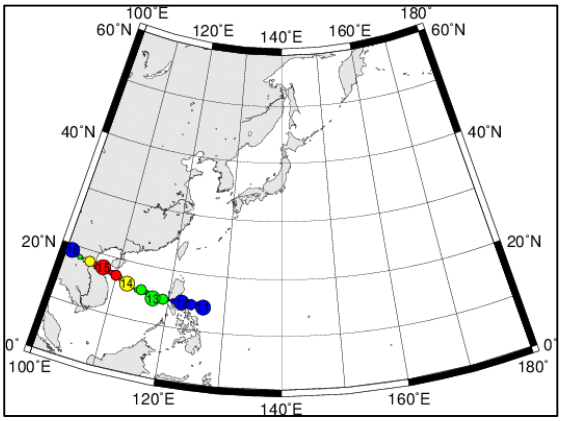
SONCA



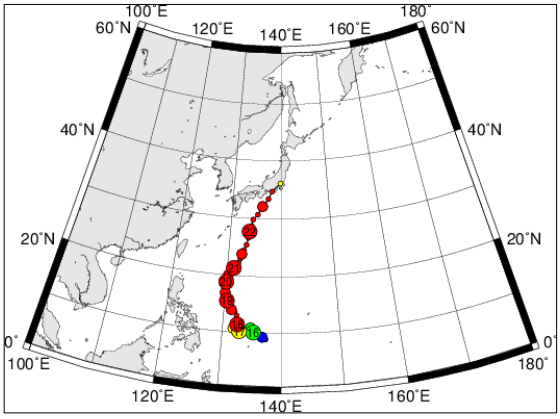
NESAT



PAKHAR

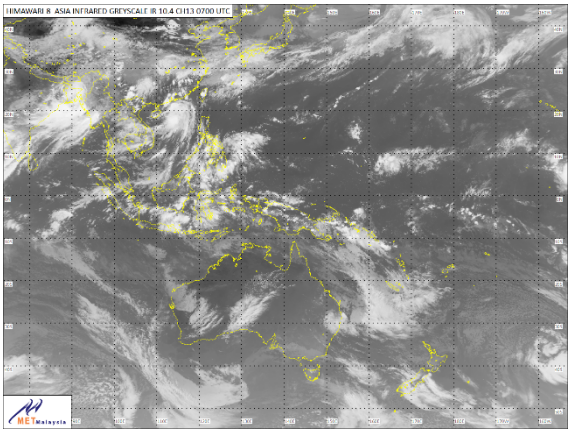


DOKSURI



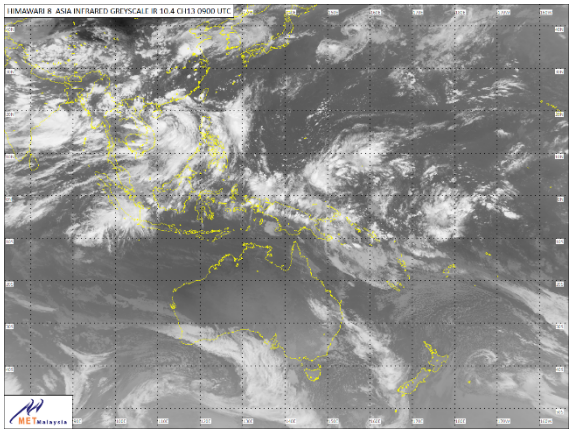
LAN

Figure 1b: Tracks of seven typhoons and tropical storms affecting Malaysia from January until 22 October 2017. The circled numbers represents the date of occurrence of the typhoons and tropical storms (Source: National Institute of Informatics (NII), Research Organization of Information and Systems (ROIS), Japan http://agora.ex.nii.ac.jp/digital-typhoon/latest/track).



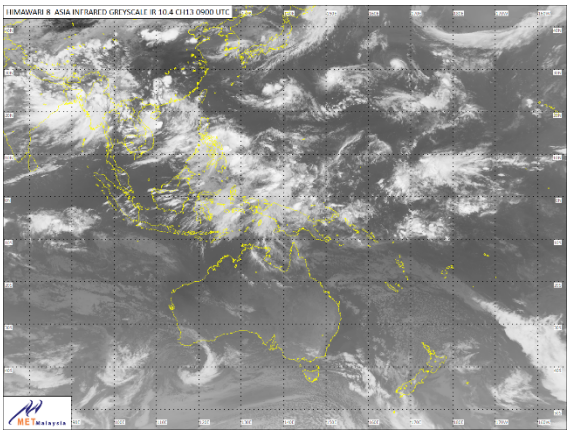
MERBOK

Image produced by Malaysian Meteorological Department on 07:00UTC 12/06/2017



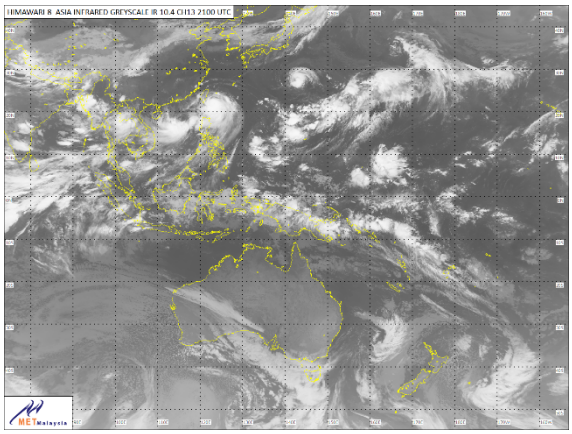
TALAS

Image produced by Malaysian Meteorological Department on 09:00UTC 15/07/2017



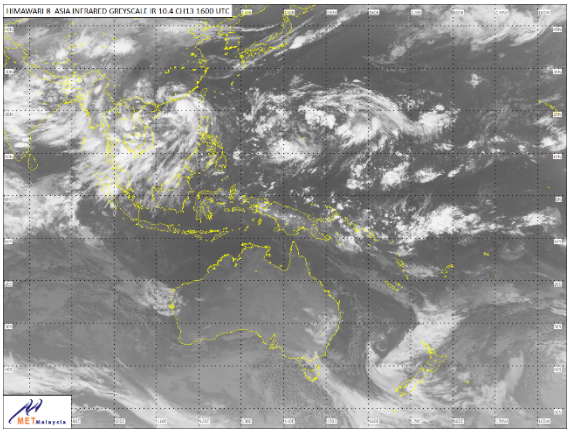
SONCA

Image produced by Malaysian Meteorological Department on 09:00UTC 23/07/2017



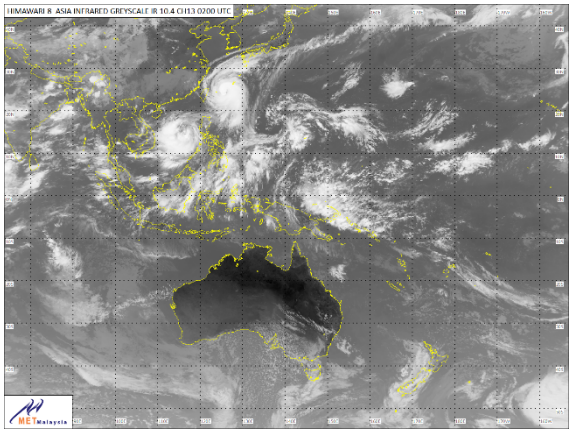
NESAT

Image produced by Malaysian Meteorological Department on 21:00 28/07/2017



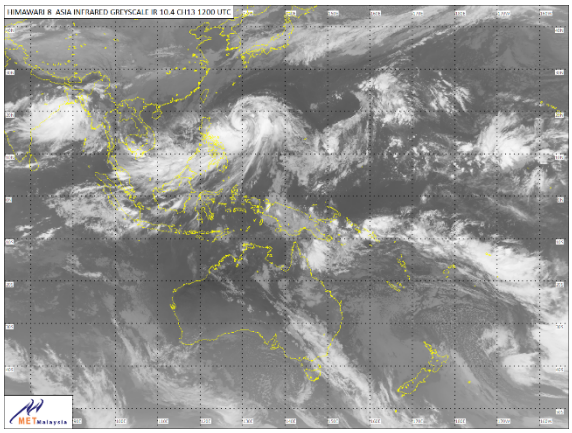
PAKHAR

Image produced by Malaysian Meteorological Department on 16:00UTC 26/08/2017



DOKSURI

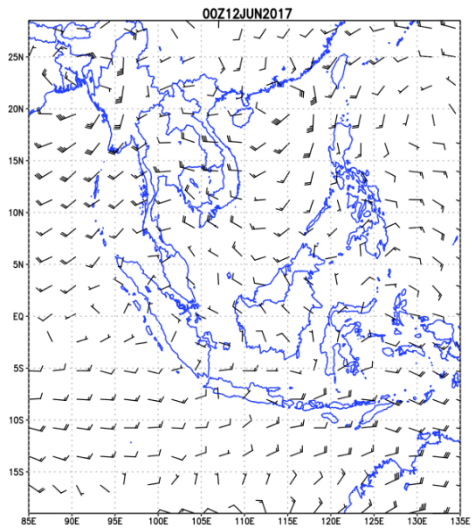
Image produced by Malaysian Meteorological Department on 02:00UTC 13/09/2017



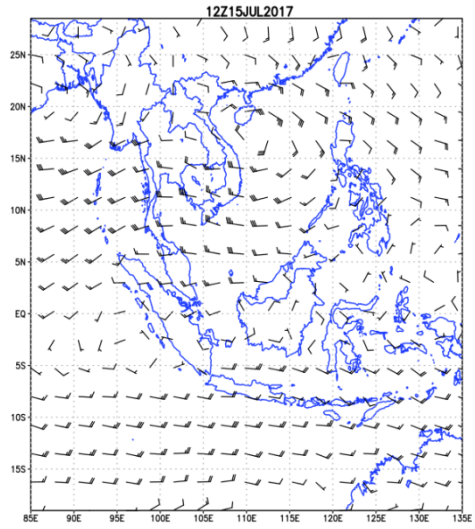
LAN

Image produced by Malaysian Meteorological Department on 12:00UTC 19/10/2017

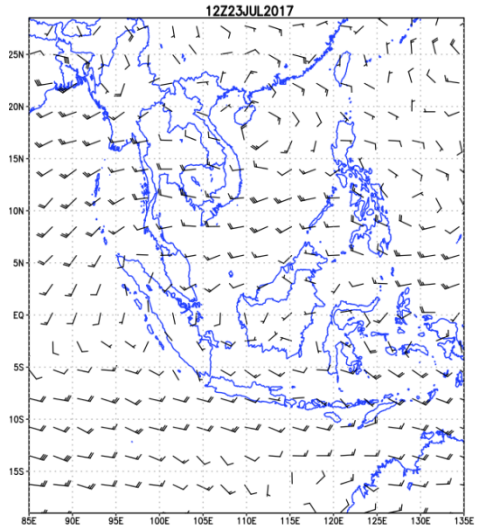
Figure 2: HIMAWARI-8 Infrared Grey Scale satellite imageries showing the rain cloud clusters associated with some of the selected tropical storms and cyclones over the Malaysian region



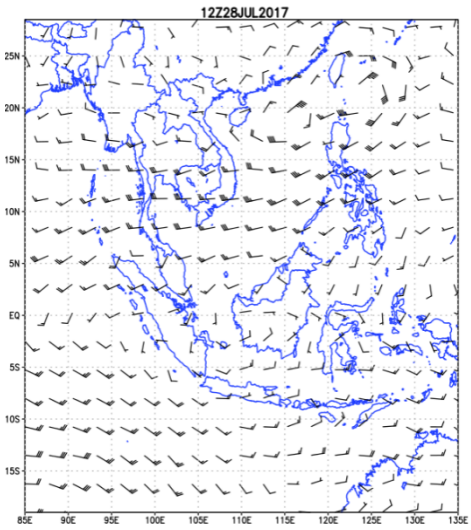
MERBOK



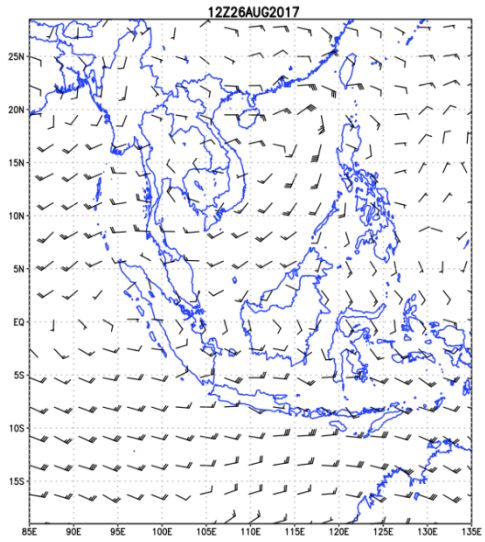
TALAS



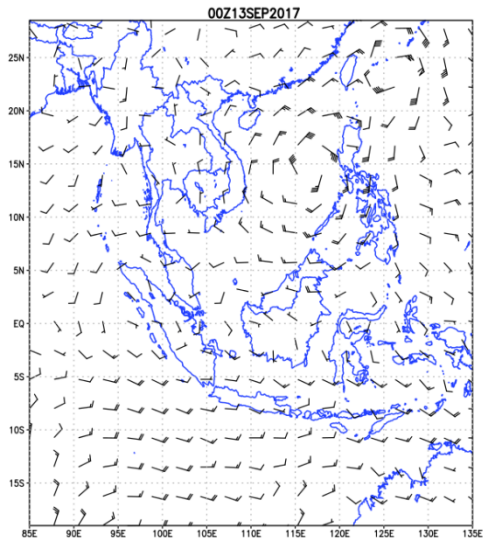
SONCA



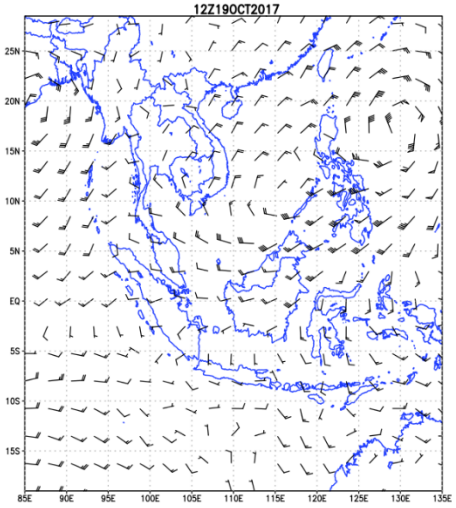
NESAT



PAKHAR



DOKSURI



LAN

Figure 3: 1000hPa wind charts from the Global Forecast System showing wind patterns during the passage of tropical storms MERBOK, TALAS, SONCA, and PAKHAR and Typhoon NESAT, DOKSURI and LAN.

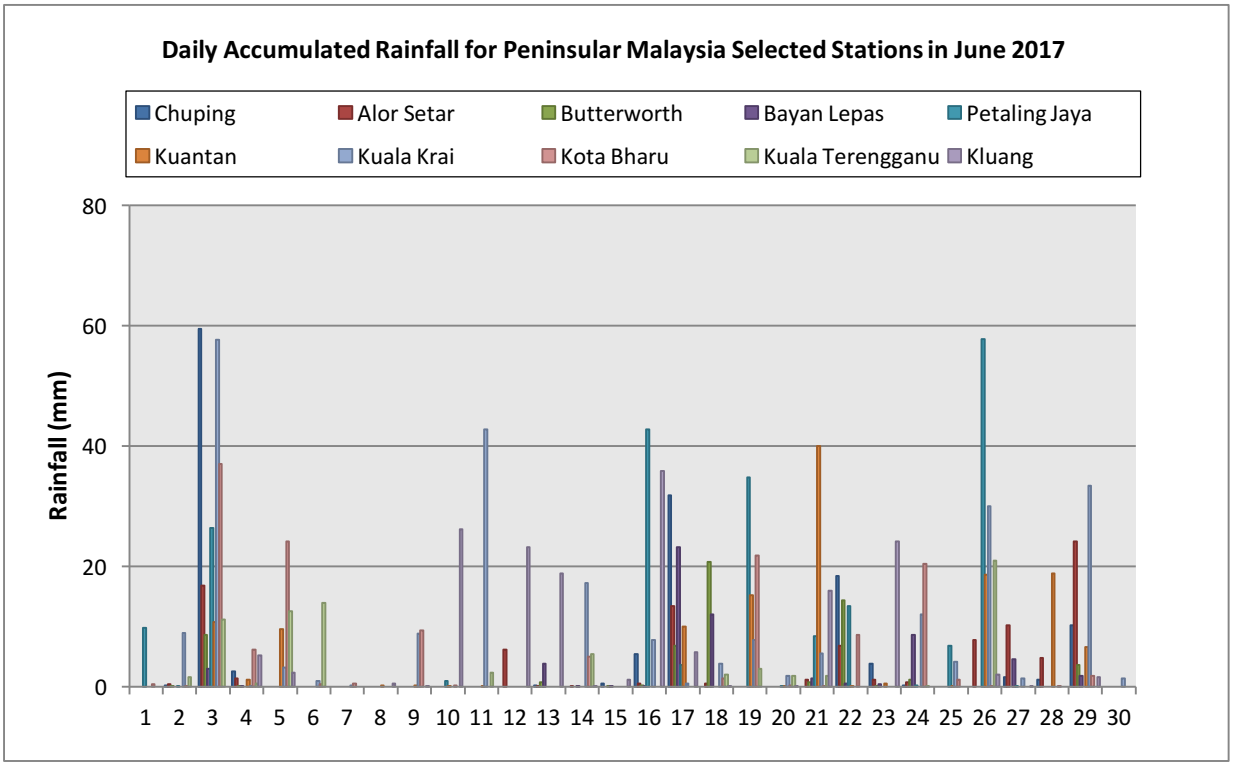


Figure 4a Daily rainfall chart of selected meteorological stations in Peninsular Malaysia for June 2017: Tropical storms MERBOK (11/06/2017-13/06/2017)

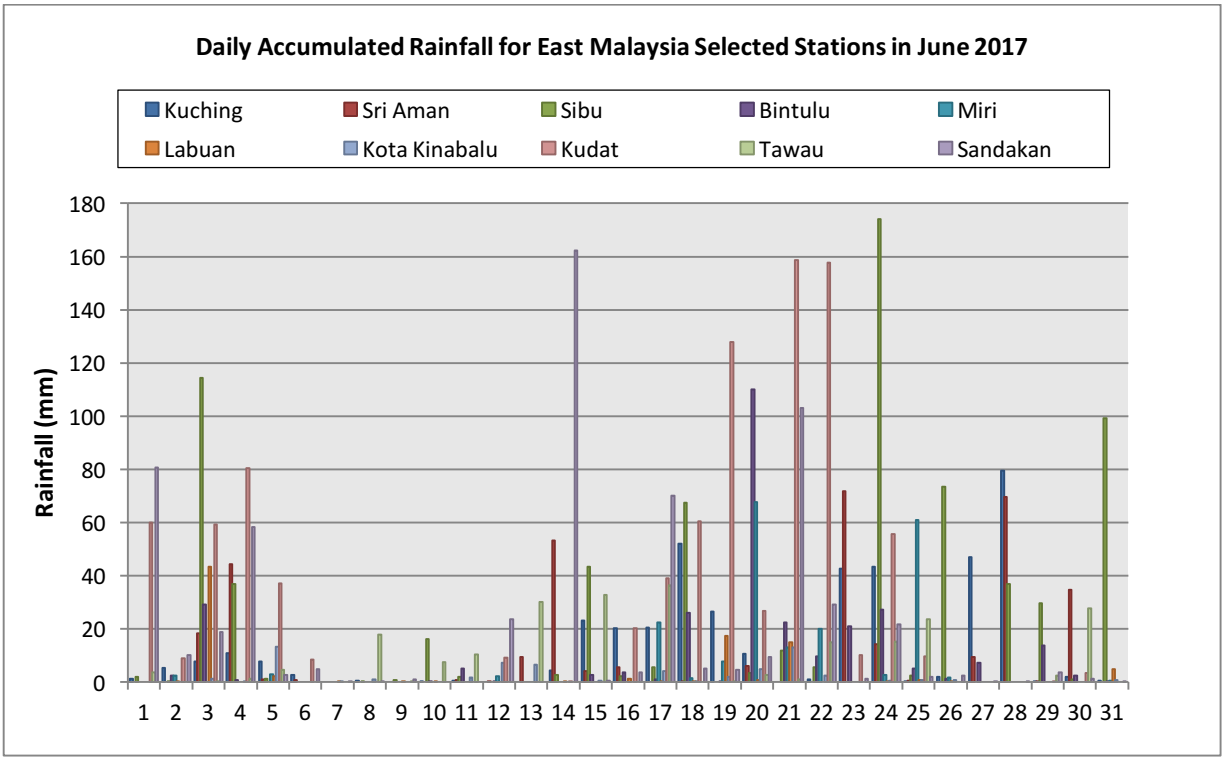


Figure 4b Daily rainfall chart of selected meteorological stations in East Malaysia for June 2017: Tropical storms MERBOK (11/06/2017-13/06/2017)

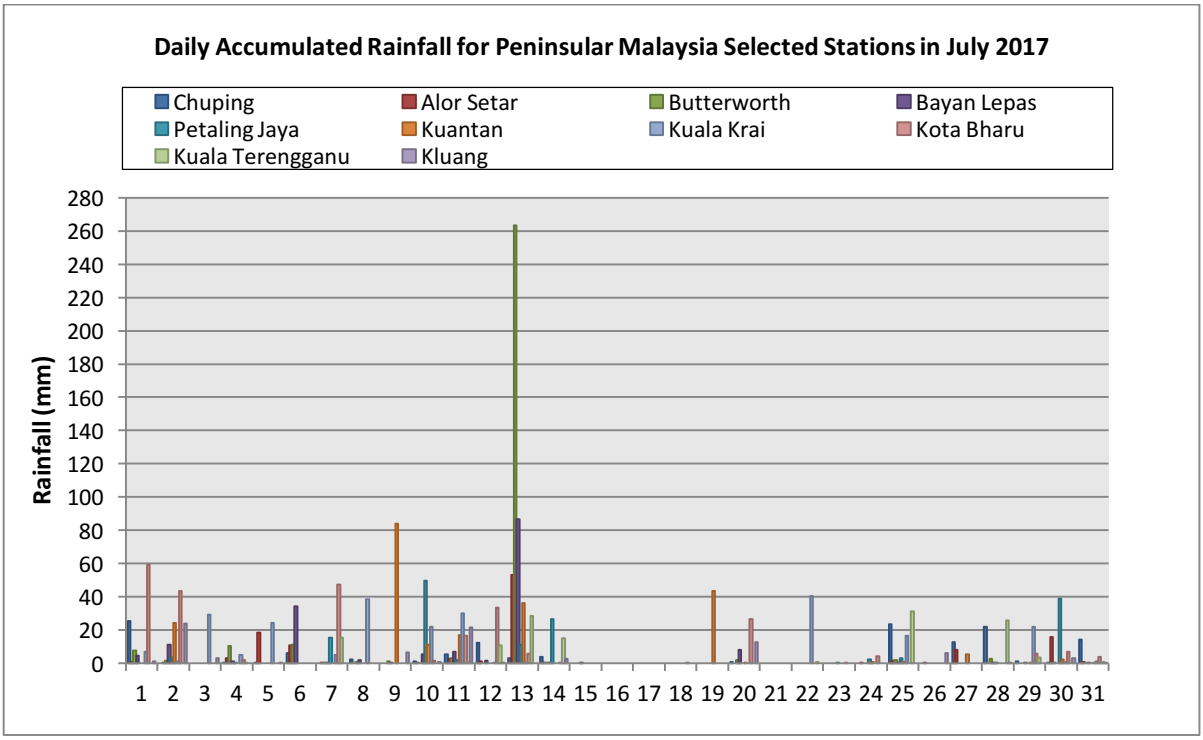


Figure 4c Daily rainfall chart of selected meteorological stations in Peninsular Malaysia for July 2017: Tropical Storm NANMADOL (02/07/2017-05/07/2017), TALAS (15/07/2017-17/07/2017), KULAP (21/07/2017-25/07/2017), ROKE (22/07/2017/-23/07/2017), SONCA (23/07/2017-25/07/2017) and HAITANG (29/07/2017-31/07/2017) and Typhoon NORU (21/07/2017-08/08/17) and NESAT (26/07/2017-30/07/2017)

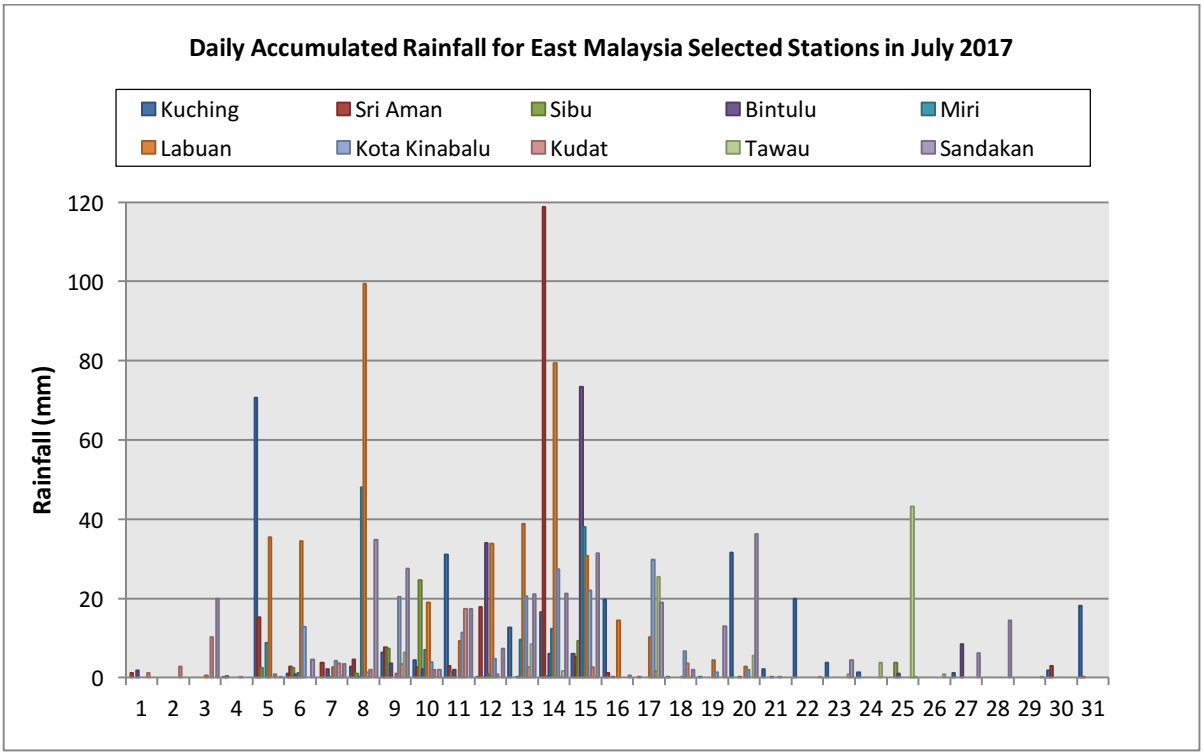


Figure 4d Daily rainfall chart of selected meteorological stations in East Malaysia for July 2017: Tropical Storm NANMADOL (02/07/2017-05/07/2017), TALAS (15/07/2017-17/07/2017), KULAP (21/07/2017-25/07/2017), ROKE (22/07/2017/-23/07/2017), SONCA (23/07/2017-25/07/2017) and HAITANG (29/07/2017-31/07/2017) and Typhoon NORU (21/07/2017-08/08/17) and NESAT (26/07/2017-30/07/2017)

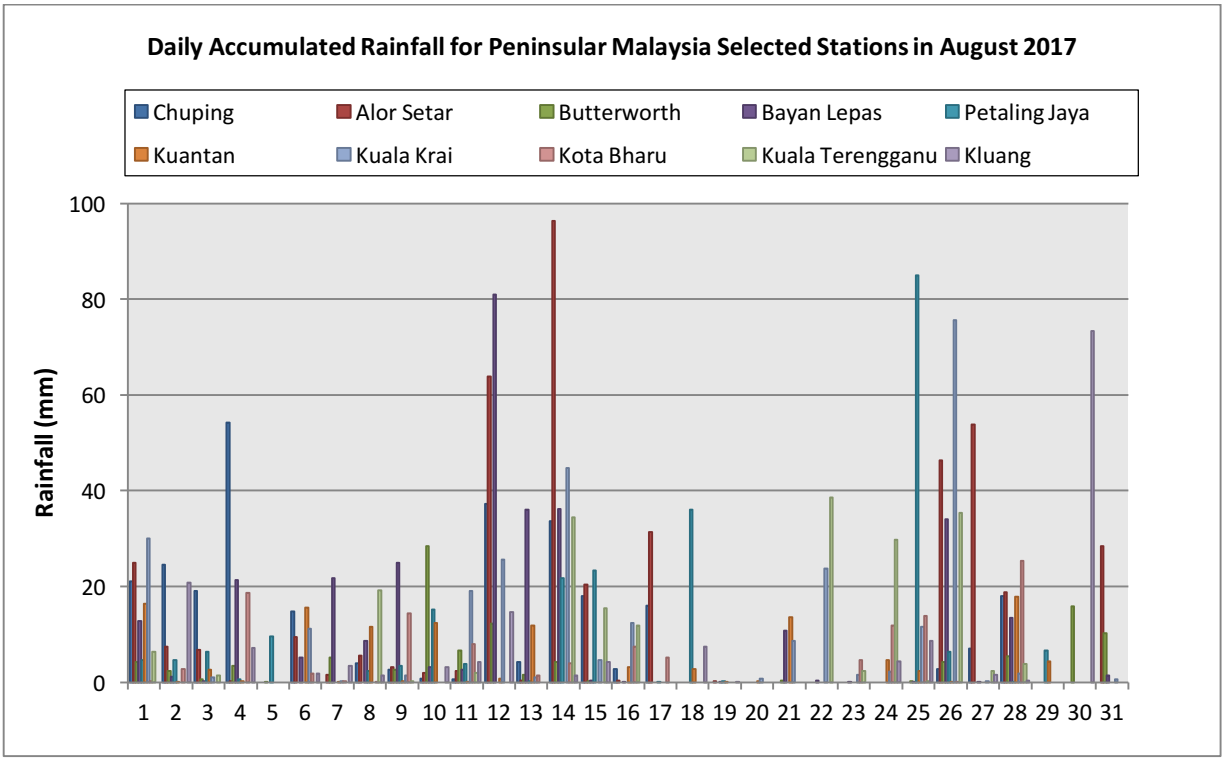


Figure 4e Daily rainfall chart of selected meteorological stations in Peninsular Malaysia for August 2017: Tropical Storm NALGAE (02/08/2017-06/08/2017), PAKHAR (24/08/2017-27/08/2017), MAWAR (31/08/2017-04/09/2017) and Typhoon BANYAN (11/08/2017-17/08/2017), HATO (20/08/2017-24/08/2017) and SANVU (28/08/2017-03/09/2017)

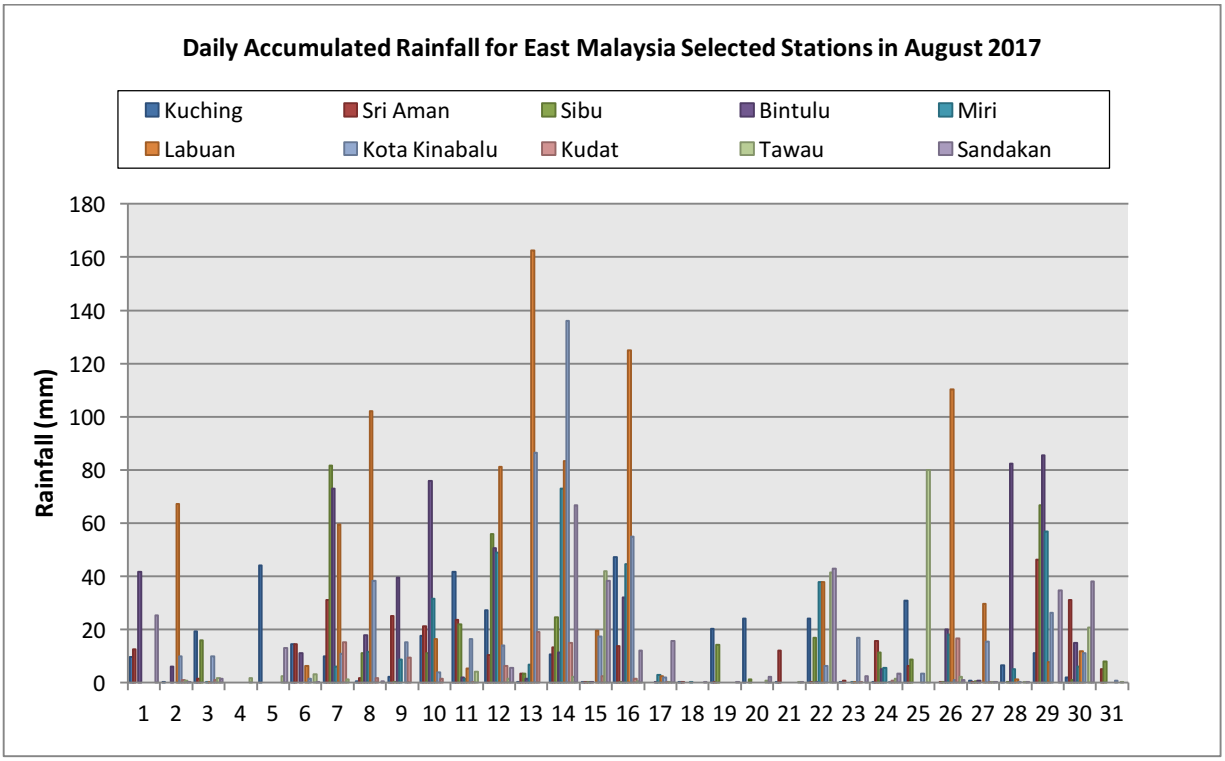


Figure 4f Daily rainfall chart of selected meteorological stations in East Malaysia for August 2017: Tropical Storm NALGAE (02/08/2017-06/08/2017), PAKHAR (24/08/2017-27/08/2017), MAWAR (31/08/2017-04/09/2017) and Typhoon BANYAN (11/08/2017-17/08/2017), HATO (20/08/2017-24/08/2017) and SANVU (28/08/2017-03/09/2017)

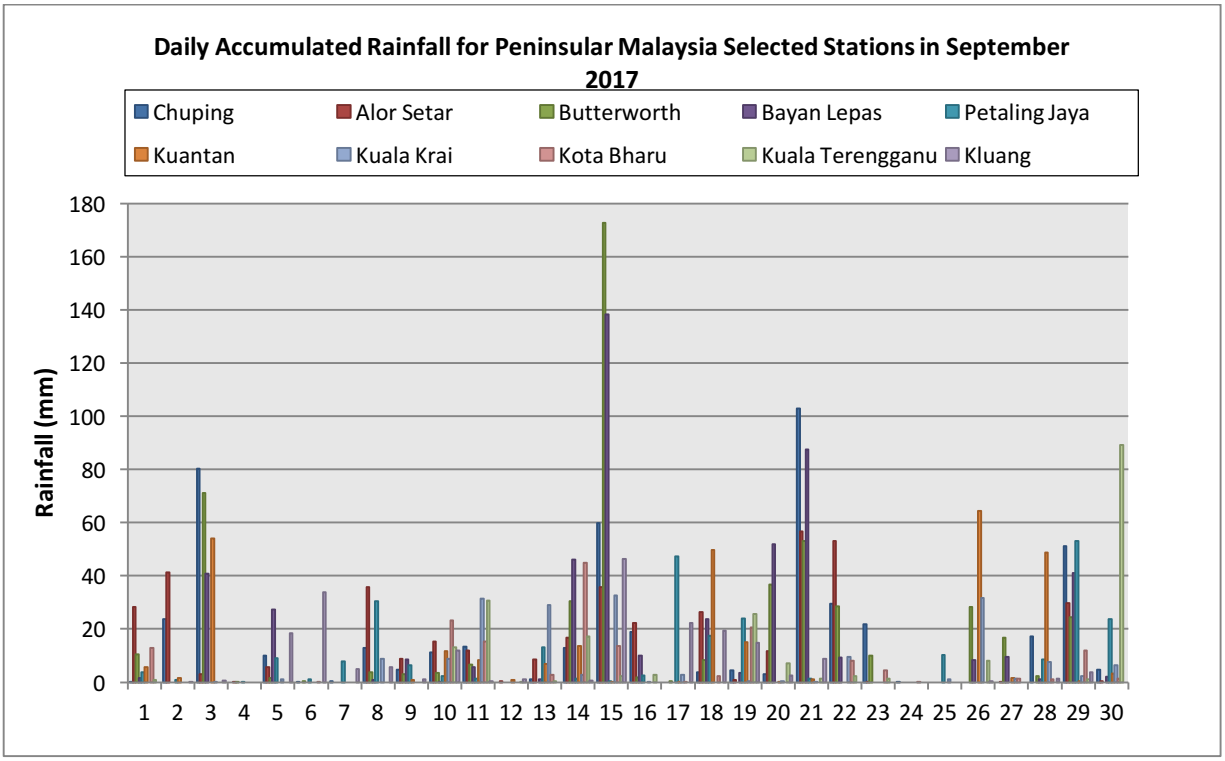


Figure 4g Daily rainfall chart of selected meteorological stations in Peninsular Malaysia for September 2017: Tropical storm GUCHOL (06/09/2017-06/09/2017), TALIM (09/09/2017-15/09/2017) and Typhoon DOKSURI (12/09/2017-15/09/2017)

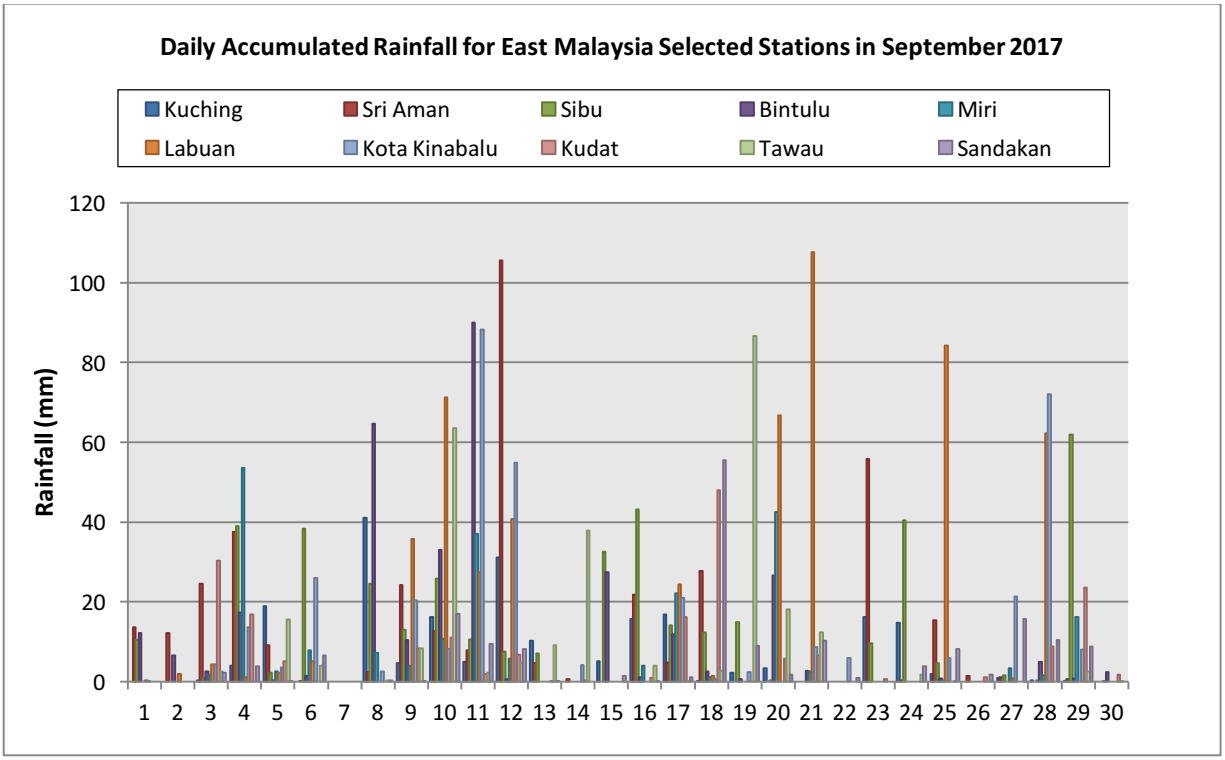


Figure 4h Daily rainfall chart of selected meteorological stations in East Malaysia for September 2017: Tropical storm GUCHOL (06/09/2017-06/09/2017), TALIM (09/09/2017-15/09/2017) and Typhoon DOKSURI (12/09/2017-15/09/2017)

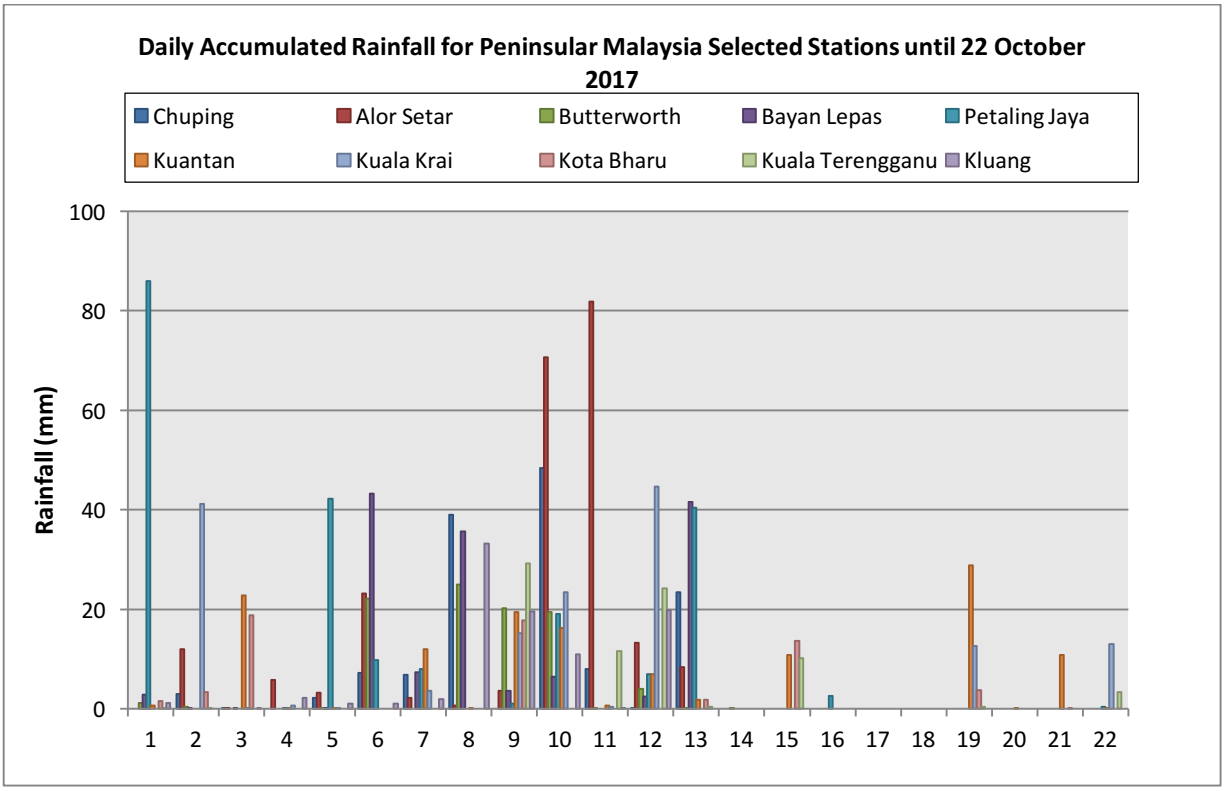


Figure 4i Daily rainfall chart of selected meteorological stations in Peninsular Malaysia until 22 October 2017: Typhoon KHANUN (12/10/2017-16/10/2017) and LAN (16/10/2017-22/10/2017)

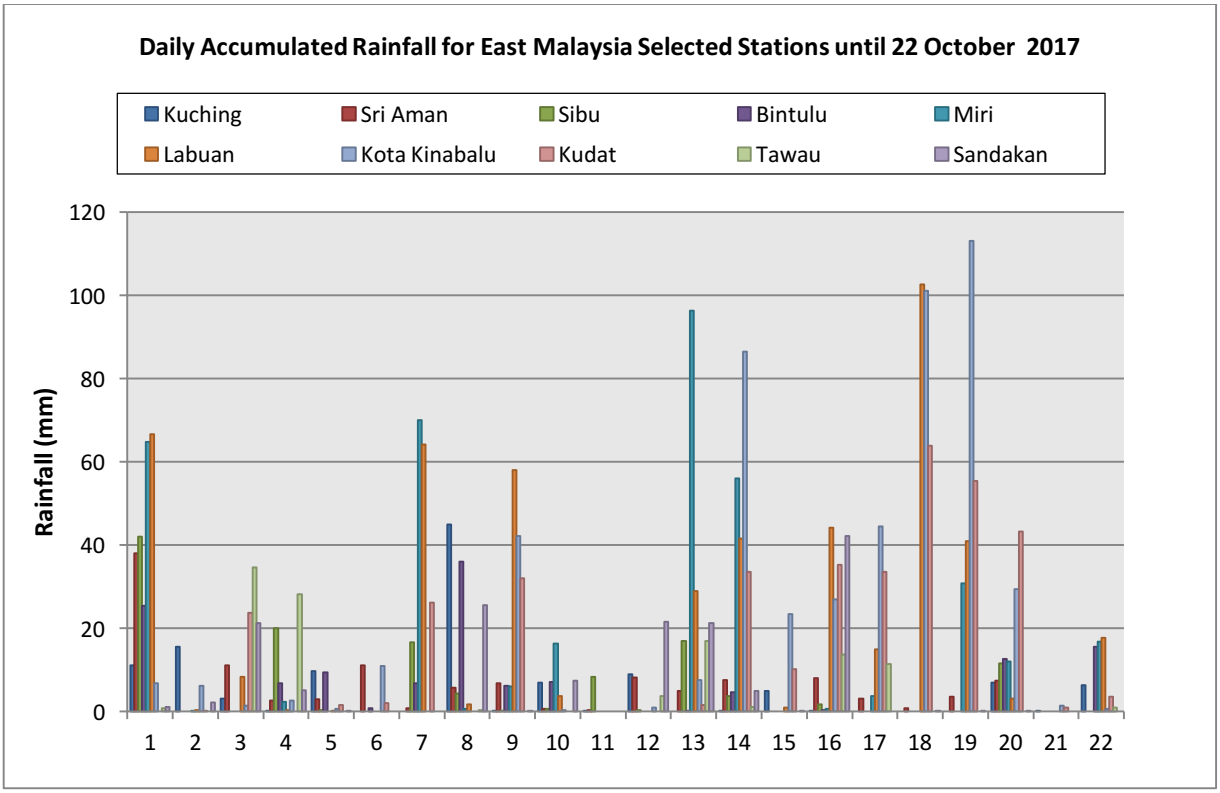


Figure 4j Daily rainfall chart of selected meteorological stations in East Malaysia until 22 October 2017: Typhoon KHANUN (12/10/2017-16/10/2017) and LAN (16/10/2017-22/10/2017)

1. Hydrological Assessment (highlighting water-related issues/impact)

The occurrence of Typhoon Doksuri on 12th until 15 September 2017 had caused heavy rainfall over northern parts of Peninsular Malaysia. The northwesterly wind blew from Bay of Bengal brought moisture across northern peninsular towards the center of Typhoon Doksuri located over southern Vietnam. Heavy and continuous rainfall caused flash flood over Penang and Kedah states and hundreds were evacuated. Flood victims have been stationed at several relief centers during the period. Preliminary study found that heavy rainfall episode is due to the tails effect of Typhoon Doksuri.

Recently, the presence of Typhoon Lan on 16th until 22nd October 2017 had causedheavy and continuous rainfall over Sabah states and Labuan inEast Malaysia. Flash flood, landslides, fallen trees and damage houses were reported over Sabah due to heavy rainfall and strong winds. Thousands were evacuatedfrom the affected areas in Sabah and stationed at several relief centers during the period.

2. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)

Although there were twenty-one typhoons and tropical storms close to Malaysia from January to October 2017, there was no socio-economic damage suffered by the country. There were no typhoons or tropical storms which directly affected Malaysia. Major flood disasters only occurred during the Northeast Monsoon (December 2016 until February 2017) in few states in Malaysia. About 25,000 people were affected and received services at the evacuation centers provided by various government agencies and NGO's.

3. Regional Cooperation Assessment (highlighting regional cooperationsuccesses and challenges)

Typhoon information issued by the Regional Specialized Meteorological Centre (RSMC) – Tokyo Typhoon Centre and JTWC as well as numerical weather prediction products of European Centre for Medium-Range Weather Forecasts (ECMWF) and Japan Meteorological Agency (JMA) are used in analysis and forecasting of weather during a typhoon passage close to Malaysia. The

on-going project on the Development of Regional Radar Network among MMD, TMD and JMA are important for weather monitoring in the region.

II. Summary of progress in Priorities supporting Key Result Areas

1. Development of Regional Radar Network and QPE

Malaysian Radar Network operates by the Malaysian Meteorological Department (MMD) consists of twelve radar stations - seven of them are located in Peninsular Malaysia and five of them are in Sabah & Sarawak (Borneo). There are eight S-band and four C-band radars. Generally the stations are sparsely located in the whole country to provide full coverage of the territory. The radar data is collected at the remote stations and transmitted via dedicated telecommunication line to the Central Collection Server located at headquarters, Petaling Jaya, Selangor. The processed radar products are disseminated via intranet and internet to the users and clients in the department and public near real- time. The radar data and processed products are archived at high capacity storage system. Clients could easily retrieve the archived radar products on-line around the clock.

The radar data collected on real-time from all the radar stations are processed and composited to generate the products as required. The composite of the radar data is based on the maximum intensity of that particular volume of data. One of the products is to composite the radar data to display the composite radar images of the country. These radar data must be going through quality control to ensure the product generated are of the best quality. In relation to this, MMD has sent two officers to attend the Bilateral Training Workshop on Radar Quality and QPE at Tokyo, Japan on 19th to 23rd December 2016. With the knowledge and experiences acquired during the training, MMD is currently using the control techniques provided by JMA such as clutter map, adjustment of composite table and statistical analysis. On the technical aspect, the contractor appointed by MMD will ensure the technical calibration on radar system are complied with the recommendation as stipulated by the radar supplier. The electronic testing equipment used to calibrate the radar system is calibrated annually at the standard calibration laboratory.

Quantitative Precipitation Estimation (QPE) is another important aspect of radar product which is very useful for the rainfall estimation to be used in the flood

forecasting and runoff model in Malaysia. JMA has explained about necessary steps to introduce research product into operational as real time QPE products and further explained importance of quality control of rain gauge and radar data. In relation to this, the discussion via an email between MMD and JMA is on-going to further explore the possible technical and data management cooperation to improve on the quality of the radar data in Malaysia.

Experimental Test of Radar Data Sharing

The experimental test of radar data sharing project among JMA, TMD and MMD which was started from 10th November 2016 and still continue for years. This project is aimed to promote development of regional radar network in the region. In this joint project, the members agreed to share their experience and knowledge with new participating countries in Southeast Asia, in order to promote radar network projects conducted under both Typhoon Committee and WIGOS in WMO RA-II.

Radar Integrated Nowcasting System (RaINS)

RaINS is the upgraded version of Short-range Warning of Intense Rainstorms in Localized Systems (SWIRLs) developed by Hong Kong Observatory (HKO). In RaINS, the decay and growth of the thunderstorm cells is corrected by blending the SWIRL with NWP using RAPIDS (Rainstorm Analysis and Prediction Integrated Data-processing System). Right now RaINS is undergoing intensive testing for the purpose of operationalized it at MMD. The HKO has kindly granted permission as well as technical assistance to the MMD in implementing SWIRLS in Malaysia.

Identified opportunities/challenges, if any, for further development or collaboration:

The MMD gives higher priority in human capital development to further improve their knowledge in the field of weather forecasting and model improvement. As far as typhoon is concerned, MMD is keen to collaborate with tropical cyclone expert in the region to understand the typhoon itself and its impacts. The surge and forecast track of the tropical storm are the main areas that are not fully understood by many of our officer. For the first step, MMD had sent one officer to join a Research Fellowship WGDRR organized and hosted by the Shanghai Typhoon Institute (STI) in Shanghai, China from the 4 to 17 September 2017. The objective of the fellowship is introducing the techniques for evaluating benefits of tropical cyclone disaster prevention and preparation to the Members.

Priority Areas Addressed:

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

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2. Improvement of Flood Forecasting (caused by typhoon and monsoonal surges)

To date the Department of Irrigation and Drainage (DID) has 811 hydrological telemetry stations, 876 manual flood gauges, 103 flood warning boards and 472 automatic flood warning sirens in flood prone areas. Several flood forecasting models have been developed to support flood forecasting tasks in DID, namely:

i. National Flood Forecasting and Warning System for Muda river basin (NaFFWS Sg Muda)

ii. National Flood Forecasting and Warning System for Padas river basin (NaFFWS Sg Padas)

iii. National Flood Forecasting and Warning System for Sarawak river basin (NaFFWS Sg Sarawak)

iv. National Flood Forecasting and Warning System for Kerian river basin (NaFFWS Sg Kerian)

v. National Flood Forecasting and Warning System for Muar river basin (NaFFWS Sg Muar)

vi. National Flood Forecasting and Warning System for Kedah river basin (NaFFWS Sg Kedah) (new system will be ready by end of 2017)

New flood forecasting system called as NaFFWS Sg. Kedah will be completed by October 2017. It will utilise two types of model which is Hydrodynamic Flood Forecasting Model (HFFM) and Statistical Flood Forecasting Model (SFFM). The HFFM model developed using Infoworks 1D software and Floodworks system to do the real-time operation. The HFFM able to produce flood map at certain location particularly located near to river. Meanwhile, the SFFM model contains by three types of model using Stage Regression, Rainfall Correlation and Unit Hydrograph. The SFFM model will be function as backup system since they can simulate faster than HFFM. The NaFFWS Sg Kedah also will use the input from radar and NWP from Malaysian Meteorological Department. The NWP data will help the NaFFWS system to have forecast flood up to 2 days ahead.Malaysia is committed to the programme under ESCAP/WMO Typhoon Committee as member of Working Group on Hydrology (WGH). Two project namely Annual Operating Plan (AOP 4): The application of Operational System for Urban Flood Forecasting and Inundation Mapping

(OSUFFIM) and AOP 5: Extension of Xin'anjiang Model Application. The AOP 5 that begin since 2013 had been completed in the 2016 which is two river basin involved for the development called as Sg. Segamat and Sg. Dungun. Meanwhile AOP 4 that already begin in 2014 still under development and will be extend until 2020. The preliminary field survey has been carry out in the August 2017 to finalise the selection of the river basin for the case study.

Identified opportunities/challenges, if any, for further development or collaboration:

Hydrodynamic characteristics of a river in urbanizing areas change rapidly. Thus, hydrologic models in such an area require constant calibration and validation. Currently, another flood forecasting model is being developed by the DID, namely the National Flood Forecasting and Warning System for Kelantan, Terengganu and Pahang river basin is expected to be completed by October 2018.

In the other hand, the more challenging issues is to have flash flood forecasting system that able to give early warning to the peoples especially in the urban area. The new technology could be explore and use of advance ICT System together with radar and satellite technology may be give good opportunities to develop better flash flood forecasting system.

Priority Areas Addressed:

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

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3. **Enlightening the public on flood information (caused by typhoon and monsoonal surges)**

Rainfall, water level and flood information are disseminated to the authorities and public via mobile phone text messages, emailing and the website http://publicinfobanjir.water.gov.my. This website has been enhanced and improved in terms of system technology, hardware, analytical processing and network expansion as well as its contents to meet the requirements of operational staff for monitoring the flood situation in the country. This website was developed and designed to be more public-friendly and simplify the process of data sharing between others agencies. Besides that, DID also constantly holds exhibitions to educate the public on flood warning system includes the functionality of flood siren. Meanwhile, MMD also consistently disseminate and educate the public on severe weather conditions and the precautions to be taken.

Identified opportunities/challenges, if any, for further development or collaboration:

Remote areas in Malaysia that lack access to the media facilities are often caught unaware of these information. Therefore, the Government of Malaysia is working to widen the broadband coverage across the country to better disseminate these information by using Website, Mobile Application and Mass Media.

Priority Areas Addressed:

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

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4. The Forty-ninth Session of the ESCAP/WMO Typhoon Committee

The 49th Session of the ESCAP / WMO Typhoon Committee was held in Yokohama, Japan from 21 February 2017 to 24 February 2017. The participation of Malaysia in this 49th Session benefits the country in terms of reducing adverse effects due to typhoons. Malaysia's involvement in this meeting is crucial in giving important agencies such as the National Disaster Management Agency (NADMA), Department of Irrigation and Drainage (DID), as well as the Ministry of Women, Family and Community Development useful knowledge and information from the technical discussions presented in the meeting session. The presence of the Malaysian delegates in this meeting is extremely vital because Malaysia is also at risk from typhoon-related disasters.

In addition, the Malaysian Meteorological Department also involved in providing inputs for the Strategic Plan TC 2017 - 2021 discussed in this meeting. This Strategic Plan will be the guidance by all TC member countries to apply and adapt to their respective country's operations. Malaysia's participation in this session also serves to ensure TC programs and activities for the year 2017 will benefit Malaysia, especially from the forecasting aspects of tropical / typhoon and management to mitigate the effects of typhoon disaster. The participation of Malaysian delegates is necessary as it discussed issues in respective areas of expertise in WGDRR and WGH. At the same time, the latest information from the sharing and technical discussions presented in the session also help to improve the operations and activities of the Department.

Identified opportunities/challenges, if any, for further development or collaboration:

NIL

Priority Areas Addressed:

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

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5. Enhancement of High Performance Computing (HPC) and Active Archive System for Numerical Weather Prediction (NWP)

Lengthy spells of heavy rainfalls during the Northeast monsoon have caused severe inundation over low-lying areas in the northeast of Peninsular Malaysia and also in East Malaysia in the months of December 2014. However, these heavy rainfall episodes are unrelated to tropical cyclones. In order to enhance the disaster management capacity in the country in the initial preparations for such phenomena, there is a need for early weather warning with long predicted periods of 3 days to 7 days and strengthening the weather service delivery system.

MMD has completed the enhancement of High Performance Computing (HPC) and Active Archive System for Numerical Weather Prediction (NWP) Project. The purpose of this project is to enhance the weather forecasting system by improving the effectiveness of the Weather Forecast and Research (WRF) models. The enhancement includes increasing model resolution to one (1) kilometer and the forecast range to 7 days in 3 hours. The output then be used by meteorologists for further research and also to provide the nation with better weather predictions.

To meet the requirements to produce 7 days forecast within 1 kilometer in less than 3 hours, the HPC consists high speed interconnects, 296 compute nodes, 2 management nodes, 3 login and archive nodes and 6 I/O nodes. The WRF models are able to scale up to 100 Teraflops sustained system performance. The Project started in August 2016 and to date, MMD have achieved several milestones and the project go-live in June 2017.

Identified opportunities/challenges, if any, for further development or collaboration:

MMD has the mission to provide detailed regional weather forecast beside conducts extensive research and future development in numerical weather prediction

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

Priority Areas Addressed

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6. Research Fellowship of Working Group on Disaster Risk and Reduction (WGDRR)

Research Fellowship WGDRR was organized and hosted by the Shanghai Typhoon Institute (STI) in Shanghai, China from the 4 to 17 September 2017. The objective of the fellowship is introducing the techniques for evaluating benefits of tropical cyclone disaster prevention and preparation to the Members. Malaysian Meteorological Department (MMD) is the sole agency responsible for monitoring and issuing early warnings of extreme weather disasters including typhoon. MMD is always proactive in empowering service delivery to Malaysians in terms of science, advanced technology, preparedness as well as preventive measures through systematic management of the effects of typhoons progress. The participation of the officers in the two-week research program was able to expose officials in learning the methods of impact assessment of the typhoon by using products as a result of advancement in science and technology, especially predictive movements, intensity and typhoon products to Malaysia and surrounding waters. In addition, this program also enhances the bilateral relations between the MMD and the STI in particular and the ESCAP / WMO Typhoon Committee in collaboration with the region on the extreme weather of the typhoon and its impact. The presence of officials can help the Department improve its expertise in issuing extreme weather warnings that help reduce disaster risk.

Identified opportunities/challenges, if any, for further development or collaboration:

NIL

Priority Areas Addressed:

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

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7. Disaster Preparedness related to typhoons and monsoonal flooding

ITEM 1: Outreach/ Education Programme

a) National Disaster Preparedness Month

October was declared as National Disaster Preparedness Month in Malaysia with the main objective to create awareness and strengthen national resilience to disasters. The National Disaster Management Agency and Sarawak State Government took the leads and arranged the launching ceremony showcased for this year 2017. All around the country, several events and numerous activities such as conferences, school activities and community awareness programmes were conducted.

b) Local Disaster Management Players' Preparedness Course

To integrate the strength and effort of the Government agencies at the National, State and District levels to come together and be seriously involved in disaster management especially in preparing for and mitigating the impacts of disaster in accordance with the priorities of the Sendai Framework for DRR, Local Disaster Management Players' Preparedness Course was conducted aims to make sure that local players are ready to this coming northeast monsoon season by knowing their role and responsibility in disaster management with better coordination and communication among themselves.

c) Community- Based Disaster Risk Management

The CBDRM is a two-pronged programme whereby not only does it serve as a platform to convey information on disasters to communities at risk prone areas, but also to build a community that is resilient and able to act to save themselves, family, neighbours and community members when disaster strikes. The objectives of this program are to enhance understanding, knowledge and capacity of the government agencies, non-government organisation (NGO), community leaders and public to face the impacts of earthquake and tsunami. This year, the programme was held in Labuan on July 2017 together with earthquake and tsunami table top exercise.

Identified opportunities/challenges, if any, for further development or collaboration:

NIL

Priority Areas Addressed:

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

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ITEM 2: Technological Improvements

a) Flood Hazard Map & Slope Hazard and Risk Map

The government is improving the understanding of risk through risk assessment. Currently the flood hazard map has been produced with the utilization of GIS and geospatial technology.

b) Government Integrated Radio Network (GIRN)

The 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 had shown that there were more than 12 radio networks used by these 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 is targeted to cover 95% of Malaysia's populated land and areas extending 10 nautical miles from the shoreline.

c) Internet and Social Media

Related Government agencies in Malaysia also utilizes the internet as one of the media to disseminate early warning and disaster situation information such as Air Pollution Index, near real time river level, air visibility, weather situation and forecast, alternative roads, and hotspots.

Government agencies have also actively using social media network like Facebook and Twitter in order to disseminate information to the public apart from establishing web portals.

Identified opportunities/challenges, if any, for further development or collaboration:

NIL

Priority Areas Addressed:

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

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ITEM 3: Improved Typhoon-Related Disaster Risk Reduction

a) Mainstreaming Science & Technology in DRR

Malaysia will continue its strategies in mainstreaming disaster risk reduction agenda into the planning and development process through National Platform on Disaster Risk Reduction and Action Plan or MyDRR. It has yielded outstanding results in terms of marshalling science and technology for disaster risk management in Malaysia. In this regard, Malaysia has institutionalized the Scientific Expert Panel (SEP) for Disaster Risk Reduction in 2016. This group of

experts comprises of key public and private science institutions in the country as the advisory component to NADMA. It shows that Malaysia recognize the science & technology (S&T) as an impetus towards providing appropriate information and knowledge to make informed decisions and take effective action. In 2017, 2 series of workshop on Science, Technology and Innovation for DRR were conducted with collaboration of SEP. Flood and extreme weather are among the clusters that have been emphasised.

b) International Cooperation Efforts

Malaysia embarked on The Weather & Climate Science for Service Partnership for Southeast Asia research project with UK Met Office which aims to form strong, sustainable science and innovation partnerships that can be harnessed to advance scientific understanding and modelling capabilities which can be used to deliver underpinning services to protect lives and livelihoods across SE Asia, and particularly in Malaysia.

The UK Met Office work collaboratively with institutions in Malaysia namely National Disaster Management Agency (NADMA), Meteorology Department of Malaysia (MMD), Department of Irrigation and Drainage (DID) and National Hydraulic Research Institute (NAHRIM) to engage in scientific weather related research and to collaborate on the development of improved processes to provide advice related to high impact weather events. The overarching aims of this project are to improve the understanding of the impact of large scale atmospheric processes on the weather and climate of SE Asia and Malaysia; to assess, develop and improve convective scale models (local fine scale models) in order to make better forecasts of high impact weather over SE Asia and in particular for Malaysia; to improve the processes which translate weather and flood forecast models into advice that can help mitigate against high impact weather in Malaysia at a range of lead-times from hours to months to ensure that the requirements of the users of weather forecasts influence the science carried such that advances of weather forecasts meet the needs of the users; and to develop a disaster risk reduction framework and guidelines to assess risk associated with weather and climate extremes.

c) Global Platform for Disaster Risk Reduction

Malaysia was participated in the 5th Session Global Platform for Disaster Risk Reduction (GPDRR) which took place in Cancun, Mexico from 24 to 26 May 2017. The deliberations on 4 priorities of actions, sessions also commit on additional priorities including monitoring implementation of the Sendai Framework; substantially increase the number of countries with national and local disaster risk reduction strategies by 2020; coherence with the sustainable development and climate change agendas; gender-sensitive and inclusive disaster risk reduction; and international cooperation initiatives, such as private-private cooperation and building a coalition of countries for critical infrastructure.

Priority Areas Addressed:

KRA	1	2	3	4	5
Integrated		√		√	
Meteorology					
Hydrology					
DRR					

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