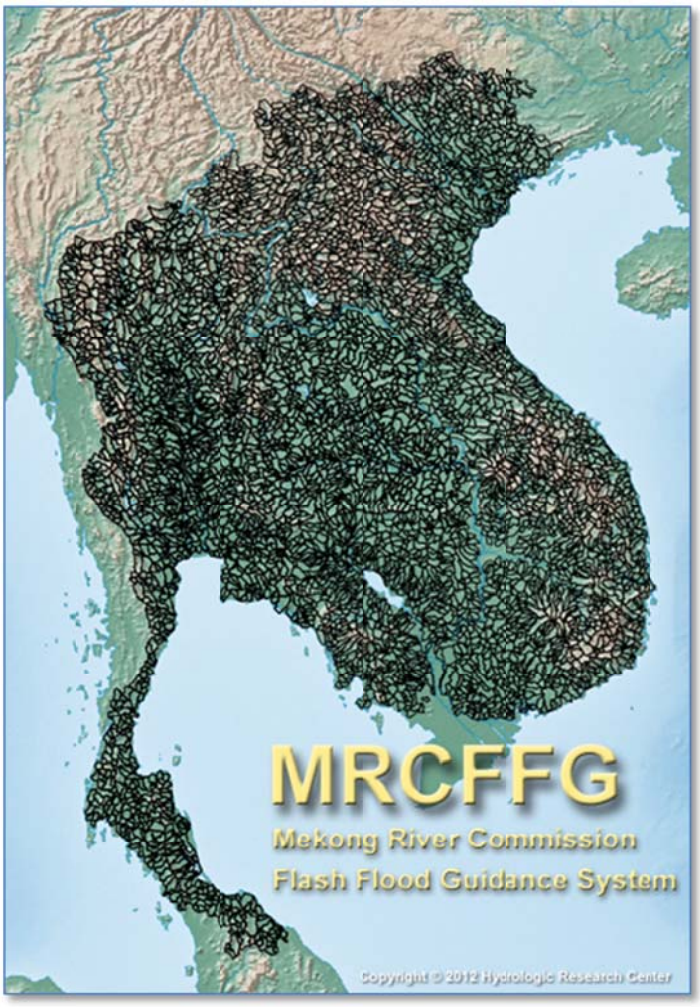
Mekong River Commission

Flood Management and Mitigation Programme

Evaluation Report on Flash Flood Guidance System for Flood Season 2015

Cover from 1st June – 31st December 2015

Final



Prepared by
Regional Flood Management and Mitigation Centre
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Certification of Approval
of Internal FMMP Technical Document

Evaluation Report on Flash Flood Guidance System for Flood Season 2015

Cover from 1st June – 31st December 2015

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List of Abbreviations

ASM	Average Soil Moisture
FFG	Flash Flood Guidance
FFGS	Flash Flood Guidance System
FMMP	Flood Management and Mitigation Programme (MRC)
FTP	File transfer protocol
HE-sat	Hydro-estimator Satellite Precipitation
HRC	Hydrological Research Centre in San Diego, California (USA)
Hydmet	Rainfall and water level station data transfer software (MRC)
ITCZ	Inter Tropical Conversion Zone
LMB	Lower Mekong Basin
LMRB	Lower Mekong River Basin
MAP	Mean Areal Precipitation
MCs	MRC Members' Countries
Mekong-FFS	Mekong River Flood Forecasting System
MRC	Mekong River Commission
MRC-FFG	MRC Flash Flood Guidance
MRC-FFGS	Mekong River Commission's Flash Flood Guidance System
MRC-FFGCS	Mekong River Commission Flash Flood Guidance Computational Server
MRC-FFGDS	Mekong River Commission Flash Flood Guidance Dissemination Server
MRCS	Mekong River Commission Secretariat
OFDA	Office of US Foreign Disaster Assistance
RFMMC	MRC's Regional Flood Management and Mitigation Centre
TMD	Thai Meteorological Department
USAID	US Agency for International Development
UTC	Coordinated Universal Time

1. Introduction

Flash flooding is a flood of short duration with a relatively high peak discharge, the response time within 6 hours or less after the heavy rain event [1]. Flash floods are generally difficult to warn or forecasted because of their short time concentration, massive destruction power and sudden occurrence. Therefore early warning systems and preparedness are critical elements to saving lives.

The flash flood guidance (FFG) system is a diagnostic tool to analyze weather related events that can initiate flash floods [8]. To respond to regional and national needs and in order to address the problems of flash floods in Mekong River Commission (MRC) member countries (i.e. Cambodia, Lao PDR, Thailand and Viet Nam), the MRC and the Hydrological Research Centre (HRC) in San Diego, California, USA with the financial support from the Office of US Foreign Disaster Assistance (OFDA) of the US Agency for International Development (USAID) have jointly implemented flash flood mitigation under MRC's Flood Management and Mitigation Programme (FMMP). The project is based on extensive training and capacity building of local staff, and implementation of the central system (hard- and software) in MRC's Regional Flood Management and Mitigation Centre (RFMMC) in Phnom Penh, Cambodia. In early September 2009 the computational and dissemination servers for the MRC-FFG system were installed at the RFMMC, which allowed the line agencies of the MRC member countries and the RFMMC to obtain access to the MRC-FFG system products for operational purposes as well as for training.

The MRC-FFG system is designed to provide FFG information on a small basin scale across the four riparian countries from various hydro-meteorological sources (see Figure 1-1). FFG is an index that indicates how much rainfall is needed to cause minimal flooding in that basin. The FFG value indicates the total volume of rainfall over the given duration which is just enough to cause bank-full flow in the draining stream outlet. Consequently, rainfall volumes of the same duration that are greater than the FFG value indicate a likelihood overbank flows at the draining stream outlet. The FFG warnings scale is shown in Figure 1-2.

The MRC-FFG system model is a soil accounting model that needs satellite rainfall estimates as input data and the output is a warning for the next 1 hour, 3 hour and 6 hours for basins with a mean area of approximately 150-200 km^2 in size that have a plausible chance of suffering from flash floods. The rainfall threshold needed to release a warning depends on the hydrological characteristics of the watershed. This threshold or FFG number is the volume of rainfall of a given duration (1-6 hours) over a given small catchment that is just enough to cause bank-full flow at the outlet. The primary purpose of the MRC-FFG system is to provide near real-time information guidance products pertaining to the imminence of potential small-scale flash flooding. The system provides the necessary products to support the

development of warnings for flash floods from intense rainfall events through the use of satellite and gauge-based rainfall estimates.

There are two computer servers: (1) the MRC-FFG Computational Server (MRC-FFGCS) and (2) the MRC-FFG Dissemination Server (MRC-FFGDS) in the MRC-FFG hardware components which have divided the processing demand of FFG product processing and dissemination through separate roles of server functions (see Figure 1-3) [7]. The MRC-FFGCS is responsible for all of the real-time data acquisition, ingest, and model processing, product export and upload of products to the dissemination server. The MRC-FFGDS disseminates the information by providing the user with remote real-time access to the MRC-FFG system products for online review and/or download to their local computer for further application in forecasting activities.

Since 2010 during the flood season, the MRC-FFG system had been operating successfully ([3], [4], [5], [6]). Reference is made to the records of tropical storms and records of tropical depressions. The MRC-FFG system had detected several high risk village and district areas in the MRC member countries during flood season from May until late December which varies depending on the weather conditions such as the Inter Tropical Convergence Zone (ITCZ), low pressure, and typhoon.

During the 2015 flood season, the forecaster of FMMP has continued operating routinely the MRC-FFG system on a daily basis for the provision of flash flood guidance products. The information on flash flood risk areas that were detected by the MRC-FFG system was uploaded on the MRC flood forecasting webpage in parallel with the river flood forecast (see Figure 1-4). The warning that the MRC-FFG system has identified as being ‘critical’ is daily collected in Excel, and can be downloaded from its website. Information regarding ‘critical’ weather conditions and risk of flash floods is disseminated through e-mail to alert the national line agencies, NGOs and the public at large. The system operated on a 24/7 basis during the 2015 flood season from May until late December; the dissemination of information depended on the weather conditions.

The first evaluation report on MRC-FFG system was issued in 2011 [3]. The report has been produced to evaluate the performance of MRC-FFG system for the 2011 flood season from May until 31 October. The present report is the fifth evaluation report of MRC-FFG system. The purpose of this report is to evaluate the performance of MRC-FFG system in village and district areas of the MRC member countries for the detection of the risk areas for potential flash floods during the 2015 flood season from May until the late of December. The FFG warnings are issued for the respective national territories of Cambodia, Lao PDR and Viet Nam. However from 2015 flood season onwards the RFMMC provides flash flood risk information for Thailand only in the Thai territory located within the Lower Mekong Basin (LMB).

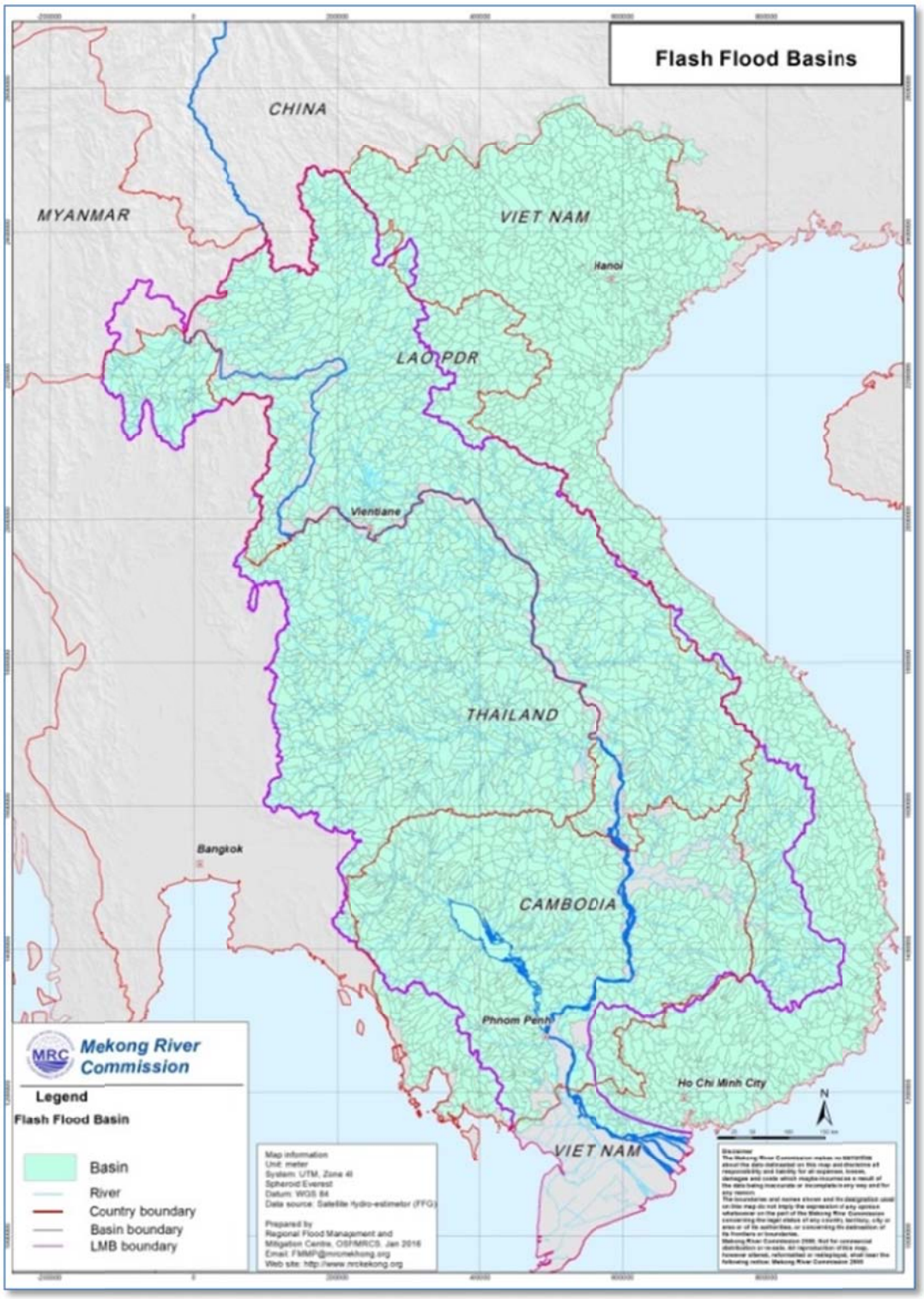


Figure 1-1 Flash flood sub-basins of MRC-FFG system.

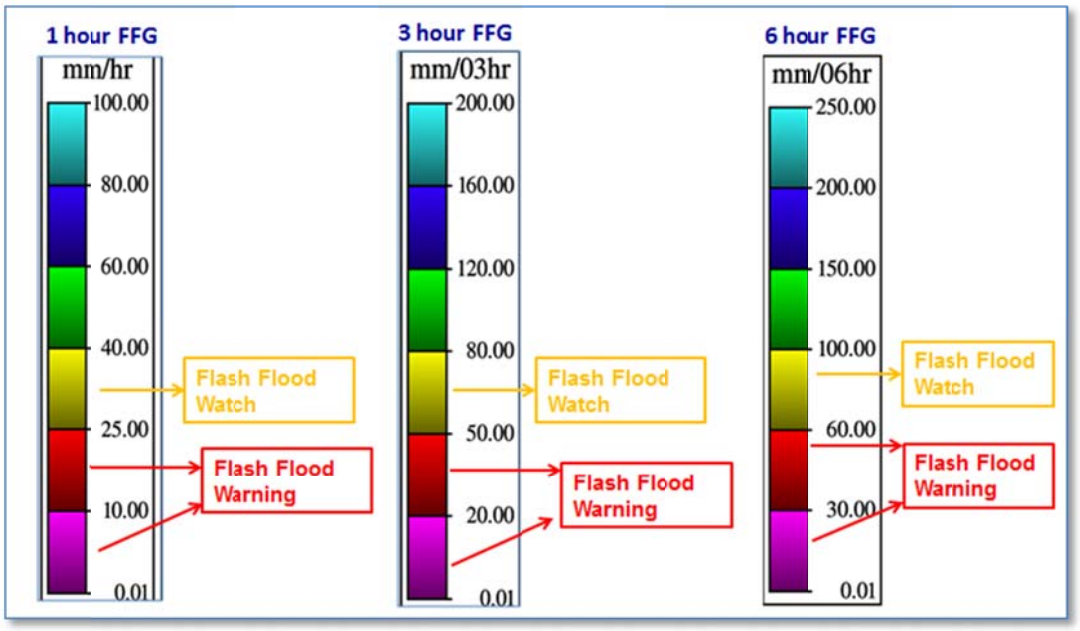


Figure 1-2 FFG warnings scale.

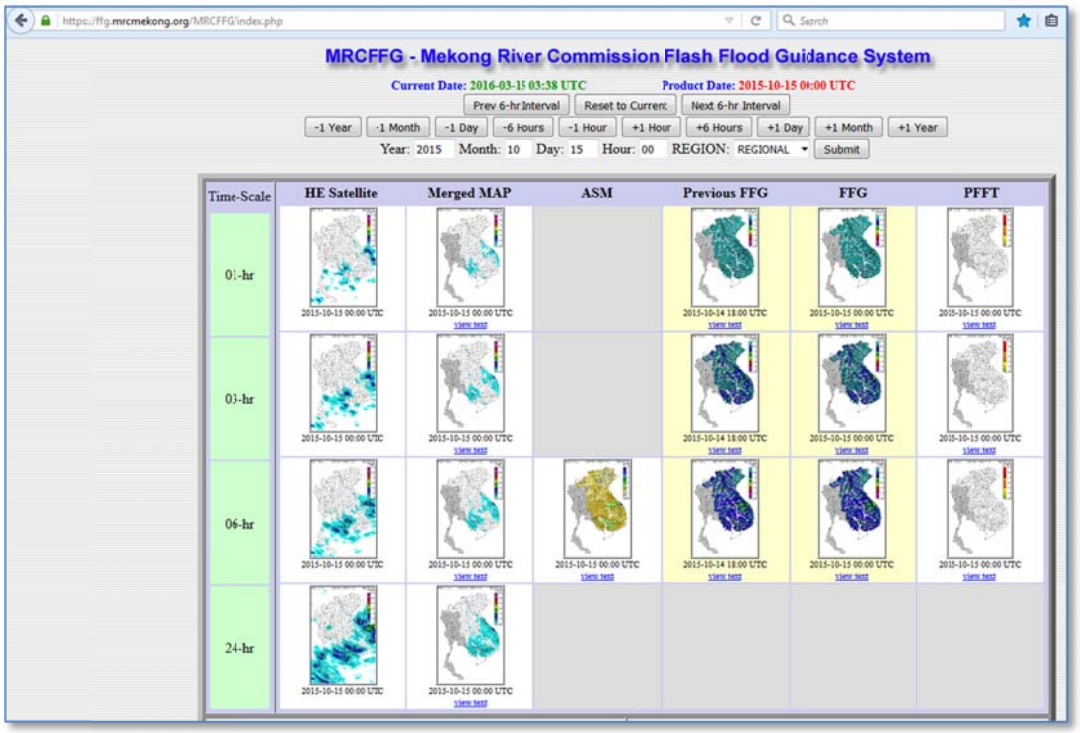


Figure 1-3 MRC-FFG dissemination server user interface.

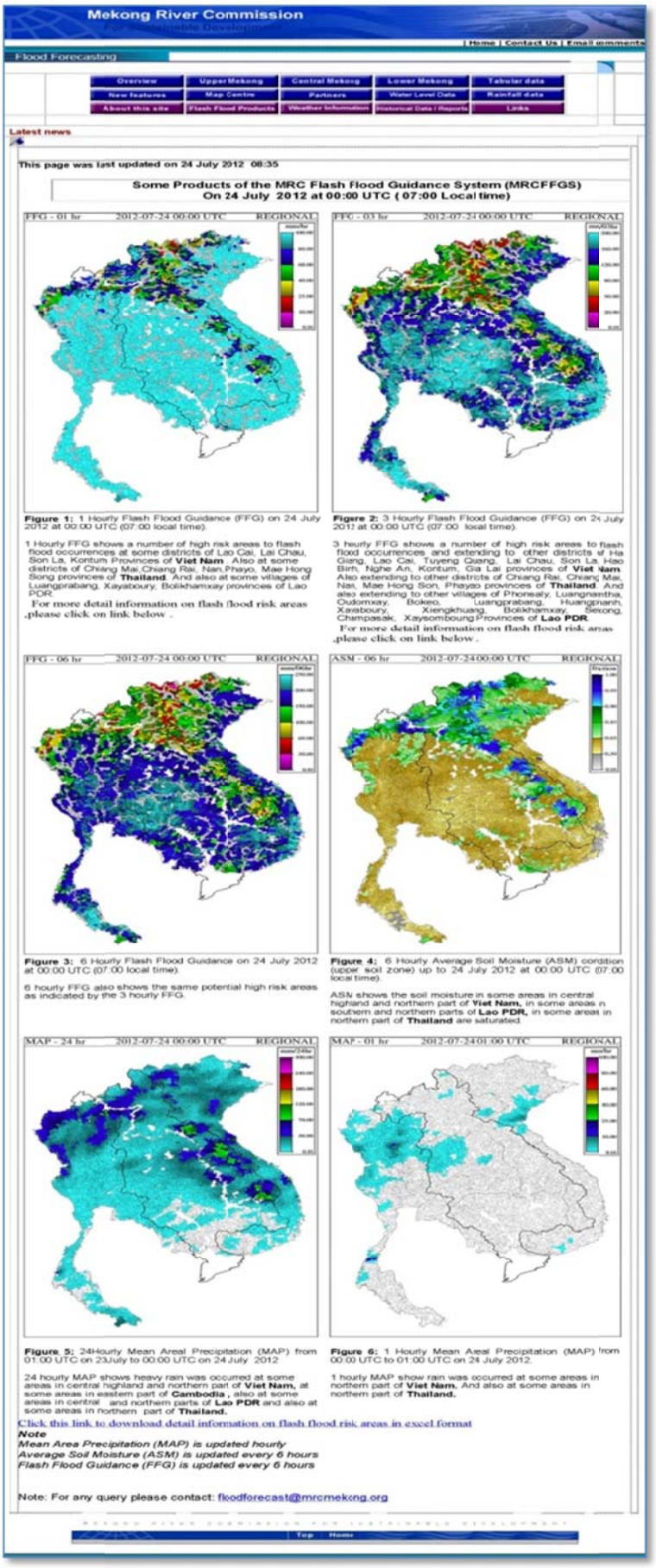


Figure 1-4 MRC-FFG system on the MRC flood forecasting website.

2. Methodology to Evaluate Flash Flood Guidance Product

The methodology for evaluation of flash flood guidance products used in the flash flood report is based on two concepts, according to the evaluation reports on MRC-FFG system for flood season 2011 to 2014 ([3], [4], [5], [6]). The first concept evaluates the feed-back of the FFGS detected risk areas from the information sources like the media or the press. As the link between the regional flood center and the local people is not fully established, the feed-back information on flash flood areas was mainly collected from the national media, such as online newspapers.

The second concept evaluates the FFG results through the recorded water levels that are available in the operational database of RFMMC. If MRC-FFG system detected flash flood warnings in the sub-areas where the gauge station is available, the MRC-FFG results can be evaluated by comparing with the water level data of the gauge station located in the downstream part of sub-catchments.

The record daily rainfall of observed stations, where available at the flash flood risk areas also used as the support data for evaluate the flash flood occurred. However, occasionally it is difficult to evaluate the FFG results using the media information, due to the fact that flash floods occurred in areas that are difficult to access and why the reporting of FFG results is lacking. Although the MRC-FFG system often successfully had indicated a flash flood risk in the flooded areas, database information of occurred flash floods was not accurate and complete, which makes validation of the system difficult ([2]).

3. Flash Flooding in the Mekong Region during the Flood Season 2015

The climate of the LMB is under the influence of monsoon winds of seasonal characters (i.e. southwest monsoon and northeast monsoon). The southwest monsoon which usually starts in mid-May and ends in mid-October brings a stream of warm moist air from the Indian Ocean towards the LMB causing abundant rain over the Mekong region. Rainfall during this period is not only caused by the southwest monsoon but also by the ITCZ and tropical cyclones which produce a large amount of rainfall. The northeast monsoon normally starts in mid-October and ends in mid-February bring the cold and dry air from the anticyclone in China's mainland over major parts of the LMB.

During the year 2015 there were 30 tropical storms which developed over the Pacific Ocean and or over the East Sea (see Figure 3-1). There were four tropical storms, namely (1) KUJIRA, (2) KOMEN, (3) VAMCO and (4) MUJIGAE which caused serious flash floods affecting the LMB. Figure 3-1 represents the track of the tropical storm during the year 2015. The other cause of flash floods in the Lower Mekong region is the ITCZ, low pressure and tropical depression which also led to flash flood occurrence at some areas in the Mekong mainstream and its tributaries. Figure 3-2 represents an example of the weather chart on 16 July 2015 during the ITCZ occurrence in the Mekong region. The scattered moderate rainfall that occurred at some mainstream and tributaries of the Mekong River from May to November 2015 is shown in Figure 3-3.

Table 3-1 represents the list of districts and villages with flash flood risks that were detected by the MRC-FFG system and were affected by the 2015 flood season from May to mid-November. It should be noted that in Cambodia and Lao PDR warnings are given at village level, which these are provided in Thailand and Viet Nam at district level. Figure 3-4 illustrates the FFG warnings MAP[1] in different countries.

Table 3-1 The number of warning issued that were detected by the MRC-FFG in the flood season 2015, warning for Viet Nam include areas outside the LMB and warning for Thailand not include areas outside of LMB.

Country	Total (May to mid of November 2015)
Viet Nam	136 districts
Thailand	20 districts
Loa PDR	963 villages
Cambodia	3 villages

[1] MAP = mean areal precipitation, which is the average rainfall over a given area, generally expressed as an average depth over the area.

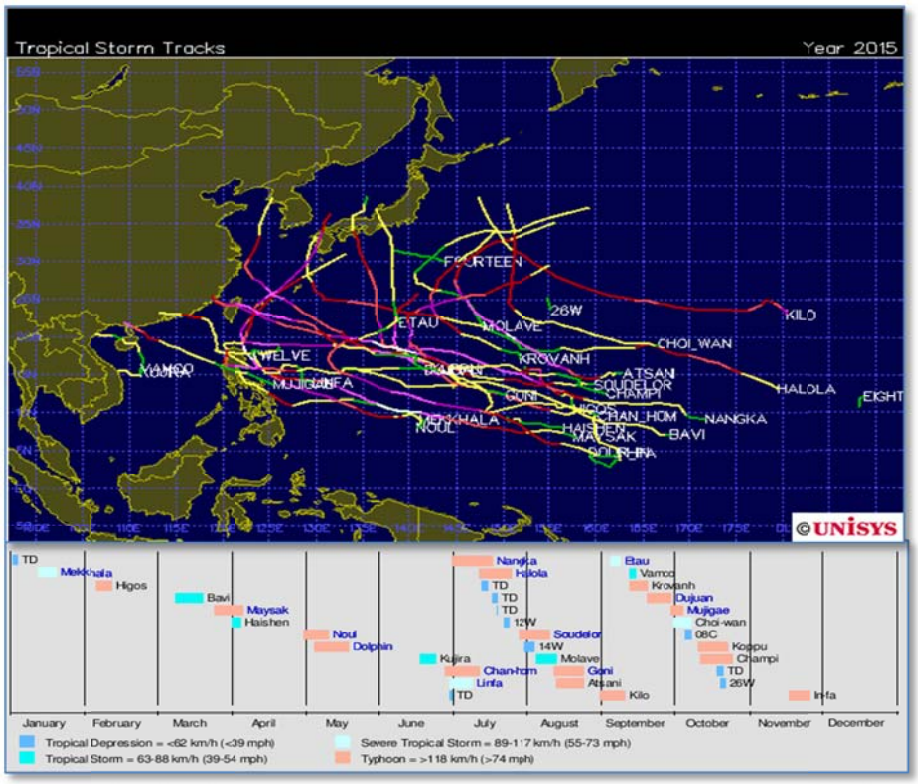


Figure 3-1 Tropical storm track for Western Pacific in 2015. Source: UNISYS.

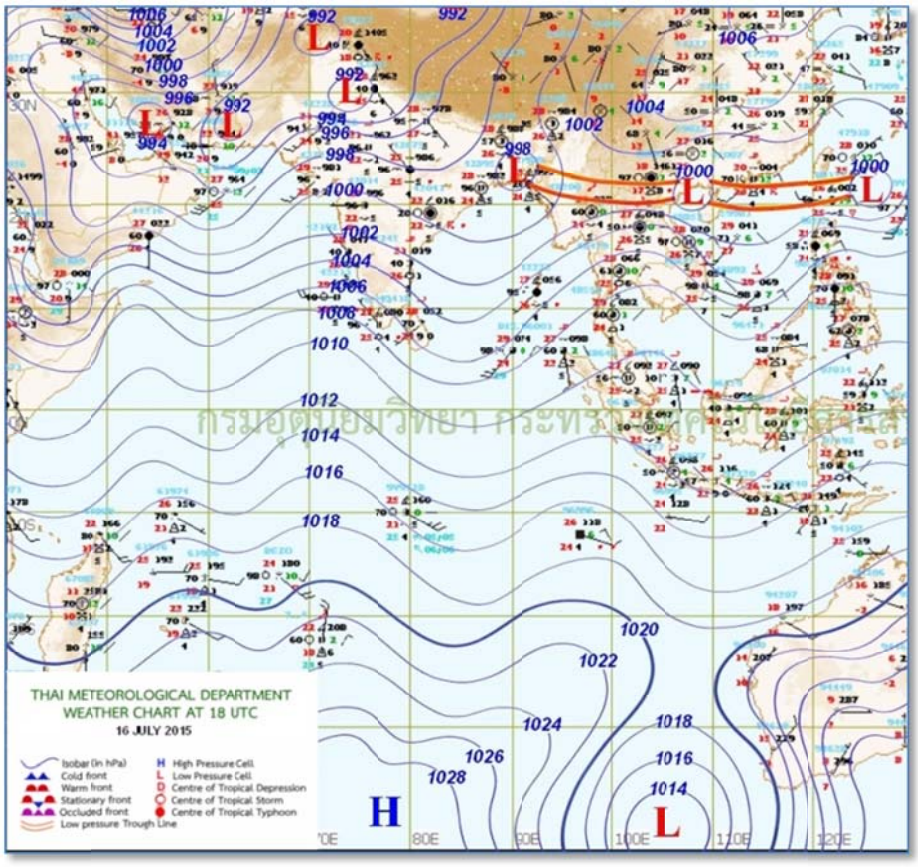


Figure 3-2 Weather Chart issued at 18:00 UTC on 16 July 2015. Source: the Thai Meteorological Department.

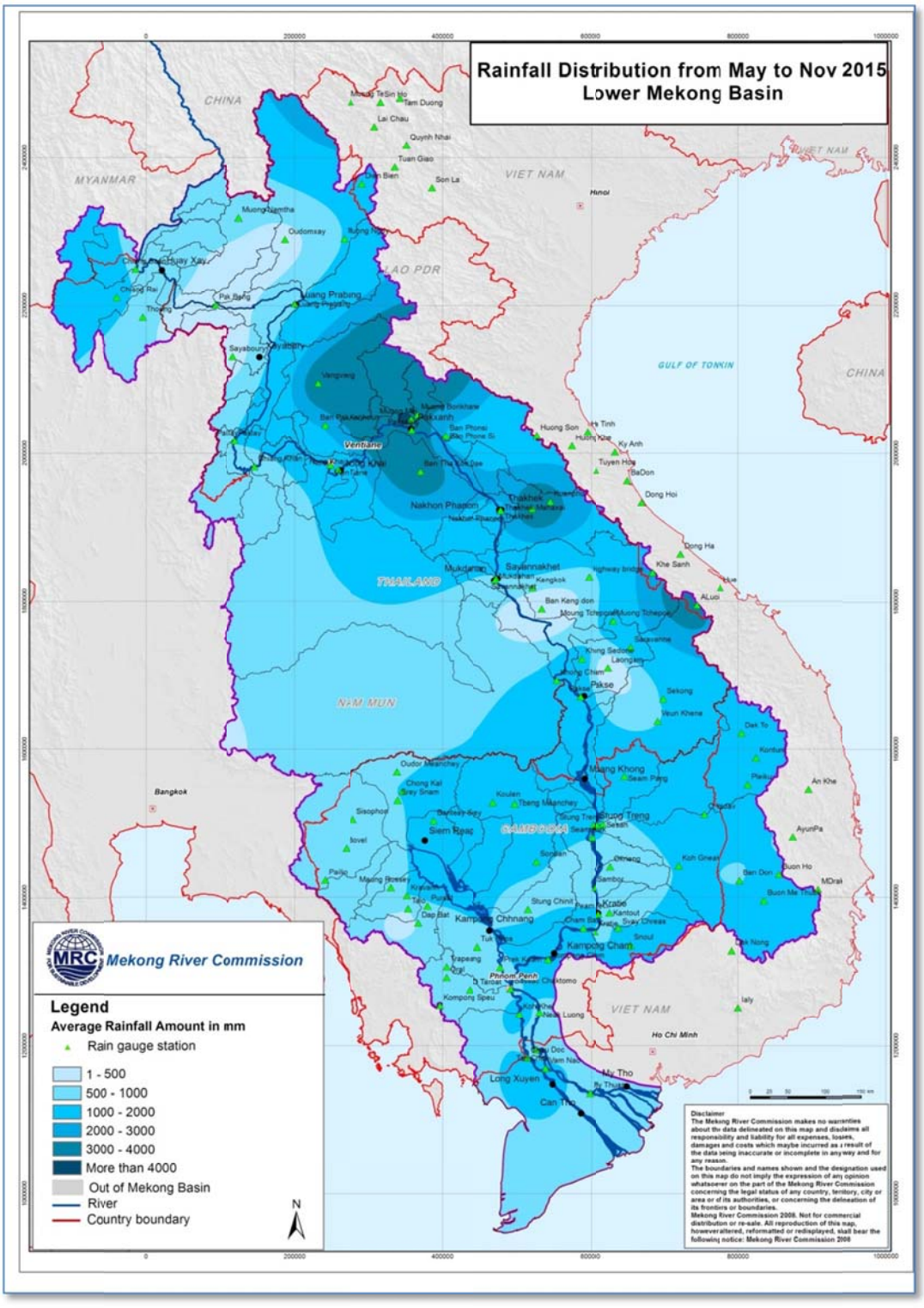


Figure 3-3 Rainfall distribution Map over the LMB from May to November 2015.

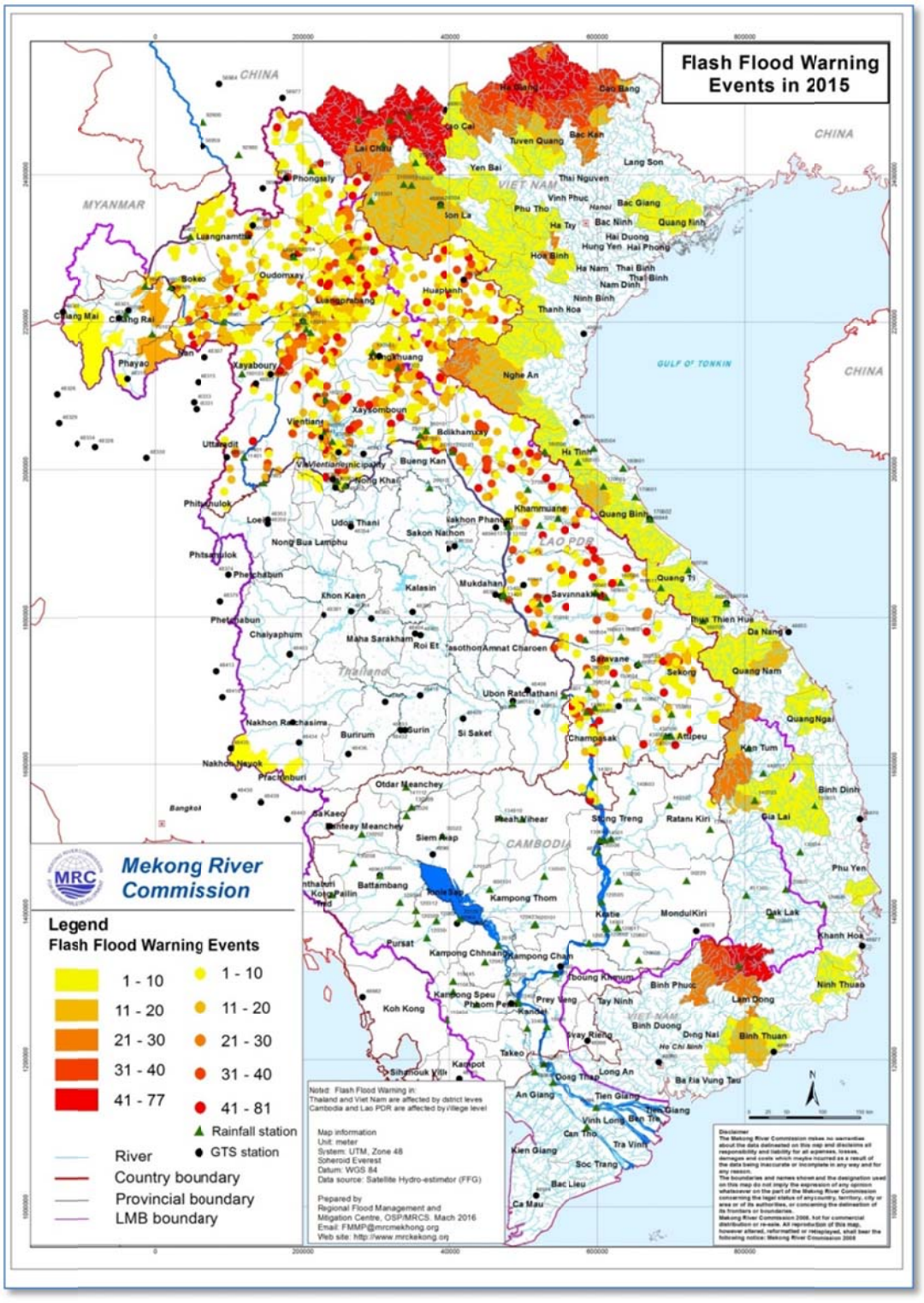


Figure 3-4 Flash flood warnings map during flood season 2015 by MRC-FFG system.

4. Flash flooding in Northern provinces of Viet Nam and Lao PDR caused by the tropical storm KUJIRA during the period from 20 to 25 June 2015

4.1 The tropical storm KUJIRA during the last week of June 2015

On 20 June 2015 at 7.00 PM local time the tropical depression in the middle of South China Sea was upgraded to the tropical storm KUJIRA, which was centered about 340 km at latitude 16.0 degrees North and latitude 111.5 degrees East in Southeast of Da Nang, Viet Nam with maximum sustained winds of about 65 km/h (see Figure 4-1). The storm is the first tropical storm in the East Sea of the year 2015. The meaning of KUJIRA is "whale" in Japanese. Figure 4-1 illustrates the position of the tropical storm KUJIRA formed in the middle of the East Sea at 7.00 PM local time on 20 June 2015.

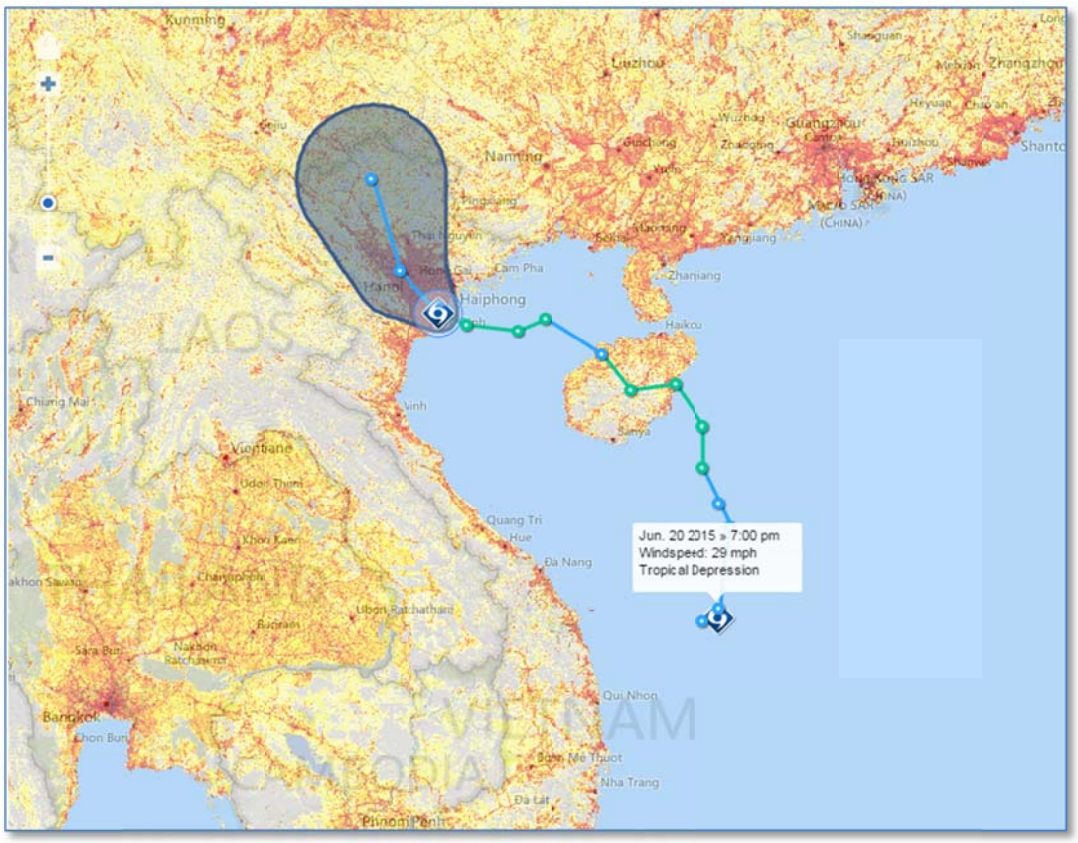


Figure 4-1 The position of the tropical storm KUJIRA was formed in the middle of the East Sea. Source: the Disaster Alert Network.

On 22 June 2015 at 7.00 PM local time the center of tropical storm KUJIRA hit Hainan Island at latitude 18.0 degrees North and latitude 111.5 degrees East in the upper East Sea with maximum sustained winds about 65 km/h (see Figure 4-2). It then moved into the Gulf of Tonkin and hit northeastern Viet Nam bringing strong winds and heavy rainfall on 24 June 2015 (see Figure 4-3). This caused heavy rainfall in the entire northern region of Viet Nam. The tropical storm KUJIRA is the first storm of the year 2015 to hit Viet Nam. It is the 8th typhoon of the year 2015 Pacific typhoon season.

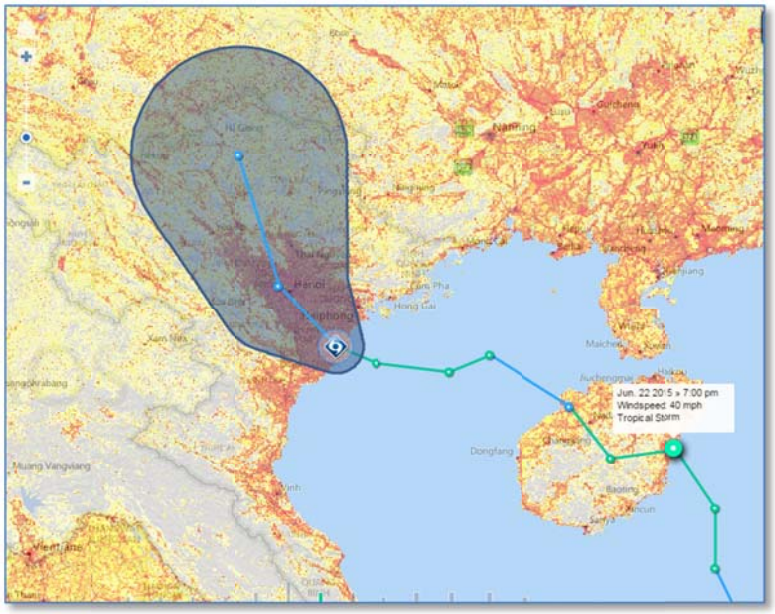


Figure 4-2 The position of the tropical storm KUJIRA hit Hainan Island in the upper East Sea at 7.00 PM local time on 22 June 2015. Source: the Disaster Alert Network.

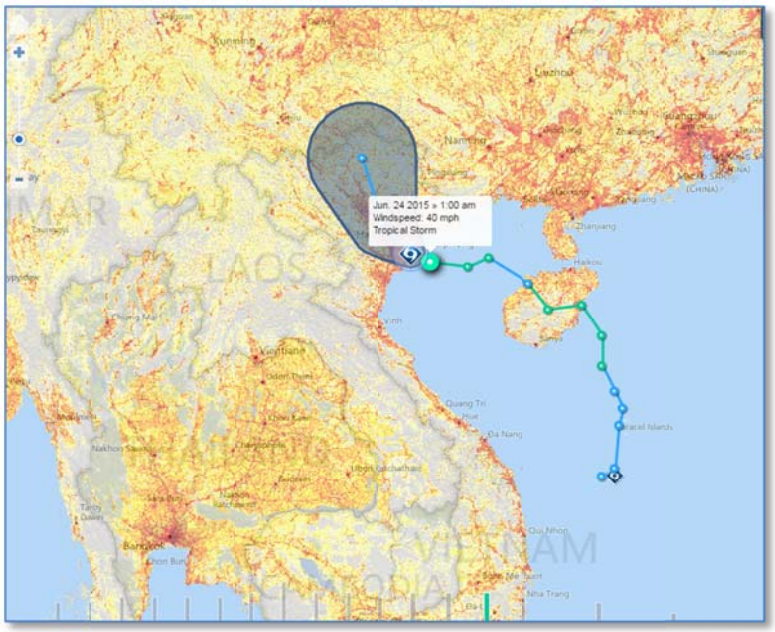


Figure 4-3 The position of tropical storm KUJIRA that made its second landfall in Viet Nam at 1.00 AM local time on 24 June 2015. Source: the Disaster Alert Network.

The tropical storm KUJIRA was downgraded to the tropical depression in northern Viet Nam around 7.00 PM local time on 24 June 2015 (see Figure 4-4). It has brought strong winds and heavy rainfall on a large scale in the Northern provinces after making landfall in Viet Nam's northeastern Quang Ninh and Hai Phong provinces, according to the National Center for Hydro-meteorological Forecasting, Viet Nam. It was due about 100 kilometers North of Hanoi city with maximum sustained winds about 50 km/hr. The flash flood after the tropical storm KUJIRA swept away 23 houses and killed at least three people in Son La Province, about 200 km west of Hanoi, according to the media (see Appendix 1). According to the National Hydro-meteorological Forecast Center, on 25 June 2015, around 7.00 AM Phnom Penh time, the tropical depression was moving to the Northwest of Viet Nam with maximum sustained winds about 30 km/hr (see Figure 4-5). It later declined into the tropical low pressure, but heavy rains were still occurring in northeastern provinces of Viet Nam,

During 20 - 25 June 2015, the LMB was covered by the low pressure and tropical storm KUJIRA which caused heavy rain at several areas in the North, Center and South Central Coast of Viet Nam, some areas in the North and Center of Lao PDR, some areas in the northern parts of Cambodia, and also in some areas at the northeastern provinces of Thailand (see Figure 4-5). Figure 4-5 illustrates the weather chart of the Mekong region during the last week of July 2015.

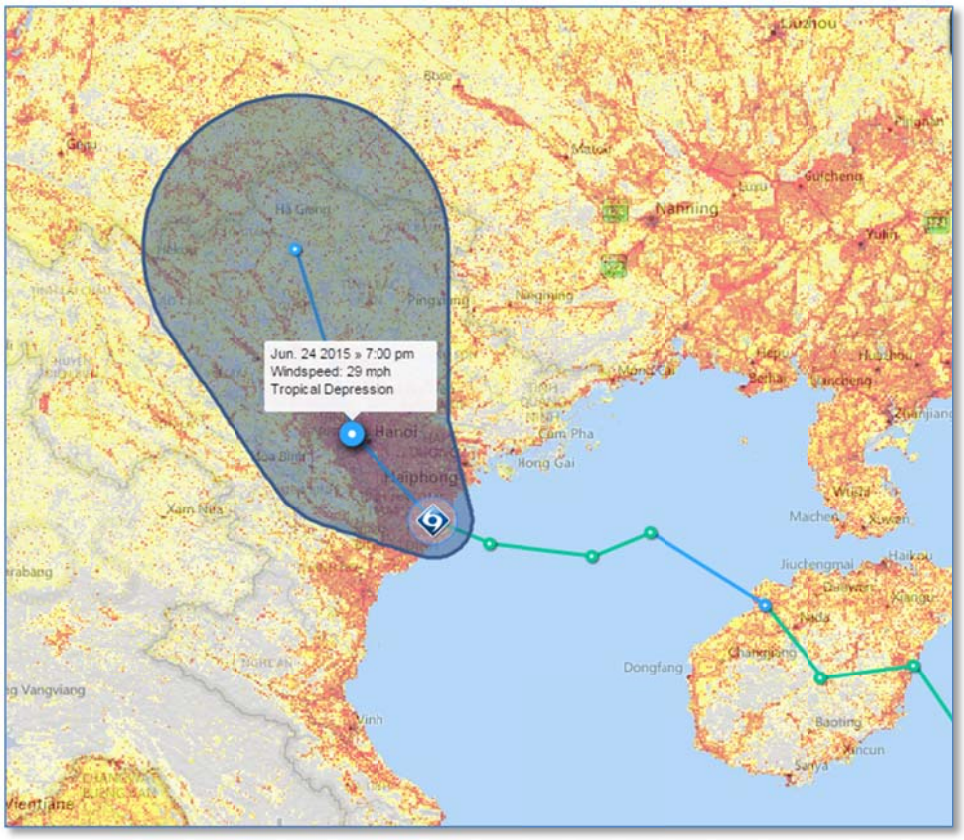


Figure 4-4 The position of tropical depression in the upper Viet Nam at 7.00 PM local time on 24 June 2015. Source: the Disaster Alert Network.

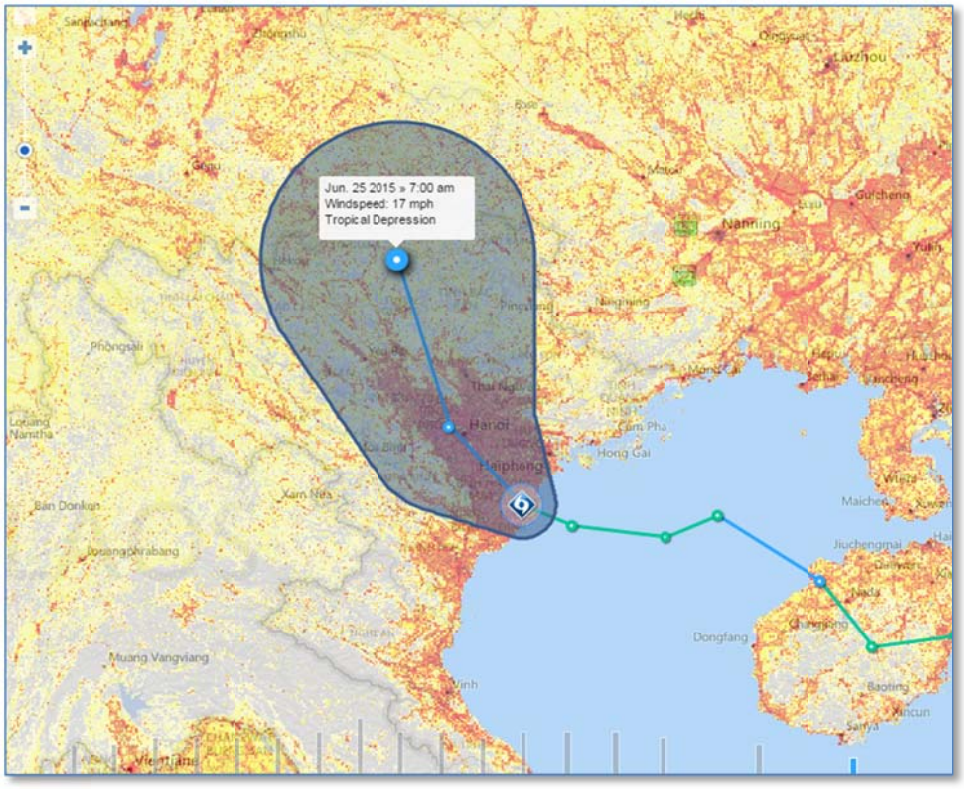


Figure 4-5 The position of tropical depression in the Northwest of Viet Nam at 7.00 AM Phnom Penh time on 25 June 2015. Source: the Disaster Alert Network.

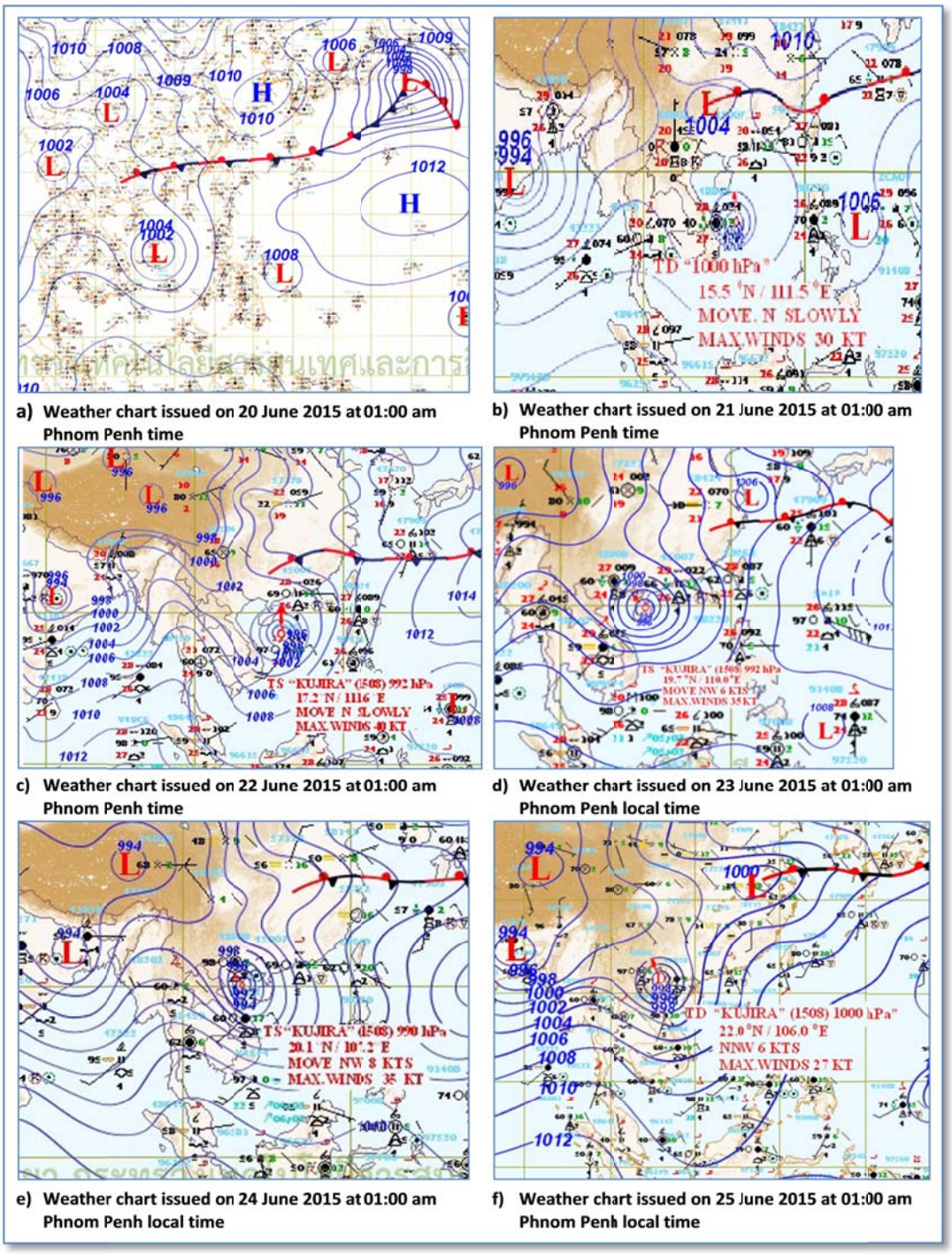


Figure 4-6 The weather chart of the Mekong region on 20-25 June 2015 at 01:00 AM Phnom Penh local time. Source: the Thai Meteorological Department.

4.2 Heavy rainfall during the period of tropical storm KUJIRA

During the period 20 - 25 June 2015 heavy rainfall and strong winds were brought to Viet Nam by the tropical storm KUJIRA. Due to the storm circulation, heavy rainfalls hit several areas in the northern and central parts of Viet Nam, and also in

Lao PDR's northeastern Huaphan Province according to the media report (see Appendix 1).

Table 4-1 shows the daily rainfall amounts at some rain gauge stations located within the northern provinces of Viet Nam (see Figure 4-7), which were based on the rainfall data available during the tropical storm KUJIRA from 20 to 25 June 2015. The data records from 7:00 AM to 7:00 AM the following day for each recorded day. Unfortunately, the rainfall data was not available of some rain gauge stations located within the northern provinces of Lao PDR such as Phongsaly, Muong Namtha, Oudomxay and Moung Ngoy stations during the storm KUJIRA. Referring to Table 4-1, the daily rainfall on 25 June 2015 reached maximum about 246 mm at the Son La station located in the upper North of Viet Nam.

After the tropical storm KUJIRA made landfall in Viet Nam, it was then downgraded to a tropical depression on June 24, 2015. It brought heavy rainfall on the large area in the Mekong mainstream and tributaries. Figure 4-8 illustrates the daily rainfall distribution in the LMB on 24 and 25 June 2015 that was obtained from rain gauge stations located within the LMB.

Results in Figure 4-8 (a) show that heavy rainfall was occurring in the central provinces of Lao PDR, especially in Khammouane, Bolikhamxa, Champassak and Saravane provinces, and also in Cambodia's northeastern Siem Reap and Oddar Meanchey provinces.

Results in Figure 4-8 (b) show that heavy rainfall occurred in some areas in the upper part of the Lower Mekong Basin, especially in Lao PDR's northeastern provinces of Luang Prabang, Pakxanh and Phongsaly, and Viet Nam's northwestern province of Lai Chau, and also some areas in the lower part of the Lower Mekong Basin, especially in Lao PDR's southern province of Champassak, and in Cambodia' northeastern Stung Treng and Ratanakiri provinces, respectively.

Table 4-1 The daily rainfall amounts at some rain gauge stations of the northern provinces of Viet Nam during on 20 - 25 June 2015.

Rain gauge station	Daily rainfall amount in mm, during 20 - 25 June 2015					
	20-June	21-June	22-June	23-June	24-June	25-June
Muong Te	0.2	45	3	0	-	77
Sin Ho	7	0.4	3.6	23	0	77.9
Tam Duong	47	14	0.1	1	0.7	77.3
Pha Din	-	-	2	4	5	118
Yen Chau	-	0.1	17	9	19	73
Mai Chau	0.5	-	7.1	5	15	64
Lai Chau	0.2	29	0	0.2	0	36
Quynh Nhai	0.2	29	0	0.2	0	36
Tuan Giao	-	-	1	2	2	121
Dien Bien	-	0.1	7	0.5	0	21
Son La	0	16	13	13	20	246

Note: "–" indicates that rainfall data is not available

Figure 4-9 represents the 24hr Mean Areal Precipitation (MAP) during the period of tropical storm KUJIRA from 20 to 25 June 2015. Figure 4-9 presents that the 24hr MAP indicates that the northern parts of Viet Nam, the central and northern parts of Lao PDR, and also in the northern part of Cambodia was covered by heavy rainfall.

The 24hr Hydro-estimator Satellite Precipitation (HE-Sat) at 00:00 UTC during the period of storm KUJIRA, 20 - 25 June 2015, is shown in Figure 4-10. It shows that the heavy rainfall was occurring over parts of northern Viet Nam, and also over parts of northern and central Lao PDR on 24 and 25 June 2015.

Figure 4-11 represents the 6hr Average Soil Moisture (ASM) conditions during the period of the storm KUJIRA on 20 to 25 June 2015. Results show that during the storm, some areas in the northern and central parts of Viet Nam, and also at some areas in the northern, southern and central parts of Lao PDR were saturated. Meanwhile, during the heavy rain falling on these saturated grounds were facing possible high flash flood occurrences.

The comparison of the observed daily accumulated rainfall with the 24hr MAP and the 24hr HE-sat is shown in Figure 4-12. The data was obtained from 6 rain gauge stations; namely, the Muong Te, Sin Ho, Tam Duong, Yen Chau, Quynh Nhai and Son La stations respectively, (see Figure 4-7). Results show the uncertainty in the MRC-FFG results (i.e. 24hr MAP and 24hr HE-Sat) to produce rainfall when compared with the observed rainfall during the storm KUJIRA. The 24hr MAP and 24hr HE-Sat quite varied (i.e. underestimated and overestimated) when compared with the observed rainfall of these 6 stations.

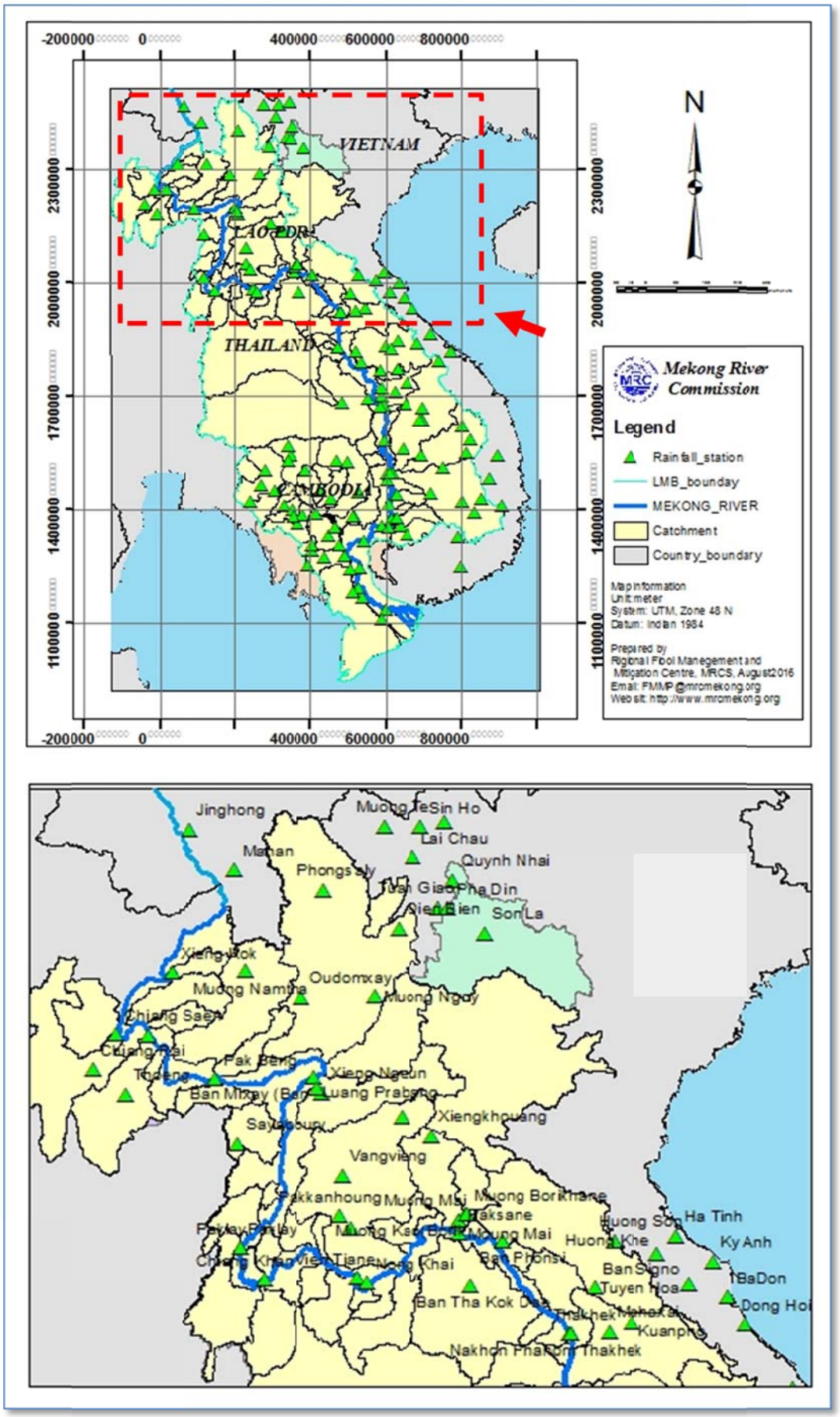


Figure 4-7 Location of rain gauge stations located surrounding in the northern of Viet Nam.

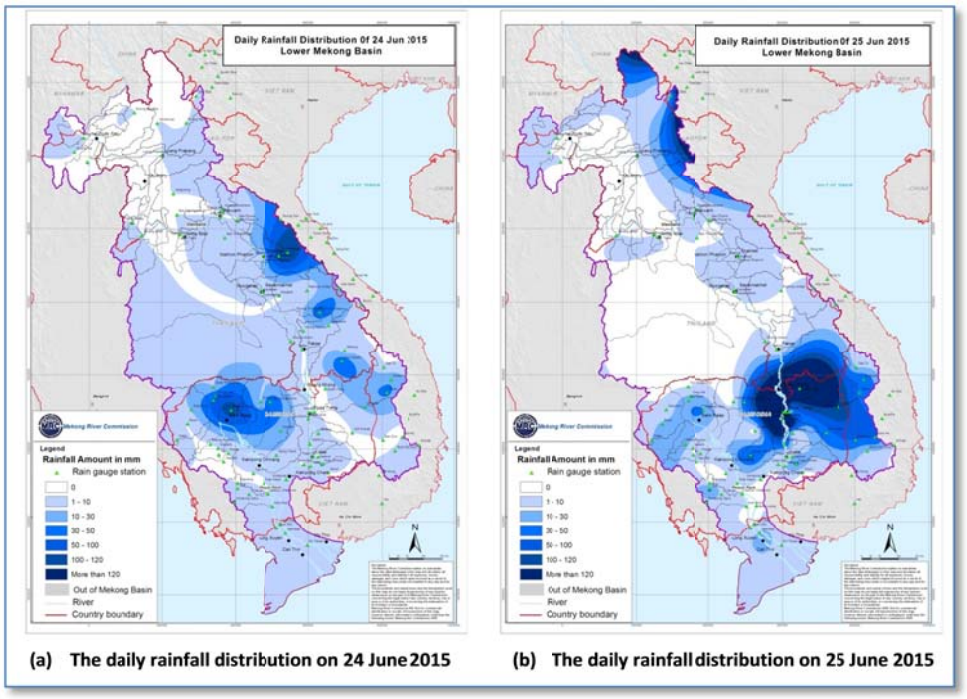


Figure 4-8 Daily rainfall distribution on 24 and 25 June 2015 in the LMB. Source is RFMMC.

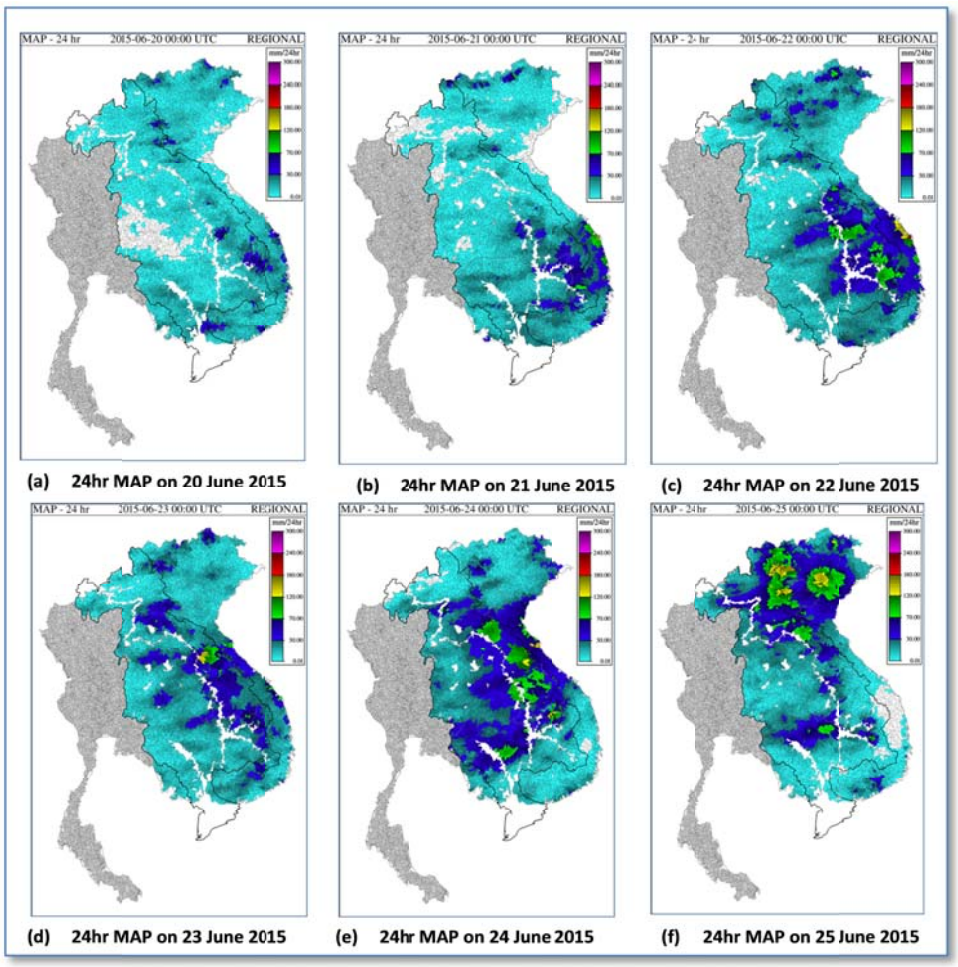


Figure 4-9 The 24hr MAP during the period of the tropical storm KUJIRA at 00:00 UTC on 20 to 25 June 2015.

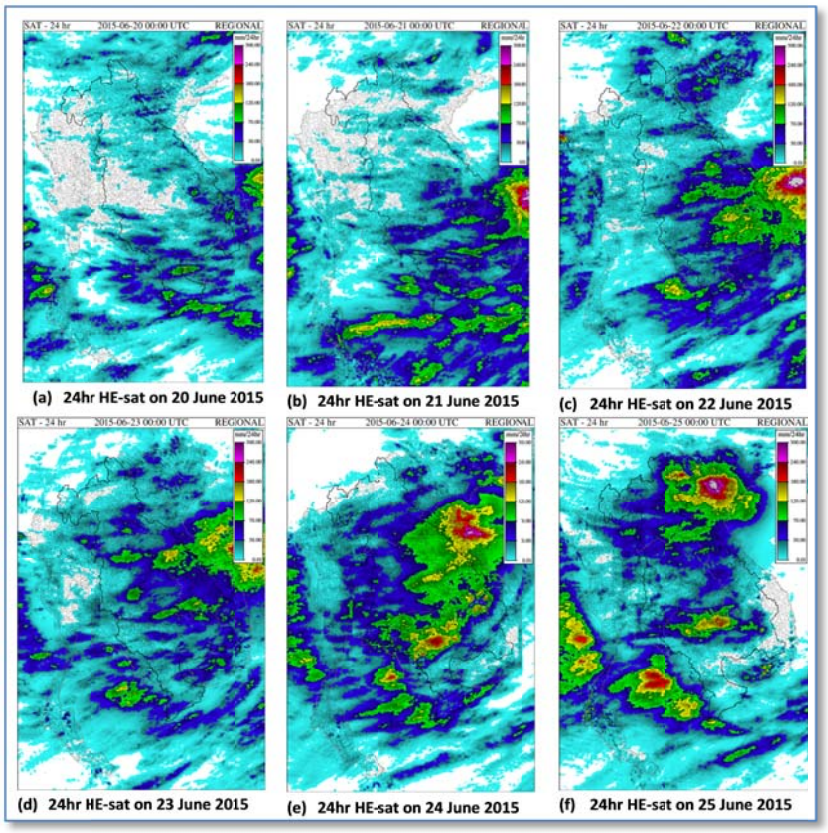


Figure 4-10 The 24hr HE-sat during the period of the tropical storm KUJIRA at 00:00 UTC on 20 to 25 June 2015.

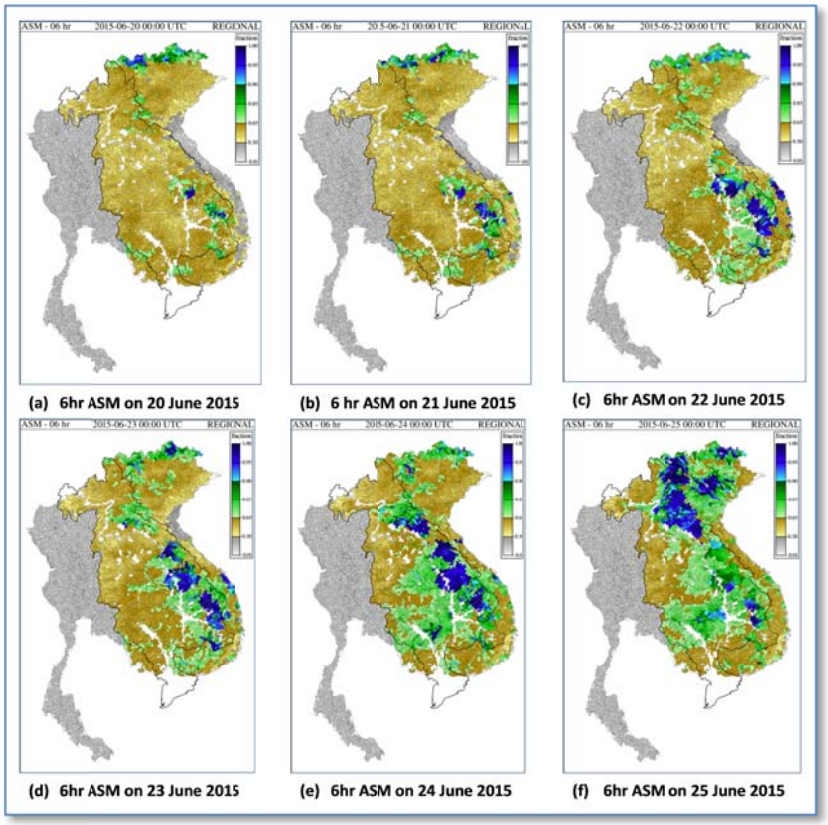


Figure 4-11 The 6hr ASM condition during the period of the tropical storm KUJIRA at 00:00 UTC on 20 to 25 June 2015.

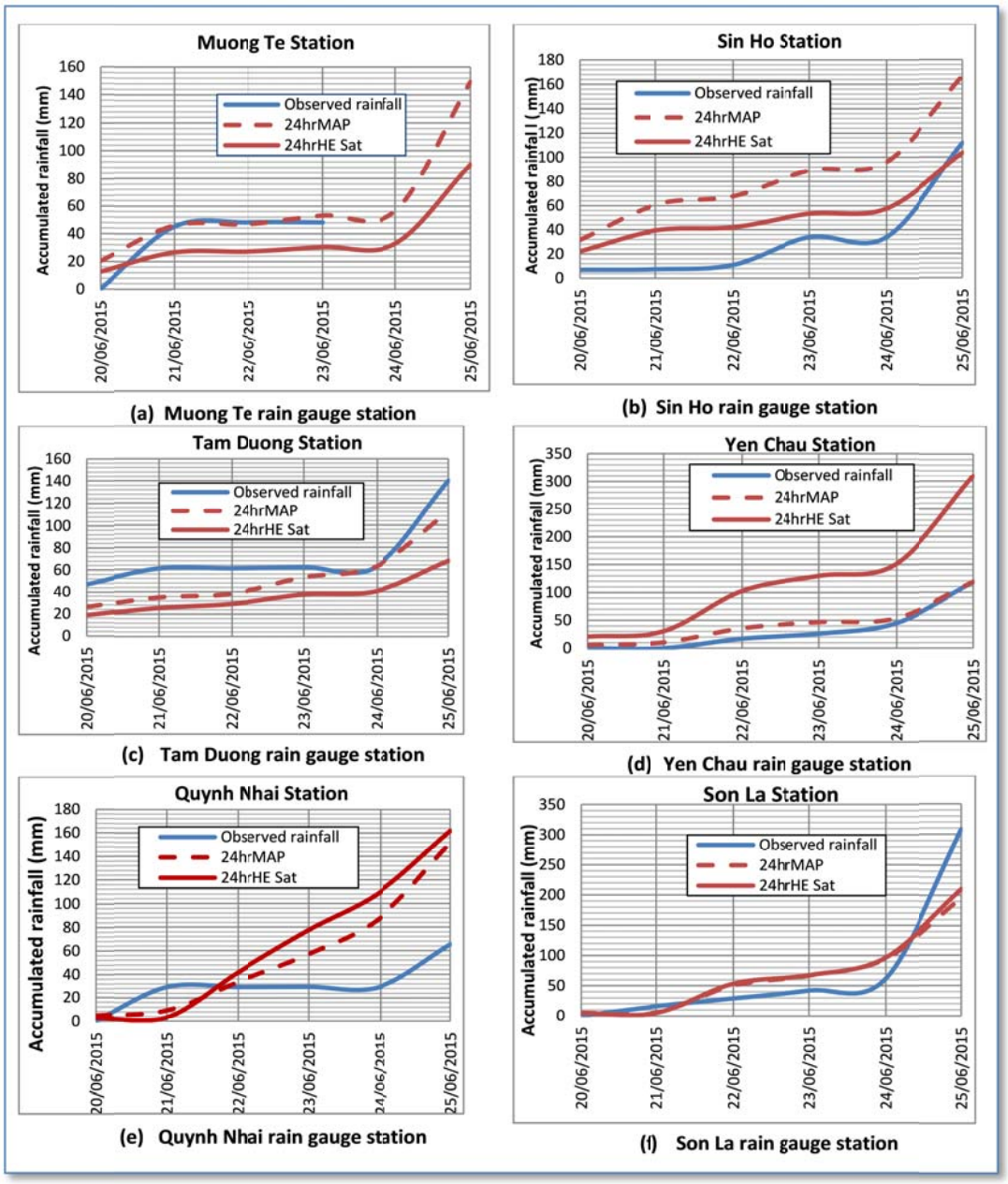


Figure 4-12 Accumulated observed rainfall (mm), 24hr MAP (mm) and 24hr HE-sat (mm) at 6 rain gauge stations located within the upper North of Viet Nam.

4.3 Rising water levels in some tributaries of the Mekong River during the period of tropical storm KUJIRA

During 20 - 25 June 2015 the tropical storm KUJIRA hits the LMB and then developed into a low pressure before dissipating. Heavy rainfalls generated from depression of the tropical storm KUJIRA has affected the flow regime at many river monitoring stations on tributaries and Mekong River mainstream, located in the northern part of Viet Nam, as well as some areas in the northern part of Lao PDR. The storm KUJIRA caused the water level to rise rapidly at some river monitoring

stations in the upper and central part of the LMB (see Figure 4-13). According to the media (see appendix 1.1), this situation generated many flash flood occurrences in several areas in Viet Nam's northern Son La and Lai Chau provinces, and some provinces located in upper parts of Lao PDR, especially the provinces of Huaphanh and Oudomxay provinces.

The graph in Figure 4-14 to 4.16 illustrate water levels during the period of tropical storm KUJIRA of three gauge stations, namely Vangvieng, Muong Ngoy and Muong Kaa stations, located in the northern parts of the LMB; the water levels were recorded twice a day at 7 AM and 7 PM. Overall from 21 to 23 June water levels were rising rapidly and slightly dropping by 23 June 2015.

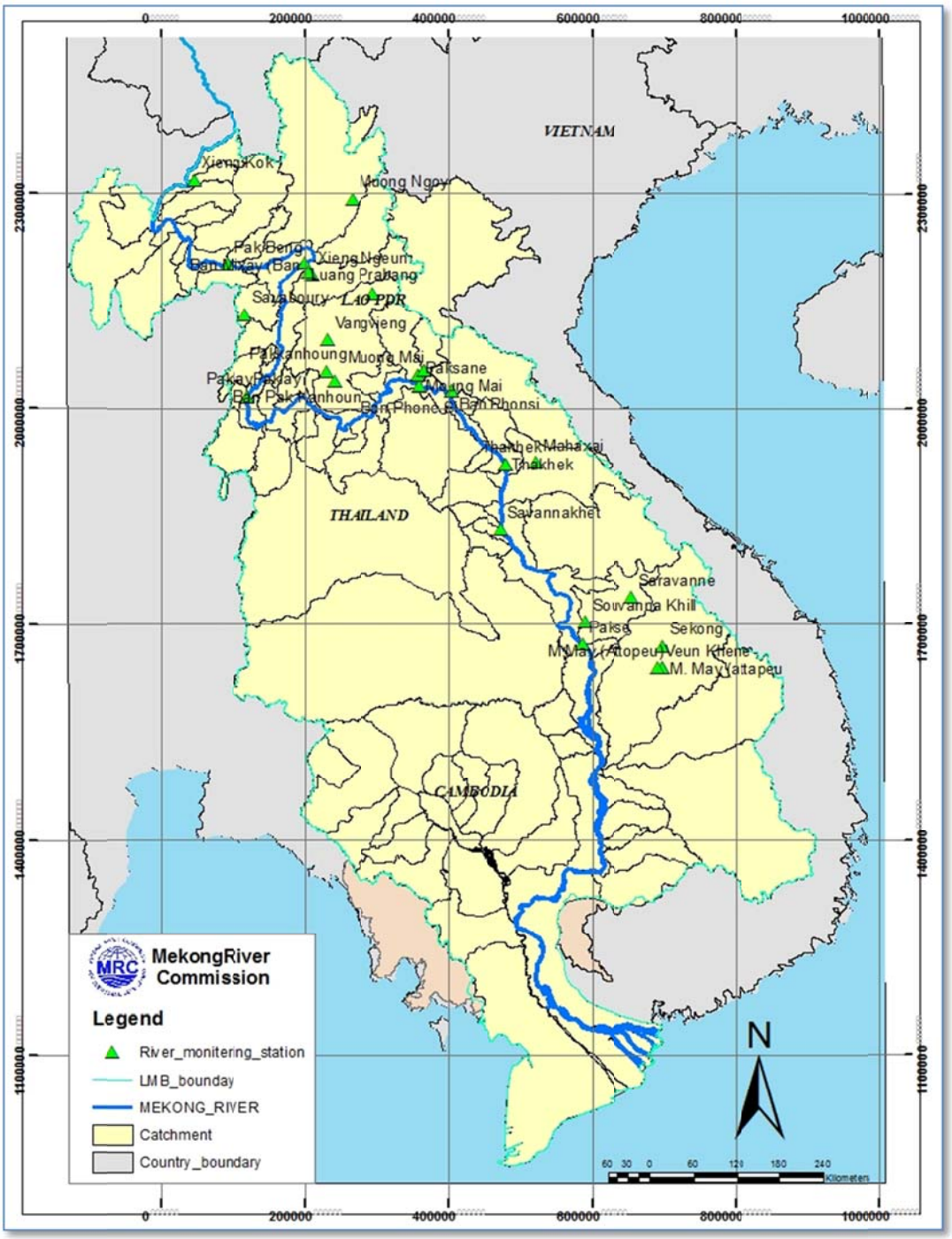


Figure 4-13 The location of river flow monitoring stations located within the northern of Viet Nam, and in the northern of Lao PDR on the Mekong River.

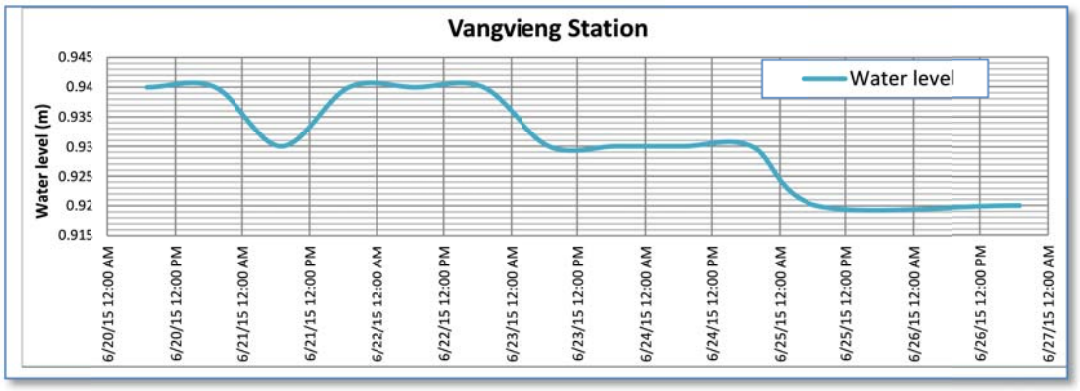


Figure 4-14 Water level at the Vangvieng River monitoring station during the tropical storm KUJIRA.

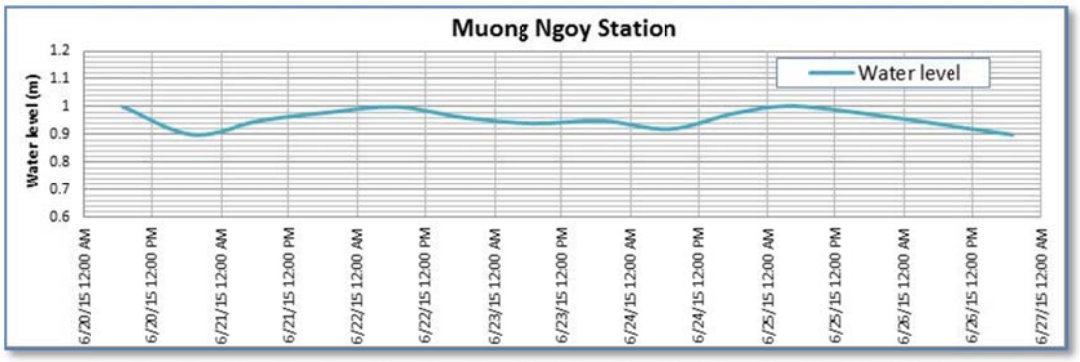


Figure 4-15 Water level at the Muong Ngoy monitoring station during the tropical storm KUJIRA.

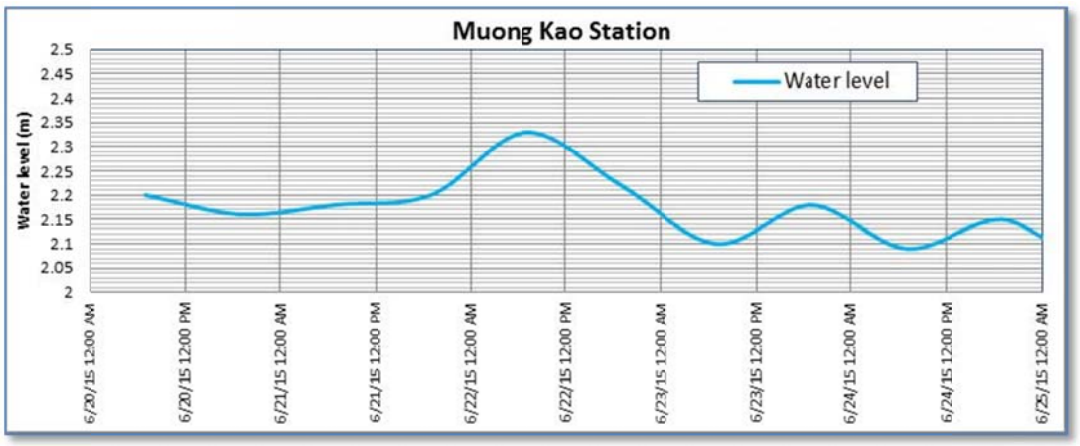


Figure 4-16 Water level at the Muong Kao monitoring station during the tropical storm KUJIRA.

4.4 Flash flooding in the northern provinces of Viet Nam and Lao PDR, caused by typhoon storm KUJIRA

The MRC-FFG system detected several flash flood risk areas in LMB during the KUJIRA storm from 20 to 25 June 2015. Severe flash floods occurred on several

tributaries and Mekong River mainstream in the central and northern parts of Lao PDR, as well as in the upper parts of Viet Nam.

The floods and flash floods situation in Viet Nam during the tropical storm KUJIRA was based on the information from the media, from the internet, the National Hydro-meteorological Forecast Center and newspaper sources (see Appendix 1.1). The tropical storm KUJIRA killed eight people and caused floods which swept away many houses in the northern Viet Nam's Son La Province. Nearly 400 houses were flooded and more than 70 houses collapsed. More than 500 ha of rice paddies and crops were inundated, livestock was washed away, and local irrigation systems and roads were seriously damaged.

On 24 and 25 June, the tropical storm brought heavy rainfall to the northern Viet Nam's Son La Province (see appendix 1.1). While on 25 June 2015, the maximum rainfall reached maximum about 246 mm of Son La station located in the upper North of Viet Nam (see Table 4-1). During this time many districts in Son La were submerged and at least 23 houses were also wiped out by flood waters. The floods also eroded a number of roads causing traffic congestion.

Table 4-2 represents the list of FFG warnings of the next 1, 3 and 6 hours flash floods detected by MRC-FFG system at 00:00 UTC (07:00 Phnom Penh time) on 25 June 2015 at some districts of the northern provinces of Viet Nam, especially in Bac Kan, Binh Thuan, Cao Bang, Gia Lai, Ha Giang, Ha Tay, Hoa Binh, Hoa Binh, Kon Tum, Lai Chau, Lam Dong, Lao Cai, Nghe An, Phu Tho, Son La, Thanh Hoa, Tuyen Quang and Yen Bai provinces.

The floods and flash floods situation in Lao PDR during the tropical storm KUJIRA was based on the information from the media (see Appendix 1.3). Heavy rainfall began on 23 June 2015 across the northern and central parts of Lao PDR. Heavy rainfall continued in Lao PDR's upper Huaphan Province on 24 and 25 June 2015 especially, flash floods in Phongsai and Bangtang villages of Xiengkhor District. It caused the water level to exceed 30 m in depth in some areas, constituting of the worst floods in living memory.

Table 4-3 represents the list of FFG warnings of the next 1, 3 and 6 hours flash flood detected by MRC-FFG system at 00:00 UTC (07:00 Phnom Penh time) on 25 June 2015 at some villages of northern and central parts of Lao PDR, especially in Bolikhamxay, Champassak, Huaphanh, Khammouane, Luang Prabang, Phongsaly, Vientiane, Xaysomboun and Xiangkhouang provinces.

Figure 4-17 and Figure 4-18 represent map FFG warnings of the next 1, 3 and 6 hours flash flood by MRC-FFG system at 00:00 UTC (07:00 am Phnom Penh time) on 24 and 25 June 2015. On June 24, 2015 at 00:00 UTC (07:00 AM Phnom Penh time), MRC-FFG system estimated the FFG warnings at many districts of the northern provinces of Viet Nam, especially in Bac Kan, Binh Phuoc, Cao Bang, Da Nang, Dak Lak, Gia Lai, Ha Giang, Hoa Binh, Kon Tum, Lai Chau, Lam Dong, Lao

Cai, Nghe An, Quang Nam and Quang Binh provinces. Also in many villages of the northern and central provinces of Lao PDR, especially in Attapeu, Bolikhamxay, Champassak, Huaphanh, Khammouane, Luang Prabang, Savannakhet, Sekong, Vientiane, Xaysomboun and Xiangkhouang provinces; were at the risk of flash flood occurrences.

Table 4-2 The list of FFG warnings of the next 1, 3 and 6 hours flash flood in Viet Nam on 25 June 2015 at 00:00 UTC by MRC-FFG system.

1hour Flash Flood Guidance in Viet Nam			3hours Flash Flood Guidance in Viet Nam			6 hours Flash Flood Guidance in Viet Nam		
Provinces	Districts	FFG value	Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
Ha Tay	TX. Son Tay	24.87	Island	Tam Thanh	39.33	Bac Kan	Bach Thong	38.30
Ha Tay	Ba Vi	24.87	Ha Tay	TX. Son Tay	35.08	Bac Kan	TX. Bac Kan	38.30
Cao Bang	Bao Lac	14.64	Ha Tay	Ba Vi	35.08	Bac Kan	Ba Be	43.83
Cao Bang	Thong Nong	22.32	Ha Giang	Meo Vac	42.25	Bac Kan	Ngan Son	37.42
Cao Bang	Nguyen Binh	18.48	Ha Giang	Yen Minh	42.25	Binh Thuan	Tanh Linh	43.96
Cao Bang	Hoa An	22.32	Ha Giang	Quan Ba	42.25	Binh Thuan	Ham Thuan Nam	43.96
Lao Cai	Bat Xat	16.48	Ha Giang	Bac Me	39.54	Cao Bang	Ha Quang	47.99
Lao Cai	Sa Pa	17.97	Ha Giang	Vi Xuyen	42.25	Cao Bang	Thong Nong	41.10
Lao Cai	Than Uyen	16.86	Cao Bang	Bao Lac	34.16	Cao Bang	Hoa An	41.10
Bac Kan	TX. Bac Kan	18.97	Cao Bang	Ha Quang	43.06	Cao Bang	Bao Lac	43.10
Bac Kan	Ba Be	14.64	Cao Bang	Thong Nong	36.64	Cao Bang	Nguyen Binh	39.84
Bac Kan	Bach Thong	18.97	Cao Bang	Nguyen Binh	33.39	Gia Lai	Ia Grai	45.21
Phu Tho	Thanh Son	15.94	Cao Bang	Hoa An	36.64	Ha Giang	Vi Xuyen	42.40
Lai Chau	TX. Lai Chau	19.68	Lao Cai	Bat Xat	24.98	Ha Giang	Meo Vac	36.00
Lai Chau	Muong Te	17.39	Lao Cai	Sa Pa	23.39	Ha Giang	Yen Minh	38.42
Lai Chau	Phong Tho	15.85	Lao Cai	Than Uyen	30.55	Ha Giang	Quan Ba	36.00
Lai Chau	Sin Ho	16.33	Bac Kan	TX. Bac Kan	25.99	Ha Giang	Bac Me	44.25
Lai Chau	Muong Lay	18.01	Bac Kan	Ba Be	37.85	Ha Tay	Ba Vi	52.27
Lai Chau	Tuan Giao	16.4	Bac Kan	Ngan Son	45.79	Ha Tay	TX. Son Tay	52.27
Lai Chau	Dien Bien	16.13	Bac Kan	Bach Thong	25.99	Hoa Binh	Ky Son	45.64
Lai Chau	Dien Bien Dong	15.57	Tuyen Quang	Na Hang	42.38	Hoa Binh	Da Bac	37.89
Son La	TX. Son La	20.08	Yen Bai	Van Chan	40.22	Hoa Binh	Mai Chau	47.21
Son La	Thuan Chau	19.13	Yen Bai	Tram Tau	40.22	Kon Tum	Sa Thay	40.55
Son La	Phu yen	16.51	Phu Tho	Thanh Son	27.27	Lai Chau	Muong Te	34.14
Son La	Mai Son	18.8	Lai Chau	TX. Lai Chau	27.54	Lai Chau	Phong Tho	38.69
Son La	Song Ma	19.14	Lai Chau	Muong Te	28.27	Lai Chau	Sin Ho	41.95
Son La	Moc Chau	19.87	Lai Chau	Phong Tho	26.05	Lai Chau	Dien Bien	36.52
Hoa Binh	Da Bac	15.09	Lai Chau	Sin Ho	26.01	Lai Chau	Dien Bien Dong	32.73
Hoa Binh	Mai Chau	21.32	Lai Chau	Muong Lay	25.9	Lai Chau	Muong Lay	36.01
Hoa Binh	Ky Son	23.44	Lai Chau	Tuan Giao	24.61	Lai Chau	TX. Lai Chau	41.02
Thanh Hoa	Quan Hoa	21.32	Lai Chau	Dien Bien	27.7	Lai Chau	Tuan Giao	33.15
Kon Tum	Sa Thay	22.34	Lai Chau	Dien Bien Dong	28.98	Lam Dong	Bao Lam	57.92
Gia Lai	Ia Grai	22.84	Son La	TX. Son La	28.02	Lao Cai	Bat Xat	34.47
			Son La	Quynh Nhai	36.15	Lao Cai	Sa Pa	30.77
			Son La	Muong La	38.03	Lao Cai	Than Uyen	43.10
			Son La	Thuan Chau	29.07	Nghe An	Tuong Duong	43.93
			Son La	Phu yen	28.9	Nghe An	Con Cuong	43.36
			Son La	Mai Son	29.29	Phu Tho	Thanh Son	40.07
			Son La	Song Ma	35.57	Phu Tho	Tam Thanh	52.06
			Son La	Yen Chau	41.4	Son La	Quynh Nhai	57.61
			Son La	Moc Chau	34.68	Son La	Song Ma	41.19
						Son La	Thuan Chau	39.86
						Son La	TX. Son La	37.76
						Son La	Mai Son	39.11
						Son La	Bac Yen	59.50
						Son La	Phu yen	43.95
						Son La	Yen Chau	46.45
						Son La	Moc Chau	44.50
						Thanh Hoa	Quan Hoa	47.37
						Thanh Hoa	Muong Lat	49.74
						Tuyen Quang	Na Hang	51.46
						Yen Bai	Van Chan	44.66
						Yen Bai	Tram Tau	52.08

Table 4-3 The list of FFG warnings of the next 1, 3 and 6 hours flash flood in Lao PDR's northern Huaphanh Province on 25 June 2015 at 00:00 UTC by MRC-FFG system.

1 hour Flash Flood Guidance in Lao				3 hour Flash Flood Guidance in Lao				6 hour Flash Flood Guidance in Lao			
Provinces	Districts	Villages	FFG Value	Provinces	Districts	Villages	FFG Value	Provinces	Districts	Villages	FFG Value
Huaphanh	Xamneua	SOBKA	18.98	Huaphanh	Xamneua	SOBKA	26.61	Huaphanh	Xamneua	SOBKA	36.07
Huaphanh	Viengthon	NATHOUANE	21.78	Huaphanh	Xiengkhor	NAHEUANG	41.39	Huaphanh	Xiengkhor	NAHEUANG	48.13
Huaphanh	Viengthon	KHONG	21.78	Huaphanh	Xiengkhor	NASEUA	41.39	Huaphanh	Xiengkhor	NASEUA	48.13
Huaphanh	Viengthon	HATSA	22.74	Huaphanh	Xiengkhor	MOUANGDUNG	41.39	Huaphanh	Xiengkhor	MOUANGDUNG	48.13
Huaphanh	Viengthon	SAKOK	22.74	Huaphanh	Xiengkhor	BANNA	44.8	Huaphanh	Xiengkhor	BANNA	47.33
Huaphanh	Viengthon	DORNKHOUN	19.44	Huaphanh	Xiengkhor	PHONGBAO	44.8	Huaphanh	Xiengkhor	PHONGBAO	47.33
Huaphanh	Viengthon	ANG-HOM	22.74	Huaphanh	Xiengkhor	HOUAYDAET	44.8	Huaphanh	Xiengkhor	HOUAYDAET	47.33
Huaphanh	Viengthon	LENG	21.26	Huaphanh	Xiengkhor	BANPONG	44.8	Huaphanh	Xiengkhor	BANPONG	47.33
Huaphanh	Viengthon	HOUAYSANGORN	20.32	Huaphanh	Xiengkhor	PAKHOMPET	44.8	Huaphanh	Xiengkhor	NONGKHAM	58.35
Huaphanh	Viengthon	NGONE	20.32	Huaphanh	Xiengkhor	NABEUNG	44.8	Huaphanh	Xiengkhor	BANMUANG	58.35
Huaphanh	Viengthon	NUOM	20.32	Huaphanh	Xiengkhor	HOUAYHIENG	44.8	Huaphanh	Xiengkhor	HOUAYHEUA	58.35
Huaphanh	Viengthon	BOR	20.32	Huaphanh	Xiengkhor	BANMOUANG	44.8	Huaphanh	Xiengkhor	PHONGXAI	58.35
Huaphanh	Viengthon	LONGNGOUAPA	21.78	Huaphanh	Xiengkhor	PAKHOM NOY	44.8	Huaphanh	Xiengkhor	VANGTANG	58.35
Huaphanh	Viengthon	PHOULUANG	21.78	Huaphanh	Xiengkhor	LONGTONG	44.8	Huaphanh	Xiengkhor	PAKHOM	58.35
Huaphanh	Viengthon	PHIENGDON	21.78	Huaphanh	Xiengkhor	PAKHOMGNAI	41.39	Huaphanh	Xiengkhor	PAKHOMPET	47.33
Huaphanh	Viengthon	NAPOUAK	21.78	Huaphanh	Xiengkhor	NAMTEUN	44.8	Huaphanh	Xiengkhor	NABEUNG	47.33
Huaphanh	Viengthon	VIENGTHONG	21.78	Huaphanh	Xiengkhor	PAHANG	44.8	Huaphanh	Xiengkhor	HOUAYHIENG	47.33
Huaphanh	Viengthon	HOUAYMAKFAY	18.98	Huaphanh	Xiengkhor	HOUAYNGEUM	44.8	Huaphanh	Xiengkhor	PAKHOM NOY	48.13
Huaphanh	Viengthon	SAN-ONG	22.05	Huaphanh	Xiengkhor	PHALONG	44.8	Huaphanh	Xiengkhor	LONGTONG	47.33
Huaphanh	Viengthon	NAVIENG	21.78	Huaphanh	Xiengkhor	NAKHAM	41.39	Huaphanh	Xiengkhor	PAKHOMGNAI	48.13
Huaphanh	Viengthon	NASAN	22.74	Huaphanh	Viengthon	NATHOUANE	30	Huaphanh	Xiengkhor	NAMTEUN	47.33
Huaphanh	Viengthon	MOUANGHIEM	21.78	Huaphanh	Viengthon	KHONG	30	Huaphanh	Xiengkhor	PHAHOY	58.35
Huaphanh	Viengthon	NAPHANHONG	21.78	Huaphanh	Viengthon	HATSA	31.32	Huaphanh	Xiengkhor	PAHANG	47.33
Huaphanh	Viengthon	GNOT-HIT	21.78	Huaphanh	Viengthon	SAKOK	31.32	Huaphanh	Xiengkhor	HOUAYNGEUM	47.33
Huaphanh	Viengthon	PHONXONG	21.26	Huaphanh	Viengthon	DORNKHOUN	27.18	Huaphanh	Xiengkhor	MUANGNAMH	58.35
Huaphanh	Viengthon	NGAO	20.71	Huaphanh	Viengthon	ANG-HOM	31.32	Huaphanh	Xiengkhor	PHALONG	47.33
Huaphanh	Viengthon	NAHAY	20.32	Huaphanh	Viengthon	LENG	29.29	Huaphanh	Xiengkhor	THALAT	58.35
Huaphanh	Viengthon	POUNGMA	22.06	Huaphanh	Viengthon	NAMSATH	34.9	Huaphanh	Xiengkhor	POUNGSAET	58.35
Huaphanh	Viengthon	POUNGTHOUM	22.06	Huaphanh	Viengthon	HOUAYSANGORN	28.95	Huaphanh	Xiengkhor	PABOUA	58.35
Huaphanh	Viengthon	PHONSAATH	22.74	Huaphanh	Viengthon	NGONE	28.95	Huaphanh	Xiengkhor	SOBPHONG	58.35
Huaphanh	Viengthon	THEHING	21.78	Huaphanh	Viengthon	NUOM	28.95	Huaphanh	Xiengkhor	HOMPHOU	58.35
Huaphanh	Viengthon	NAMPOUNG	22.74	Huaphanh	Viengthon	BOR	28.95	Huaphanh	Xiengkhor	PHIENGSA	58.35
Huaphanh	Viengthon	MEUA KAO	22.05	Huaphanh	Viengthon	LONGNGOUAPA	30	Huaphanh	Xiengkhor	KORHAY	58.35
Huaphanh	Viengthon	NGAO	20.71	Huaphanh	Viengthon	PHOULUANG	30	Huaphanh	Xiengkhor	KEOLOM	58.35
Huaphanh	Viengthon	CH AK	22.05	Huaphanh	Viengthon	HOUAPHOU	34.9	Huaphanh	Xiengkhor	NAKHANG	58.35
Huaphanh	Viengthon	HUAYSA	22.74	Huaphanh	Viengthon	PHIENGDON	30	Huaphanh	Xiengkhor	KEOLANH	58.35
Huaphanh	Huameuang	SOBLAP	23.36	Huaphanh	Viengthon	NAPOUAK	30	Huaphanh	Xiengkhor	CHAERFAI	58.35
Huaphanh	Huameuang	HOMTHONG	23.36	Huaphanh	Viengthon	VIENGTHONG	30	Huaphanh	Xiengkhor	PHA-AO	58.35
Huaphanh	Huameuang	NAMTAN	23.36	Huaphanh	Viengthon	NAPHONE	34.9	Huaphanh	Xiengkhor	PHABAOD	58.35
Huaphanh	Huameuang	NAPHIENG	23.36	Huaphanh	Viengthon	HOUAYMAKFAY	26.61	Huaphanh	Xiengkhor	PHIENGHOM	58.35
Huaphanh	Huameuang	HOUAYHOU	20.12	Huaphanh	Viengthon	SAN-ONG	30.46	Huaphanh	Xiengkhor	KEOVAEN	58.35
Huaphanh	Huameuang	KADAENG	20.12	Huaphanh	Viengthon	NAVIENG	30	Huaphanh	Xiengkhor	BOMBE	58.35
Huaphanh	Huameuang	VANGMOR	23.36	Huaphanh	Viengthon	NASAN	31.32	Huaphanh	Xiengkhor	DINDAENG	58.35
Huaphanh	Huameuang	PHIENGDI	23.36	Huaphanh	Viengthon	MOUANGHIEM	30	Huaphanh	Xiengkhor	NAKHAM	48.13
				Huaphanh	Viengthon	NAPHANHONG	30	Huaphanh	Viengthon	NATHOUANE	40.89
				Huaphanh	Viengthon	GNOT-HIT	30	Huaphanh	Viengthon	KHONG	40.89
				Huaphanh	Viengthon	PHONXONG	29.29	Huaphanh	Viengthon	HATSA	41.61
				Huaphanh	Viengthon	NGAO	29.36	Huaphanh	Viengthon	SAKOK	41.61
				Huaphanh	Viengthon	NAHAY	28.95	Huaphanh	Viengthon	DORNKHOUN	41.61
				Huaphanh	Viengthon	POUNGMA	30.38	Huaphanh	Viengthon	ANG-HOM	41.61
				Huaphanh	Viengthon	POUNGTHOUM	30.38	Huaphanh	Viengthon	LENG	38.25
				Huaphanh	Viengthon	PHONSAATH	31.32	Huaphanh	Viengthon	NAMSATH	46.58
				Huaphanh	Viengthon	THEHING	30	Huaphanh	Viengthon	HOUAYSANGORN	41.29
				Huaphanh	Viengthon	NAMPOUNG	31.32	Huaphanh	Viengthon	NGONE	41.29
				Huaphanh	Viengthon	MEUA KAO	30.46	Huaphanh	Viengthon	NUOM	41.29
				Huaphanh	Viengthon	NGAO	29.36	Huaphanh	Viengthon	BOR	41.29
				Huaphanh	Viengthon	CH AK	30.46	Huaphanh	Viengthon	PHOULUANG	40.89
				Huaphanh	Viengthon	HUAYSA	31.32	Huaphanh	Viengthon	HOUAPHOU	46.58
				Huaphanh	Huameuang	SOBLAP	31.47	Huaphanh	Viengthon	PHIENGDON	40.89
				Huaphanh	Huameuang	HOMTHONG	31.47	Huaphanh	Viengthon	NAPOUAK	40.89
				Huaphanh	Huameuang	NAMTAN	31.47	Huaphanh	Viengthon	VIENGTHONG	40.89
				Huaphanh	Huameuang	NAPHIENG	31.47	Huaphanh	Viengthon	NAPHONE	46.58
				Huaphanh	Huameuang	HOUAYHOU	27.92	Huaphanh	Viengthon	HOUAYMAKFAY	36.07
				Huaphanh	Huameuang	KADAENG	27.92	Huaphanh	Viengthon	SAN-ONG	40.19
				Huaphanh	Huameuang	VANGMOR	31.47	Huaphanh	Viengthon	NAVIENG	40.89
				Huaphanh	Huameuang	PHIENGDI	31.47	Huaphanh	Viengthon	NASAN	41.61
								Huaphanh	Viengthon	MOUANGHIEM	40.89
								Huaphanh	Viengthon	NAPHANHONG	40.89
								Huaphanh	Viengthon	GNOT-HIT	40.89
								Huaphanh	Viengthon	PHONXONG	38.25
								Huaphanh	Viengthon	NGAO	41.09
								Huaphanh	Viengthon	NAHAY	41.29
								Huaphanh	Viengthon	POUNGMA	39.84
								Huaphanh	Viengthon	POUNGTHOUM	39.84
								Huaphanh	Huameuang	SOBLAP	36.97
								Huaphanh	Huameuang	HOMTHONG	36.97
								Huaphanh	Huameuang	NAMTAN	36.97
								Huaphanh	Huameuang	NAPHIENG	36.97
								Huaphanh	Huameuang	HOUAYHOU	35.42
								Huaphanh	Huameuang	KADAENG	35.42
								Huaphanh	Huameuang	VANGMOR	36.97
								Huaphanh	Huameuang	PHIENGDI	36.97
								Huaphanh	Viengthon	PHONSAATH	41.61
								Huaphanh	Viengthon	THEHING	40.89
								Huaphanh	Viengthon	NAMPOUNG	41.61
								Huaphanh	Viengthon	MEUA KAO	40.19
								Huaphanh	Viengthon	NGAO	41.09
								Huaphanh	Viengthon	CH AK	40.19
								Huaphanh	Viengthon	HUAYSA	41.61

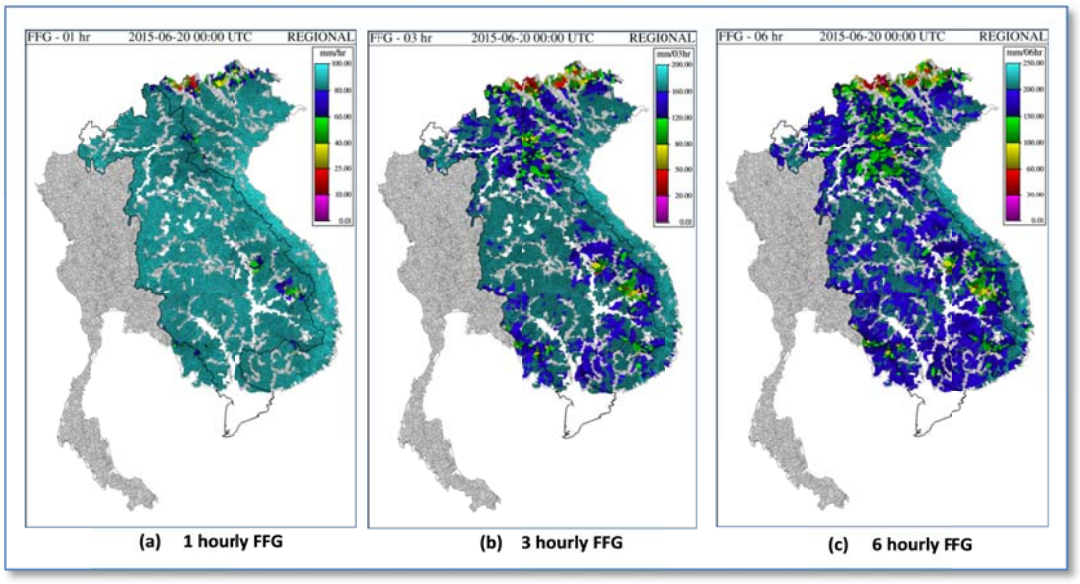


Figure 4-17 The 1 hourly, 3 hourly and 6 hourly FFG warnings on 24 June 2015 at 00:00 UTC (07:00 AM Phnom Penh time).

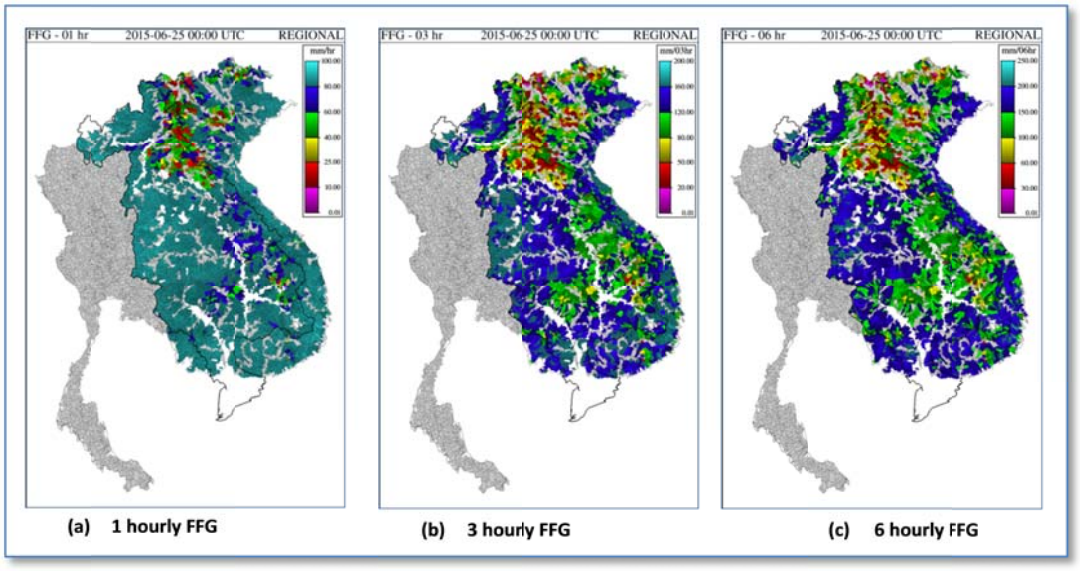


Figure 4-18 The 1 hourly, 3 hourly and 6 hourly FFG warnings on 25 June 2015 at 00:00 UTC (07:00 AM Phnom Penh time).

4.5 Summary

During the tropical storm KUJIRA in the last week of June 2015, severe flash floods occurred on several tributaries and Mekong River mainstream in the central and northern parts of Lao PDR, and also in the upper parts of Viet Nam. It caused damages to roads and bridges, irrigation schemes and other village infrastructures, such as schools, water supplies and health centers. Eight people were killed and four were missing, following flash flood triggered by the KUJIRA tropical storm in Thuan Chau and Yen Chau districts in the northern parts of Son La Province.

Referring to Table 4-2 and Table 4-3, MRC-FFG system has shown efficiency and ability in providing real time 'forecasts' for the next 1, 3 and 6 hours on 25 June 2015 at 00:00 UTC (7:00 AM Phnom Penh time) to detect the FFG warnings at some districts of Son La Province, Viet Nam, and also in Lao PDR's northern Xiengkhor District of Huaphanh Province. This corresponded with media reports that flash floods hit Son La, Viet Nam and Xiengkhor District of Huaphanh Province, Lao PDR after heavy rainfall on 24 and 25 June 2015 (see appendix 1).

Based on a comparison of the observed daily accumulated rainfall versus the 24hr MAP, and the 24hr HE-sat of the Son La station as shown in Figure 4-12 (f), results exhibit the 24hr MAP and the 24hr HE-sat perform quite well as the results are close to the observed daily rainfall when compared to other 5 rain gauge stations (i.e. Muong Te, Sin Ho, Tam Duong, Yen Chau and Quynh Nhai). Thus, following the results of the Son la station, the 24hr MAP and the 24hr HE-sat, are capable of providing precipitation information during the KUJIRA storm with regards to flash flood warnings. Unfortunately the analysis of the comparison of the observed rainfall with the 24hr MAP and 24hr HE-sat in Lao PDR could not be performed as the rainfall data were not available (missing data) of some rain gauge stations located within the northern provinces of Lao PDR, such as Phongsaly, Muong Namtha, Oudomxay and Moung Ngoy stations during the storm KUJIRA.

5. Flash flooding in central provinces of Lao PDR, caused by ITCZ during the period from 17 to 21 July 2015

5.1 Weather situation on the third week of July

On 17 July 2015 at 01.00 AM Phnom Penh Time, the ITCZ lies across the lower North of Myanmar, the upper North of Lao PDR and the North of Viet Nam while the moderate Southwest monsoon prevails over Andaman Sea, the Gulf of Thailand, Thailand and Indochina Peninsular (see Figure 5-1).

During the period from 17 to 21 July, the ITCZ continued to lie across the North of Myanmar, the upper North of Lao PDR and the North of Viet Nam. Figure 5-1 1illustrates the weather chart of the Mekong region on 17 respectively 21 July 2015 at 01:00 AM Phnom Penh time. Results show that the LMB was covered by low pressure which caused wide spread heavy rain during the period 17 – 21 July, which affected at some parts of Myanmar, the North and North East of Thailand, the North and North East of Cambodia, the Center and North of Lao PDR, and also the northern Viet Nam.

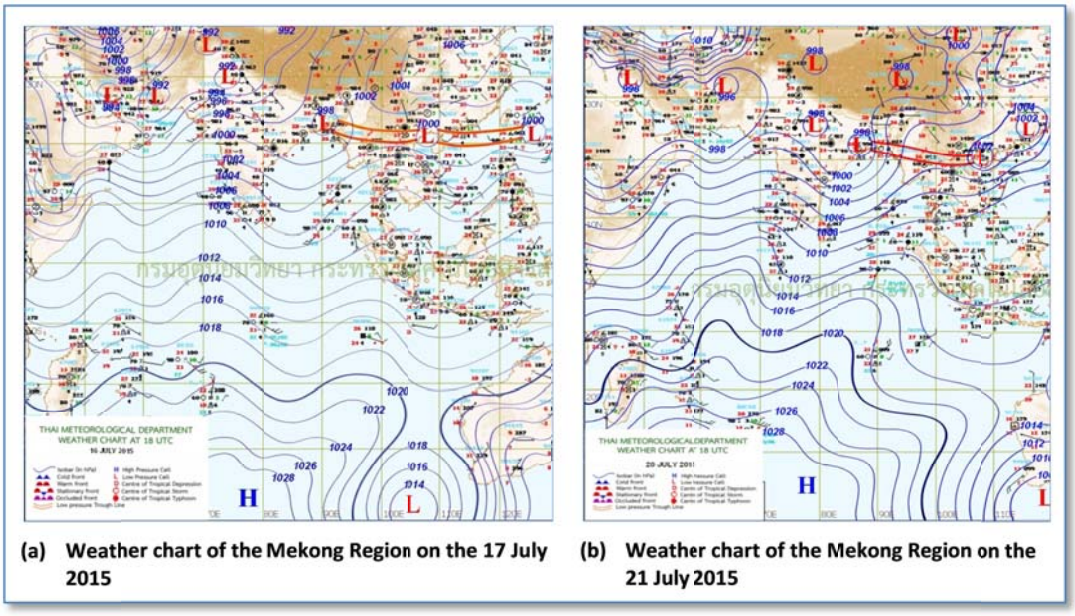


Figure 5-1 The weather chart of the Mekong region on the 17 July and the 21 July 2015 at 18:00 UTC (01:00 AM Phnom Penh time), source by Thai Meteorological Department.

5.2 Rainfall on the third week of July 2015

During the period 17 - 21 July 2015, some provinces of the central and southern parts of Lao PDR and also some provinces in the central parts of Viet Nam were covered by the heavy rainfall due to the ITCZ. The recorded daily rainfall of some rainfall stations in the central and southern parts of Lao PDR rose up from 100 to 300 mm/day. The daily recorded rainfall on 20 July at the Mahaxai rain gauge station of the Xe Bang Fai catchment reached a maximum of about 400 mm. Figure 5-2 presents the map of 24 hour HE-sat during the period 17 - 21 July 2015 at 00:00 UTC (7:00 AM Phnom Penh time). The results show that heavy rainfall occurred over parts of the LMB.

The comparison of the observed daily accumulated rainfall with the 24hr MAP and the 24hr HE-sat during the heavy rain caused by the ITCZ from 17 - 21 July 2015 is shown in Figure 5-3. The data was obtained from eight rain gauge stations; namely the Mahaxai, Kuanpho, Highway Bridge, Muong Mai, Muong Tchepone, Muong Borkhane, Ban Phonsi and Ban Had Paengi stations located in the central parts of Lao PDR. The analysis of the rainfall obtained from the Hydmet (observed rainfall) and the MRC-FFG system (i.e. 24hr MAP and 24hr HE-sat) shows that the MRC-FFG system performed quit well for Mahaxai and Kuanpho stations during 17 - 19 July 2015. In summary, the analysis of the results shows the uncertainty of the MRC-FFG system to produce the 24hr MAP and 24hr HE-sat during this period, as for some stations the 24hr MAP and 24hr HE-sat were lower than the observed rainfall (underestimated), and for some stations the 24hr MAP and 24hr HE-sat were higher than the observed rainfall (overestimated).

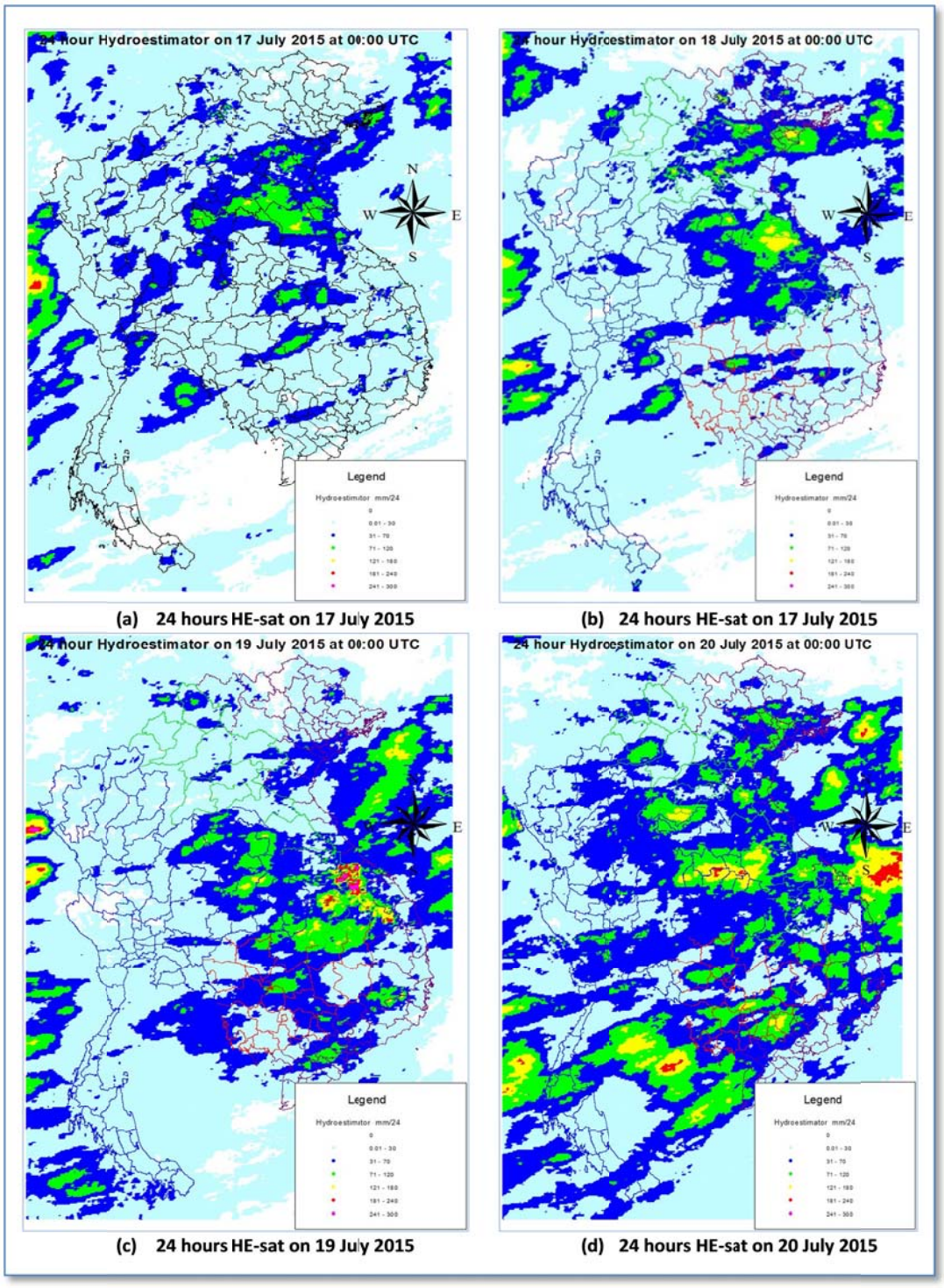


Figure 5-2 The 24 hourly Hydro-estimator Satellite Precipitation (HE-sat) during the period of the Inter Tropical Convergence Zone from 17 - 20 July 2015 at 00:00 UTC.

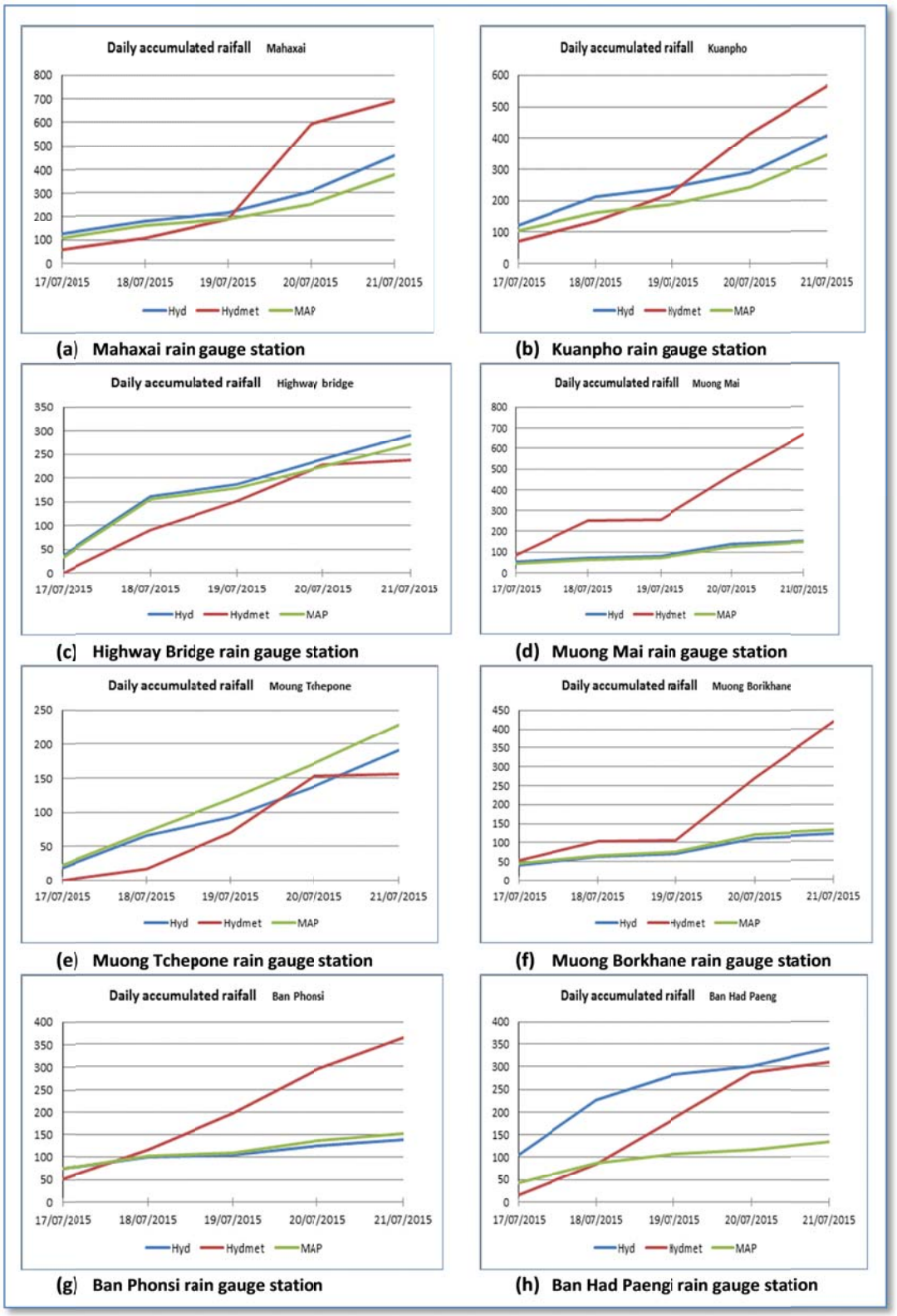


Figure 5-3 Accumulated observed rainfall (Hydmet), 24hr MAP and 24hr HE-sat (Hyd) at 8 rain gauge stations: Mahaxai, Kuanpho, Highway bridge, Muong Mai, Muong Tchepone, Muong Borkhane, Ban Phonsi and Ban Had Paengi stations located in central parts of Lao PDR.

5.3 Raising water level at some tributaries of Mekong River

Heavy rains occurred during the ITCZ from 17 - 21 July 2015 in some sub-catchments of the LMB located in the central and northern parts of Lao PDR, causing a rise in water levels at some tributaries of Nam khan, Nam Ngiep, Xe Bang Fai, Xe Bang Hieng rain gauge stations from 18 to 21 July 2015.

Figure 5-4 illustrates the rise of water levels caused by the ITCZ during 17 - 21 July at 10 monitoring stations located in the central parts of Lao PDR. Results show that water levels increased significantly from 2.88 m on 20 July to 7.8 m on 22 July at Moung Mai station in the Nam Ngiep catchment. While at the Ban Khendone station located in Savannakhet Province of Xe Bang Hieng River, the water level increased significantly from 2.94 m on 19 July to 8.1 m on 21 July, reached the flood level, and on 20 July flooding began. According to media reports of 21 July (see appendix 1.3), the heavy rainfall caused floods and flash floods in some areas of Savannakhet and Champassak provinces. This corresponded with the records of the water level on 20 July of Ban Khendone station. Likewise, water levels increased rapidly in the tributaries of Nam Songkhran River at the Ban Thabok Daeng station located in Thailand on the same day that caused water level rising rapidly at the Ban Khendone station located in Lao PDR.

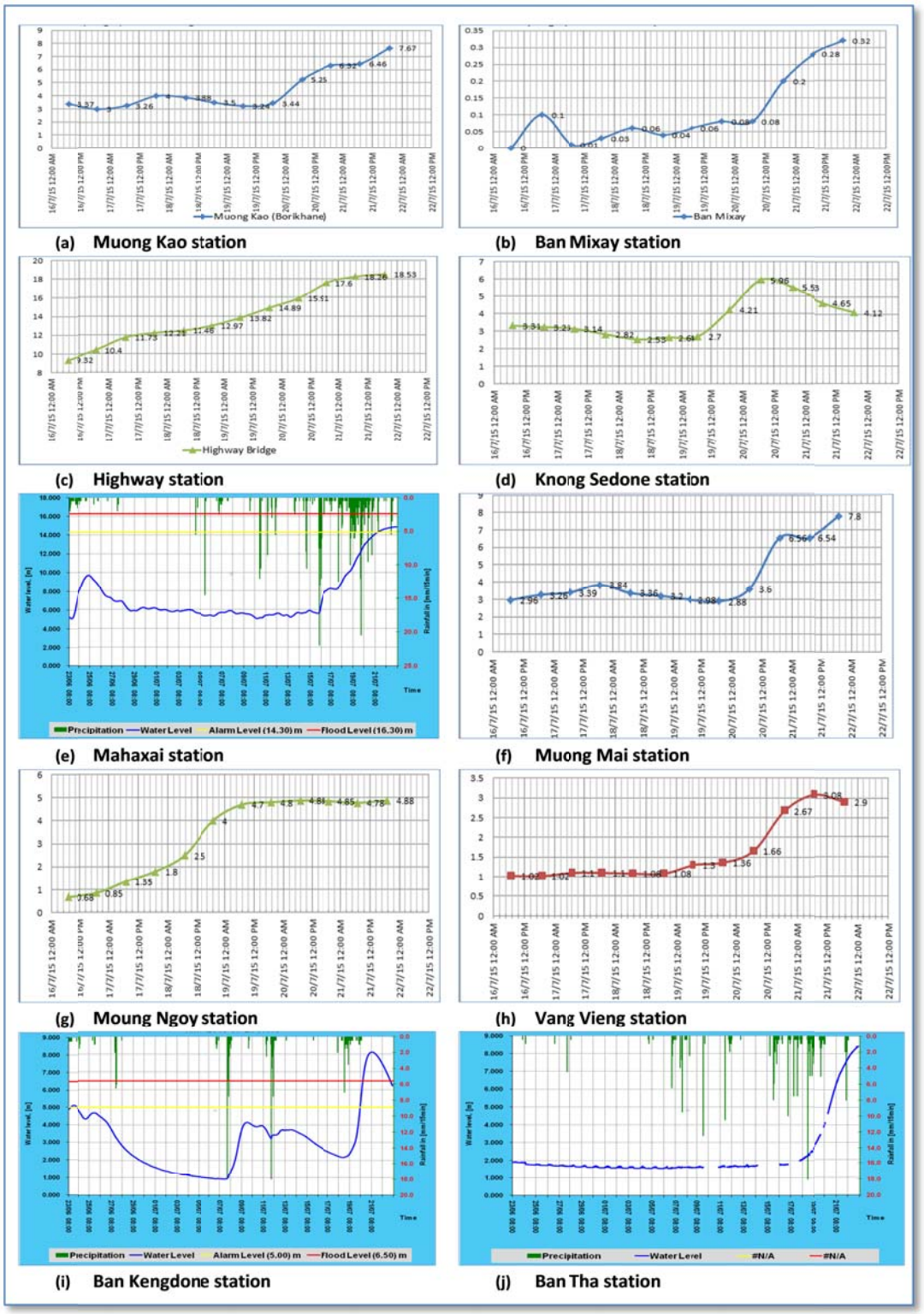


Figure 5-4 Water levels at 10 monitoring stations located in the central parts of Lao PDR during the period 17 - 21 July 2015, caused by the ITCZ.

5.4 Flash flood in the central provinces of Lao PDR during the ITCZ

On 17 July and 20 July 2015 at 00:00 UTC (07:00 Phnom Penh time), the MRC-FFG system detected some warning FFG village areas in the central provinces of Lao PDR, such as Champassak, Attapeu, Phongsaly, Luang Prabang, Bolikhamxay, Khammouane, Vientiane, Savannakhet, Saravane, Sekong Xiangkhouang and Xaisomboun provinces. Figure 5-5 represents the 3 hour FFG values on 17 July and 20 July at 00:00 UTC that were detected by the MRC-FFG system at some areas of central provinces of Lao PDR.

The information on flash flood risk areas that was detected by the MRC-FFG system on 17 July 2014 at 00:00 UTC (see Figure 5-5 (a)) was confirmed by the information published in the Lao PDR newspaper ”the Vientiane Times” on 21 July 2015 (see appendix 1.3). Some flash flood risk areas that were detected by the MRC-FFG system on 17 July 2015 at 00:00 UTC corresponded with the reported by the Vientiane Times.

The Laos Newspaper “KPL” on 21 July 2015 (see appendix 1.3) informed that the flash flood caused by heavy rainfall occurred at some areas of Xiangkhouang, Luang Prabang, Vientiane, Champassak and Savannakhet provinces in central and southern part of Lao PDR, which corresponded with the MRC-FFG system detection on the 20 July 2015 at 00:00 UTC (see Figure 5-5 (b)), as well as corresponding with the recorded water levels on 20 July of Ban Khendone station.

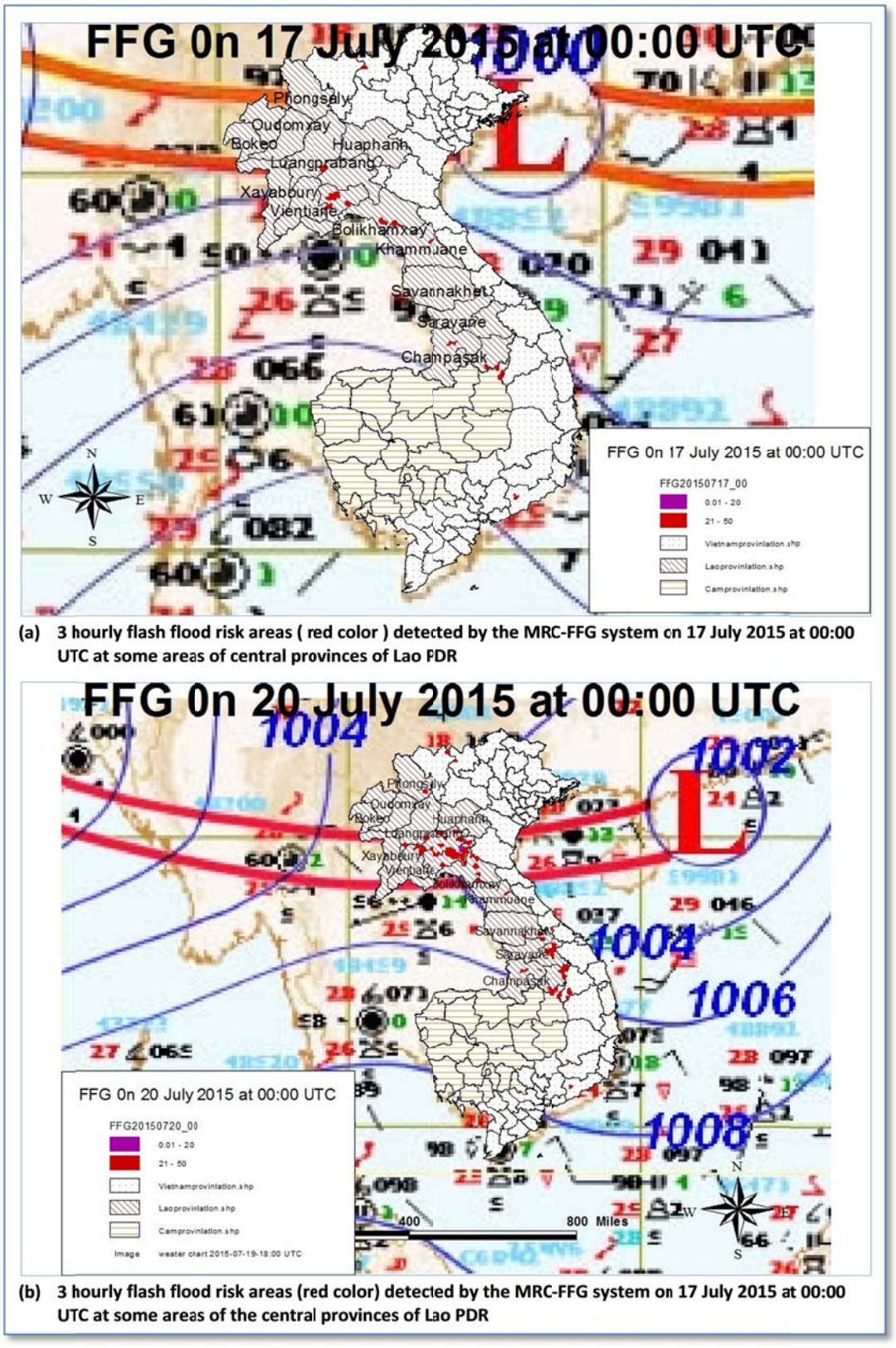


Figure 5-5 3 hourly flash flood risk areas (red color) detected by the MRC-FFG system on 17 July 2015 at 00:00 UTC at some areas of central provinces of Lao PDR.

5.5 Summary

During the third week of July from 17 - 21 July 2015, the LMB was covered by ITCZ which caused heavy rainfalls in some areas of the central and southern parts of Lao PDR, such as Xiangkhouang, Luang Prabang, Vientiane, Champassak and Savannakhet provinces. During this period, the record daily rainfall of some rainfall stations rose up from 100 to 300 mm/day.

Referring to Figure 5-3, the MRC-FFG system did not performance very well to estimate the 24hr MAP and 24 HE-sat when compared with the observed rainfall of almost all stations (8 stations) during on 19 - 21 July 2015. In summary, the results of analysis in Figure 5-3 show the uncertainty in MRC-FFG system to estimate the rainfall of 24hr MAP and 24 HE-sat during the period 17 - 21 July 2015.

Due to heavy rainfall caused by the ITCZ water level at many monitoring stations located in the central and southern parts of Lao PDR quickly rose. On 17 July at 00:00 UTC (07:00 AM Phnom Penh time) the MRC-FFG system detected FFG warnings in some villages of Bolikhamxay, Khammouane, Xaisomboun provinces, Lao PDR. These warning areas were confirmed by the information published on the Lao newspaper “Vientiane Time” and “KPL” on 21 July 2015 (see appendix 1.3).

While, during the period from 19 to 21 July the water level increased significantly to 5 m high in the Xe Bang Hieng River of Ban Khendone station located in Savannakhet Province, and reached the flood level, and beginning to flood on 20 July, which caused flash flood in some villages of Savannakhet Province. According to the media reported on 21 July 2015, flooding and flash flood occurred in some villages of Savannakhet Province corresponding with the recording of water level at Ban Khendone station, and also the MRC-FFG system detected FFG warnings in some villages of Savannakhet Province on 20 July.

6. Flash flooding in the northern and northeastern Thailand, the northern and central Lao PDR, and the northern and central Viet Nam, caused by heavy monsoon rains and tropical storm KOMEN during the period from 26 July to 6 August 2015

6.1 The heavy monsoons rains and tropical storm KOMEN during on 26 July to 6 August 2015

During 26 - 28 July 2015 the low pressure was lying across the upper North and the Northeast of Myanmar, upper Lao PDR, upper Viet Nam, and to the low pressure cell over the Gulf of Tonkin (see Figure 7-1), according to the Thai Methodologic Department. During this period, the monsoon storms brought floods and landslides to several areas in the Lower Mekong Basin. It caused severe flooding in Northern Viet Nam and severe flash floods in this area, especially in the Province of Quang Ninh and in particular some of the mountainous areas of Dien Bien, Lai Chau, Son La and Lao Cai provinces, according to the media (see appendix 1.1). Some areas of Quang Ninh Province saw 800 mm of rainfall in the period 25 - 28 July 2015, making it the heaviest downpour in the region for 40 years (see appendix 1.1). Quang Ninh is the most affected province in Viet Nam.

Since 26 July 2015, heavy rainfall bought to Thailand's northern Chiang Rai, Phayao and Nan provinces, as well as in Lao PDR's northern Luang Namtha, Oudomxay , Bokeo, Luang Prabang, Xayabourn, Huaphan, Xiangkhouang provinces. On 28 July 2015, a local official at the District Office for Agriculture and Forestry confirmed that around 600 hectares of rice fields of 404 families in 14 villages, living on both sides of the Xe Bang Fai River, were flooded (see appendix 1.3).

On 29 July 2015 at 09:00 UTC, the Bangladesh Meteorological Department (BMD) issued information that the tropical storm KOMEN was moving slightly towards northeast after hitting the coast of Teknaf and St. Martin's Island (see Figure 7-2). During the period from 29 July to 6 August 2015, the monsoon storms brought strong winds, heavy rains resulting in floods and landslides to areas in the North and Center of LMB region, according to media information (see appendix 1).

Maps from the Thai Meteorological Department of the period 26 July - 6 August 2015 (see Figure 7-1 and Figure 7-2) show the low pressure and the storm KOMEN trough (in red) which were expected to bring heavy rains to parts of Mekong region. It indeed caused wide spread heavy rainfall affected in the region.

On 31 July 2015, flash flooding and landslides affected the Northern provinces of Viet Nam which caused 2,800 houses being damaged and destroyed, along with wide areas of crop and livestock, according to the media information (see appendix 1.1). At least 9 of the victims died when a landslide buried a house in Ha Long City.

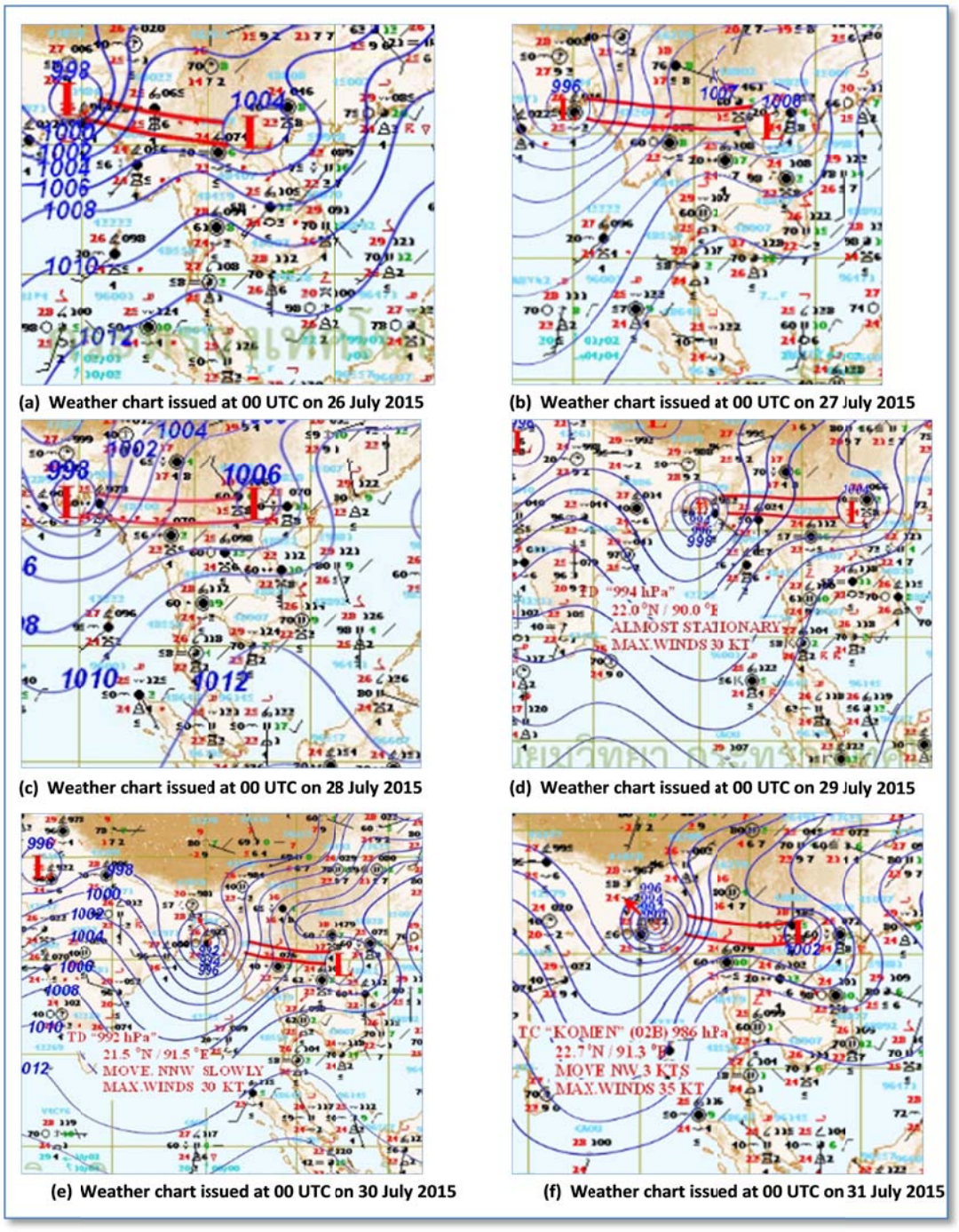
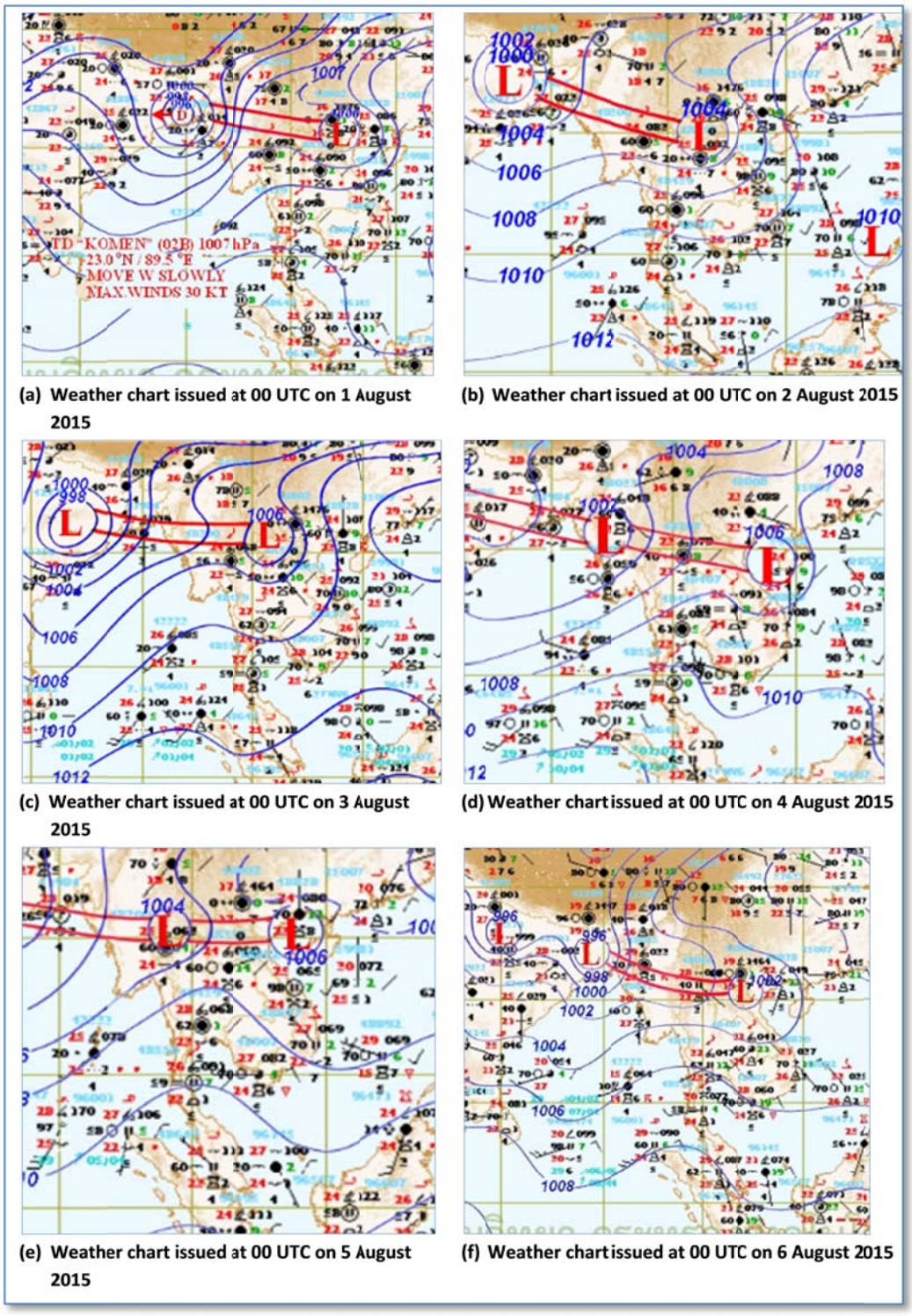


Figure 6-1 The weather chart of the Mekong region from 26 to 31 June 2015 at 7:00 AM Phnom Penh time. Source: the Thai Meteorological Department.



(a) Weather chart issued at 00 UTC on 1 August 2015

(b) Weather chart issued at 00 UTC on 2 August 2015

(c) Weather chart issued at 00 UTC on 3 August 2015

(d) Weather chart issued at 00 UTC on 4 August 2015

(e) Weather chart issued at 00 UTC on 5 August 2015

(f) Weather chart issued at 00 UTC on 6 August 2015

Figure 6-2 The weather chart of the Mekong region during the period from **1** to 6 August 2015 at 00:00 UTC (7:00 AM Phnom Penh time). Source: the Thai Meteorological Department.

6.2 Heavy rainfall during the period from 26 July to 6 August 2015

During the period from 26 July to 6 August 2015, heavy rainfall and strong winds were brought to Lower Mekong Basin by heavy monsoon rains and tropical storm KOMEN. Due to the storm circulation, heavy rainfalls hit several areas in the northern parts of Viet Nam, especially in Quang Ninh, Cao Bang, Lang Son, Bac Kan, Bac Giang, Thai Ngugen, Ha Giang , Tuyen Quang, Lai Chau, Son La and Dien Bien provinces, the northern and northeastern parts of Thailand, especially in Chiang Rai, Phayao, Nan, Phrae, Tak, Phetchabun, Loei, Nong Khai, Bueng Kan, Sakon Nakhon and Nakhon Phanom provinces, and also in the northern and central parts of Lao PDR, especially in Bonkhamxay, Khammouane, Vientiane, Borikhamxay, Bokeo, Luang Namtha and Xaysomboun provinces (see appendix 1).

Table 6-1 shows the daily rainfall amounts at some rain gauge stations located within the northern provinces of Viet Nam, the northern and northeastern provinces of Thailand and the central provinces of Lao PDR, which were based on the rainfall data available during on 26 July to 6 August 2015. The data records from 7:00 AM to 7:00 AM on the following day for each recorded day. In Viet Nam, the daily rainfall on 1 August 2015 reached maximum about 161 mm at the Pha Din station located in Lai Chau Province. On 29 July the daily rainfall reached maximum about 183 mm at Paksane station on the Mekong River located in Lao PDR. According to the information from the media, heavy rainfall occurred during three days, from 26 to 28 July 2015, in the middle and upstream areas of the Mekong River in Viet Nam, Laos and Thailand, with rainfall totals of up to 598 mm in Lao PDR and 354 mm in Thailand (see appendix 1).

Figure 7-3 illustrates the daily rainfall distribution in the LMB from 26 July to 29 July 2015 that was obtained from rain gauge stations located within the Lower Mekong River Basin. Referring to Figure 7-1 and Figure 7-2, the low pressure system pressed by a continental high pressure in the central and northern areas of LMB corresponded with the daily rainfall distribution as shown in Figure 7-3. During on 26 - 29 July (see Figure 7-3) the heavy rainfall associated with the heavy monsoon rains occurred over the northern and central parts of Lao PDR, particularly in Huaphanh, Xiangkhouang, Xaysomboun and Bolikhamxay provinces.

The daily rainfall distribution from 26 July to 6 August 2015 in the LMB is shown in Figure 7-4. In summary, heavy rains occurred over the North and Center of Lower Mekong Basin causing severe flooding in the northern provinces of Viet Nam, in the northern and central provinces of Lao PDR and also in the northern and northeastern provinces of Thailand.

Figure 7-5 and Figure 7-6 represent the 24 hourly MAP during on 26 July to 6 August 2015 caused by the heavy rainfall. Results show that the heavy rainfall

occurred in some parts in northern Viet Nam, as well as some parts of northern, central and southern Lao PDR, and also some parts in north and northeastern Thailand, which corresponded with the weather charts from 21 July to 6 August 2015 as shown in Figure 7-1 and Figure 7-2.

The 24 hourly HE-sat at 00:00 UTC during the heavy rainfall from 26 July to 6 August 2015 is shown in Figure 7-7 and Figure 7-8. Results show that the heavy rainfall occurred over parts of northern Viet Nam, especially in Quang Ninh, Cao Bang, Lang Son, Bac Kan, Bac Giang, Thai Ngugen, Ha Giang, Tuyen Quang, Lai Chau, Son La and Dien Bien provinces. Likewise in the LMB, the heavy rainfall occurred in some areas at northern and central Lao PDR, and also some parts in the northern and northeastern Thailand.

Figure 7-9 and Figure 7-10 represent the 6 ASM conditions at 00:00 UTC (7:00 AM Phnom Penh time) during monsoon rains from 26 July to 6 August 2015. In summary, the soil moistures are statured at some areas in the northern and central parts of Viet Nam, some areas in the northeast Thailand, and also some areas in the northern, southern and central parts of Lao PDR during this storm corresponding with the weather chart in Figure 6-1 and Figure 6-2.

The comparison of the observed daily accumulated rainfall with the 24hr MAP and the 24hr HE-sat during the heavy rainfall period from 26 July to 6 August 2015 is shown in Figure 6-11 and Figure 6-12. The data was obtained from 7 rain gauge stations located within the northern parts of Viet Nam; namely the Muong Te, Lai Chau, Tuan Giao, Dien Bien, Quynh Nhai, Son La and Pha Din stations, respectively, 6 rain gauge stations located in the northern and northeastern parts of Thailand; namely the Chiang Saen, Chiang Khong, Chiang Rai, Thoeng, Nakhom Phanom and Nong Khai stations, respectively, and also 4 rain gauge stations located within the central provinces of Lao PDR, namely the Vientiane, Paksane, Thakhek and Ban Phone stations, respectively.

The results in Figure 6-12 show MRC-FFG system has performed quite well from 26 July to 01 August for Chiang Saen, Chiang Khong, Chiang Rai, Thoeng stations. Results in Figure 6-13 show MRC-FFG system has performed well from 26 to 30 July at Vientiane and Thakhek stations, and also from 26 to 28 July at Paksane and Ban Phnone stations.

Table 6-1 The daily rainfall amounts at some rain gauge stations of the northern provinces of Viet Nam, the northern and northeastern provinces Thailand and the northern and central provinces Lao PDR during the ITCZ from 26 July to 6 August 2015.

Station Name	Station ID	River	Country	Daily rainfall amount in mm, during 26 July - 6 August 2015											
				26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	01-Aug	02-Aug	03-Aug	04-Aug	05-Aug	06-Aug
Muong Te	220201	-	Vietnam	0.6	28	8	58	18	21	139	34.3	8.7	10	7	21
Lai Chau	220301	-	Vietnam	5	11	18	80	15.1	24.9	85	26	3	14	0.8	5
Tuan Giao	210305	-	Vietnam	56.3	5.7	2	25	0.6	1.3	155	24	26	15	34	16
Dien Bien	210301	-	Vietnam	32	3	7.5	24	9	11	19.5	138	42	3.2	1.1	2.3
Quynh Nhai	210303	-	Vietnam	19	5	0.1	15.2	2.5	11	91	42	38	47	6	1
Son La	210304	-	Vietnam	28	3	0.1	14	7.6	17.4	33	69	38	1.1	15	0.4
Pha Din	220401	-	Vietnam	58.1	2.9	0.8	53	2.6	6.4	**161**	40	61	22.8	25.2	15
Chiang Saen	10501	Mekong	Thailand	54.4	11.6	9.5	4.3	35.8	8	0.2	5.2	66.5	53.8	5.5	33.5
Chiang Khong	10801	Mekong	Thailand	3.8	4.3	4.45	4.43	4.43	4.35	4.25	4.25	4.98	6.1	7.2	6.6
Chiang Rai	50104	Nam Mae Kok	Thailand	5.8	12.8	14.7	5	27.9	1	0	9.8	39.5	28.8	5.8	26.4
Thoeng	70103	Nam Mae Ing	Thailand	62	2	3	7	1	0	0	8.5	25	11	6	0
Nakhom Phanom	13101	Mekong	Thailand	47.2	36.8	42	27.8	13.2	0	16.1	39.8	9.8	17.8	22.2	5.6
Nong Khai	12001	Mekong	Thailand	0	5.1	2.8	4.2	15.4	30.9	64.1	13.4	6.8	6.2	69.4	42.5
Pak Beng	10901	Mekong	Lao PDR	10.4	6.3	1.4	-	0.2	8.3	8.2	10.4	6.9	10.7	1.7	1.1
Luang Prabang	11201	Mekong	Lao PDR	21.2	14.6	2.6	2.4	-	18.4	2.4	21.9	17.6	8.6	1.1	14.4
Vientiane	11901	Mekong	Lao PDR	12.5	6	0.8	2.5	51.8	48.7	72.6	14.5	8.2	11.8	82.6	-
Paksane	12703	Mekong	Lao PDR	18	124.1	49.8	**183.2**	77.5	153.7	79.9	93.5	97.3	26.4	23	2.3
Thakhek	13102	Mekong	Lao PDR	36.7	37.3	35.8	33.7	11.1	16.1	21.4	40.7	9.4	10.2	13.6	1.2
Ban Phone Si	270101	Nam Nhiep	Lao PDR	61.7	98.2	75.3	83.6	84.7	49.3	35.2	35.4	6.1	18.2	8.4	16.2

Note: "–" indicates that rainfall data is not available

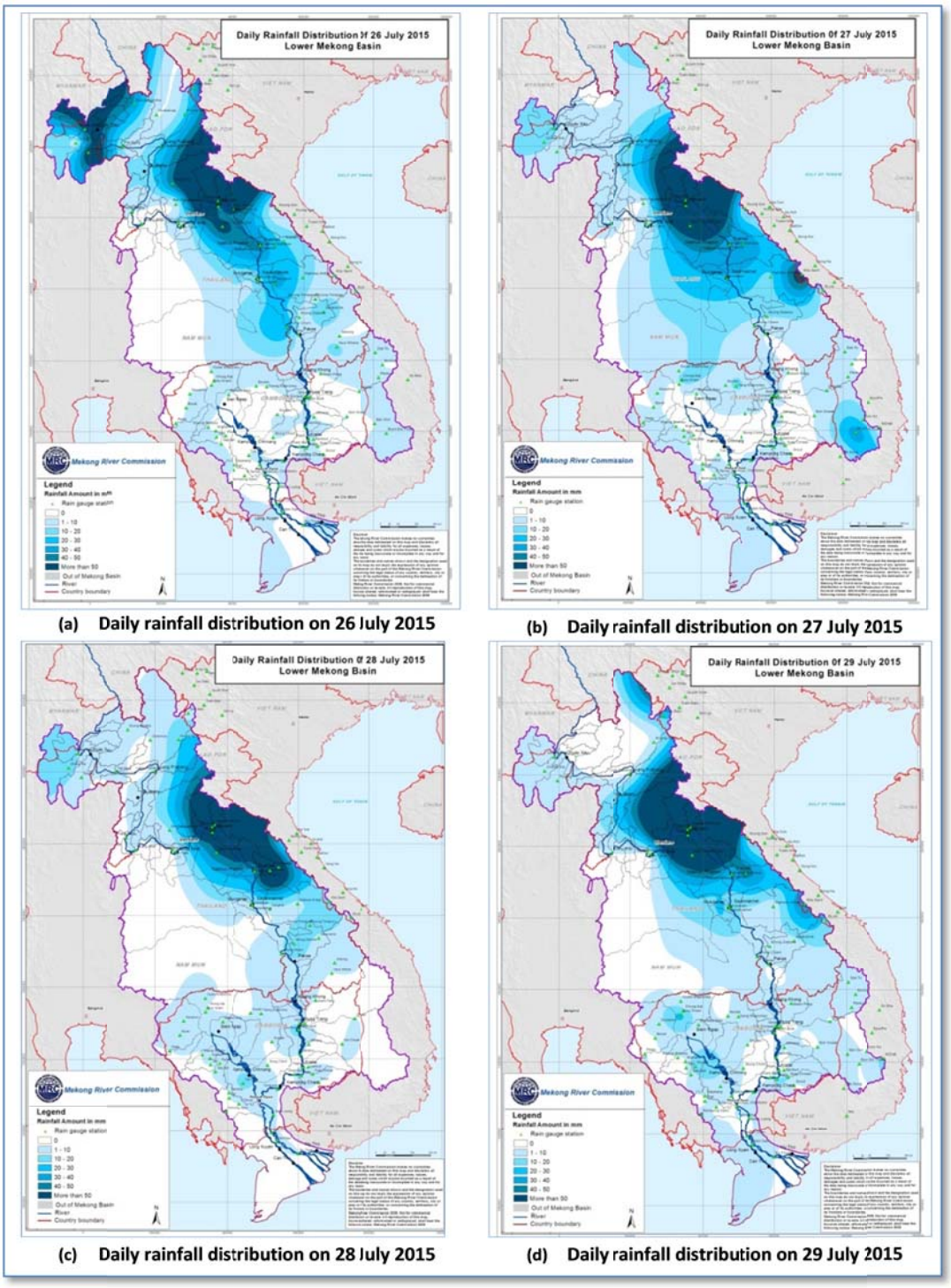


Figure 6-3 The daily rainfall distribution during the period 26 – 29 July 2015 in the Lower Mekong Basin. Source: RFMMC.

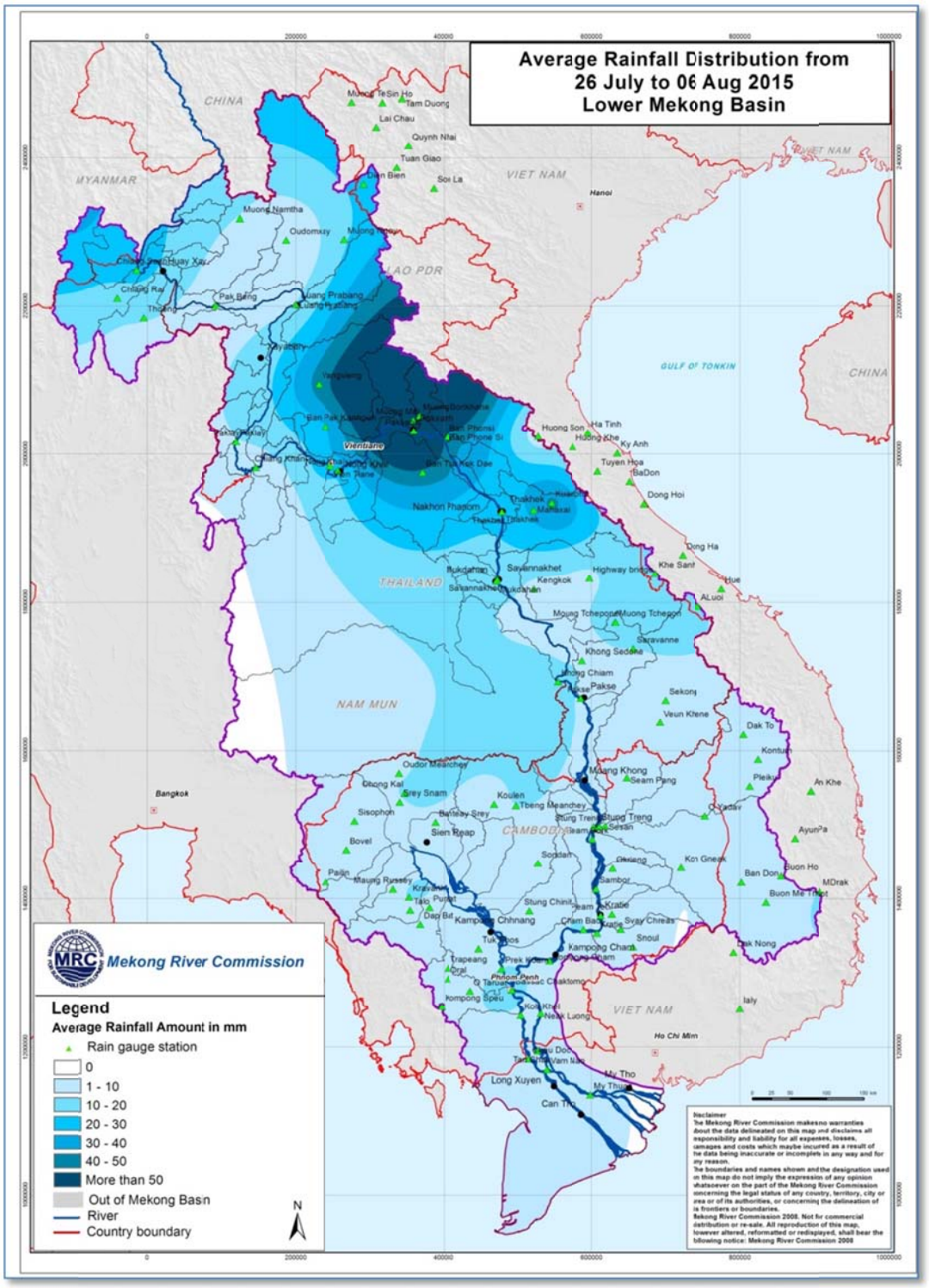


Figure 6-4 The average daily rainfall distribution during the period 26 July - 6 August 2015 in the LMB. Source: RFMMC.

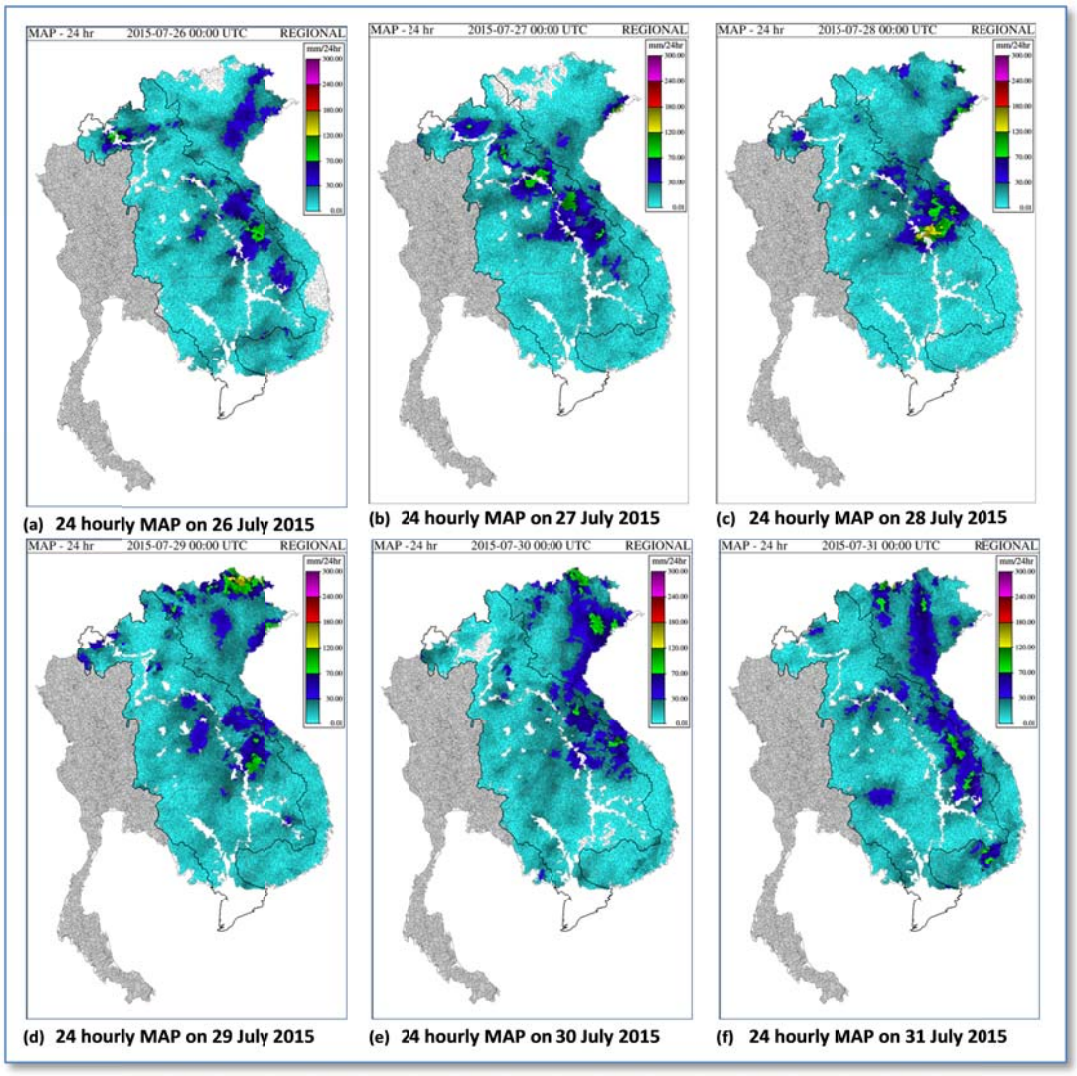


Figure 6-5 The 24 hourly Mean Areal Precipitation (MAP) during the Inter Tropical Convergence Zone from 26 - 31 July 2015 at 00:00 UTC.

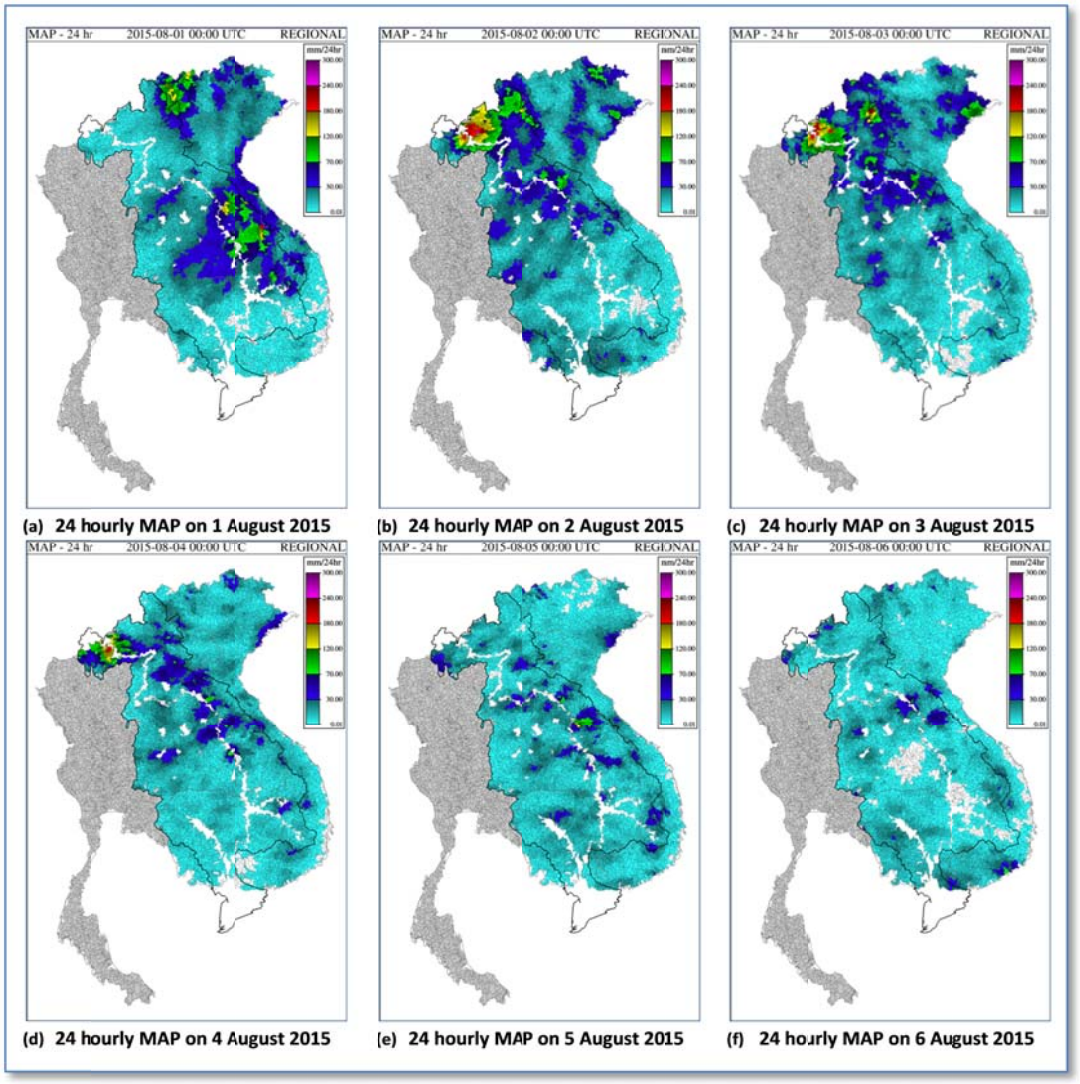
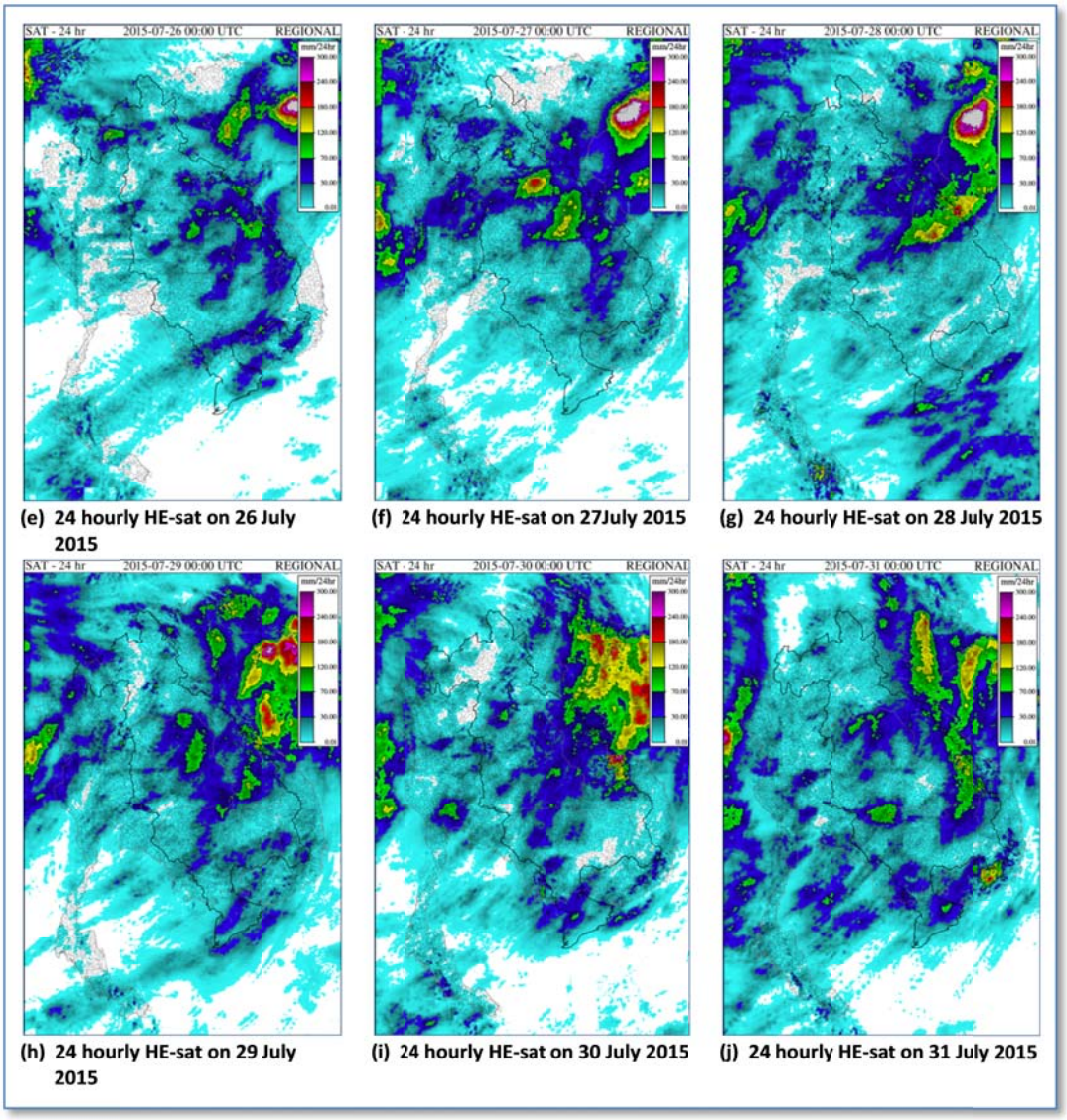


Figure 6-6 The 24 hourly MAP during the period 1 - 6 August 2015 at 00:00 UTC.



(e) 24 hourly HE-sat on 26 July 2015

(f) 24 hourly HE-sat on 27July 2015

(g) 24 hourly HE-sat on 28 July 2015

(h) 24 hourly HE-sat on 29 July 2015

(i) 24 hourly HE-sat on 30 July 2015

(j) 24 hourly HE-sat on 31 July 2015

Figure 6-7 The 24 hourly HE-sat during the period 26 - 31 July 2015 at 00:00 UTC.

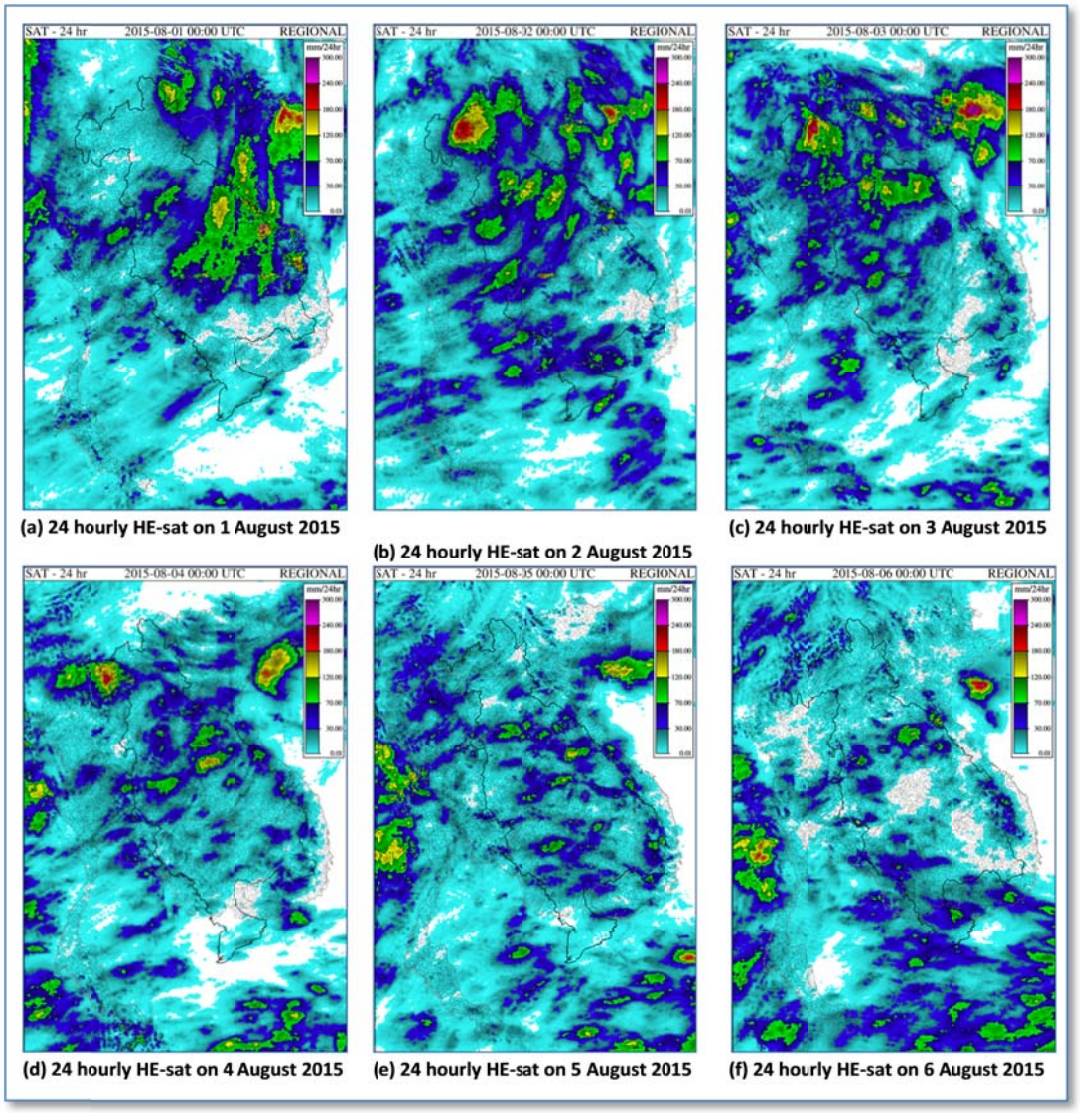


Figure 6-8 The 24 hourly HE-sat during the period 1 - 6 August 2015 at 00:00 UTC.

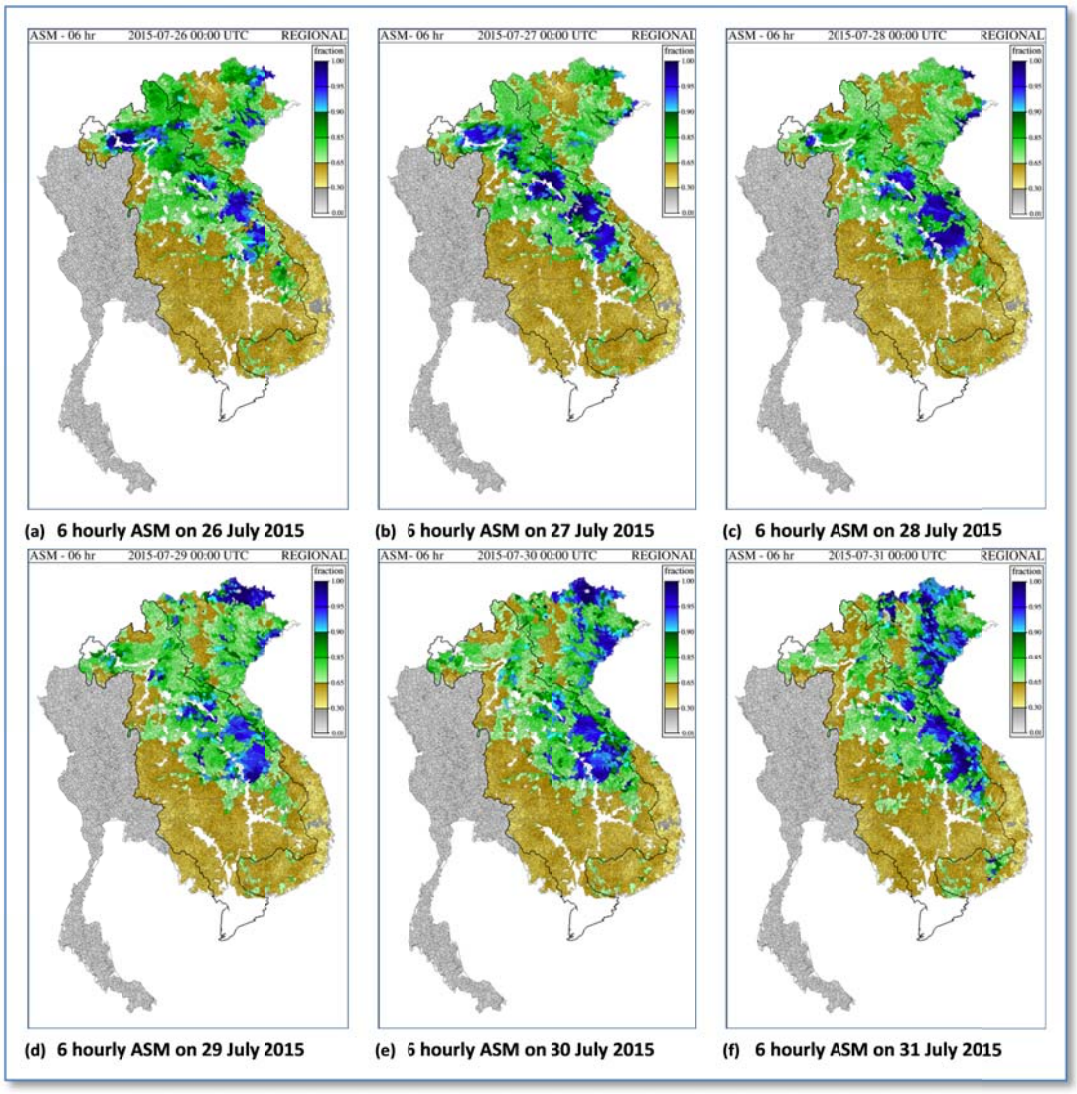


Figure 6-9 The 6 hourly ASM conditions during the period 26 - 31 July 2015 at 00:00 UTC.

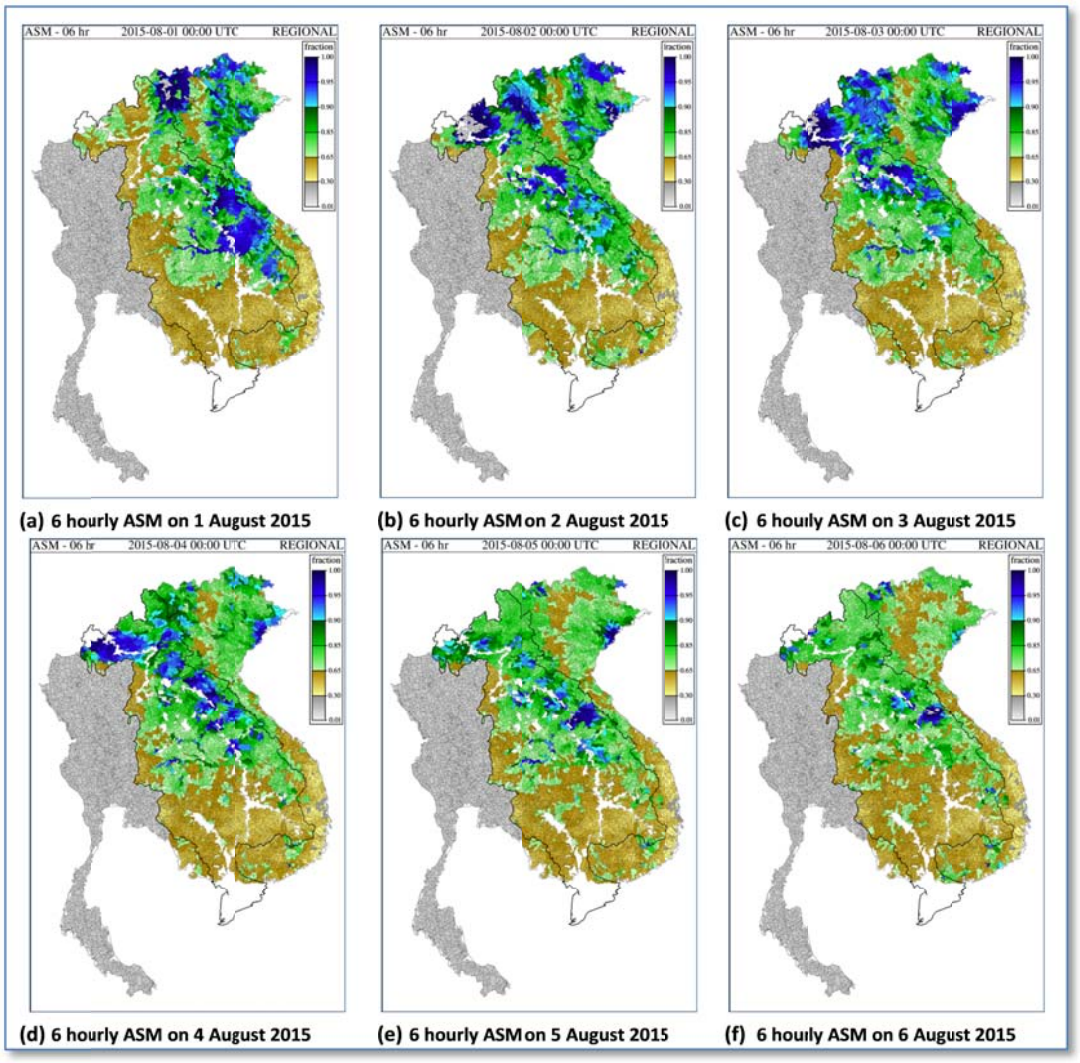


Figure 6-10 The 6 hourly ASM conditions during the period 1 - 6 August 2015 at 00:00 UTC.

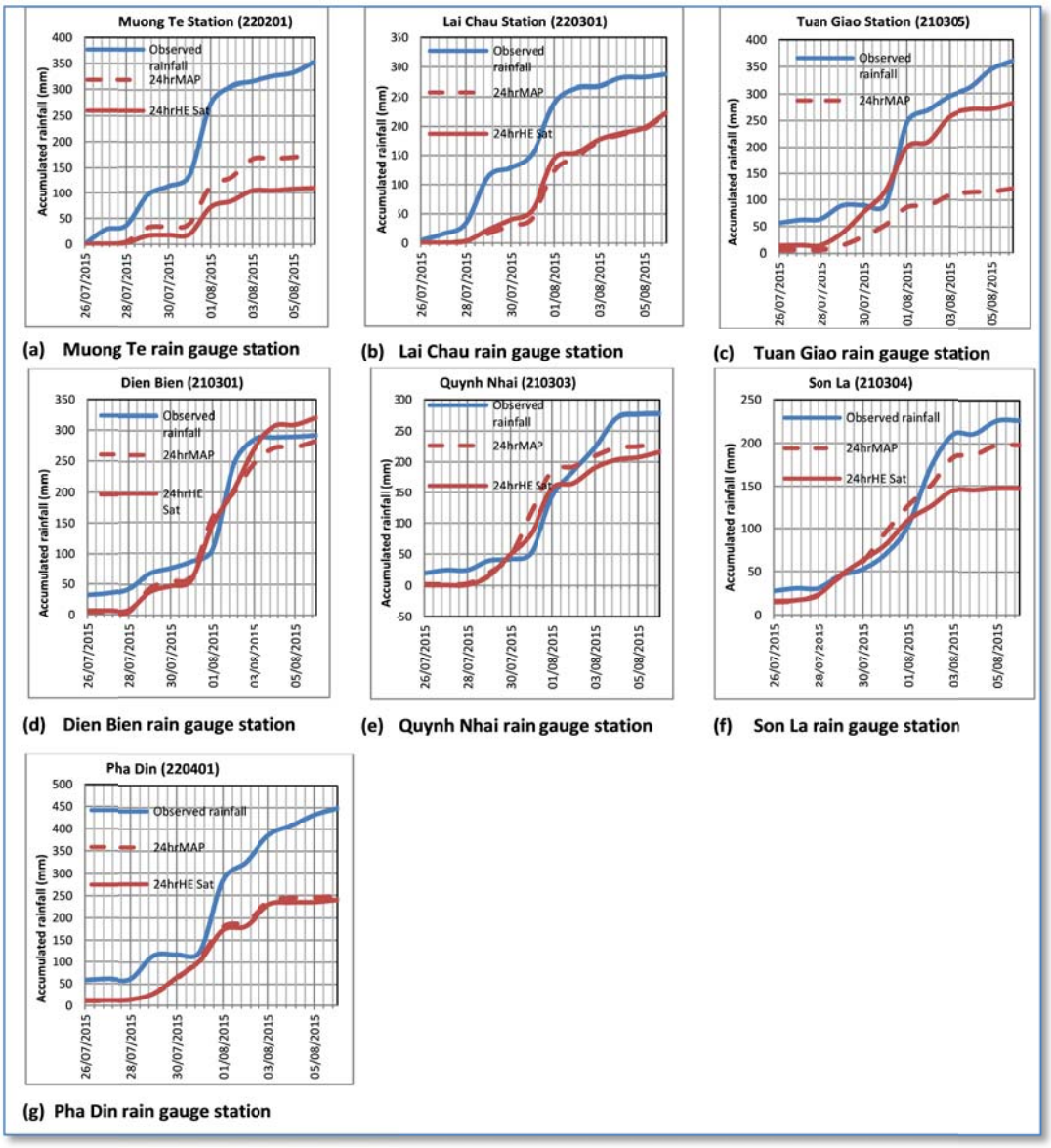


Figure 6-11 Accumulated observed rainfall (mm), 24hr MAP (mm) and 24hr HE-sat (mm) at 7 rain gauge stations located within the upper North of Viet Nam.

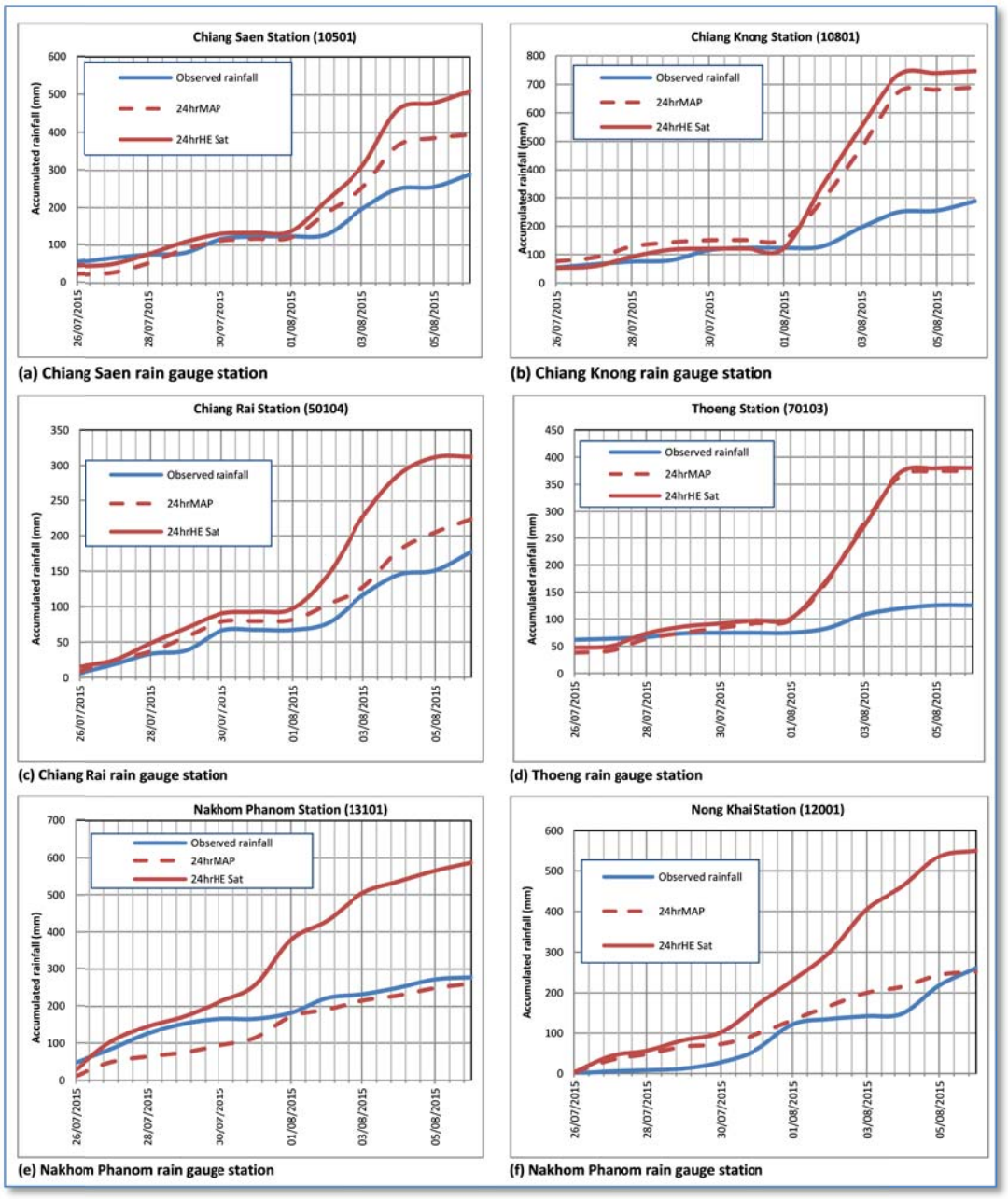


Figure 6-12 Accumulated observed rainfall (mm), 24hr MAP (mm) and 24hr HE-sat (mm) at 6 rain gauge stations located within the North and North East of Thailand.

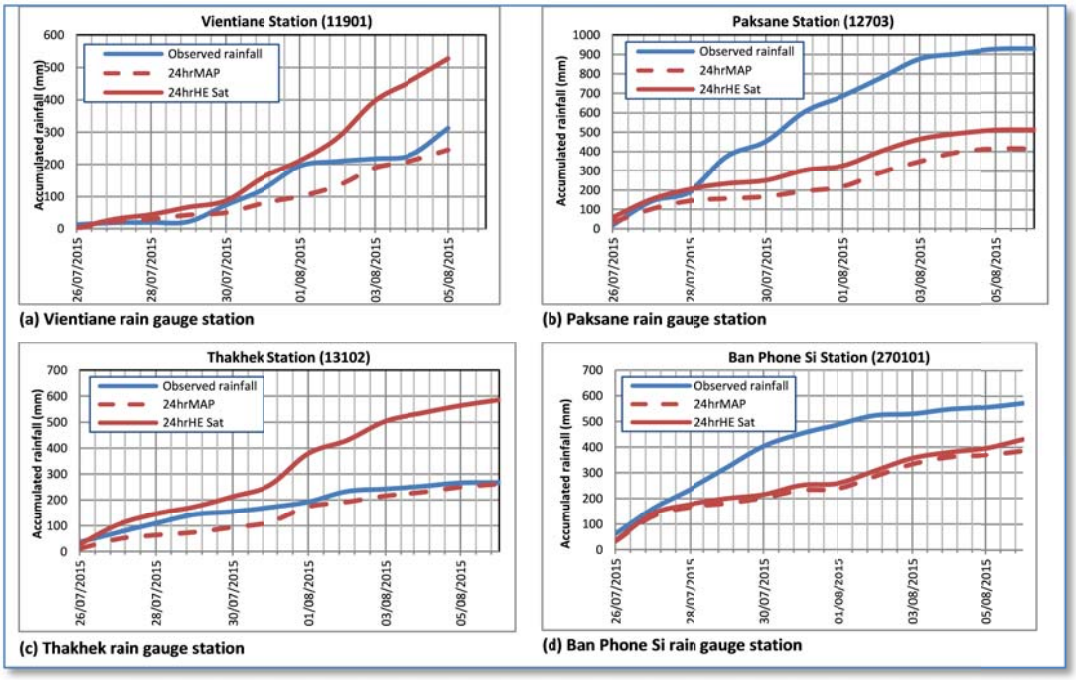


Figure 6-13 Accumulated observed rainfall (mm), 24hr MAP (mm) and 24hr HE-sat (mm) at 4 rain gauge stations located within the Center of Lao PDR.

6.3 Rising water levels in some tributaries of the Mekong River during the period from 26 July to 6 August 2015

Heavy rainfall caused by monsoon storms during the period 26 July - 6 August 2015 made water levels rising at some river monitoring stations in the upper and central parts of the LMB. It also affected to the flow regime at some river monitoring stations of the tributaries of the Mekong River north and central regions, especially in the northern Viet Nam provinces, in the central Lao PDR provinces and also in the northern and northeastern Thailand provinces.

According to media information, on 1 August 2015 rainfall engulfed Nakhon Phanom Province in Thailand and in three consecutive weeks the water levels of the Mekong River raised to 10 m, while tributaries were showing signs of overflowing.

On 28 July 2015 Weather Forecasting and Aeronautical Department of Lao PDR reported that water was rising because of heavy rains in northern Lao PDR, which could cause flooding in the lowlands of some districts in Bonkhamxay and Khammouane provinces, as well as the Mekong has recently risen from between 6 and 12 m above normal levels (see appendix 1.2).

The graphs in Figure 6-14 to Figure 6-16 illustrate water level data of 2 gauge stations, Muong Ngoy and Muong Kao stations, located in the northern Lao PDR which is close to northern Viet Nam, additionally 8 gauge stations, Kieng Kok, Pak Beng, Luang Prabang, Vientiane, Paksane, Thakhek, Ban Phone Si and Muong Kao

stations, located in the North and Center parts of Lao PDR, as well as 7 gauge stations, Chiang Saen, Chiang Khong, Ban Mai Bua Daeng, Chiang Rai, Thoeng, Nakhon Phanom and Nong Khai stations, located in the North and North-East of Thailand in the period 26 July - 6 August 2015. The water levels are recorded twice daily at 7 AM and 7 PM.

As a result of heavy rainfall in the period 26 July - 6 August 2015, see Figure 6-16, water levels increased from 4.58 m on 2 August to 8.12 m on 3 August in the tributary of the Nam Ou River at the Muong Ngoy station, and also in the tributary of Nam Sane River from 7.14 m on 2 August to 9.98 m on 3 August at the Muong Kao station. The water levels in these stations rose almost 3 m. Results in Figure 6-15 show that the water levels continued increasing more rapidly to about 6 m high in the period 26 July - 4 August at Paksane and Takhek stations in mainstream of Mekong River. Especially on 5 August at Takhek station the water level rose to 12.14 m, which was 1 m under the alarm level of 13 m. Results in Figure 6-16 show water level increased significantly at Nakhon Phanom station in the Mekong River mainstream from 7.2 m on 26 July to 11 m on 3 August, which was only 0.50 m under the alarm level. While water levels rapidly increased in the mainstream of Mekong River at Nong Khai station from 8.4 m on 5 August to 11.46 m on 7 August, which was roughly 0.10 m above the alarm level; the peak was 0.50 m short of reaching the flood level.

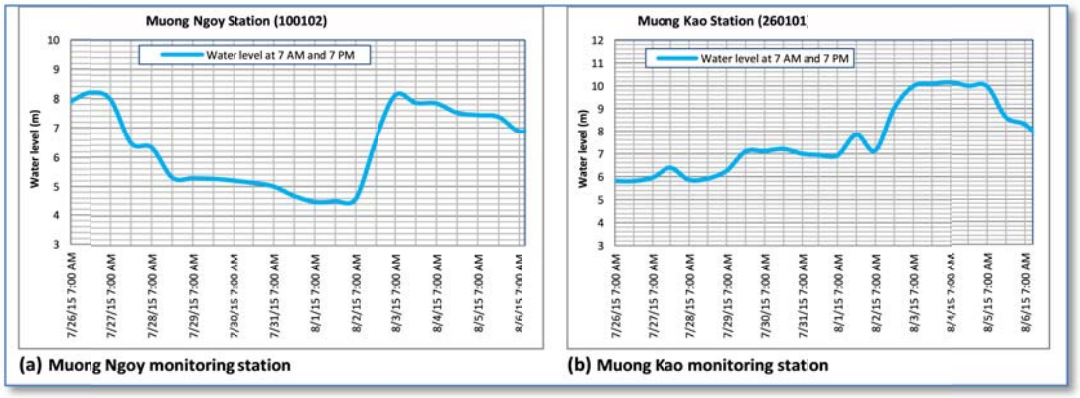


Figure 6-14 Water level at the Muong Ngoy and Muong Kao monitoring stations located in northern Lao PDR during period 26 July - 6 August 2015.

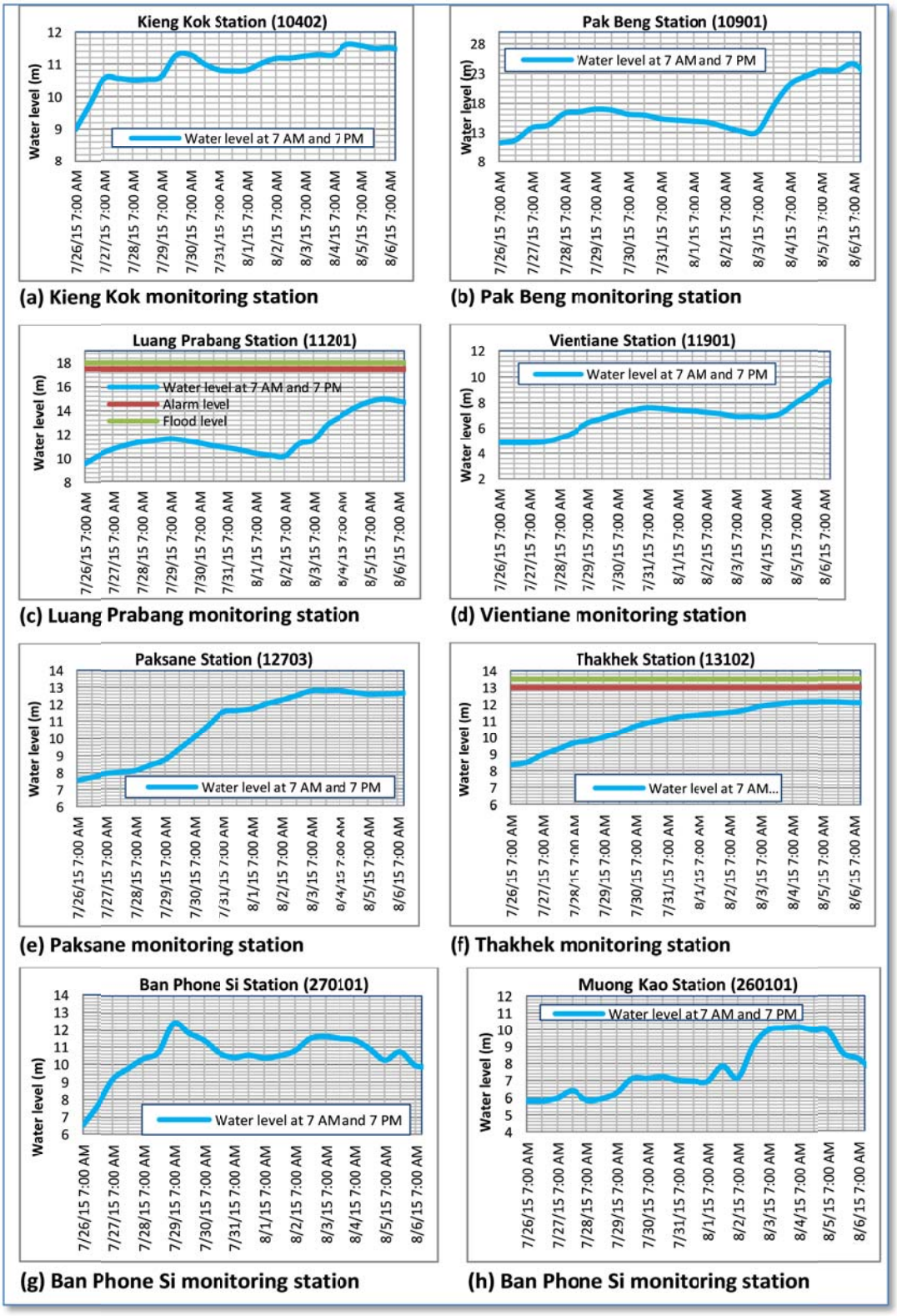


Figure 6-15 Water level at 8 monitoring stations located in the North and Center of Lao PDR during period 26 July - 6 August 2015.

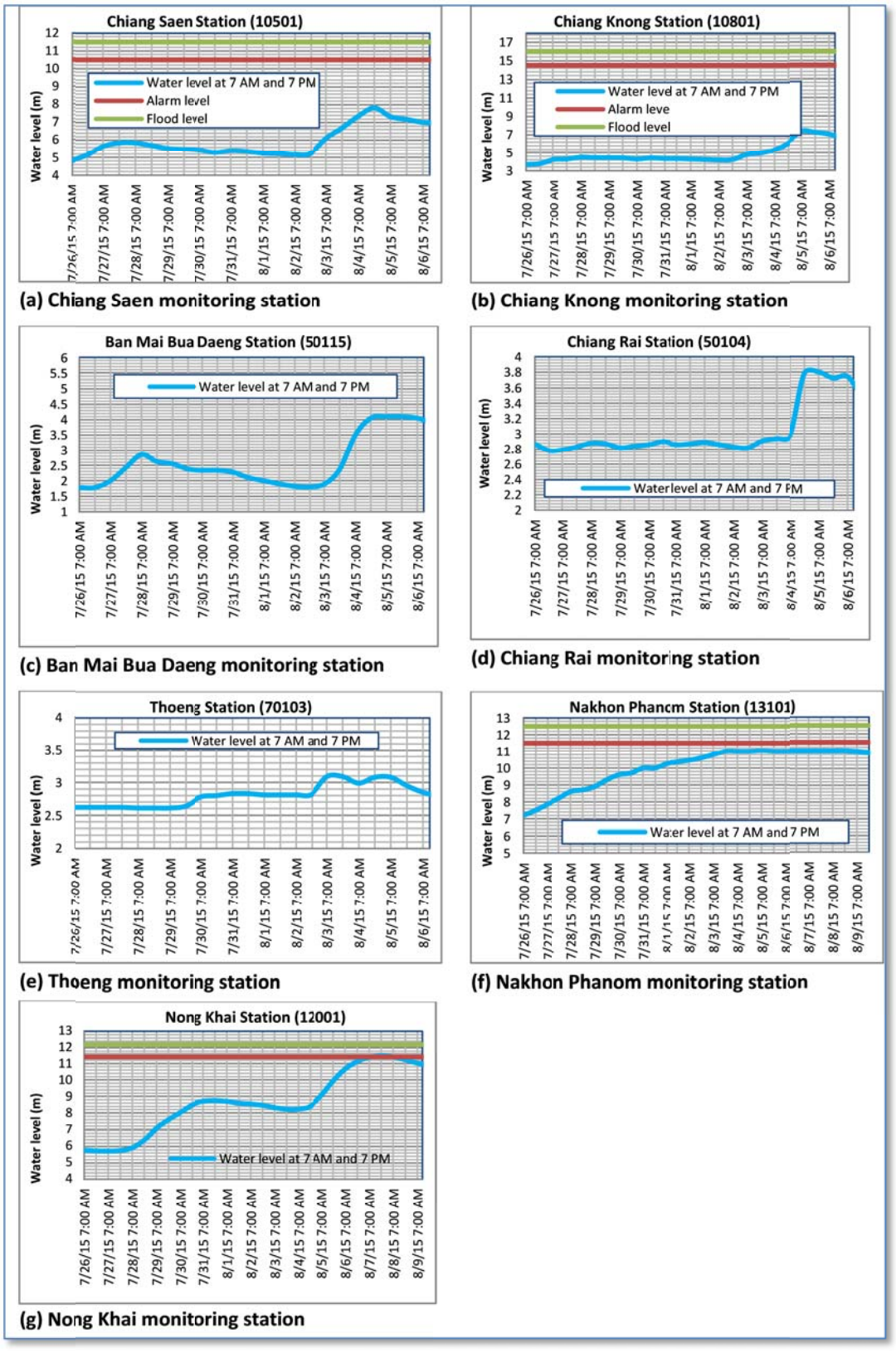


Figure 6-16 Water level at 7 monitoring stations located in the North and North-East of Thailand during period 26 July - 6 August 2015.

6.4 Flash flooding in the northern and northeastern provinces of Thailand during the period from 26 July to 6 August 2015

On 26 and 27 July, and from 2 to 6 August 2015 at 0:00 UTC (7 AM Phnom Penh Time) the MRC-FFG system detected flash flood risk areas in the northern provinces of Thailand, and especially Chiang Rai, Phayao, Nan and Chiang Mai provinces were at the risk of flash flood occurrences. Table 6-2 indicates the list of flash flood risk areas that were detected by the MRC-FFG system during the period 26 July - 6 August 2015.

The Thai Meteorological Department (TMD) reported on 26 July and 30 July 2015 that heavy rains occurred in the North and Northeast provinces of Thailand causing flooding (see appendix 1.2). On 31 July 2015 the TMD issued warnings for the people in Chiang Rai and other Northern provinces to remain on alert for flash floods, as heavy rains continued to affect these region. On 3 August 2015 people living in the provinces of Mae Hong Son, Chiang Rai, Tak, Kamphaeng Phet, Udon Thani, Nong Khai, Bueng Kan, Sakon Nakhon and Nakhon Phanom were told to brace for mudslides and flash floods. According to the news reported on 4 August 2015 that in Bueng Kan Province, as well as in other provinces in the Northeast of Thailand, continuous rainfall triggered flash floods (see appendix 1.2). According to media information more than 90 homes in Bueng Kan were damaged by flood waters.

Unfortunately, the MRC-FFG system did not detect the flash flood risk areas in the Northeast provinces of Thailand, which is not consistent with the news reports (see appendix 1.2). However, the information on flash flood risk areas that was detected by the MRC-FFG system in the period 4 – 6 August 2015 at 00:00 UTC, which was confirmed by the information published on the online news on 4 – 6 August 2015 (see appendix 1.2). The detection by the MRC-FFG system of some flash flood risk areas in Mae Suai District of Chiang Rai Province in Thailand corresponded with the reported flash flood areas as published by the media.

Table 6-2 List of 1 hourly and 3 hourly FFG warnings by MRC-FFG system on 26 July, 27 July, and 2 – 6 August 2015 at 0:00 UTC covering the period from 26 July to 6 August 2015.

Date of FFG products 26/07/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	to Flash Flood	Occurence	Chiang Rai	Thoeng	38.04
			Phayao	Chiang Kham	44.05
			Chiang Rai	Chiang Saen	42.80
			Chiang Rai	Chiang Khong	43.80
			Nan	King Amphoe Song Khae	38.18

Date of FFG products 27/07/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	to Flash Flood	Occurence	Chiang Rai	Thoeng	48.11
			Nan	King Amphoe Song Khae	49.83
			Phayao	Chiang Kham	48.11

Date of FFG products 02/08/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
Chiang Rai	Chiang Saen	8.39	Chiang Rai	Thoeng	38.30
Chiang Rai	Chiang Khong	8.39	Phayao	Chiang Kham	38.30
			Chiang Rai	Chiang Saen	23.21
			Chiang Rai	Chiang Khong	28.11
			Nan	King Amphoe Song Khae	50.55

Date of FFG products 03/08/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	to Flash Flood	Occurence	Chiang Rai	Thoeng	27.38
			Phayao	Chiang Kham	24.60
			Chiang Rai	Chiang Saen	24.78
			Chiang Rai	Chiang Khong	29.95
			Nan	King Amphoe Song Khae	24.20

Date of FFG products 04/08/2015 06:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
Chiang Rai	Thoeng	21.81	Chiang Rai	Chiang Khong	34.10
Phayao	Chiang Kham	22.53	Chiang Rai	Chiang Saen	34.10
			Chiang Rai	Thoeng	32.43
			Chiang Rai	Mae Suai	41.72
			Chiang Mai	Fang	39.67
			Chiang Mai	Mae Ai	37.80
			Chiang Mai	King Amphoe Chaipakan	40.61
			Nan	King Amphoe Song Khae	45.02
			Phayao	Chiang Kham	32.06

Date of FFG products 05/08/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	to Flash Flood	Occurence	Chiang Rai	Chiang Khong	49.74
			Chiang Rai	Chiang Saen	49.74
			Chiang Rai	Thoeng	43
			Chiang Rai	Mae Suai	49.33
			Chiang Mai	Fang	49.33
			Chiang Mai	King Amphoe Chaipakan	49.33
			Phayao	Chiang Kham	44.12

Date of FFG products 06/08/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	to Flash Flood	Occurence	Chiang Rai	Mae Suai	39.13
			Chiang Mai	Fang	39.13
			Chiang Mai	Mae Ai	39.13

6.5 Flash flooding in the northern and central provinces of Lao PDR during in the period from 26 July to 6 August 2015

The MRC-FFG system detected flash flood risks and issued several FFG warnings in the northern, central and some areas in southern provinces of Lao PDR, as a result of heavy monsoon rains and tropical storm KOMEN during the period 26 July - 6 August 2015. During this period monsoon storms had caused major flash flooding and landslides in some areas of Lao PDR; the 3 hourly MRC-FFG system detected flash flood risk areas in many provinces in the northern, central and southern parts of Lao PDR, such as Luang Namtha, Oudomxay , Bokeo, Luang Prabang, Huaphanh, Xayaboury, Xiangkhouang, Bolikhamxay, Sekong, Saravane, Savannakhet, Champassak, Xaysomboun, Vientiane and Khammouane provinces.

According to the information from the newspaper published on 28 July 2015, around 600 hectares of rice fields of 404 families in 14 villages living on both sides of the Xe Bang Fai River were flooded; while heavy downpours occurred over Vientiane (see appendix 1.1). Since 2 August 2015 the torrential rains caused flooding in several areas of Lao PDR, especially in the Bokeo, Borikhamxay, Khammouane, Luang Namtha and Xaysomboun provinces and affected thousands of people. More than 1,400 families in the four districts of Borikhamxay Province were affected since torrential rains lashed the area on 2 August 2015, while 4,200 hectares of recently planted rice seedlings were submerged, according to the information from the newspaper on 6 and 8 August 2015 (see appendix 1.3).

Flash flood risk areas were detected by MRC-FFG system with 3 hourly FFG warnings at 00:00 UTC (7:00 AM Phnom Penh time) on 28 July, 30 July and 2 August; these are shown in Figure 6-17. The FFG warnings by MRC-FFG for detected risk areas are presented in Figure 6-17; the areas corresponded with the newspaper information that flash floods hit Borikhamxay, Khammouane, Vientiane provinces.

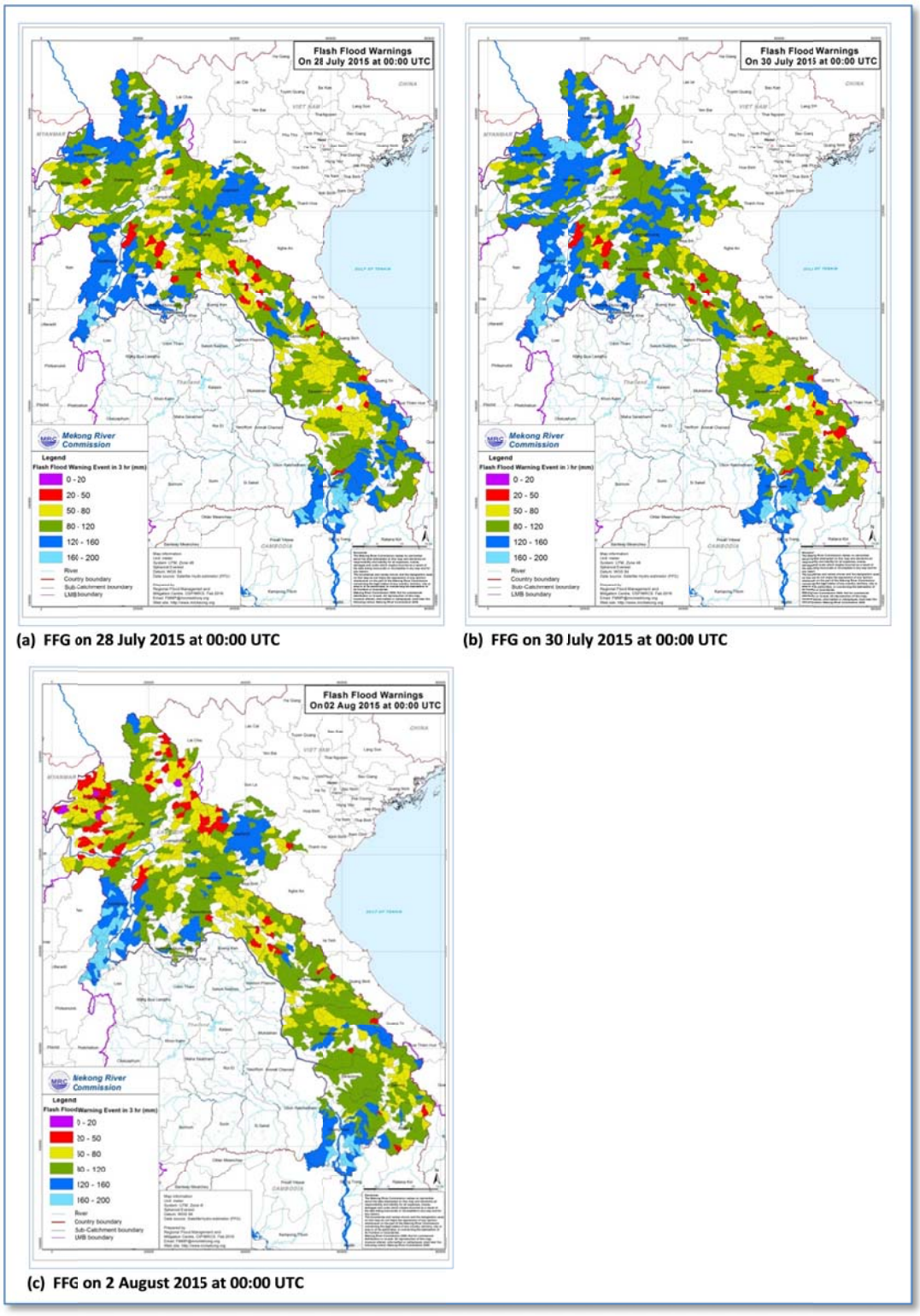


Figure 6-17 MRC-FFG system detected FFG warning of 3 hourly FFG at some districts in northern, central and southern parts of Lao PDR on 28 July, 30 July, and 2 August 2015. Source: RFMMC.

6.6 Flash flooding in the northern provinces of Viet Nam during the period from 26 July to 6 August 2015

The flood situation in Viet Nam during the period 26 July - 6 August 2015 was based on media information from the internet, the National Hydro-meteorological Forecast Center and other newspaper sources (see Appendix 1.1).

An unusual two-day torrential rainfall of 574 to 828 mm caused floods in many areas of the northeastern Quang Ninh Province on 26 July, especially in Ha Long, Dong Trieu, Uong Bi, Cam Pha, Van Don and Hoanh Bo districts (see appendix 1.1). The rainfall was the heaviest downpour in the last 40 years, which totaled 828 mm in Quang Ninh Province. According to the report from the media, more than 2800 houses collapsed in the deluge and 143 ha of crops and about 880 fishing pens were swamped with water, 23 people have been reported either dead or missing in Quang Ninh Province. On the 27 July flash floods caused by torrential rains claimed three lives and caused substantial property damage in Quang Ninh Province.

Figure 6-18 illustrates the detection by the MRC-FFG system of 3 hourly flash flood risk areas at some districts in the northern and central parts of Viet Nam on 27 July, 28 July, 1 August and 4 August. Results show the MRC-FFG system identified FFG warnings in many districts of Bac Kan, Binh Thuan, Cao Bang, Gia Lai, Ha Giang, Ha Tinh, Hoa Binh, Kon Tum, Lao Chi, Lai Chau, Phu Tho, Quang Binh, Quang Ninh, Quang Tri, Son La, Thanh Hoa, Thua Thien Hue and Tuyen Quang provinces.

Based on the available information from the media, the flash floods hit the Quang Ninh, Ha Giang, Lao Cai, Lai Chau, Lao Chau and Son La provinces, which covered the same risk areas of the MRC-FFG system's results of 3 hourly FFG on 27 and 28 July, 1 August and 4 August, as mentioned earlier (see Figure 6-18).

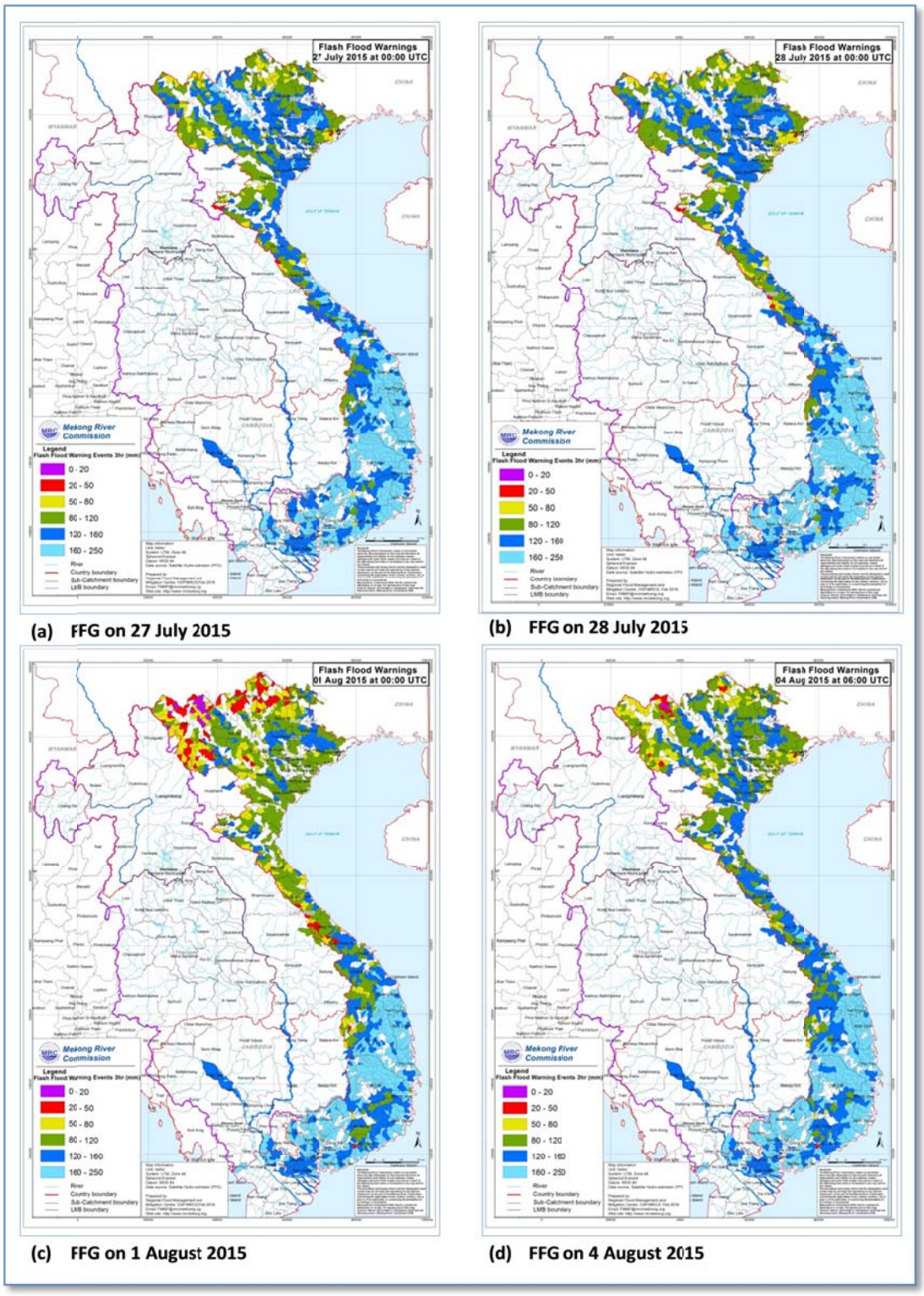


Figure 6-18 MRC-FFG system detected FFG warning of 3 hourly flash flooding at some districts in northern and central parts of Viet Nam on 27 to 28 July, 1 August, and 4 August 2015. Source: RFMMC.

6.7 Summary

During the monsoon rains and tropical storm KOMEN during the period 20 June -6 August 2015, severe flash floods occurred on several tributaries and mainstream of the Mekong River in the northern and northeastern parts of Thailand, the central and northern parts of Lao PDR, as well as in the upper parts of Viet Nam (see appendix 1).

In Viet Nam, since 26 July 2015 the news reported that heavy rains caused flash flood in many areas of the northeastern coast of Quang Ninh Province, including Ha Long, Dong Trieu, Uong Bi, Cam Pha, Van Don and Hoanh Bo districts. Referring to the Figure 6-18 ((a) to (b)) on 27 to 28 July 2015, MRC-FFG system detected several flash flood risk areas and issues FFG warnings to Cam Pha, Ba Che and Hoah Bo districts in Quang Ninh Province. Media reports reports confirmed flash floods occurrences in the same areas (see appendix 1.1). However during the period 2- 6 August the MRC-FFG system detected only Hoah Bo District as flash flood risk area that corresponded with the information from the media.

In summary, flash floods hit several district areas located along the bay of northeastern Quang Ninh Province, such as Ha Long, Uong Bi, Cam Pha and Van Don districts. Unfortunately these district areas were not detected by the MRC-FFG system. During the period 1 - 4 August 2015 the MRC-FFG system showed efficiency in the ability to detect real time flash flood risk areas and provide district warnings for Dien Bien, Lai Chau, Son La and Lao Cai provinces in Viet Nam (see Figure 6-18 (c) to (d)). The flash flood information from the media reported that flash flood occurred in these areas. However, there were minor differences between the information from the media and the MRC-FFG system results.

In Lao PDR, based on the available information of flash flood occurrences on 28 and 30 July, and 2 August issued by the media (see appendix 1.3), flash floods occurred in the same provinces (Borikhamxay, Khammouane and Vientiane provinces) as were detected by the MRC-FFG system, but in different districts (see Figure 6-17).

Unfortunately during the period 4 - 6 August the high flash flood risk areas in the northeastern provinces of Thailand were not detected by MRC-FFG system, while the media reported that flash flood hit several areas in the northeastern Bueng Kan, Nong Khai provinces of Thailand during this storm (see appendix 1.2).

The analysis of the HE-sat, MAP and observed rainfall data from the ground observed stations at selected stations is shown in Figure 6-11 to Figure 6-13. In general, the results of 7 rain gauge stations located within the upper North of Viet Nam show that most of the HE-sat and MAP values ‘underestimated’ of the observed rainfall (see Figure 6-11). The analysis shows that the Dien Bien rain gauge station is

capable of providing consistent information on the flash floods in periods when the tropical storm hit this area.

In Thailand during the storm the HE-sat and MAP values 'overestimated' the observed rainfalls of 6 rain gauge stations. The HE-sat and MAP did not perform well during the period 1 - 6 August for Chiang Khong and Thoeng stations (see Figure 6-12). The analysis of the comparison between the 24hr HE-sat, 24hr MAP and observed rainfall of four stations located in Lao PDR (see Figure 6-13) show that results varied; the observed rainfall values are 'higher' than the HE-sat and MAP at Paksane and Ban Phone Si stations, and 'lower' than HE-sat and MAP at Vientiane and Thakhek stations.

Due to heavy rainfall caused by the monsoon rains and tropical storm KOMEN, water levels at many hydrological stations of the above mentioned sub-catchments quickly rose in the Lower Mekong Basin (see Figure 6-14 to Figure 6-16). Unfortunately during this storm there was a lack of water level information in the northern and central parts of Viet Nam to evaluate the MRC-FFG system performance.

Several areas in the northern part of Viet Nam were hit by flash floods during the monsoon rains and tropical storm KOMEN during the period 20 June - 6 August 2015.

7. Flash flooding in the central and northern Lao PDR and the northern and northeastern Thailand, caused by low pressure in the period from 3 to 8 September 2015

7.1 The low pressure during the beginning of September 2015

During the period 3 - 8 September 2015 according to information from the TMD a low pressure area was situated across the upper North of Myanmar, Thailand, Lao PDR, and Viet Nam, and was connected with a low pressure cell over the Gulf of Tonkin (see Figure 7-1 (a) to (f)). Figure 7-1 illustrates the weather chart of the LMRB region during on 3 - 8 September 2015 at 00:00 UTC (07:00 AM Phnom Penh time). When the LMRB was covered by low pressure, this caused wide spread heavy rainfall which affected most of Northern regions of Lao PDR and Viet Nam, as well as in some parts of the northern and northeastern Thailand.

During the period 3 - 8 September 2015 heavy rainfall led to serious flooding and also flash flood in some provinces of northern and central Lao PDR, and northern and northeastern Thailand. The most affected provinces in Thailand were Nakhon Phanom, Nong Khai and Nan. In Lao PDR the following provinces were affected, such as Xaysomboun, Khammouane, and Luang Prabang, according to media information (see appendix 1).

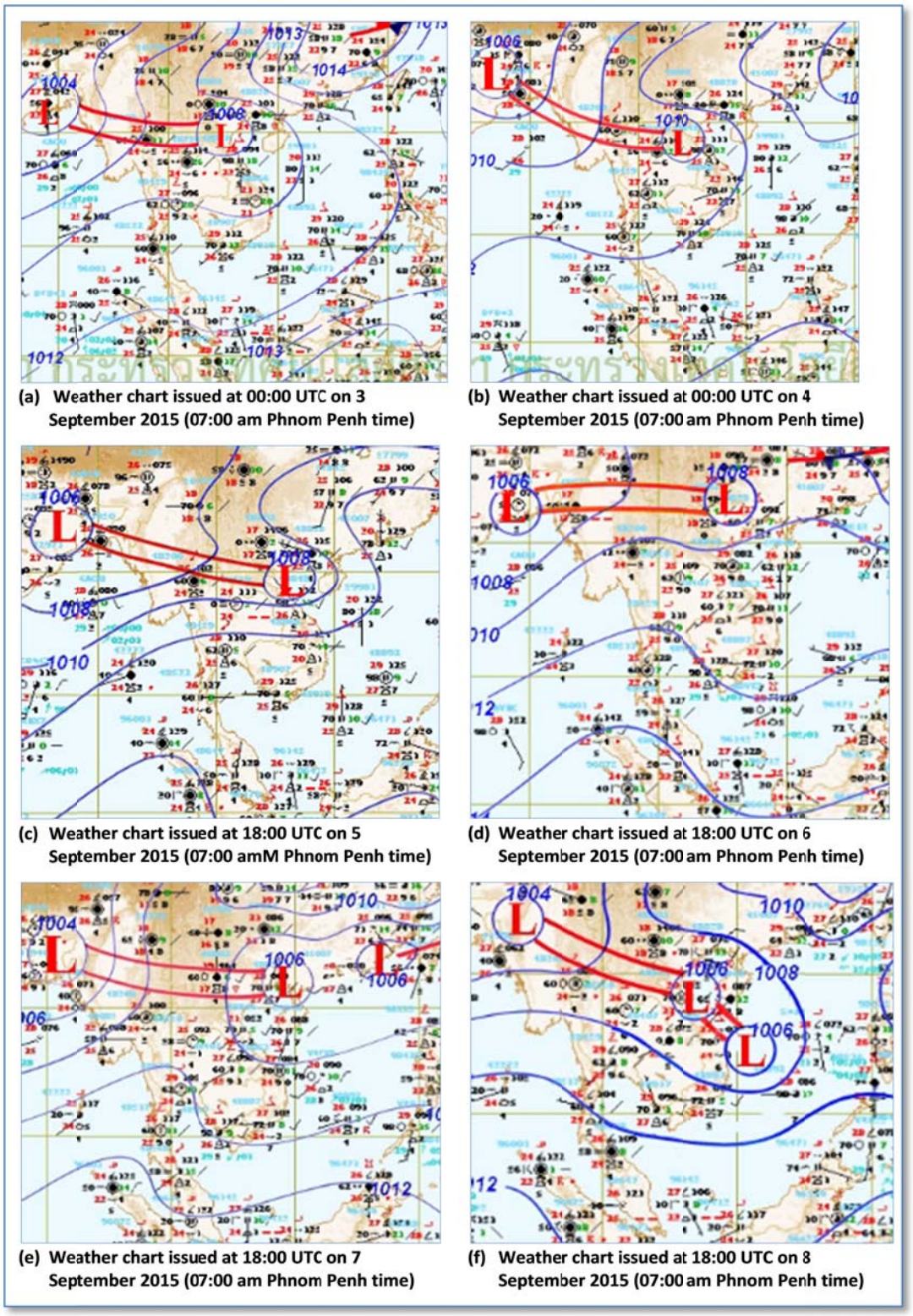


Figure 7-1 The weather chart of the Mekong region on 3 - 8 September 2015 at 00:00 UTC (07:00 AM Phnom Penh time). Source: Thai Meteorological Department.

7.2 Heavy rainfall during the low pressure in the period from 3 to 8 September 2015

During the period 3 - 8 September 2015 low pressure and strong winds caused heavy rainfalls in some areas of LMR region (see Figure 7-1). Due to the storm circulation during this period, heavy rainfalls hit several areas in the northern and central parts of Lao PDR and also some areas in the northern and northeastern parts of Thailand, according to media information (see appendix 1). Table 7-1 shows the daily rainfall amounts at some rain gauge stations located within the North and Central provinces of Lao PDR and the North and North Eastern provinces of Thailand (see Figure 7-2), which are based on the rainfall data recorded in the period 3 - 8 September 2015. The data were recorded at 7:00 AM to 7:00 AM of the following day. On 2 September the daily rainfall reached a maximum of about 190 mm at the Ban Tha Kok Daeng station on Nam Songkram River, located in the northeastern province of Sakon Nakhon, Thailand (see Figure 7-2).

Figure 7-3 illustrates the daily rainfall distribution in the LMB region in the period 3 – 6 September 2015. The results presented in Figure 7-3 clearly show that on 3 September heavy rainfall occurred over the central Viet Nam and Lao PDR, the northern Lao PDR, and also at some areas in the northern and northeastern Thailand. On 5 September heavy rainfall in these areas reduced slightly and on 6 September rainfall increased in the northern part of Lao PDR. Due to the heavy rainfall flash floods occurred in high risk areas, as these were reported in the media (see appendix 1).

Figure 7-4 presents the 24hr MAP at 7 AM local time during the low pressure period 3 - 6 September 2015. Figure 7-5 presents the 24hr HE-sat at 7 AM local time during the same period.

Results indicate that during the period 3 – 6 September heavy rainfall occurred in the central part of Viet Nam, northern and central parts of Lao PDR, as well as in some areas of the northern and northeastern Thailand, which corresponds with Figure 7-3.

Figure 7-6 represents the 6hr ASM conditions during on 3 - 6 September. Results show that the soil moisture at some areas in northern and central parts of Lao PDR, the northern part of Viet Nam, as well as the northern and northeastern parts of Thailand was saturated.

The comparison of the observed daily accumulated rainfall with the 24hr MAP and the 24hr HE-sat is shown in Figure 7-7. The data was obtained from five rain gauge stations located in Lao PDR, namely the Pak Beng, Luang Prabang, Paksane, Thakhek and Mahaxai stations, and also three rain gauge stations located in Thailand, namely the Nong Khai, Ban Tha Kok Daeng and Nakhon Phanom stations located in Thailand.

Table 7-1 Daily rainfall amounts at some rain gauge stations of the northern and central provinces of Lao PDR, and the north and northeastern provinces of Thailand.

Station Name	Station ID	River	Country	Daily rainfall amount in mm, during 12-16 September, 2015						
				02-Sep	03-Sep	04-Sep	05-Sep	06-Sep	07-Sep	08-Sep
Pak Beng	10901	Mekong	Lao PDR	41.2	10.2	14.3	5.2	2.4	8.6	-
Luang Prabang	11201	Mekong	Lao PDR	1.4	4	52.2	28	19.2	-	-
Muong Ngoy	100102	Nam Ou	Lao PDR	1.4	3.2	3.4	-	4.2	-	-
Paksane	12703	Mekong	Lao PDR	15.8	52.2	2.4	12.4	-	-	-
Vientiane	11901	Mekong	Lao PDR	12.8	88.6	4.5	-	-	-	0.8
Thakhek	13102	Mekong	Lao PDR	36.2	32.5	11.4	44.1	-	-	-
Mahaxai	320107	Xe Bang Fai	Lao PDR	37.8	88.2	10.5	6.1	-	-	18.1
Nong Khai	12001	Mekong	Thailand	17.3	135.5	3.7	3.4	0	0	0
Ban Tha Kok Daeng	290102	Nam Songkhram	Thailand	**190.5**	30.8	29.5	31.5	0	0	0
Nakhon Phanom	13101	Mekong	Thailand	23.6	0	9.4	38.5	0	0	35.7

Note: "–" indicates that rainfall data is not available

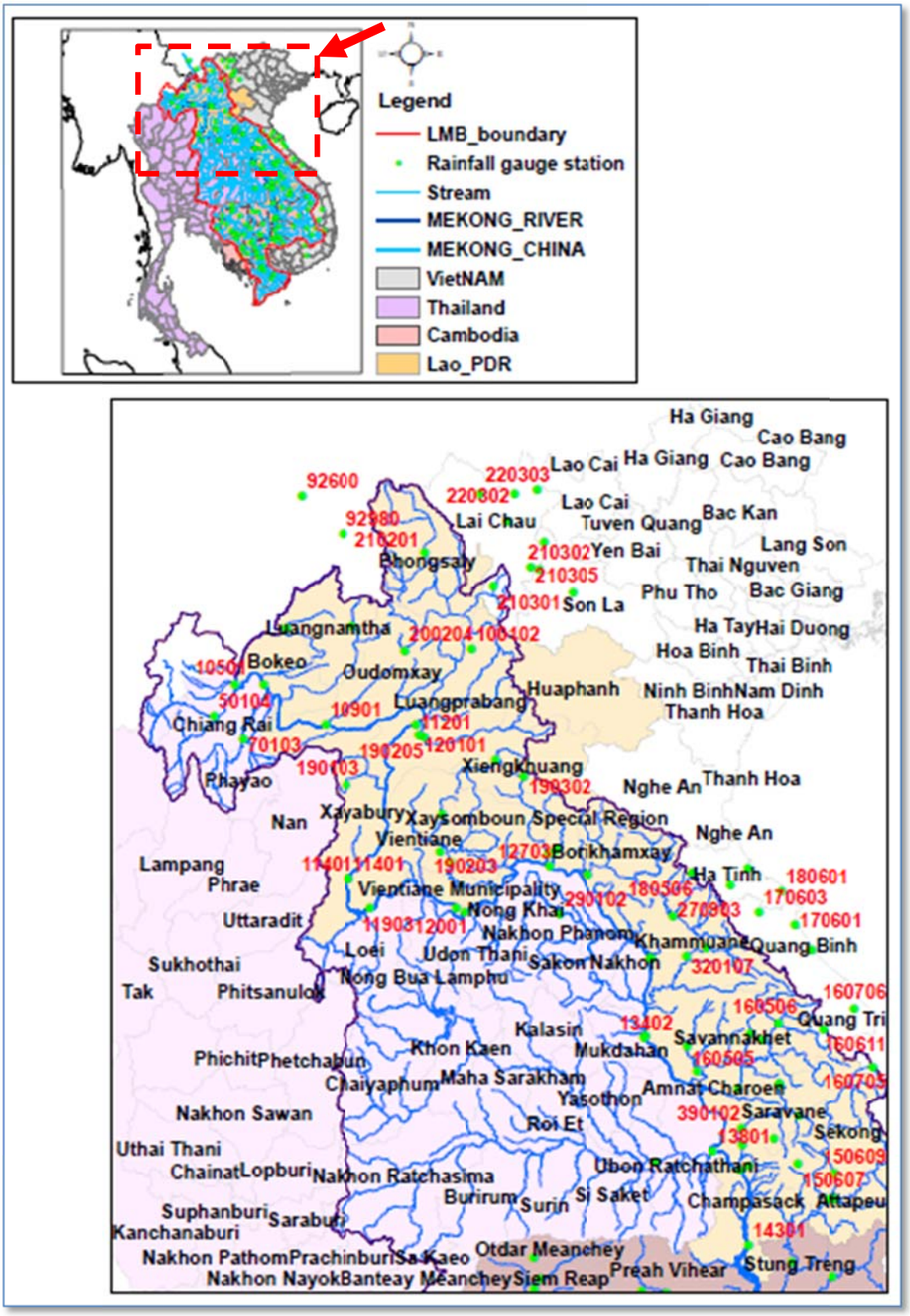


Figure 7-2 Location of Hydmet stations (green dots and red numbers) in the surrounding of the areas affected by the low pressure in period 2 - 8 September 2015.

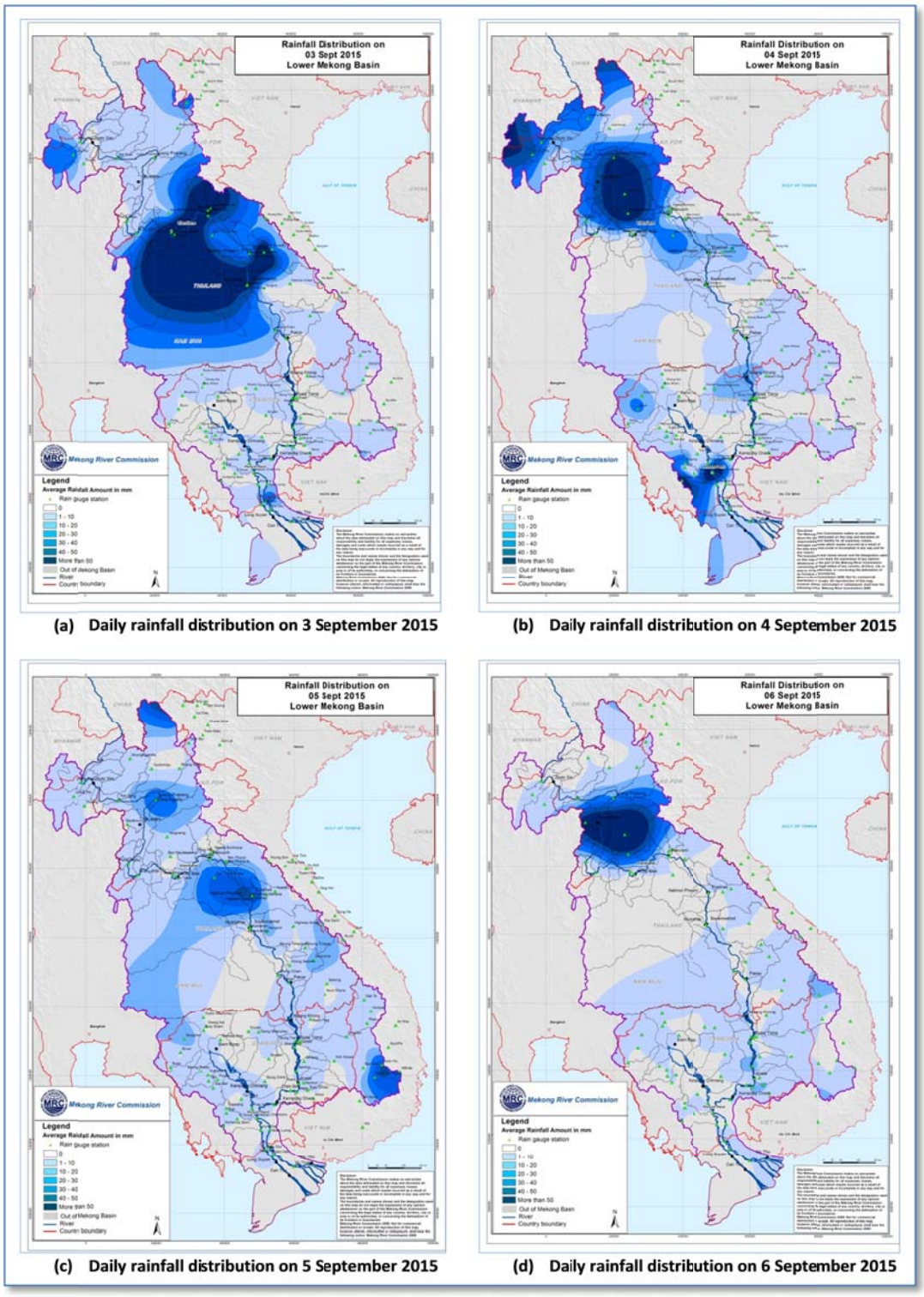


Figure 7-3 The daily rainfall distribution in period 3 - 6 September 2015 in the Lower Mekong Basin. Source: RFMMC.

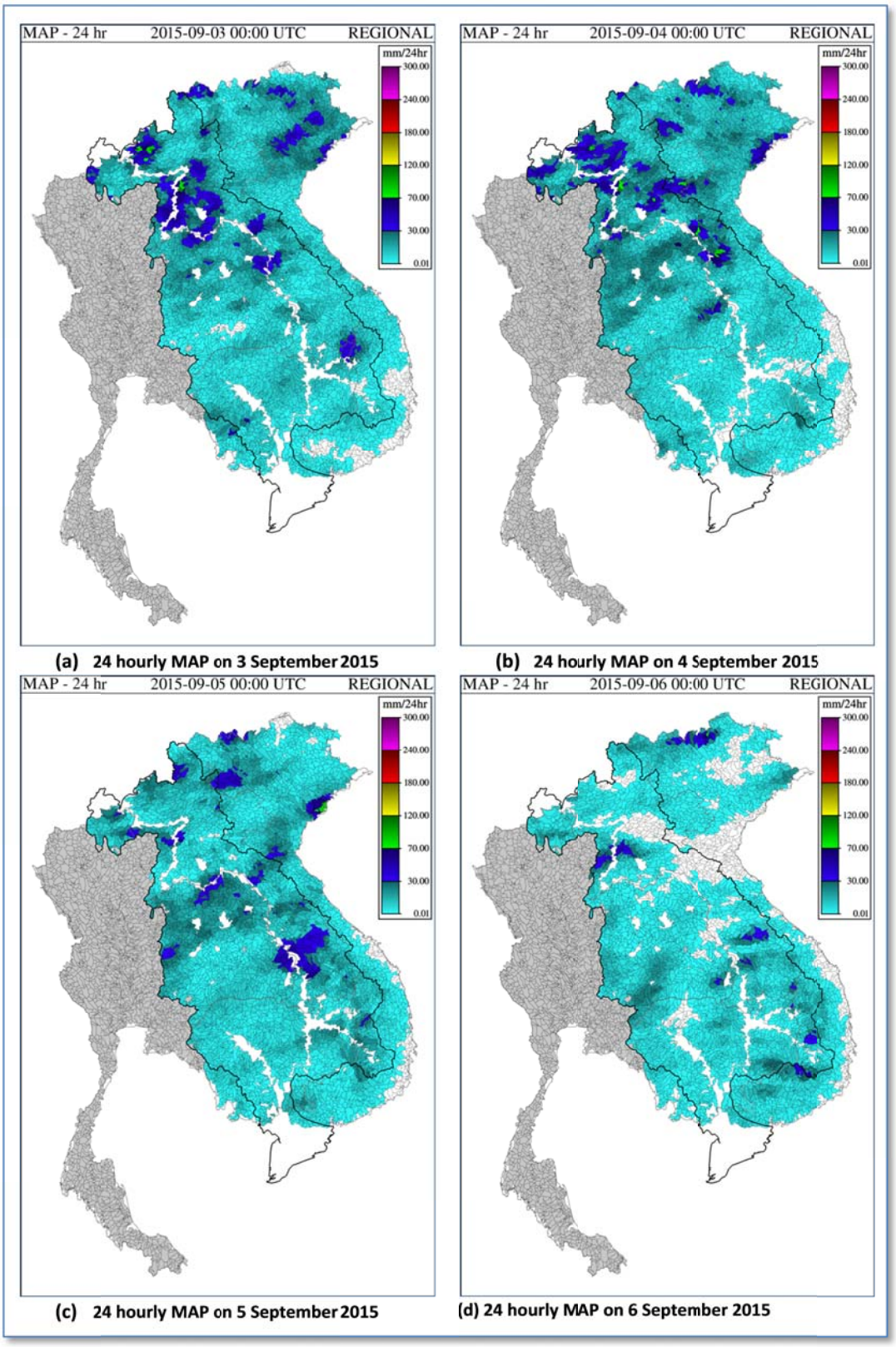


Figure 7-4 The 24 hourly Mean Areal Precipitation (MAP) in period 3 - 6 September 2015 at 00:00 UTC (7:00 AM Phnom Penh time).

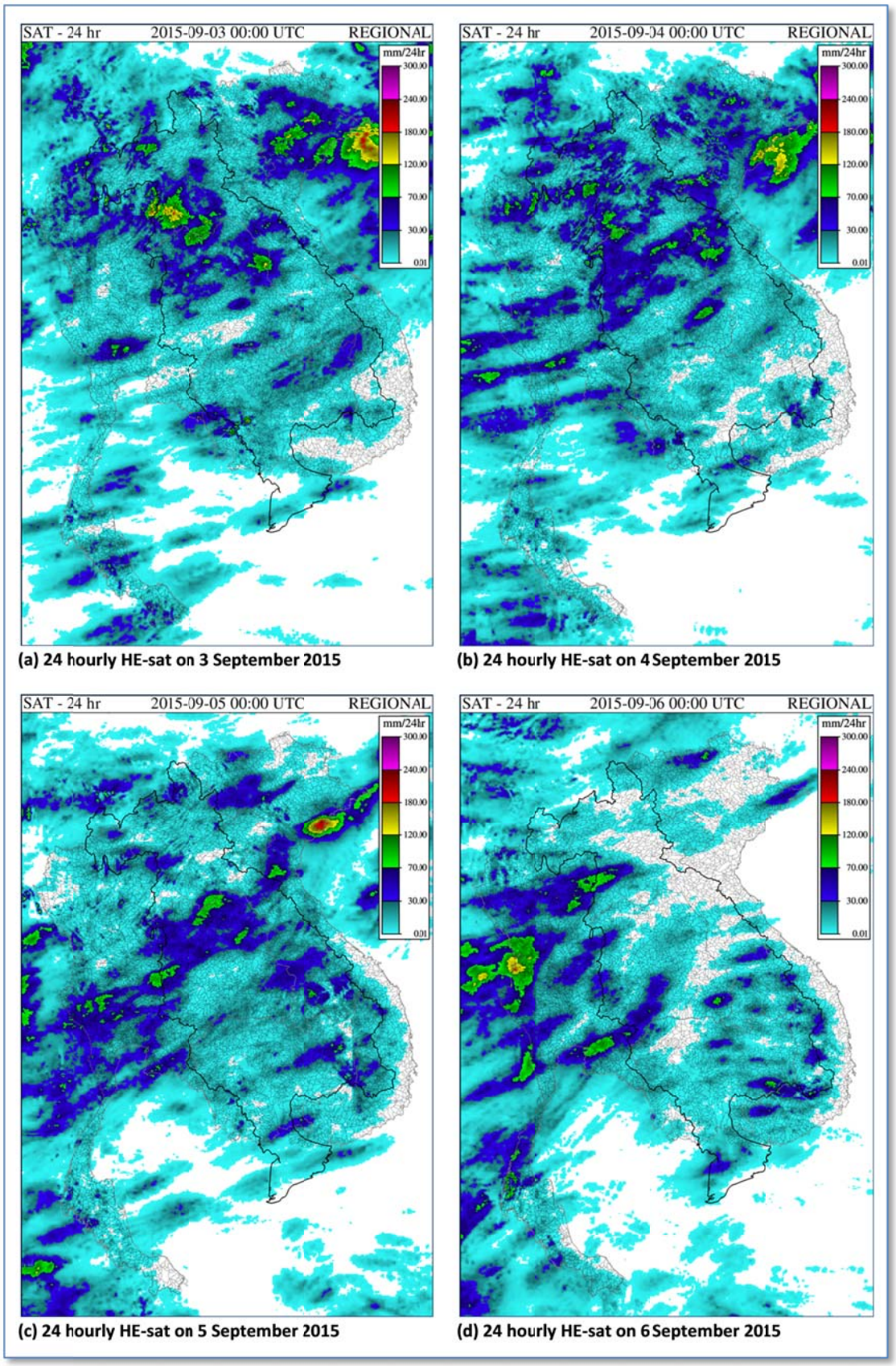


Figure 7-5 The 24 hourly HE-sat during period 3 - 6 September 2015 at 00:00 UTC (7 AM Phnom Penh time).

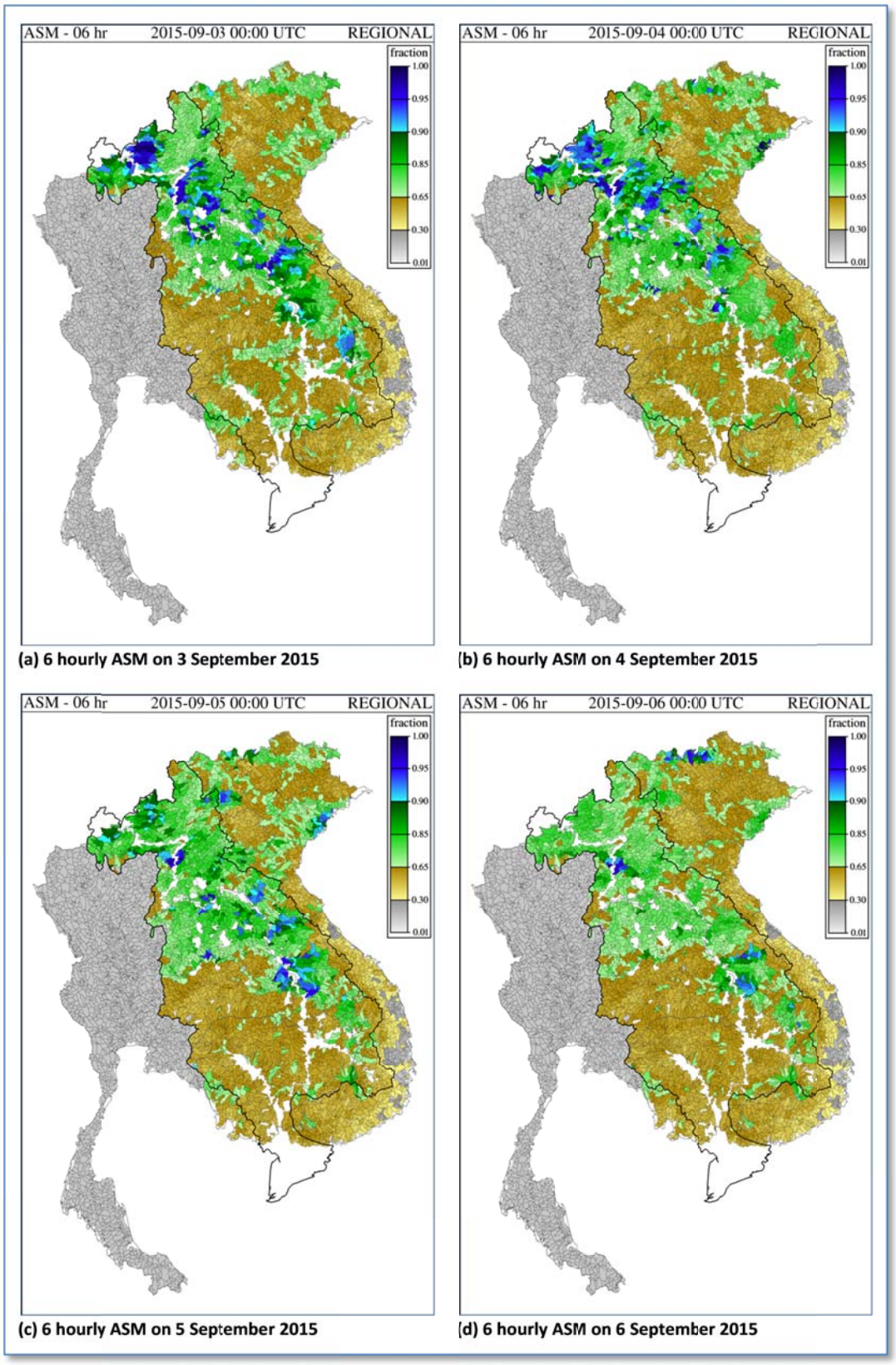


Figure 7-6 The 6 hourly ASM condition during period 3 - 6 September 2015 at 00:00 UTC (7 AM Phnom Penh time).

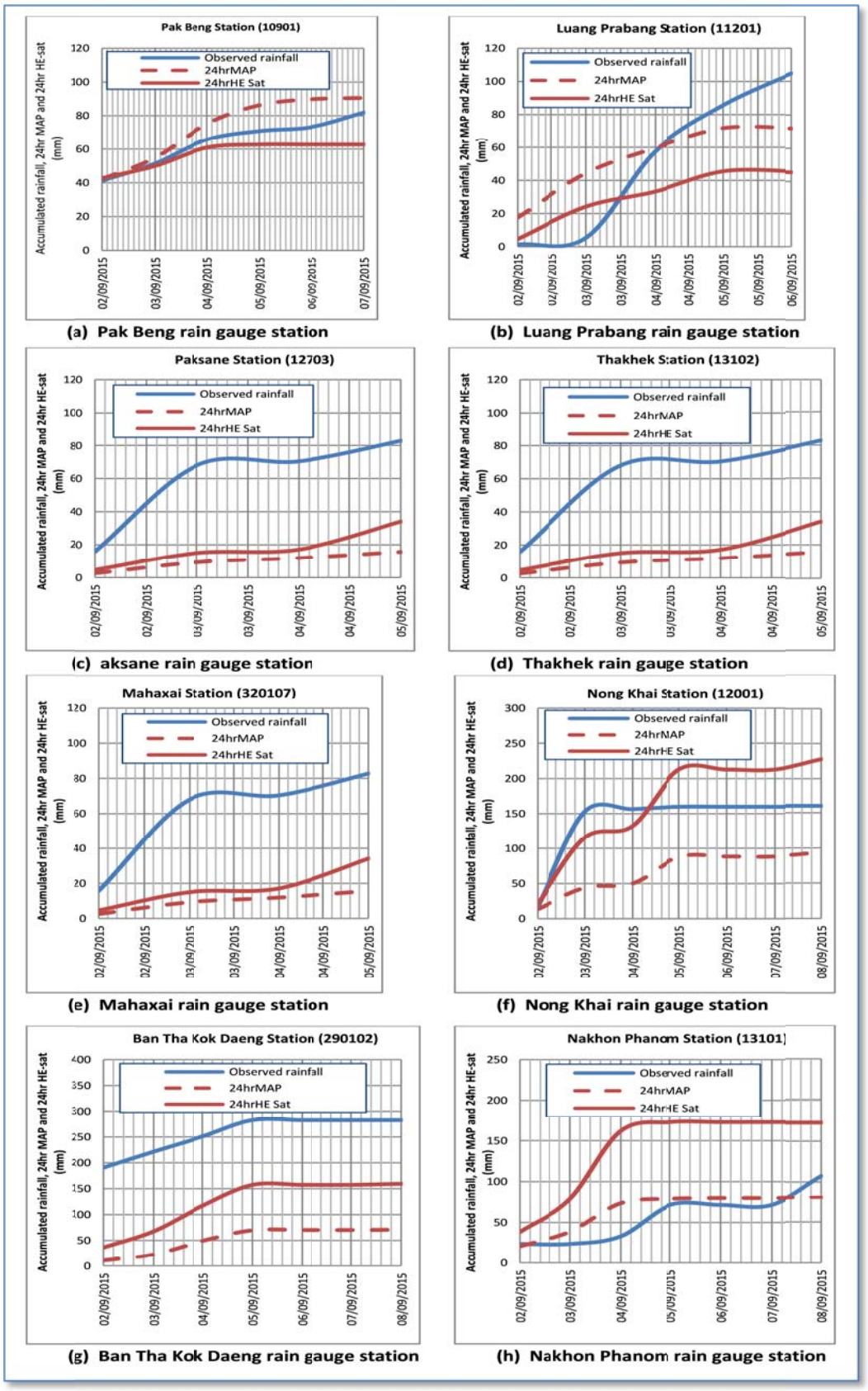


Figure 7-7 Accumulated observed rainfall (mm) versus the 24hr MAP (mm) and 24hr HE-sat (mm) at 8 rain gauge stations located within the central and northern parts of Lao PDR, and the northeastern parts of Thailand.

7.3 Rising water levels in some tributaries of the Mekong River during the period from 2 to 8 September 2015

The low pressure caused heavy rainfall during the period 2 - 8 September 2015 that affected some of Mekong River's tributaries reaching dangerous levels (see appendix 1). The water was backing-up and rising quickly on the mainstream and tributaries of the Mekong at Nong Khai, Ban Tha Kok, Nakhon Phanom, Luang Prabang, Paksane and Thakhek stations, and also other rivers following almost a week of constant rain (see Figure 7-8 and Figure 7-9).

Figure 7-8 illustrates the water levels recorded in three monitoring stations, namely Nong Khai, Ban Tha Kok Daeng and Nakhon Phanom, located in northern and northeastern Thailand. On 2 September water levels rose quickly and peaked at about 3 m high in one single day at Nong Khai station on mainstream of the Mekong River, and continued to rise moderately until 8 September (see Figure 7-8 (a)). In summary, water levels in three stations started rising up on 1 September and decreasing on 8 September.

Figure 7-9 illustrates the water level recordings of five monitoring stations, namely; the Pak Beng, Luang Prabang, Paksane, Thaknek and Mahaxai stations, located in the central and northern Lao PDR, that were affected by the heavy rainfall. During the period 1 - 5 September water levels significantly increased at Pak Beng, Paksane and Mahaxai stations. In particularly on tributaries of the Xe Bang Fai River of Mahaxai station, located in Khammouane Province the water levels increased about 4 m high in two days.

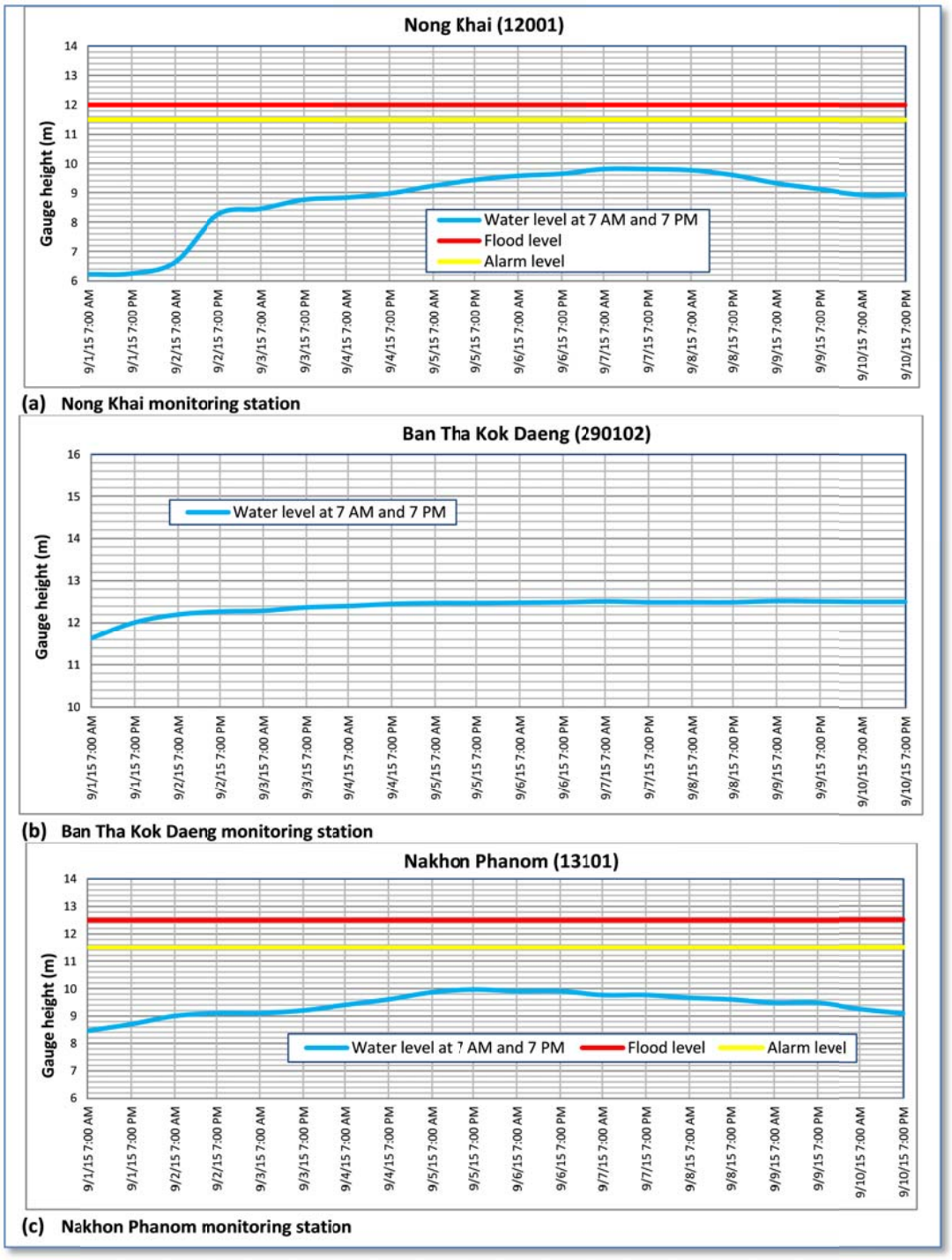


Figure 7-8 Water levels at the Nong Khai, Ban Tha Kok Daeng and Nakhon Phanom monitoring stations located in the northeastern Thailand during period 1 - 10 September 2015.

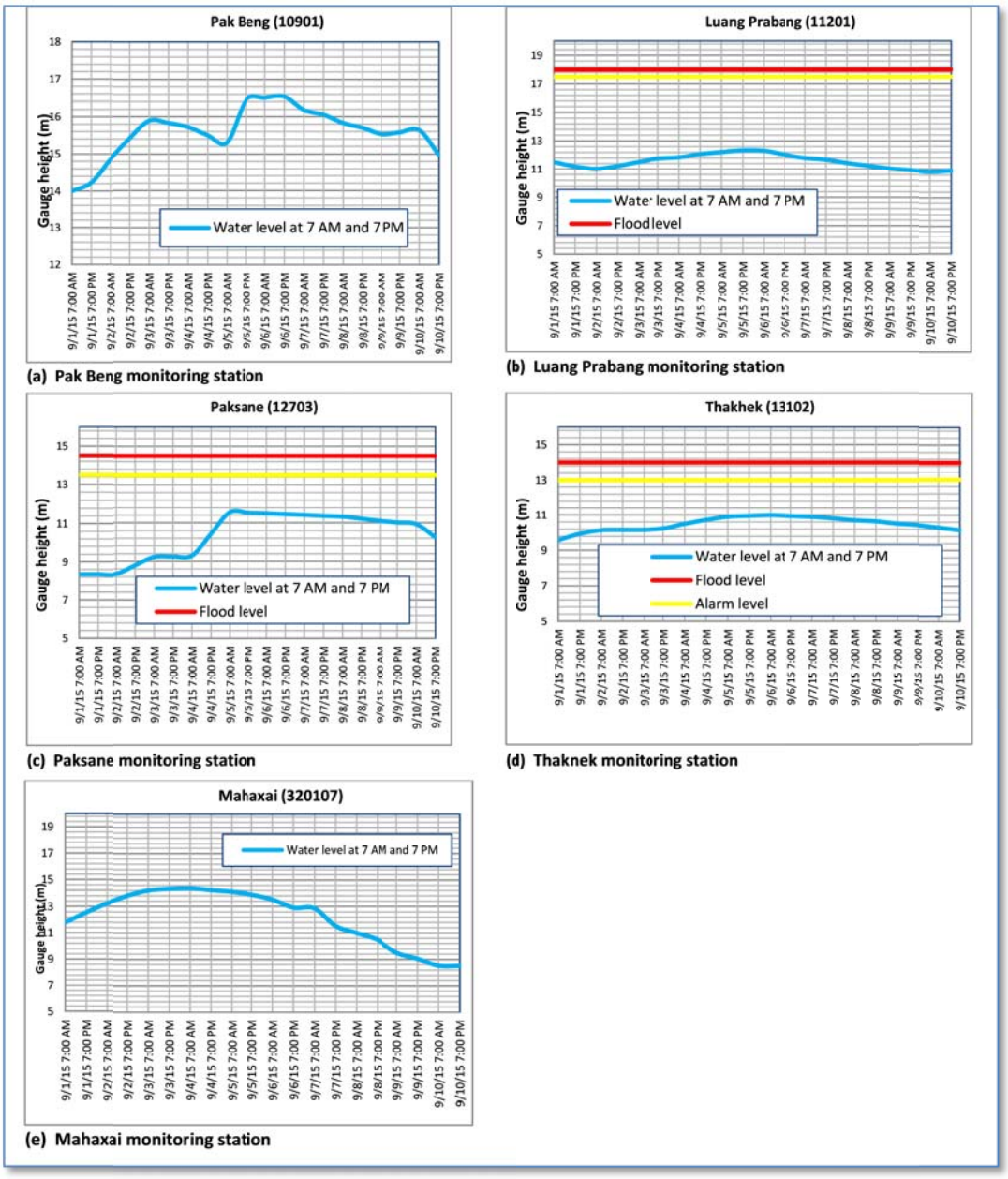


Figure 7-9 Water levels at the Pak Beng, Luang Prabang, Paksane, Thaknek and Mahaxai monitoring stations located in northeastern Thailand.

7.4 Flash flooding in the northern and northeastern provinces of Thailand caused by low pressure during the period from 2 to 8 September 2015

During the period 2 - 8 September 2015 low pressure caused heavy rainfalls that led to inundation and flash flooding in many areas of the northern and central parts of the LMB. The MRC-FFG system detected many high risk areas in the northern and northeastern part of Thailand (see Table 7-2 and Figure 7-10).

Table 7-2 illustrates the list of FFG warnings of flash flood occurrences at some districts in the northern and northeastern provinces of Thailand that were detected by the MRC-FFG system in the period 3 – 5 September. Figure 7-10 illustrates the MRC-FFG system's detected the 3 hourly FFG warnings at some districts in the northern and northeastern provinces of Thailand during the period 3 – 5 September. Overall results show that the MRC-FFG system detected many flash flood risk areas at some districts in Chiang Rai, Phayao, Lampang, Nan, Nong Khai and Udon Thani provinces.

According to media information (see appendix 1.2) many flash floods occurred at some districts of Nakhon Phanom, Nong Khai and Nan provinces of Thailand, which corresponded with the FFG's results in Table 7-2. Figure 7-10 shows flash flood warnings at some districts in Nong Khai and Nan provinces. Unfortunately the MRC-FFG system did not perform well to detect flash flood risk areas of any district in Nakhon Phanom Province, while media information confirmed that some of these districts experienced flash flooding.

Table 7-2 The list of FFG warnings at some districts in the northern and northeastern of Thailand detected by the MRC-FFG system on 3 and 4 September 2015 at 00:00 UTC (7:00 AM Phnom Penh time).

(a) FFG on 3 September 2015

Date of FFG products 03/09/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	to Flash Flood	Occurence	Chiang Rai	Thoeng	48.39
			Phayao	Chiang Kham	49.08
			Chiang Rai	Chiang Saen	46.15
			Chiang Rai	Chiang Khong	46.15
			Phayao	Muang Phayao	42.40
			Lampang	Wang Nua	42.4
			Lampang	Ngao	42.4
			Nan	King Amphoe Song Khae	44.02

(b) FFG on 4 September 2015

Date of FFG products 04/09/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
Phayao	Muang Phayao	21.83	Chiang Mai	Mae Ai	35.66
Lampang	Wang Nua	21.83	Chiang Mai	Fang	35.66
Lampang	Ngao	21.83	Chiang Rai	Thoeng	47.15
			Chiang Rai	Mae Suai	35.66
			Lampang	Wang Nua	29.63
			Lampang	Ngao	29.63
			Nan	King Amphoe Song Khae	39.74
			Nong Khai	Sang Khom	46.34
			Phayao	Chiang Kham	47.15
			Phayao	Muang Phayao	29.63
			Udon Thani	Na Yung	46.34

(c) FFG on 5 September 2015

Date of FFG produ 05/09/2015 00:00 UTC time

1hour Flash Flood Guidance in Thailand			3hour Flash Flood Guidance in Thailand		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	to Flash Flood	Occurence	Chiang Rai	Thoeng	47.64
			Phayao	Chiang Kham	48.01
			Nan	King Amphoe Song Khae	46.99
			Phayao	Muang Phayao	46.82
			Lampang	Wang Nua	46.82
			Lampang	Ngao	46.82

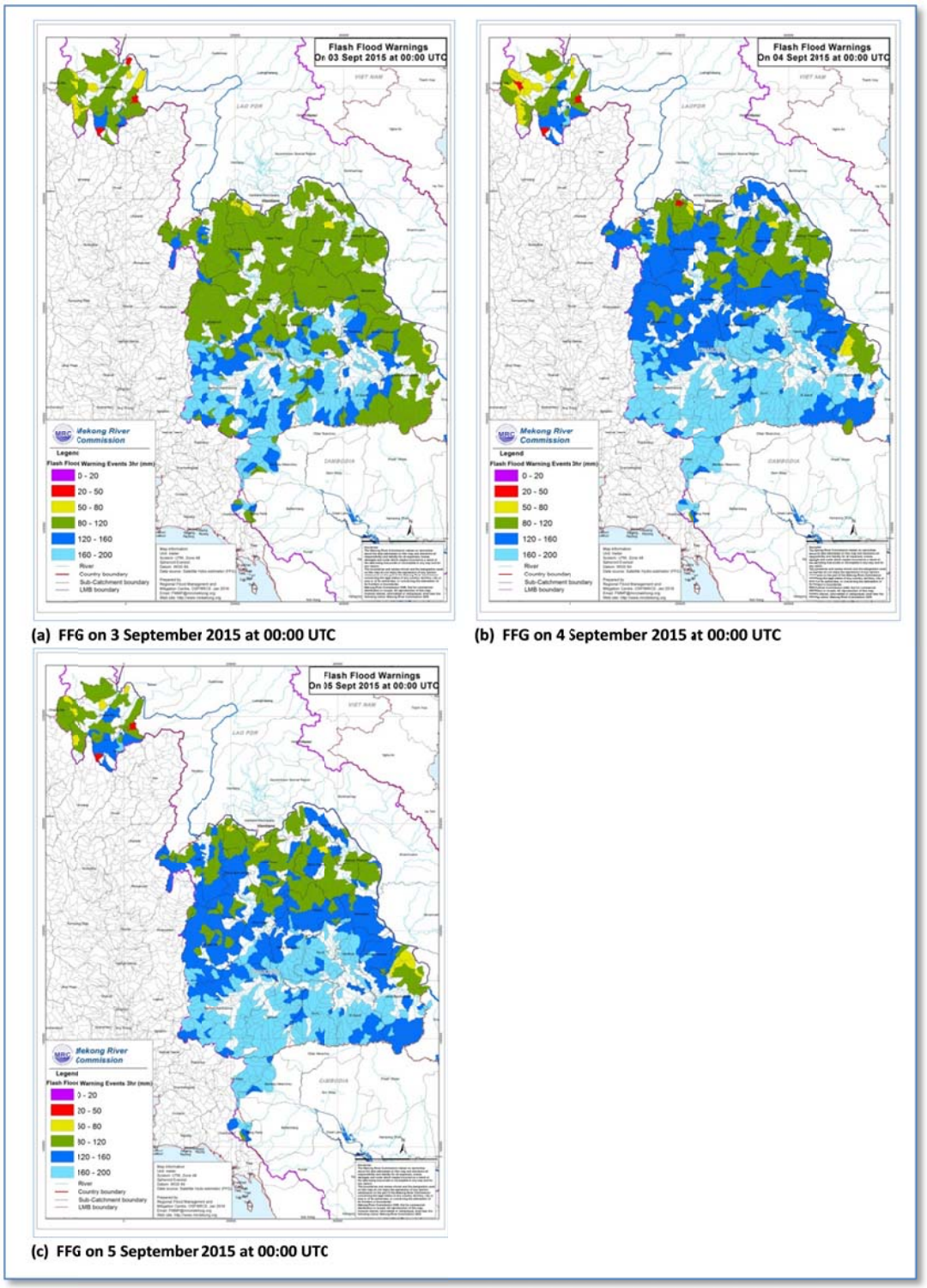


Figure 7-10 MRC-FFG system detected the 3 hourly flash flood risk areas at some districts in northern and northeastern Thailand in the period 3 – 5 September 2015. Source: RFMMC.

7.5 Flash flooding in the northern and central provinces of Lao PDR caused by low pressure during the period from 2 to 8 September 2015

During the period 2 - 8 September 2015 the MRC-FFG system detected many high risk areas in the northern and central provinces of Lao PDR (see Table 7-3 and Figure 7-11). Table 7-3 indicates the list of FFG warnings for flash flood occurrences at some villages in the northern and central provinces of Lao PDR during 3, 4 and 8 September 2015 at 00:00 UTC (7:00 AM Phnom Penh time). Figure **7-11** shows the MRC-FFG system detected the 3 hourly flash flood risk areas at some villages in the northern and central provinces of Lao PDR during the period 3 - 5 September 2015. The overall results indicate that MRC-FFG system properly detected many high risk areas of flash flood occurrences in Lao PDR at some villages of Bokeo, Bolikhamxay, Khammouanee, Luang Namtha, Luang Prabang, Phongsaly, Vientiane, Xayaboury, Xaysomboun and Xiangkhouang provinces.

The FFG's results were verified by the available information from the media on 4, 5 and 10 September 2015 (see appendix 1.2), which reported that flash flooding occurred at Xaysomboun, Khammouane and Luang Prabang provinces of Lao PDR.

Table 7-3 Flash flood risk districts in central and southern Lao PDR detected by MRC-FFG system on 3, 4 and 8 September 2015 at 0:00 UTC and 6:00 UTC

(a) FFG on 03 September 2015

Date of FFG products	03/09/2015 00:00	UTC time				
1hour Flash Flood Guidance in Lao				3hour Flash Flood Guidance in Lao			
Provinces	Districts	Villages	FFG Value	Provinces	Districts	Villages	FFG Value
Xaysomboun Special I	Xaysombou	PHOUHUAXANG	22.94	Xaysomboun Special	Phoun	PHADAENG NEUA	49.87
Xaysomboun Special I	Xaysombou	NAMCHIA	22.94	Xaysomboun Special	Xaysombou	PHOUHUAXANG	31.09
Xaysomboun Special I	Xaysombou	KHIXANG	22.94	Xaysomboun Special	Xaysombou	NAMCHIA	31.09
Xaysomboun Special I	Xaysombou	NONGXANG	22.94	Xaysomboun Special	Xaysombou	KHIXANG	31.09
Xaysomboun Special I	Xaysombou	TIABALE	22.94	Xaysomboun Special	Xaysombou	NONGXANG	31.09
Xaysomboun Special I	Xaysombou	NONGNADI	22.94	Xaysomboun Special	Xaysombou	TIABALE	31.09
Xaysomboun Special I	Xaysombou	THONGKHOUN	22.94	Xaysomboun Special	Xaysombou	NONGNADI	31.09
Xaysomboun Special I	Xaysombou	MAI	22.94	Xaysomboun Special	Xaysombou	THONGKHOUN	31.09
Xaysomboun Special I	Xaysombou	THALO	23.81	Xaysomboun Special	Xaysombou	MAI	31.09
Xaysomboun Special I	Xaysombou	PHIALUANG	23.81	Xaysomboun Special	Xaysombou	MOUANG OM	50.04
Xaysomboun Special I	Hom	VIENGKEO	20.32	Xaysomboun Special	Xaysombou	NAMEUEUNG	50.04
Bokeo	Meung	CHAKHA	17.99	Xaysomboun Special	Xaysombou	NADI	50.04
Bokeo	Meung	CHAKOR	17.99	Xaysomboun Special	Xaysombou	NAMLA	50.04
Bolikhamxay	Viengthon	SOBSOR	25.17	Xaysomboun Special	Xaysombou	KOHAY	50.04
Bolikhamxay	Viengthon	PHADAENG	25.17	Xaysomboun Special	Xaysombou	THALO	30.7
Bolikhamxay	Viengthon	NONGBUA(NONGLAENG)	25.17	Xaysomboun Special	Xaysombou	PHIALUANG	30.7
Bolikhamxay	Viengthon	VANGPENE	25.17	Xaysomboun Special	Xaysombou	NAKHOUN	41.11
Luangnamtha	Viengphou	NAMKIENG	13.97	Xaysomboun Special	Longxan	NAMYING	36.35
Luangnamtha	Viengphou	NAMSEUA	13.97	Xaysomboun Special	Longxan	XIENGMI	36.35
Luangnamtha	Viengphou	PHOULET	13.97	Xaysomboun Special	Longxan	NAPHO	36.35
Luangnamtha	Viengphou	KATANGKOUAK	13.97	Xaysomboun Special	Longxan	VANGLUANG	36.35
Luangprabang	Xieng nge	NAMLIN	22.24	Xaysomboun Special	Phoun	VANGKEO	49.87
Luangprabang	Xieng nge	NONGPA	22.24	Xaysomboun Special	Phoun	PHONEKEOTHONG	49.87
Luangprabang	Xieng nge	NALENG	22.24	Xaysomboun Special	Phoun	PHONEKHAM	49.87
Luangprabang	Xieng nge	PAKSANAM	22.24	Xaysomboun Special	Hom	VIENGKEO	26.73
Luangprabang	Nan	PHANIP	22.24	Bokeo	Meung	NAMMEUNG	34.91
Luangprabang	Nan	KHORNLONG	22.24	Bokeo	Meung	HUANA	34.91

(b) FFG on 04 September 2015

Date of FFG products	05/09/2015 00:00	UTC time					
1hour Flash Flood Guidance in Lao				3hour Flash Flood Guidance in Lao			
Provinces	Districts	Villages	FFG Value	Provinces	Districts	Villages	FFG Value
Luangprabang	Nan	PHOKHAM	17.7	Khammuane	Hinboon	KHOUN NGEUN	41.80
Luangprabang	Nan	PAKLAN	17.7	Khammuane	Hinboon	KHOUN KHAM	41.80
Luangprabang	Nan	PHONXAY	17.7	Khammuane	Hinboon	NAM SA NAM	41.80
Luangprabang	Nan	HOUAYTHIP	17.7	Khammuane	Hinboon	THAM TAME	41.80
Luangprabang	Nan	HOUAYXI	17.7	Khammuane	Hinboon	NA KHAM	41.80
Luangprabang	Nan	PHONSANA	17.7	Khammuane	Hinboon	VANG TA KHONG	41.80
Luangprabang	Nan	HOUAYPHAKNAOH	17.7	Bolikhamxay	Pakkading	NAMDEUA	45.34
Luangprabang	Nan	PHONTHONG	17.7	Bolikhamxay	Pakkading	NAKHEUA NOK	45.34

(c) FFG on 08 September 2015

Date of FFG products	08/09/2015 00:00	UTC time					
1hour Flash Flood Guidance in Lao				3hour Flash Flood Guidance in Lao			
Provinces	Districts	Villages	FFG Value	Provinces	Districts	Villages	FFG Value
Phongsaly	Nhot ou	TAKOUXANG	24.96	Champasak	Pathoomph	NAMPHAAK	49.09
Phongsaly	Nhot ou	PACHEOLIN	24.96	Luangprabang	Xieng nge	NAMLIN	41.65
Phongsaly	Nhot ou	PEULAOXOU KAO	24.96	Luangprabang	Xieng nge	NONGPA	41.65
Phongsaly	Nhot ou	LAO PHOU CHAY	24.96	Luangprabang	Xieng nge	NALENG	41.65
Phongsaly	Nhot ou	PEULAOXOU MAI	24.96	Luangprabang	Xieng nge	PAKSANAM	41.65
				Luangprabang	Nan	PHANIP	41.65
				Luangprabang	Nan	KHORNLONG	41.65
				Luangprabang	Nan	PADONG	41.65
				Luangprabang	Nan	NAMOUANG GNAI	41.65
				Luangprabang	Nan	NAMOUANG KANG	41.65
				Luangprabang	Nan	PONGDEUA	41.65
				Luangprabang	Nan	HOUAYLATH	41.65
				Luangprabang	Nan	DAN	41.65
				Luangprabang	Nan	HOUAYHOY	41.65
				Luangprabang	Nan	NAMPHAK	41.65
				Luangprabang	Nan	HOUAYME	41.65
				Luangprabang	Nan	HOUAYLONG	41.65
				Luangprabang	Nan	SISAATH	41.65
				Luangprabang	Nan	PHOKHAM	40.52
				Luangprabang	Nan	PAKLAN	40.52
				Luangprabang	Nan	PHONXAY	40.52
				Luangprabang	Nan	HOUAYTHIP	40.52
				Luangprabang	Nan	HOUAYXI	40.52
				Luangprabang	Nan	PHONSANA	40.52
				Luangprabang	Nan	HOUAYPHAKNAOH	40.52
				Luangprabang	Nan	PHONTHONG	40.52
				Luangprabang	Nan	PAKNEUN	42.45
				Luangprabang	Nan	PASACK	42.45
				Luangprabang	Nan	BANKANG	42.45
				Luangprabang	Nan	SAENGSAVANG	42.45
				Luangprabang	Nan	HOUAYHIA	40.52
				Luangprabang	Nan	PHONXAY	42.45
				Luangprabang	Phoukhoun	BANGKALO	48.97

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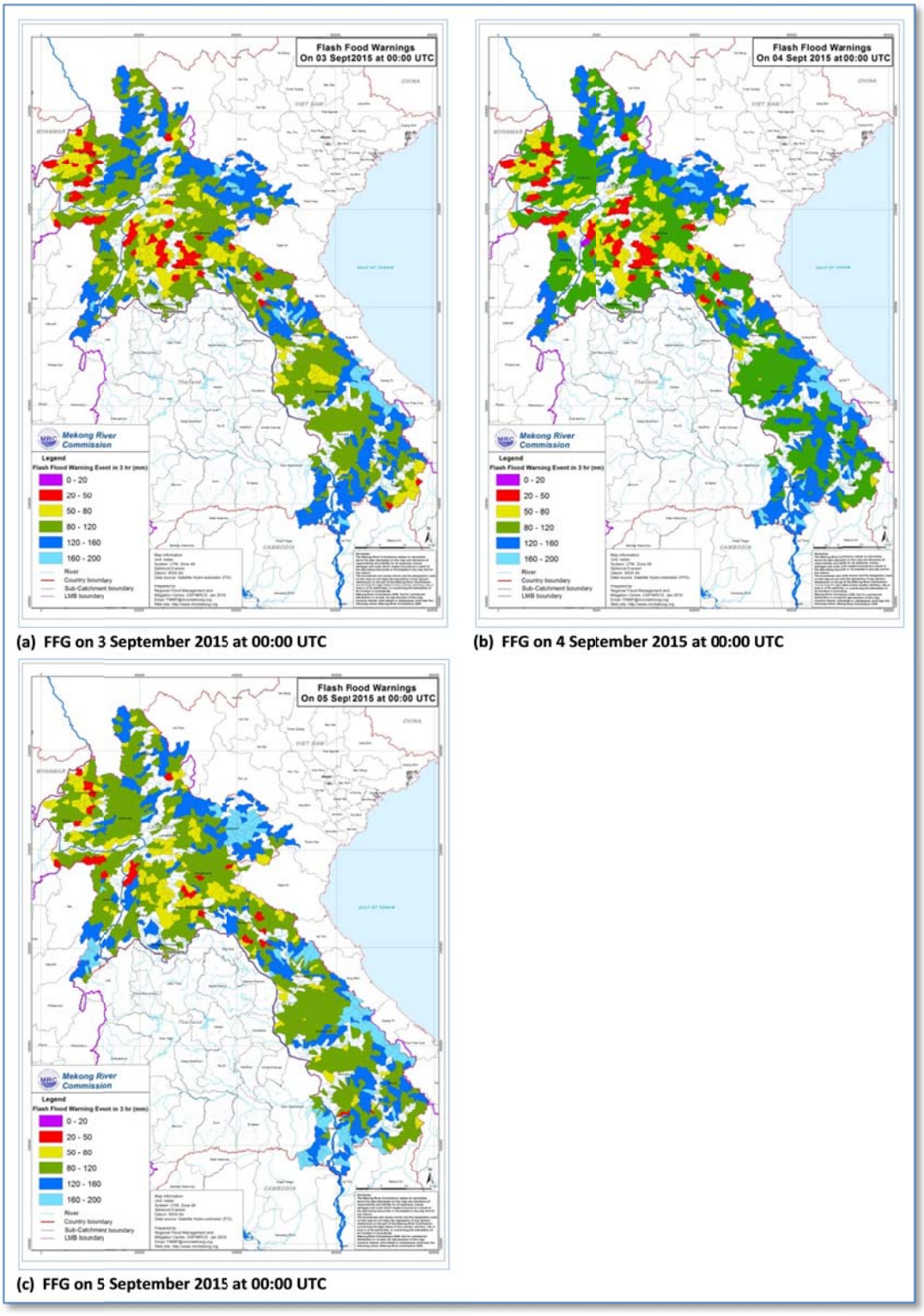


Figure 7-11 MRC-FFG system detected the 3 hourly flash flood risk areas at some districts in northern and central provinces of Lao PDR in the period 3 - 5 September 2015. Source: RFMMC.

7.6 Summary

During the period 2 - 8 September 2015 an area of low pressure was situated across the upper North of Myanmar, Thailand, Lao PDR and Viet Nam and was connected to the low pressure cell over the Gulf of Tonkin, which caused more rains with heavy rainfalls over the LMRB.

During this period heavy rainfall led to serious flooding and caused flash floods in some villages in the northern and central provinces of Lao PDR, and also in some districts in the northern and northeastern provinces of Thailand. The most affected provinces were Nakhon Phanom, Nong Khai and Nan provinces in Thailand, as well as at Xaysomboun, Khammouane and Luang Prabang provinces in Lao PDR, according to media information (see appendix 1).

In Thailand, the MRC-FFG system during this period did not perform well in detecting flash flood warnings in any district of the Nakhon Phanom Province. This was confirmed with media information that confirmed the occurrence of flash flooding in this area. However, the flash flood warning areas in some districts of Nong Khai and Nan provinces were properly detected by MRC-FFG system, which were confirmed by occurrences of flash flooding in these areas.

In Lao PDR, the MRC-FFG system has performed quite well during on 2 - 8 September; many flash flood risk areas were detected at some villages in Xaysomboun, Khammouane and Luang Prabang provinces. According to media information flash flood occurrences were confirmed in the same areas.

A comparison between the observed daily accumulated rainfall, the 24hr MAP and 24hr HE-sat of Paksane, Thakhek, Mahaxai and Ban Tha stations, indicated that the MRC-FFG system results (i.e. 24hr MAP and 24hr HE-sat) were ‘underestimating’ the observed rainfall, when compared with other rain gauge stations. The observed rainfall of Nakhon Phanom station and varies of Pak Beng, Luang Prabang and Nong Khai stations indicated the observed rainfall was ‘overestimated”.

On 4 September the MRC-FFG system detected flash flood warnings at some district of Nong Khai Province (see 7.2). Meanwhile on 2 September water level rapidly increased with peak values of about 3 m in one single day at Nong Khai station on the Mekong mainstream (see Figure 7-8 (a)); the daily rainfall reached a maximum value of about 190 mm at the Ban Tha Kon Daeng station on Nam Songkram sub-basin, which covers the area of the Nong Khai Province.

On 1 September water levels significantly increased with peak values of about 4 m in two days on tributaries of the Xe Bang Fai River of Mahaxai station, located in

Khammouane Province, while some villages of Khammouane Province were detected by MRC-FFG system.

8. Flash flooding in the central Viet Nam, the north-eastern Thailand, and the southern Lao PDR, caused by tropical storm VAMCO in the period from 13 to 17 September 2015

8.1 The tropical storm VAMCO

The tropical storm VAMCO developed into tropical storm over the South China Sea on 13 September 2015 (see Figure 8-1). It made landfall on 14 September 2015 in Viet Nam causing floods across central Viet Nam (see Figure 8-2), especially in some areas of Quang Nam and Quang Ngai provinces. It is the third tropical storm to hit Viet Nam of the year 2015. In the evening of 14 September 215 mm of rain caused by the storm VAMCO has been reported in Da Nang Province of Viet Nam before making landfall south of the city as tropical storm (see appendix 1.1). After the landfall, it continued moving west over Quang Nam Province and southern Lao PDR, where it weakened into a tropical depression on 15 September (see Figure 8-3). At 7 PM of 15 September, it started moving over northeastern Thailand and weakening into a low pressure system (see Figure 8-4).

During on 13 - 17 September 2015, the LMB region was *covered* by the low pressure and tropical storm VAMCO caused heaving rains and strong winds at some parts in central Viet Nam, southern Lao PDR, northern Cambodia and northeastern Thailand (see Figure 8-5), caused Flash floods and landslides in these areas. illustrates the weather chart of the Mekong region during the tropical storm VAMCO from 13 to 16 September 2015 at 01:00 AM Phnom Penh time.

According to the media (see appendix 1.1), it reported several flooded road, power outages and several damaged homes in Quang Nam Province, at least 30 houses damaged in Quang Binh Province, and over 60 houses damaged in southern Viet Nam due to the heavy rains, flood and strong winds. Two people were killed by this storm, nearly two thousand houses and more than 7,600 ha of agricultural lands flooded in Ho Chi Minh Province (see appendix 1.1)

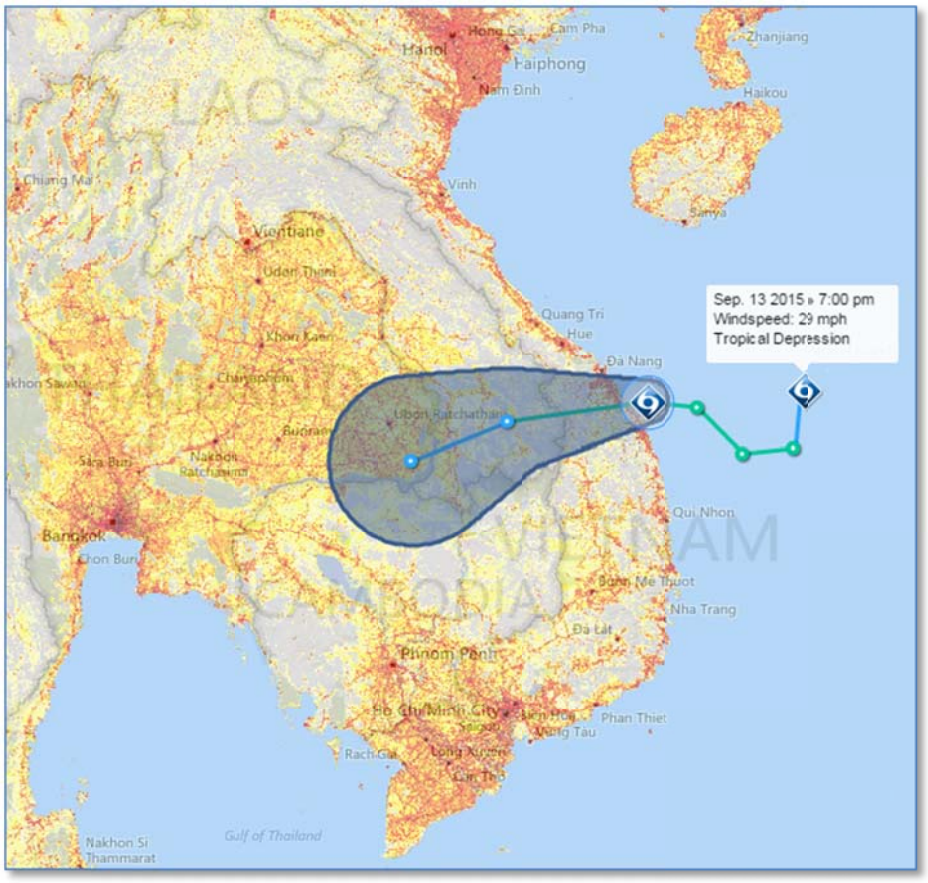


Figure 8-1 The position of the tropical storm VAMCO developed over the East Sea. Source: the Disaster Alert Network.

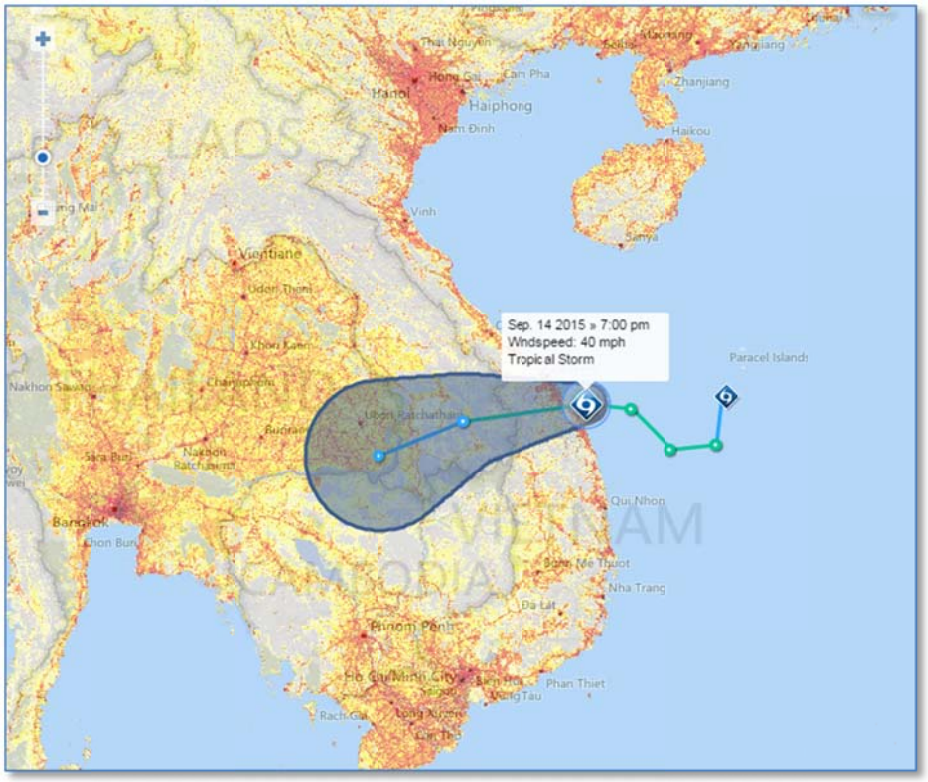


Figure 8-2 The position of the tropical storm VAMCO reached the coasts of central Viet Nam on 14 September 2015. Source: the Disaster Alert Network.

Figure 8-3 The position of the tropical depression over central Viet Nam and southern Lao at 7 AM Phnom Penh time on 15 September 2015. Source: the Disaster Alert Network.

Figure 8-4 The position of the tropical depression over northeastern Thailand at 7 PM Phnom Penh time on 15 September 2015. Sources: the Disaster Alert Network.

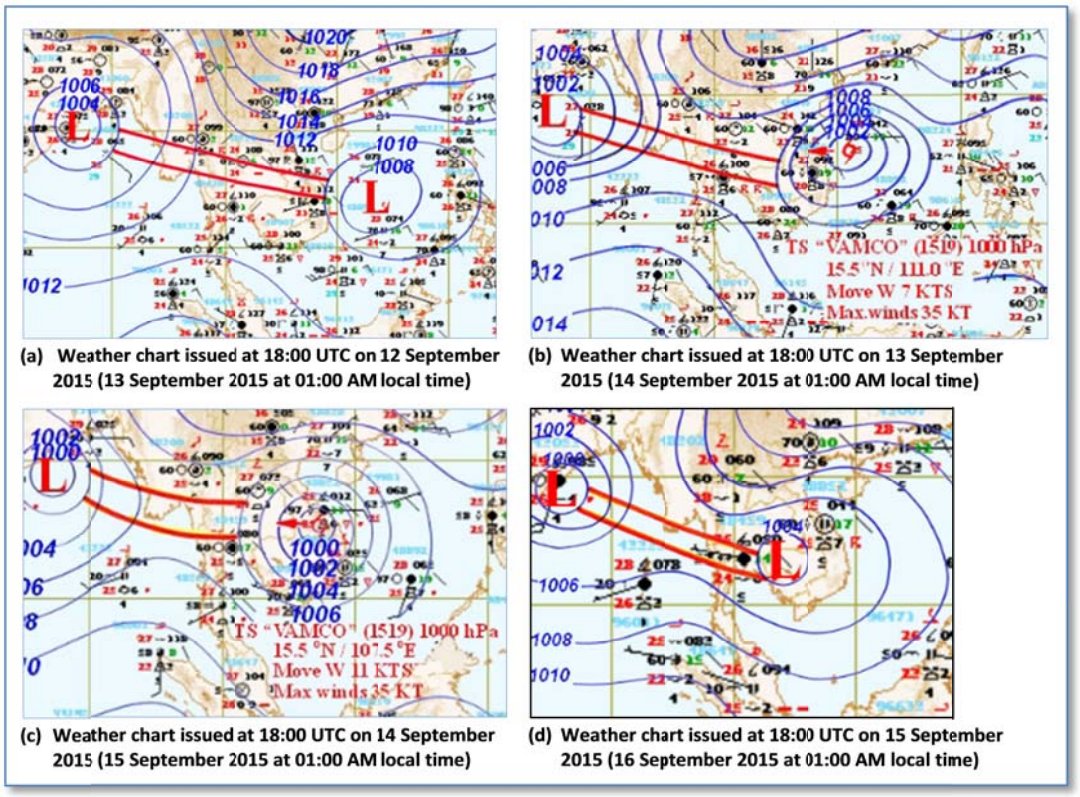


Figure 8-5 The weather chart of the Mekong region in period 12 - 15 September 2015 at 18:00 UTC (01:00 AM Phnom Penh time). Source: Thai Meteorological Department.

8.2 Heavy rainfall during the period of tropical storm VAMCO

During the period 13 - 17 September 2015 rainfall brought by the tropical depression VAMCO triggered extensive runoff in many areas of the LMB, especially in central and southern parts of Viet Nam, as well as northeastern parts of Thailand, also some areas of central and southern Lao PDR, and some areas of northeastern Cambodia (see appendix 1). Although the storm VAMCO quickly weakened across the mountainous terrain of Viet Nam and Lao PDR, it caused on 14 September in the evening local time widespread flooding and mudslides in the region.

It was reported that the storm VAMCO brought rainfall of 215 mm on 14 September in Da Nang, Viet Nam (see appendix 1.1). Table 8-1 represents the daily rainfall amounts of some rain gauge stations located within Viet Nam, Lao PDR and Thailand (see Figure 8-6) during the tropical storm VAMCO in the period 12 - 17 September 2015, which were based on the available rainfall data. The data records refer to 7:00 AM on the present day to 7:00 AM on the following day for each recorded day. The daily rainfall on 15 September reached a maximum of about 195 mm of A Luoi station (160705), located in the Thua Thien Hue Province, Viet Nam (see Figure 8-6).

Figure 8-7 illustrates the daily rainfall distribution in the LMB in the period 13 - 15 September 2015. Results show that on 15 September heavy rainfall occurred in the central Viet Nam, southern Lao PDR and northern Thailand. Due to the heavy rainfall flash floods occurred in high risk areas in these areas, according to media information (see appendix 1). Figure 8-8 shows the 24hr MAP during the period of the storm VAMCO at 7 AM local time in the period 13 - 16 September. Figure 8-9 shows the 24hr HE-sat during the period of the storm VAMCO at 7 AM local time in the same period. Results of Figure 8-8 and Figure 8-9 indicate that on 15 September heavy rainfall occurring in central Viet Nam, southern Lao PDR and northeastern Thailand, which is shown in Figure 8-7 (c).

Results of the intense rainfall over the LMB (see Figure 8-7 and Figure 8-9) caused saturated soil moisture conditions at some areas in the northeastern part of Cambodia, the central and southern parts of Viet Nam, the Northeast of Thailand, and also the South of Lao PDR. Figure 8-10 illustrates the 6hr ASM condition during the period of the storm VAMCO at 7 AM Phnom Penh time in the period 13 - 16 September 2015.

Figure 8-11 to Figure 8-13 illustrate the comparison between the accumulated observed rainfall (mm), the 24hr MAP (mm) and the 24hr HE-sat (mm). The data was obtained from 6 rain gauge stations located within central Viet Nam (see Figure 8-11), 5 rain gauge stations located within the Northeastern part of Thailand (see Figure 8-12), and 2 rain gauge stations located within the South of Lao PDR (see Figure 8-13).

Results of Figure 8-11 show the MRC-FFG system has performed quite well in producing the rainfall (i.e. 24hr MAP and 24hr HE-sat) when compared with the observed rainfall during the period 12 - 15 September of Dak Nong, My Thuan, An Khe and A Luoi stations. The overall MRC-FFG system results varied (i.e. overestimated and underestimated) when compared with the observed rainfall.

Results regarding the period 12 - 14 September presented in Figure 8-12 show that the MRC-FFG system performed reasonably well in producing rainfall (i.e. 24hr MAP and 24hr HE-sat) when compared with the observed rainfall of Khong Chiam, Ban Tha Kok Daeng and Mukdahan stations. Later on 15 September rainfall results of MRC-FFG system varied when compared with the observed rainfall of all five stations. During the period 12 - 14 September the MRC-FFG system performed satisfactory in producing rainfall (i.e. 24hr MAP and 24hr HE-sat) at Kuanpho station (see Figure 8-13).

Table 8-1 The daily rainfall amounts at some rain gauge stations of the central and southern provinces of Viet Nam, southern provinces of Lao PDR and northeastern provinces of Thailand during the storm VAMCO in the period from 13 to 16 September 2015.

Station Name	Station ID	River	Country	Daily rainfall amount in mm, during 12-16 September, 2015					
				12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep
Dak Nong	120712		Vietnam	8.6	22.4	22	5	7	10
Laly	220409		Vietnam	12.2	17	11	34	1	4
My Thuan	19804	Mekong	Vietnam	11.6	11.8	33.4	25	11.6	67.2
An Khe	130803		Vietnam	26	2	19	64	5	1
Dak To	140715		Vietnam	5.7	0.3	12.2	67	0.1	0.7
Hue	160704		Vietnam	11	15	35	99	66	0
A Luoi	160705		Vietnam	0.7	22	48	**195**	7	12.1
Chiang Khan	011903	Mekong	Thailand	0	0	4.8	0	0	2.2
Ban Tha Kok Daeng	290102		Thailand	0	5.5	0	0	2.5	3.8
Khong Chiam	13801	Mekong	Thailand	0	6.2	0.7	95.2	1.5	1.8
Mukdahan	013402	Mekong	Thailand	6.2	0	0	9.8	3.5	1
Nakhon Phanom	13101	Mekong	Thailand	28.5	0	0	5.4	11.4	0.8
Viang Vieng	180207		Loa PDR	7.6	29.4	-	16.9	0.5	-
Thakhek	13102	Mekong	Loa PDR	29.9	7.6	0.1	3.9	11.8	0.7
Kuanpho	170505		Loa PDR	0	12.4	3.4	12.6	51.9	4.1
Mahaxai	320107	Xe Bang Fai	Loa PDR	-	28.3	-	5.6	20.5	1.7

Note: "–" indicates that rainfall data is not available

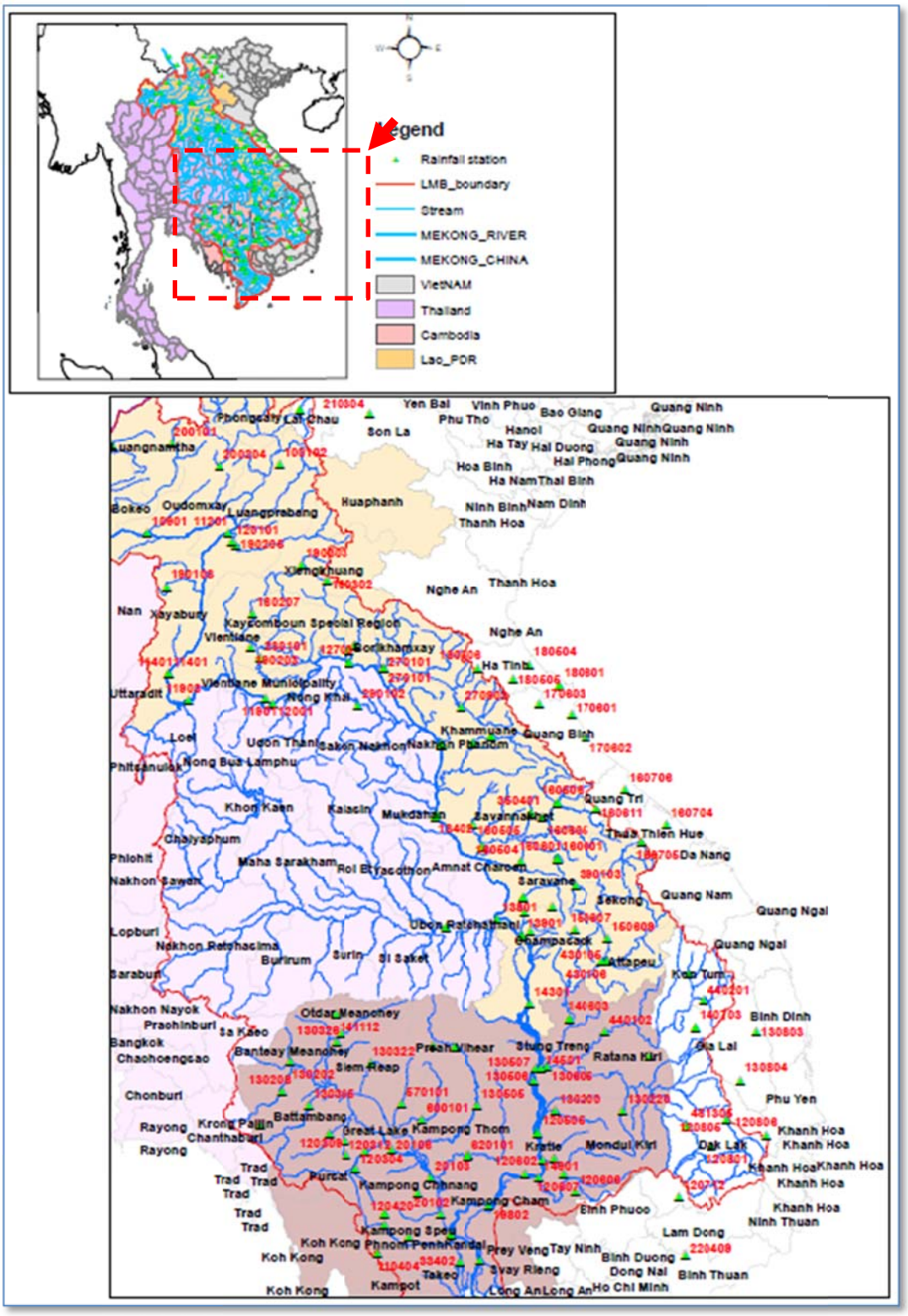


Figure 8-6 Location of Hydmet stations (green triangles and red numbers) located in the surrounding of the areas affected by the tropical storm VAMCO.

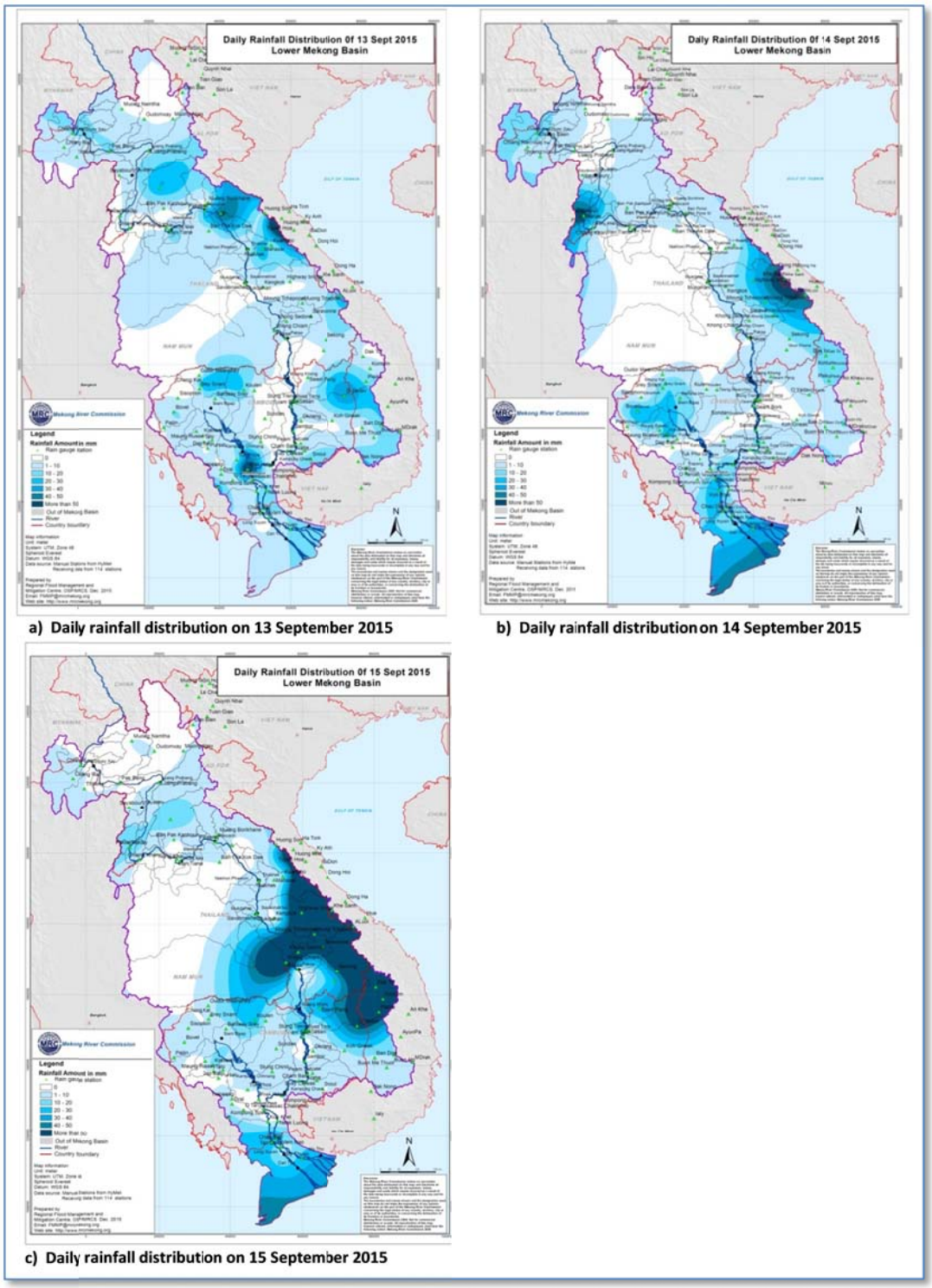


Figure 8-7 The daily rainfall distribution in the period 13 - 15 September 2015 in the Lower Mekong Basin. Source: RFMMC.

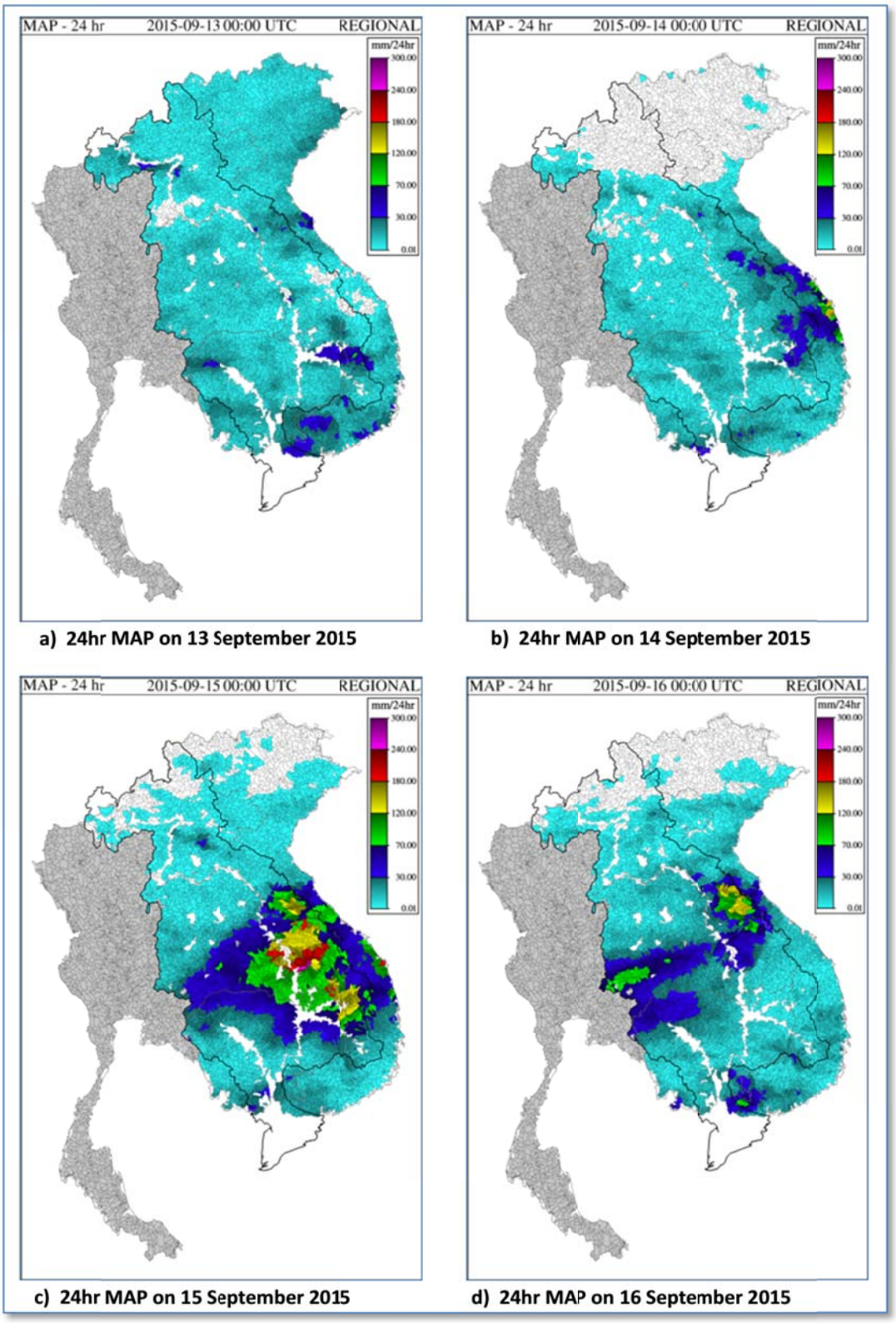


Figure 8-8 The 24hr MAP during the period of the tropical storm VAMCO at 00:00 UTC, period 13 - 16 September 2015.

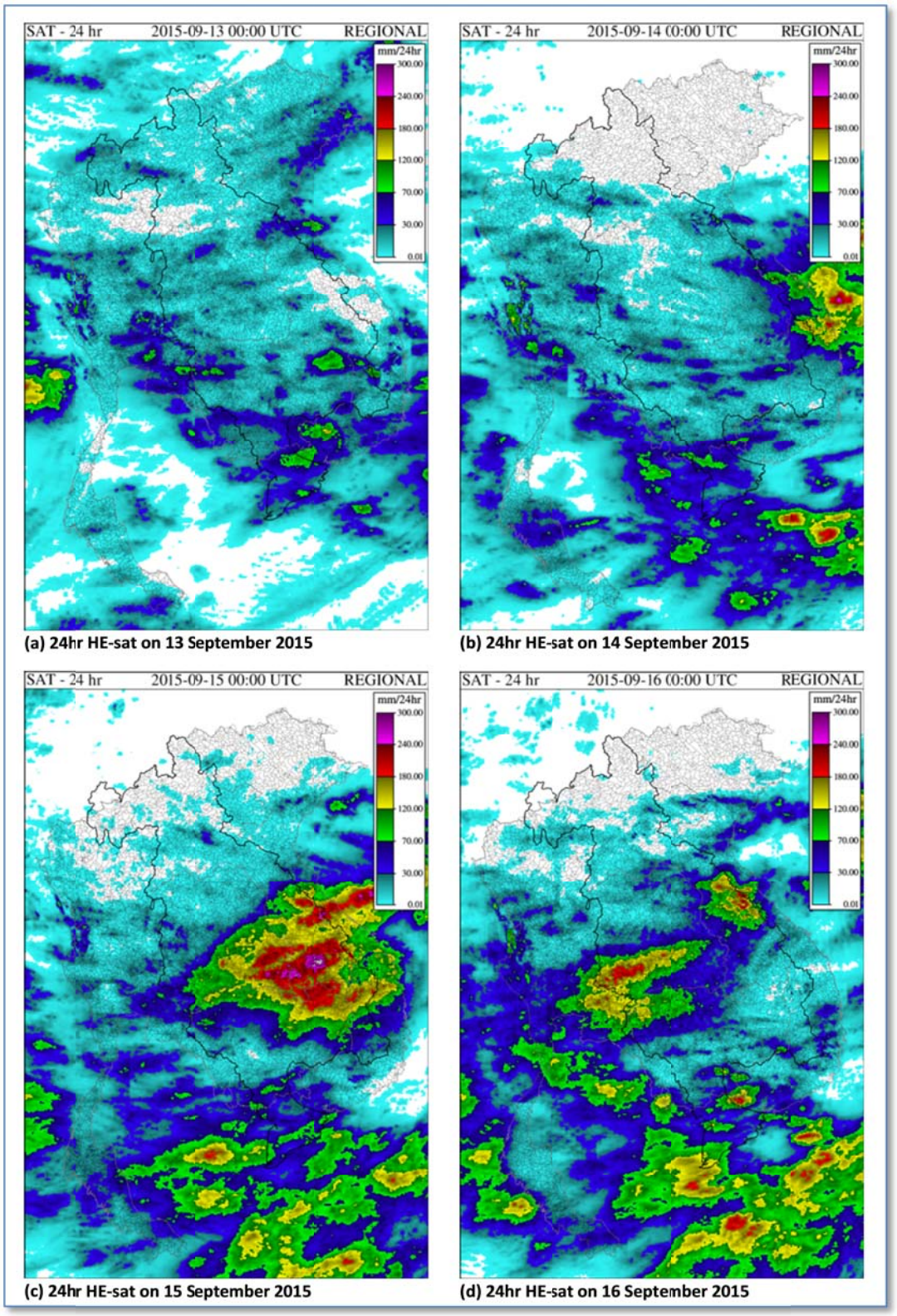


Figure 8-9 The 24hr HE-sat during the period of the tropical storm VAMCO at 00:00 UTC, period 13 - 16 September 2015.

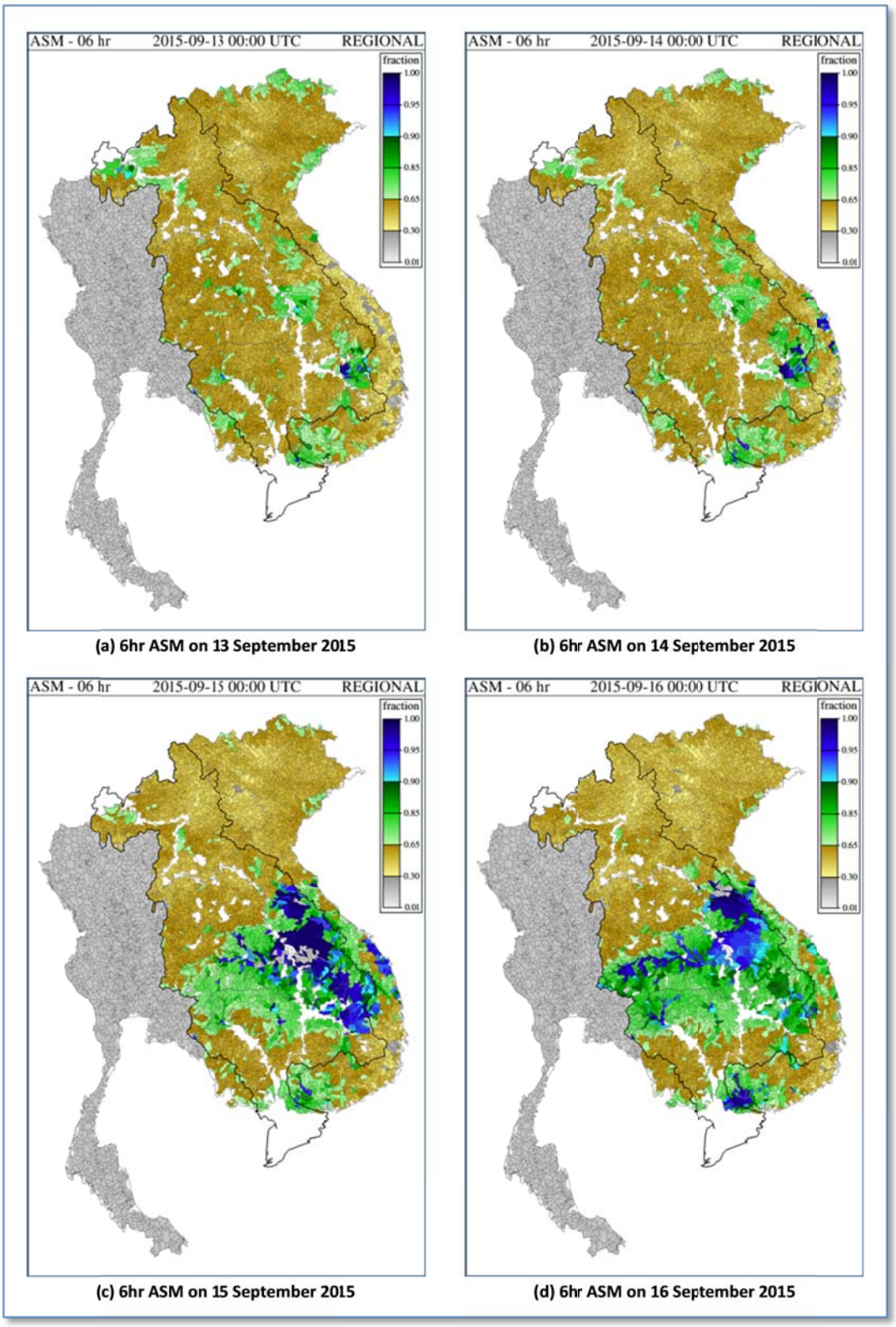


Figure 8-10 The 6hr Average Soil Moisture (ASM) condition during the period of the tropical storm VAMCO at 00:00 UTC, period 13 - 16 September 2015.

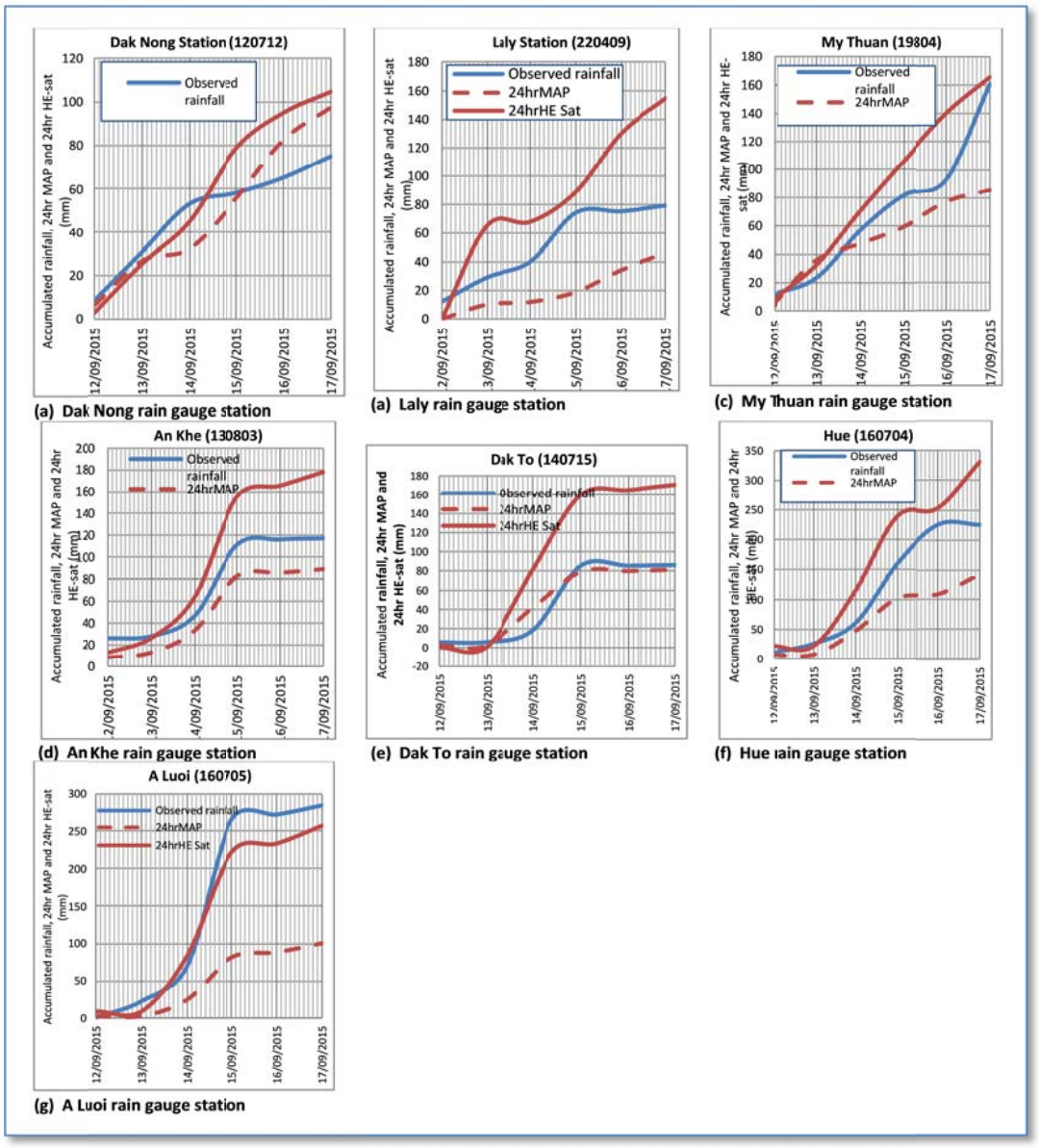


Figure 8-11 Accumulated observed rainfall (mm), 24hr MAP (mm) and 24hr HE-sat (mm) at 6 rain gauge stations located within the upper North of Viet Nam.

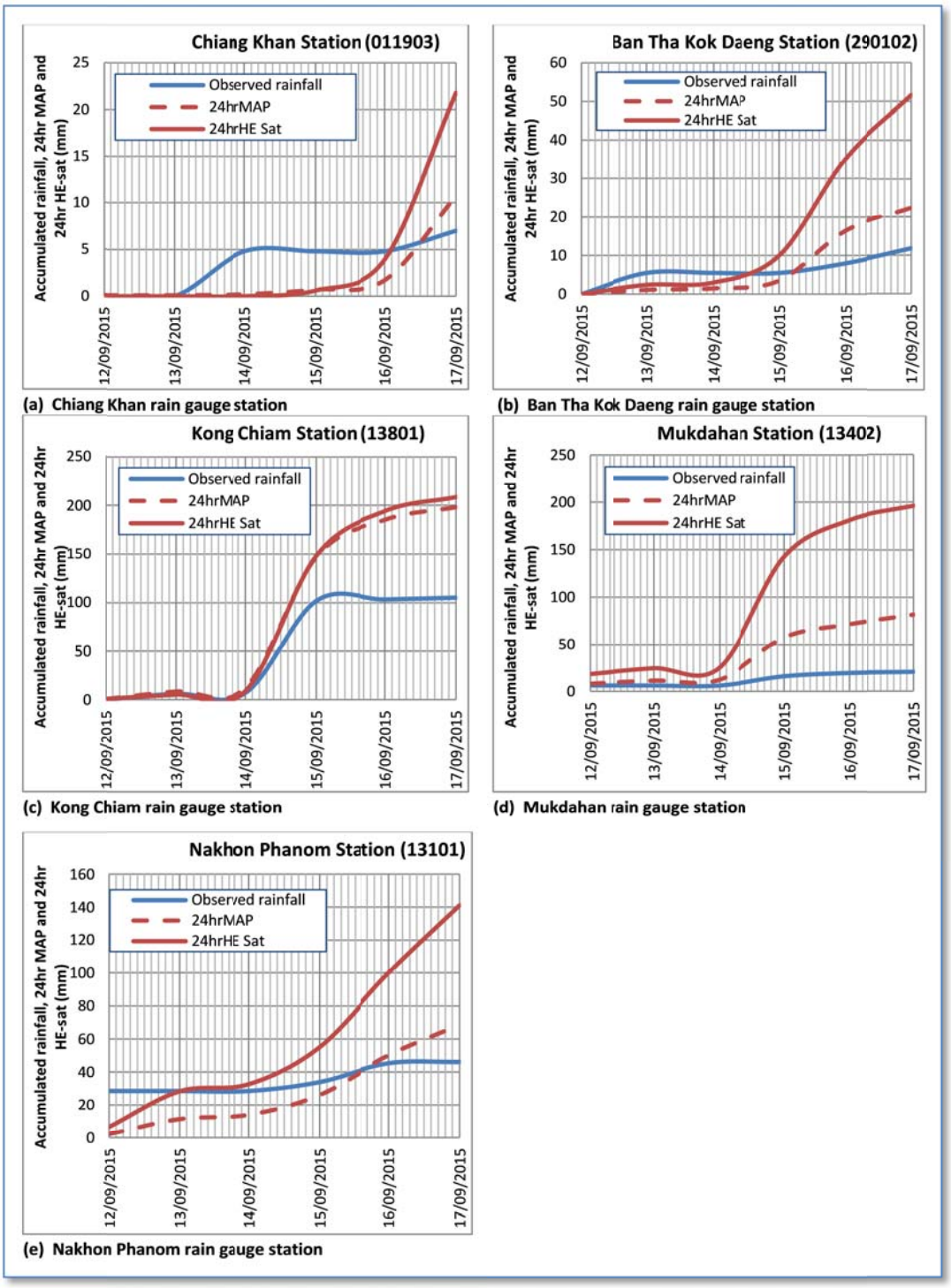


Figure 8-12 Accumulated observed rainfall (mm), 24hr MAP (mm) and 24hr HE-sat (mm) at 5 rain gauge stations located within the northeastern of Thailand.

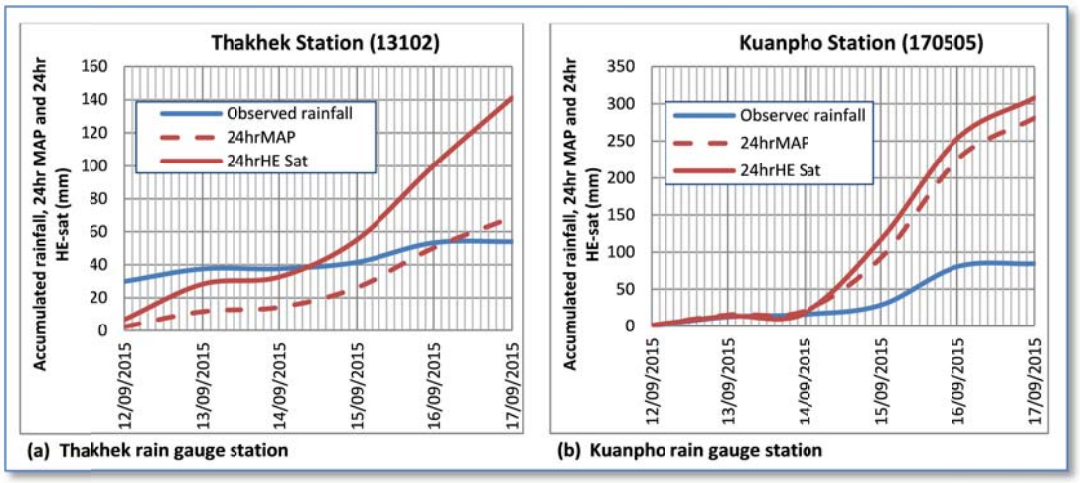


Figure 8-13 Accumulated observed rainfall (mm), 24hr MAP (mm) and 24hr HE-sat (mm) at 2 rain gauge stations located within the South of Lao PDR.

8.3 Rising water levels in some tributaries of the Mekong River during the period of tropical storm VAMCO

The tropical storm VAMCO brought heavy rainfall to the Lower Mekong River Basin during the period 13 – 18 September 2015. It affected the flow regime at many river monitoring stations on tributaries of the Mekong River, located in the central and southern parts of Viet Nam, in the central and southern parts of Lao PDR, and in the northeastern part of Thailand. These rains caused the water level to rise rapidly at some river monitoring stations in the upper and central parts of the LMB.

Figure 8-14 to Figure 8-15 illustrate the recorded water levels at some monitoring stations located in the central and southern Viet Nam, in the northeastern Thailand, and also in the southern Lao PDR that were affected by the storm VAMCO in the period 10 - 17 September 2015. Results in Figure 8-14 (b) show the recorded water levels in Kon Tum station on Dak Bla River; the water levels rose very rapidly to a height of 17.7 m on 15 September 2015 at 7:00 AM, and increased 2 m in one single day. In the period 14 - 17 September, water levels significantly increased about 4 m at Mahaxai station on the Xe Bang Fai River, located in Khammouane Province.

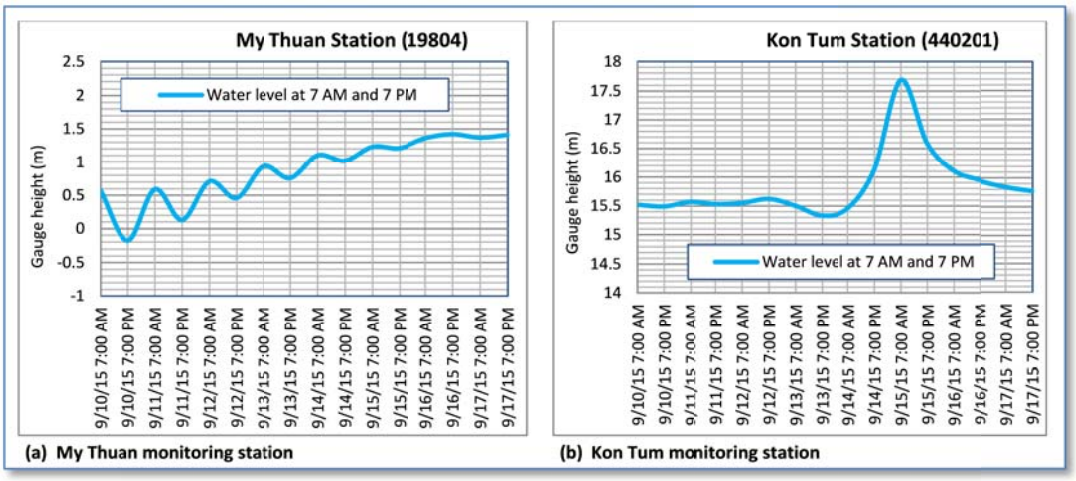


Figure 8-14` Water levels at the My Thuan and Kon Tum monitoring stations located in Viet Nam during the storm VAMCO.

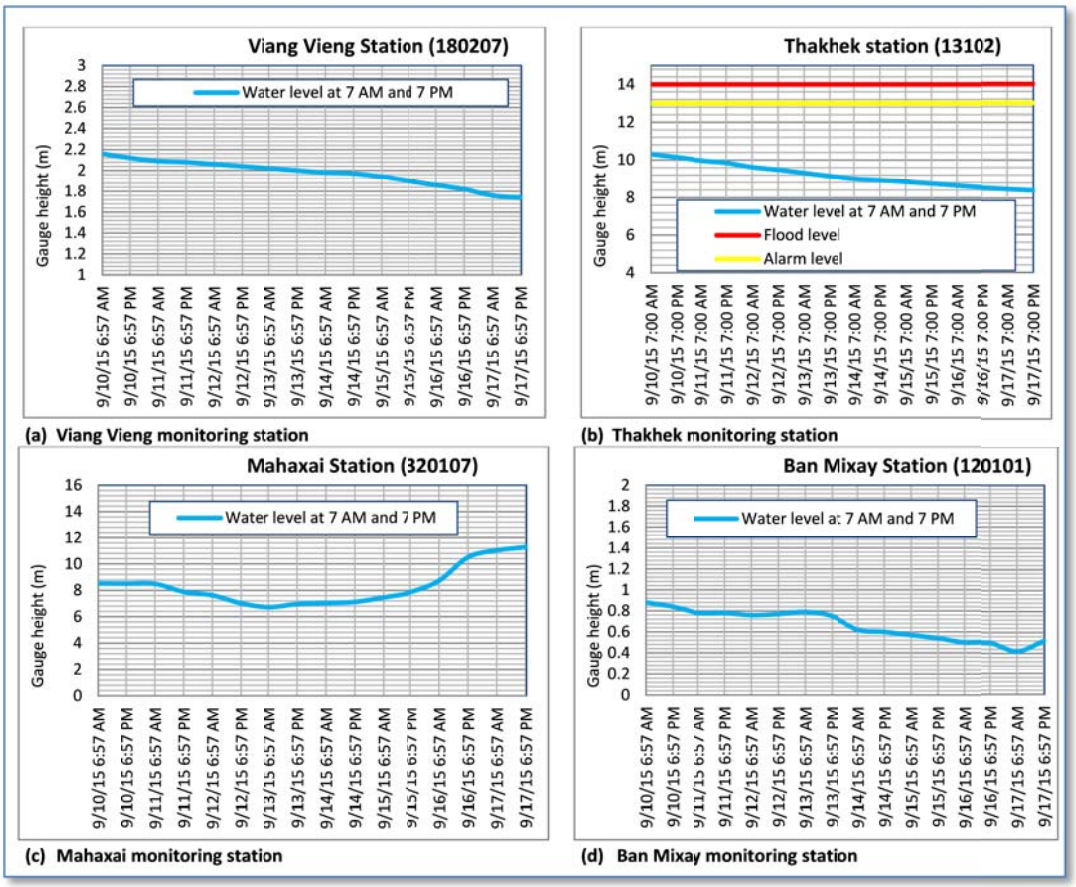


Figure 8-15 Water level at the Viang Vieng, Thakhek, Mahaxai and Ban Mixay monitoring stations located in Viet Nam during the storm VAMCO.

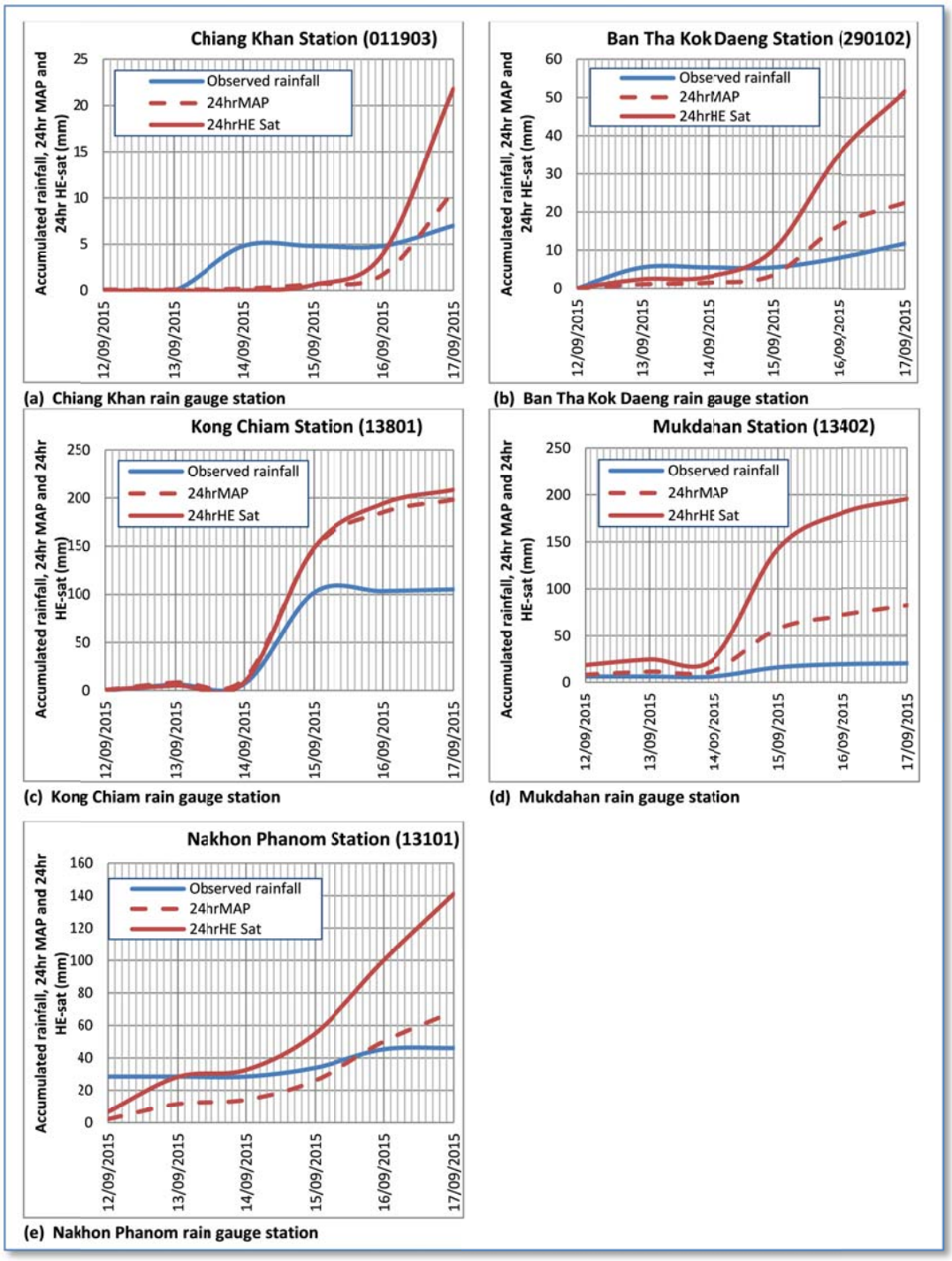


Figure 8-16 Water level at Chiang khan, Ban Tha Kok Daeng, Khong Chiam, Mukdahan and Nakhon Phanom monitoring stations located in Thailand during the storm VAMCO

8.4 Flash flooding in the central and southern provinces of Viet Nam caused by storm VAMCO

In the period 13 – 17 September 2015 the storm VAMCO caused heavy rainfalls that led to inundation and flash flooding in many areas of the Lower Mekong Basin. During the storm VAMCO the MRC-FFG detected flash flood risk areas in many

districts of central and southern provinces of Viet Nam (see Table 8-2 and Figure 8-17). Table 8-2 shows the list of flash flood risk areas in some districts in the provinces of Binh Dinh, Binh Thuan, Da Nang, Dong Nai, Gia Lai, Kon Tum, Nghe An, Quang Binh, Quang Tri, Quang Nam and Quang Ngai in Viet Nam that were detected by the MRC-FFG system in the period 14 – 17 September. Figure 8-17 shows that the MRC-FFG system detected the 3 hourly flash flood risk areas at some districts in central and southern provinces of Viet Nam in the period 14 – 17 September. According to media reports (see appendix 1.1) this situation generated many flash flood that affected several districts of the provinces Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Dong Nai and Ho Chi Minh. These provinces were the same as for which the flash flood warnings were generated through the MRC-FFG system (see Table 8-2 and Figure 8-17), except for Ho Chi Minh Province where the MRC-FFG system did not detect a flash flood risk.

Table 8-2 Flash flood risk districts in central and southern Viet Nam detected by MRC-FFG system in period 14 – 17 September 2015 at 0:00 and 6:00 UTC.

(a) On 14 September 2015 at 06:00 UTC time

Date of FFG products: 14/09/2015 06:00 UTC time

1hour Flash Flood Guidance in Vietnam			3hours Flash Flood Guidance in Vietnam		
Provinces	Districts	FFG value	Provinces	Districts	FFG Value
Kon Tum	Sa Thay	14.87	Kon Tum	Dak Glei	48.59
Gia Lai	Ia Grai	17.10	Kon Tum	Ngoc Hoi	48.59
Gia Lai	Chu Pah	17.49	Binh Dinh	Hoai Nhon	48.89
Da Nang	Hoa Vang	22.59	Binh Dinh	Hoai An	48.89
Quang Nam	Hien	22.59	Binh Dinh	Phu My	48.89
Quang Nam	Dai Loc	22.59	Kon Tum	Sa Thay	28.50
Gia Lai	An Khe	22.91	Gia Lai	Ia Grai	24.68
Gia Lai	Kong Chro	22.91	Gia Lai	Chu Pah	25.18
			Da Nang	Hoa Vang	29.88
			Quang Nam	Hien	29.88
			Quang Nam	Dai Loc	29.88
			Gia Lai	An Khe	31.60
			Gia Lai	Kong Chro	31.60
			Quang Ngai	Tu Nghia	42.59
			Quang Ngai	Son Ha	42.59
			Quang Ngai	Nghia Hanh	42.59
			Quang Ngai	Minh Long	42.59

(b) On 15 September 2015 at 06:00 UTC time

Date of FFG products: 15/09/2015 6:00 UTC (13:00 PM local time)

1hour Flash Flood Guidance in Vietnam			3hours Flash Flood Guidance in Vietnam		
Provinces	Districts	FFG value	Provinces	Districts	FFG Value
Quang Binh	Minh Hoa	20.59	Kon Tum	Dak Glei	38.02
Quang Tri	Huong Hoa	23.44	Kon Tum	Ngoc Hoi	35.24
Quang Tri	Da Krong	25.45	Quang Binh	Minh Hoa	28.93
			Quang Tri	Huong Hoa	31.30
			Quang Tri	Da Krong	33.37
			Da Nang	Hoa Vang	35.99
			Quang Nam	Hien	35.99
			Quang Nam	Dien Ban	34.07
			Quang Nam	Dai Loc	35.99
			Quang Nam	Duy Xuyen	34.07
			Quang Nam	Que Son	34.07
			Quang Ngai	Tu Nghia	44.80
			Quang Ngai	Son Ha	44.80
			Quang Ngai	Nghia Hanh	44.80
			Quang Ngai	Minh Long	44.80
			Kon Tum	Sa Thay	35.59
			Gia Lai	Chu Pah	38.70
			Gia Lai	An Khe	50.91
			Gia Lai	Ia Grai	37.72
			Gia Lai	Kong Chro	50.91

(c) On 16 September 2015 at 00:00 UTC time

Date of FFG products: 16/09/2015 00:00 UTC (07:00 AM local time)

1hour Flash Flood Guidance in Vietnam			3hours Flash Flood Guidance in Vietnam		
Provinces	Districts	FFG value	Provinces	Districts	FFG Value
Quang Binh	Minh Hoa	16.57	Binh Thuan	Tanh Linh	39.69
Quang Tri	Huong Hoa	23.02	Binh Thuan	Ham Thuan Nam	39.69
			Dong Nai	Xuan Loc	48.09
			Quang Binh	Minh Hoa	24.60
			Quang Tri	Huong Hoa	35.07
			Quang Binh	Bo Trach	39.80
			Quang Binh	Quang Ninh	39.89
			Quang Tri	Da Krong	38.97
			Da Nang	Hoa Vang	48.92
			Quang Nam	Hien	48.92
			Quang Nam	Dien Ban	44.24
			Quang Nam	Dai Loc	48.92
			Quang Nam	Duy Xuyen	44.24
			Quang Nam	Que Son	44.24
			Kon Tum	Sa Thay	47.15
			Gia Lai	Ia Grai	50.63
			Binh Thuan	Duc Linh	48.09

(d) On 17 September 2015 at 00:00 UTC time

Date of FFG products: 17/09/2015 00:00 UTC (07:00 AM local time)

1hour Flash Flood Guidance in Vietnam			3hours Flash Flood Guidance in Vietnam		
Provinces	Districts	FFG value	Provinces	Districts	FFG Value
Quang Binh	Tuyen Hoa	19.09	Dak Lak	Dak Nong	39.6
Quang Binh	Minh Hoa	18.21	Binh Thuan	Tanh Linh	39.29
			Binh Thuan	Ham Thuan Nam	39.29
			Quang Binh	Tuyen Hoa	27.22
			Quang Binh	Minh Hoa	26.19
			Nghe An	Con Cuong	50.83
			Quang Binh	Bo Trach	39.70
			Quang Binh	Quang Ninh	42.55
			Quang Nam	Dien Ban	32.87
			Quang Nam	Duy Xuyen	32.87
			Quang Nam	Que Son	32.87
			Quang Nam	Nui Thanh	39.84
			Quang Ngai	Binh Son	39.84
			Quang Ngai	Tra Bong	39.84
			Kon Tum	Sa Thay	47.13

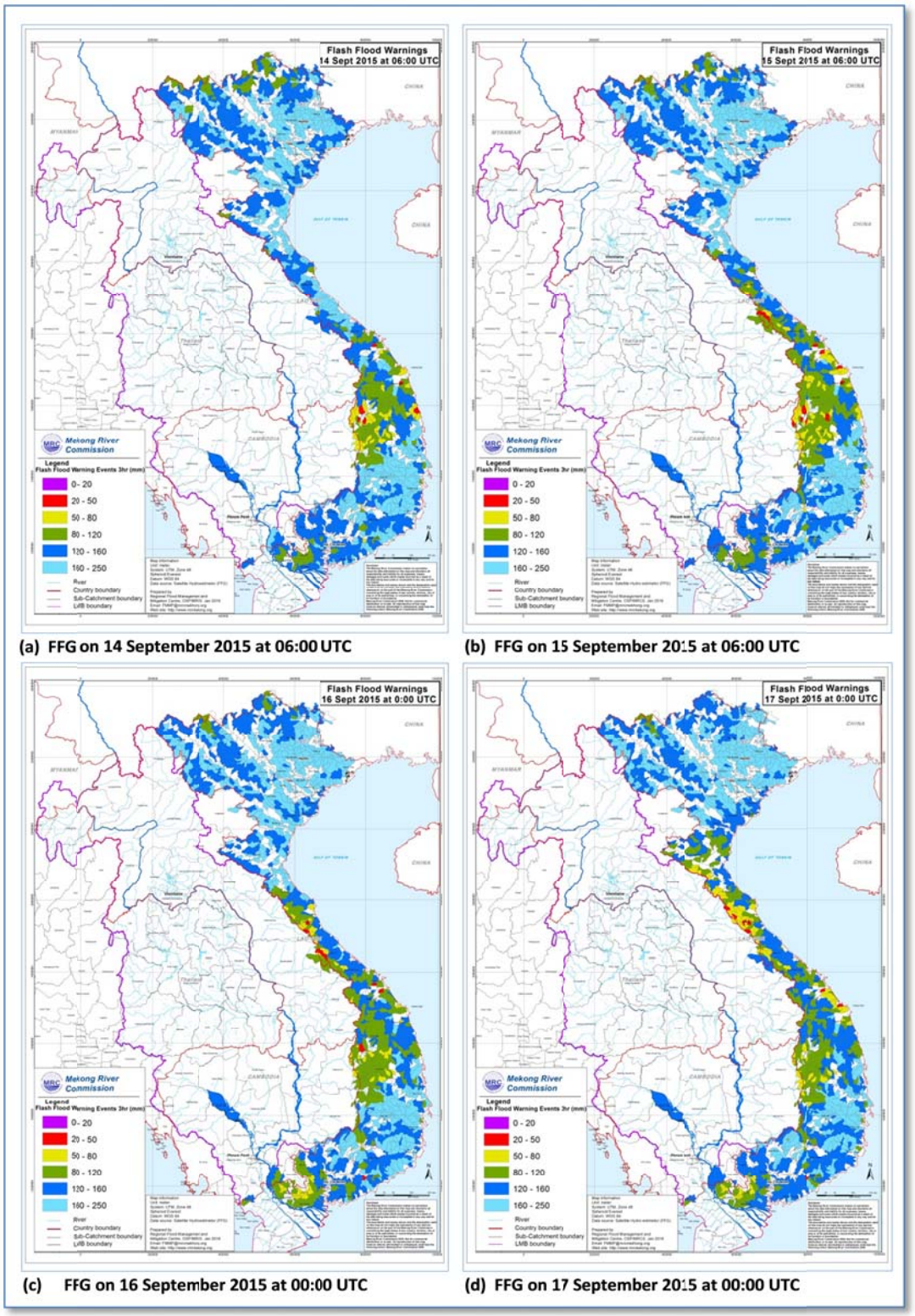


Figure 8-17 MRC-FFG system detected the 3 hourly flash flood risk areas at some districts in central and southern Viet Nam in the period 14 – 17 September 2015 at 0:00 and 6:00 UTC

8.5 Flash flooding in the northeastern provinces of Thailand caused by storm VAMCO

During storm VAMCO from 13 to 16 September 2015 the tropical storm hit the LMB and then was reduced to low pressure before dissipating. On 16 and 18 September the MRC-FFG system detected flash flood risk areas in Pak Chong and Wang Nam Khieo districts of Nakhon Ratchasima Province in Thailand (see Table 8-3 and Figure 8-18). Table 8-3 shows the list of flash flood warning for some districts in the northeastern province of Thailand that were detected by MRC-FFG system on 16 and 18 September. Figure 8-18 shows the MRC-FFG system detection of the 3 hourly flash flood risk areas at Pak Chong and Wang Nam Khieo districts of Nakhon Ratchasima in Thailand on 16 and 18 September.

According to reporting by the National New Bureau of Thailand on 18 September 2015 (see appendix 1.2) this situation generated flash floods in Nakhon Ratchasima Province which corresponded with the FFG's results and the flash flood warning for Pak Chong and Wang Nam Khieo districts of Nakhon Ratchasima Province in Thailand on 18 September 2015 (see Table 8-3 and Figure 8-18).

Table 8-3 The warnings of 3 hourly flash flood risk districts in northeastern Thailand detected by MRC-FFG system on 16 and 18 September 2015 at 0:00 UTC

(a) On 16 September 2015 at 00:00 UTC time

Date of FFG products	16/09/2015 00:00 UTC (07:00 AM local time)				
1hour Flash Flood Guidance in Thailand			**3hour Flash Flood Guidance in Thailand**		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	of Flash Flood	Occurences	Nakhon Ratchasima	Pak Chong	47.54
			Nakhon Ratchasima	Wang Nam Khieo	47.54

(b) On 18 September 2015 at 00:00 UTC time

Date of FFG products	18/09/2015 00:00 UTC (07:00 AM local time)				
1hour Flash Flood Guidance in Thailand			**3hour Flash Flood Guidance in Thailand**		
Provinces	Districts	FFG Value	Provinces	Districts	FFG Value
No Risk Areas	of Flash Flood	Occurences	Nakhon Ratchasima	Pak Chong	46.71
			Nakhon Ratchasima	Wang Nam Khieo	46.71

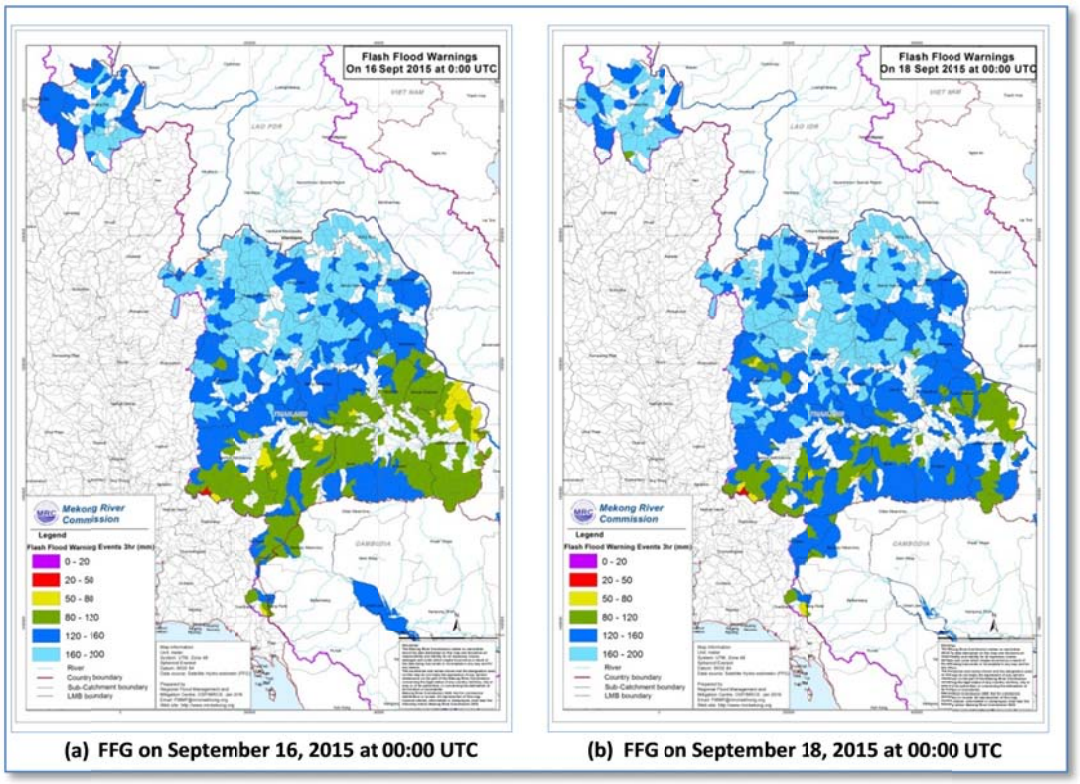
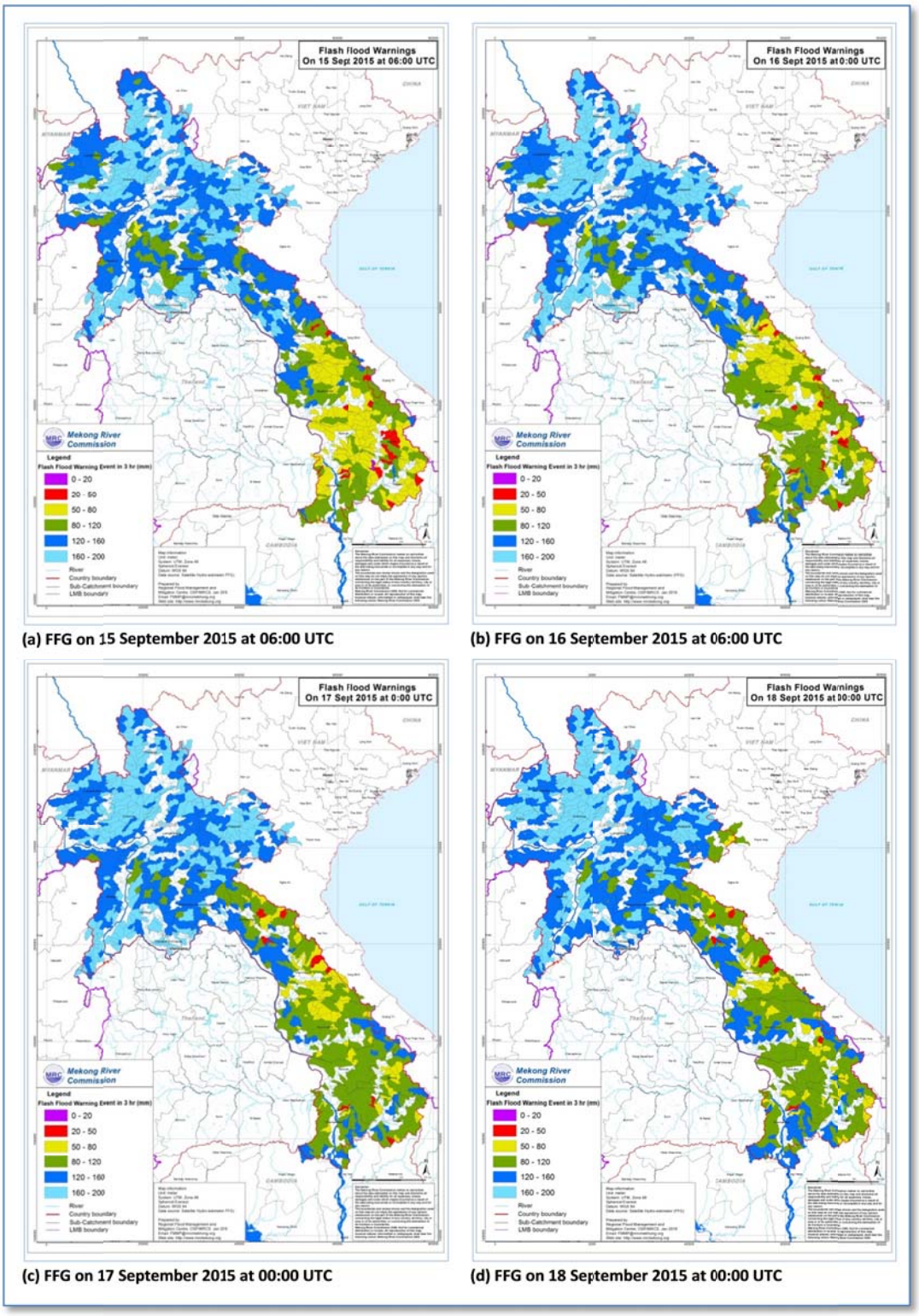


Figure 8-18 MRC-FFG system detected the 3 hourly flash flood risk areas at some districts in central and southern Viet Nam on 15 and 18 September 2015

8.6 Flash flooding in the central and southern provinces of Lao PDR caused by storm VAMCO

During the storm VAMCO from 13 to 17 September 2015 the MRC-FFG detected flash flood risk areas and generated warnings for some villages in the central and southern provinces of Lao PDR, especially in the provinces Khammouane, Bolikhamxay, Champasak, Savannakhet and Sekong (see Figure 8-19 shows the detection by the MRC-FFG system of the 3 hourly flash flood risk areas at some districts of central and southern provinces of Lao PDR in the period 14 - 17 September 2015. Based on the available media information (see appendix 1.3) no information of any flash flood warnings was reported in Lao PDR during the storm VAMCO from 13 to 17 September 2015.



(a) FFG on 15 September 2015 at 06:00 UTC

(b) FFG on 16 September 2015 at 06:00 UTC

(c) FFG on 17 September 2015 at 00:00 UTC

(d) FFG on 18 September 2015 at 00:00 UTC

Figure 8-19 MRC-FFG system detected the 3 hourly flash flood risk areas at some districts in central and southern Lao PDR in the period 15 – 18 September 2015.

8.7 Summary

The storm VAMCO brought in the period 13 – 17 September 2015 heavy rains that caused flash flooding in many areas on several tributaries and on the Mekong mainstream in the central and southern Viet Nam, the northeastern Thailand, and the central and southern Lao PDR (see appendix 1).

Referring to Table 8-1, the daily rainfall on 15 September 2015 reached a maximum of about 195 mm at A Luoi station, located in the central Thua Thien Hue Province in Viet Nam. Due to the heavy rainfall the soil moisture condition was fully saturated in some areas in the northeastern parts of Cambodia, the central and southern parts of Viet Nam, the Northeast parts of Thailand, and also the southern parts of Lao PDR (see Figure 8-10 (c)), and would most likely cause flash flooding in these areas.

Meanwhile in the period 14 – 17 September in Viet Nam the MRC-FFG system detected flash flood risk areas and generated warning for some districts in the provinces Binh Dinh, Binh Thuan, Da Nang, Dong Nai, Gia Lai, Kon Tum, Nghe An, Quang Binh, Quang Tri, Quang Nam and Quang Ngai (see Table 8-2 and Figure 8-17 (b)). Media information media confirmed that flash floods affected the same provinces that received flash flood warnings through the MRC-FFG system; an exception was Ho Chi Minh Province where the system did not detect a flash flood risk.

In Thailand in the period 16 - 18 September 2015 the MRC-FFG system detected flash flood risk areas and generated warnings for Pak Chong and Wang Nam Khieo districts in Nakhon Ratchasima Province (see Table 8-3 and Figure 8-18). This was verified with media reports that mentioned that Nakhon Ratchasima Province experienced flash floods. However the information of flash floods in the media reports did not mention which districts were affected by flash floods in Nakhon Ratchasima Province.

Unfortunately according to media information no flash flood warnings were provided during the storm VAMCO in Lao PDR (see appendix 1.2). However during this storm the MRC-FFG system detected flash flood risk areas and generated warnings for some villages in the provinces of Khammouane, Bolikhamxay, Champassak, Savannakhet and Sekong. Meanwhile in the period 14 - 17 September water levels increased significantly with roughly 4 m at Mahaxai station on the Xe Bang Fai River, located in Khammouane Province, which corresponded with the MRC-FFG system detected flash flood risk areas and generated warnings for some villages of Khammouane Province.

Based on a comparison between the observed daily accumulated rainfall, the 24hr MAP and the 24hr HE-sat, is can be concluded that the MRC-FFG system performed reasonably well in producing rainfall during the period 12 - 15 September 2015.

However the MRC-FFG system results (i.e. 24hr MAP and 24hr HE-sat) slightly varied (underestimated and overestimated values) when compared with the observed rainfall during the storm VAMCO, due to the uncertainty associated with MRC-FFG system results (see Figure 8-11 to Figure 8-13).

9. Flash flooding in the southern Viet Nam, caused by the tropical storm MUJIGAE in the period from 2 October to 5 October 2015

9.1 The tropical storm MUJIGAE during the first week of October 2015

The tropical storm MUJIGAE entered the East Sea early 2 October 2015 after traversing Luzon Island of Philippines (see Figure 9-1). It made landfall in Southern China on 4 October 2015. The combination of relatively light wind shear and warm ocean water temperatures allowed MUJIGAE to rapidly strengthen to the equivalent of a Category 4 hurricane prior to making landfall (see appendix 1.1).

According to the National Centre for Hydro-meteorological of Viet Nam, this is the fourth storm in Viet Nam's East Sea for the year 2015. The tropical storm brought torrential rain to northern Viet Nam with rainfalls of up to 400 mm in delta areas and up to 200 mm in mountainous regions.

Due to the tropical storm MUJIGAE the Lower Mekong Basin was covered by the low pressure and tropical storm MUJIGAE which caused over some parts of the northern and central Mekong region clouds and heavy rains (see Figure 9-2 and Figure 9-3). Figure 9-2 and Figure 9-3 illustrate the weather chart of the Mekong region on 2 and 5 October 2015.

Figure 9-1 The moving map of the Tropical storm MUJIGAE. Source: GDACS, JTWC, GeoHive.

Figure 9-2 Weather chart issued at 00:00 UTC on 2 October 2015 (07:00 AM Phnom Penh time).

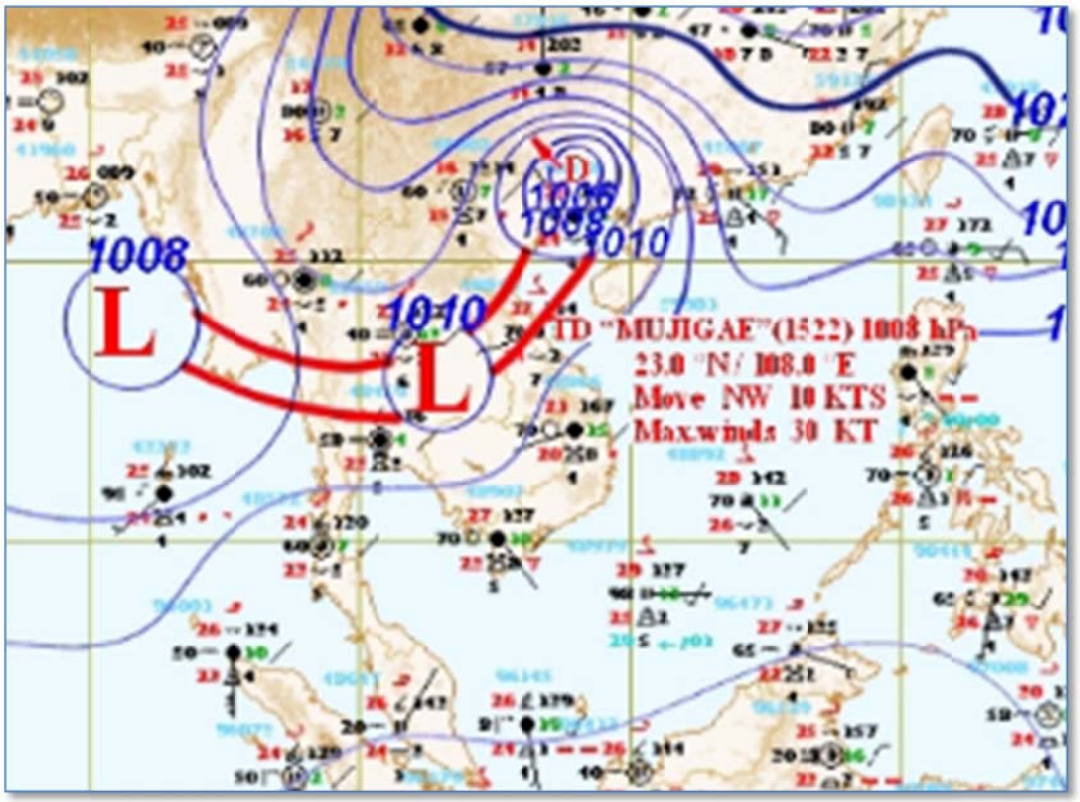


Figure 9-3 Weather chart issued at 00:00 UTC on 5 October 2015 (07:00 AM Phnom Penh time).

9.2 Heavy rainfall during the period of tropical storm MUJIGAE

During the period 2 - 5 October 2015 the Tropical Storm MUJIGAE brought heavy rainfall and strong winds to northern parts of Viet Nam. It brought according to media reports (see Appendix 1.1) heavy rains to the provinces of Quang Ninh and Hai Phong, as well as the central Khanh Hoa Province on 4 and 5 October 2015. It brought torrential rain of 300 to 500 mm for Northern provinces. Due to the storm MUJIGAE, the northern mountainous areas of Viet Nam were required to make plans for evacuating residents from areas with a high risk of flash floods and landslides, especially in Quang Ninh, Lang Son and Cao Bang provinces.

Figure 9-4 illustrates the daily rainfall distribution on 4 and 5 October 2015 that was obtained from rain gauge stations located within the LMB. Results show that heavy rainfalls occurred at Nakhon Phanom Province in the northeastern Thailand, Vientiane Province in the northern Lao PDR, Banteay Meanchey Province in the northern Cambodia, and also Kon Tum and Gai Lai provinces in the central Viet Nam.

Figure 9-5 represents the 24hr MAP during the storm MUJIGAE from 2 to 5 October 2015, the results show that the heavy rainfall occurred over parts of northern, central and southern Viet Nam, as well as in norther parts of Lao PDR, northeastern parts of Thailand and northern parts of Cambodia. The 24hr HE-sat at 00:00 UTC during the storm MUJIGAE from 2 to 5 October 2015 is shown in Figure 9-6. Results show that heavy rainfalls were occurring in some areas at the central and southern LMB region which possibly lead to flash flooding and landslides trigged by torrential rain.

Figure 9-7 represents the 6hr ASM conditions during the period 2 - 5 October 2015. Results indicates that the soil moisture condition was saturated in some areas of the northern parts of Cambodia, some areas in the southern parts of Lao PDR, and also some areas in the southern parts of Viet Nam, which corresponded with the daily rainfall distribution in Figure 9-4. This resulted in a high risk of flash floods and landslides in some areas of the central and southern parts of LMB region.

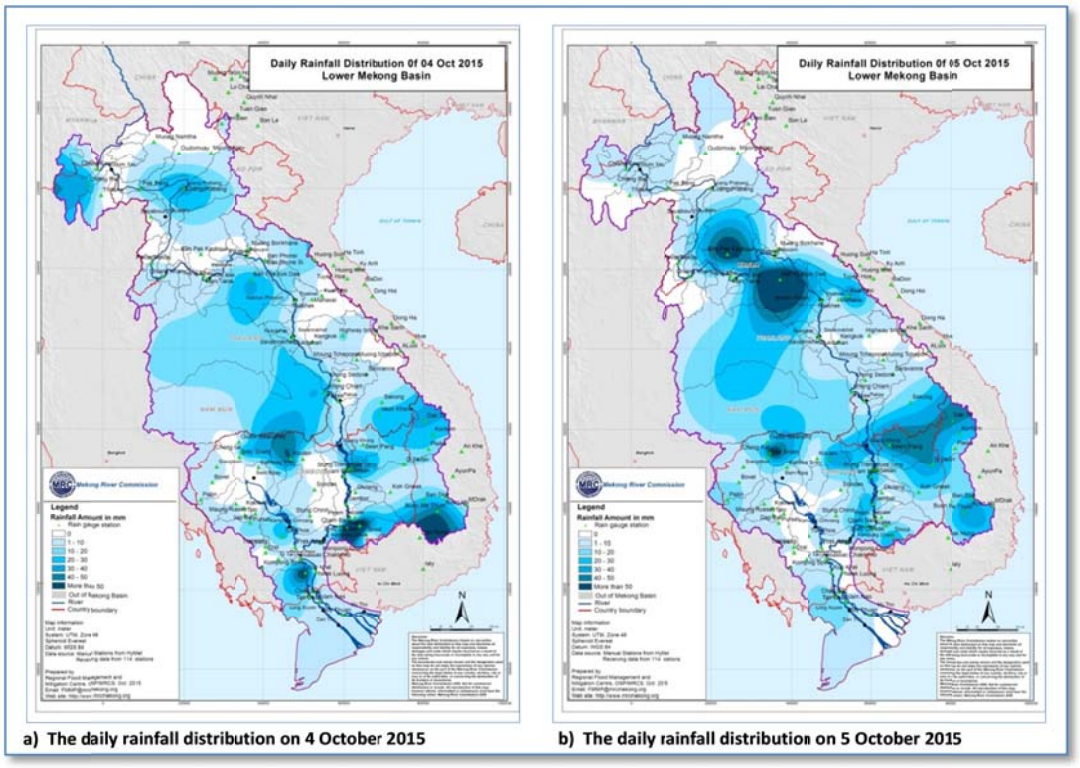


Figure 9-4 The daily rainfall distribution on 4 and 5 October 2015 in the Lower Mekong Basin. Source: the Regional Flood Management and Mitigation Centre.

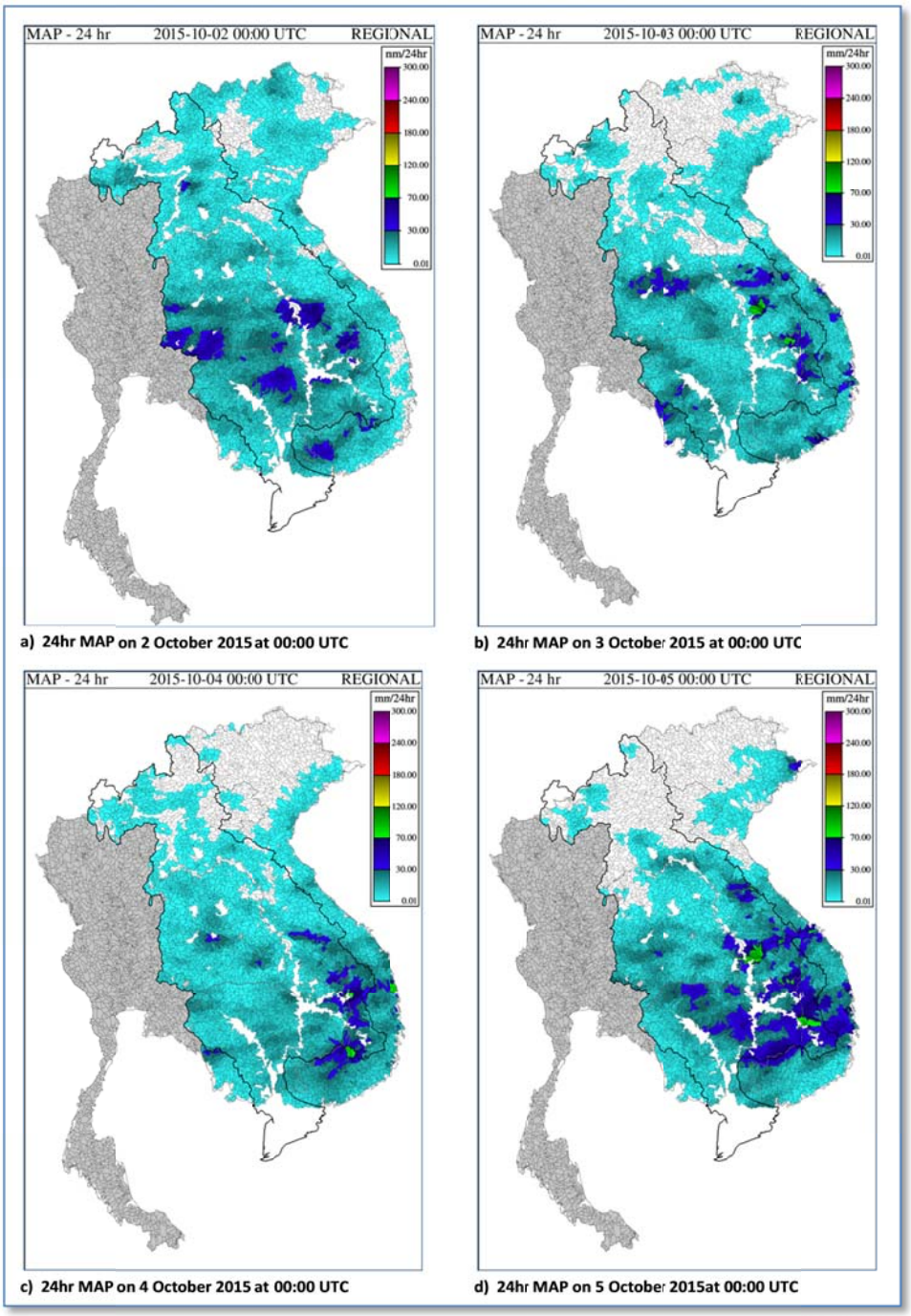


Figure 9-5 The 24hr MAP during the period of the tropical storm MUJIGAE on 2 to 5 October 2015 at 00:00 UTC (07:00 AM Phnom Penh time).

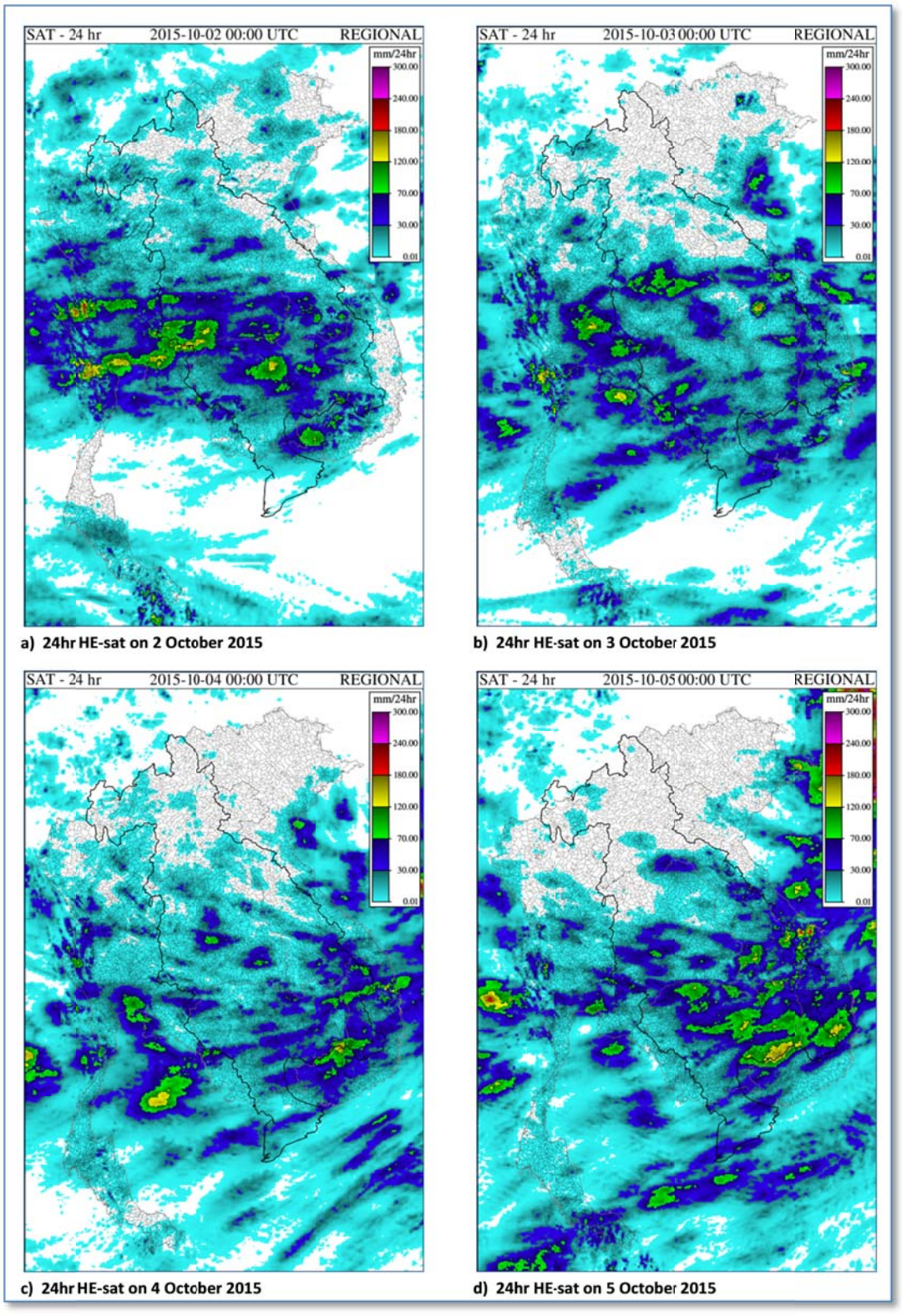


Figure 9-6 The 24hr HE-sat during the period of the tropical storm MUJIGAE in the period 20 - 25 June 2015 at 00:00 UTC (07:00 AM Phnom Penh time).

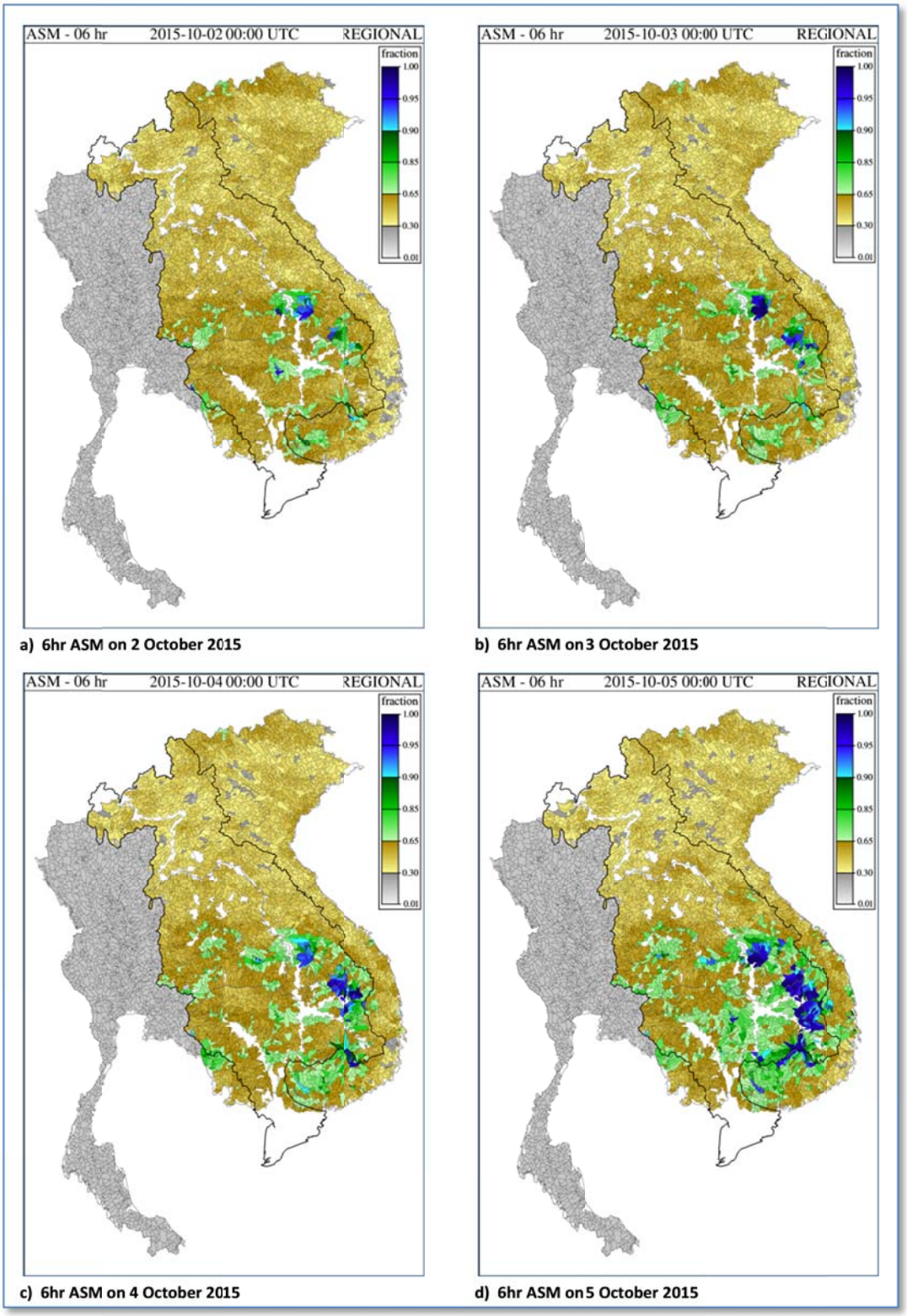


Figure 9-7 The 6hr ASM condition during of the period of the tropical storm MUJIGAE in the period 20 - 25 June 2015 at 00:00 UTC (07:00 AM Phnom Penh time).

9.3 Flash flooding in the southern provinces of Viet Nam caused by typhoon storm MUJIGAE

During the storm MUJIGAE from 2 to 5 October 2015, the MRC-FFG system detected flash flood risk areas and generated warnings for some districts of the provinces Dak Lak, Binh Phuoc, Lam Dong, Kon Tum and Gia Lai in the southern part of Viet Nam. Table 9-1 shows the 1 hourly and 3 hourly flash flood risk areas in Viet Nam on 4 and 5 October 2015 at 00:00 UTC that were detected by MRC FFG system. Figure 9-8 and Figure 9-9 represent results on the images of 1 hourly and 3 hourly FFG at 00:00 UTC (07:00 Phnom Penh time) on 4 and 5 October 2015.

Unfortunately the FFG results in Table 9-1, and Figure 9-8 and Figure 9-9 during the storm MUJIGA did not correspond with the media information which reported that flash flood hit the northern parts of Viet Nam, whereas the MRC-FFG system detected flash flood warnings at some districts of the southern parts of Viet Nam.

Figure 9-10 shows rain gauge stations located in the surrounding of the southern parts of Viet Nam. A comparison between the observed daily accumulated rainfall, the 24hr MAP and the 24hr HE-sat is shown in Figure 9-11. The data was obtained from eight rain gauge stations, namely Dak To (140715), Pleiku (140703), An Kne (130803), Ayunpa (130804), Buon Me Thuoc (120801), Mdrak (120806), Dak Nong (120712), Buon Ho (120805), Ialy (220409) stations (see Figure 9-10).

Table 9-1 The warnings of 1 and 3 hours flash flood risk areas in Viet Nam on 4 and 5 October 2015 at 00:00 UTC that were detected by MRC-FFG system.

FFG products on 4 October 2015

Date of FFG products	4/10/2015 00:00 UTC (07:00 AM local time)				
1hour Flash Flood Guidance in Vietnam			**3hours Flash Flood Guidance in Vietnam**		
Provinces	Districts	FFG value	Provinces	Districts	FFG Value
Dak Lak	Dak R'Lap	23.89	Dak Lak	Dak R'Lap	30.68
Dak Lak	Dak Nong	18.88	Dak Lak	Dak Nong	24.81
Binh Phuoc	Bu Dang	23.60	Binh Phuoc	Bu Dang	30.83
Lam Dong	Bao Lam	22.39	Lam Dong	Bao Lam	30.23
Kon Tum	Sa Thay	17.78	Kon Tum	Sa Thay	37.09
Gia Lai	Ia Grai	17.78	Gia Lai	Ia Grai	30.56
			Gia Lai	Chu Pah	35.81

FFG products on 5 October 2015

Date of FFG products	05/10/2015 06:00 UTC time				
1hour Flash Flood Guidance in Vietnam			**3hours Flash Flood Guidance in Vietnam**		
Provinces	Districts	FFG value	Provinces	Districts	FFG Value
Dak Lak	Dak Nong	18.44	Kon Tum	Dak Glei	38.03
			Kon Tum	Ngoc Hoi	36.03
			Kon Tum	Sa Thay	38.19
			Gia Lai	Chu Pah	37.43
			Gia Lai	Ia Grai	35.48
			Dak Lak	Dak R'Lap	36.92
			Dak Lak	Dak Nong	29.47
			Lam Dong	Bao Lam	39.15
			Binh Phuoc	Bu Dang	39.42

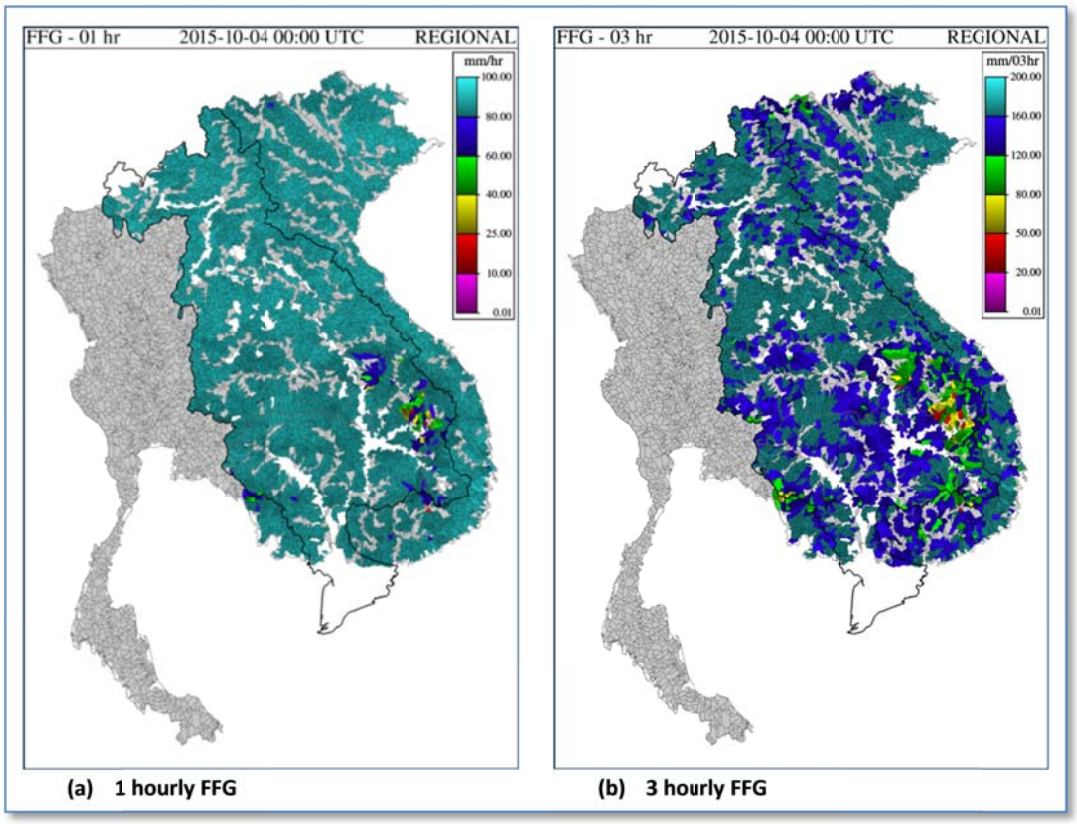


Figure 9-8 The 1 hourly and 3 hourly FFG on 4 October 2015 at 07:00 am Phnom Penh time.

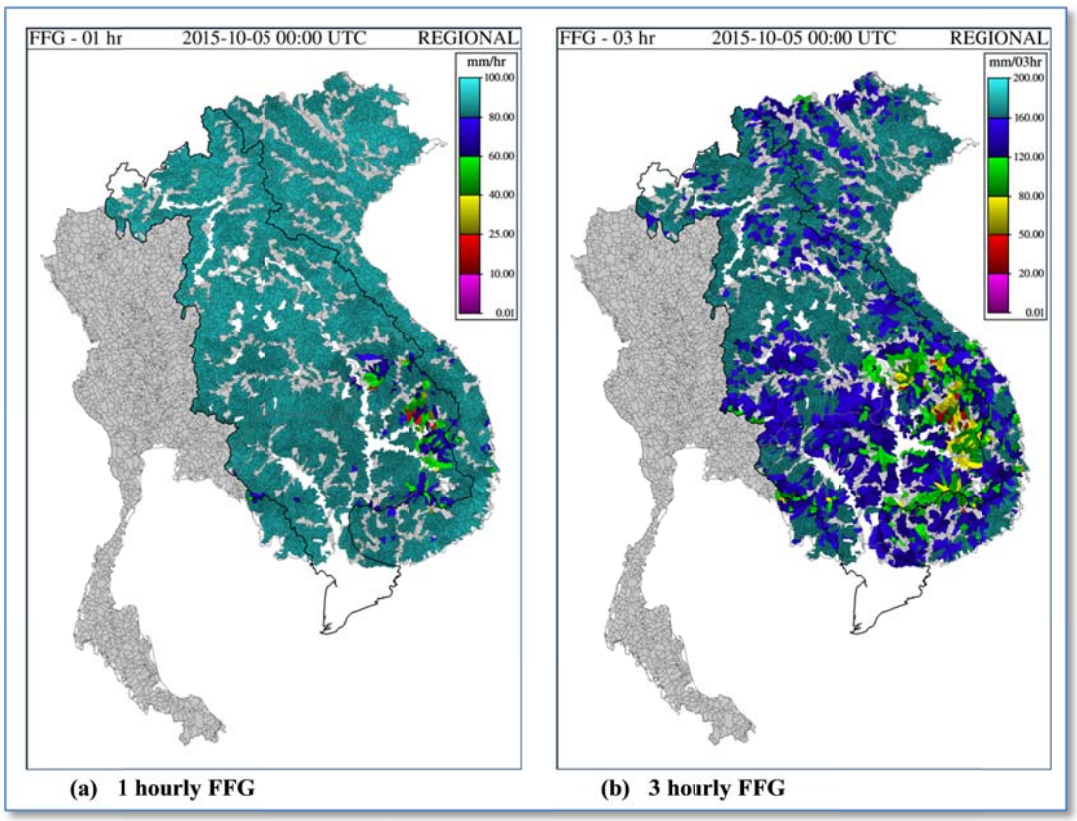


Figure 9-9 The 1 hourly and 3 hourly FFG on 5 October 2015 at 07:00 AM Phnom Penh local time.

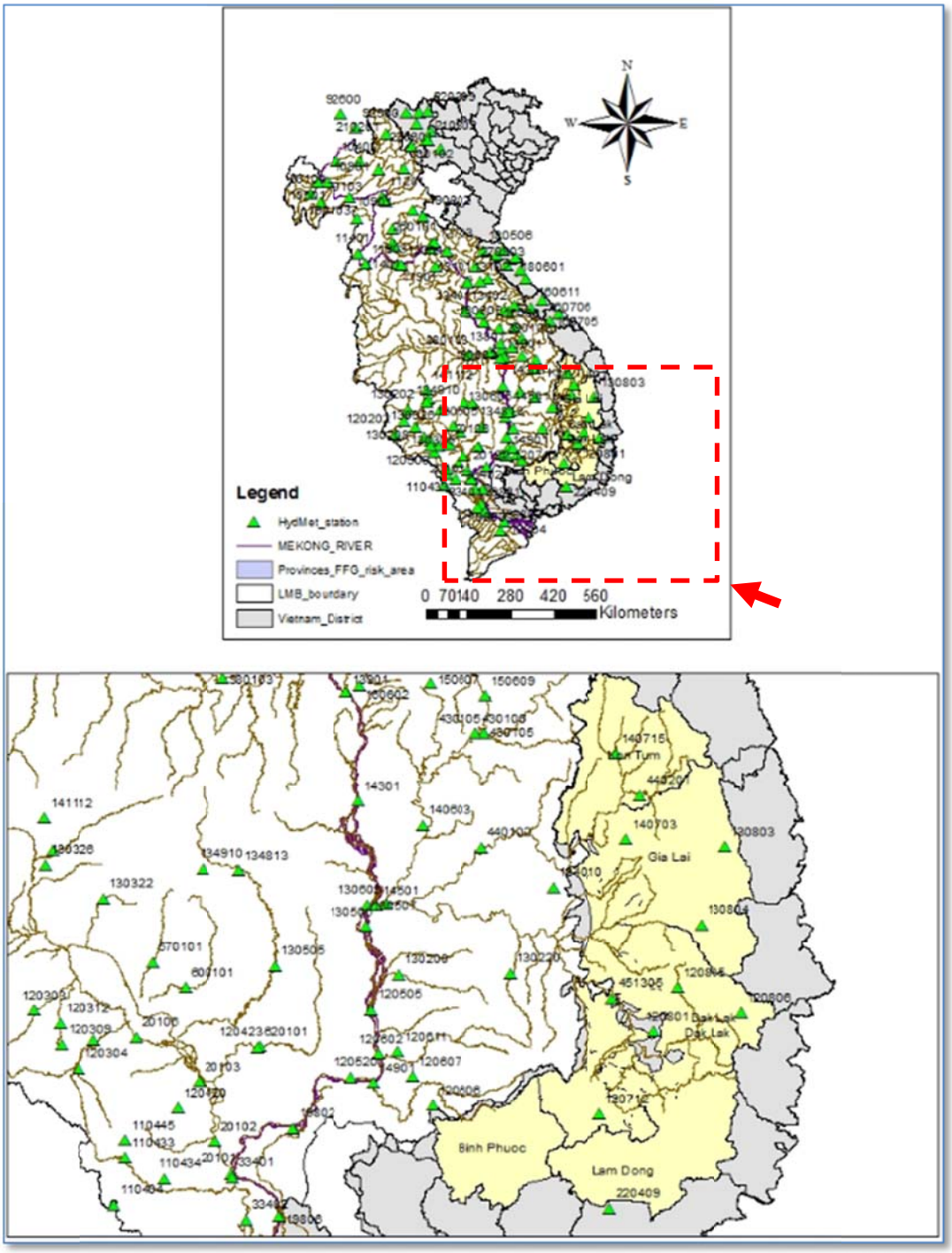


Figure 9-10 Location of HydroMet stations located in the surrounding of the southern part of Viet Nam.

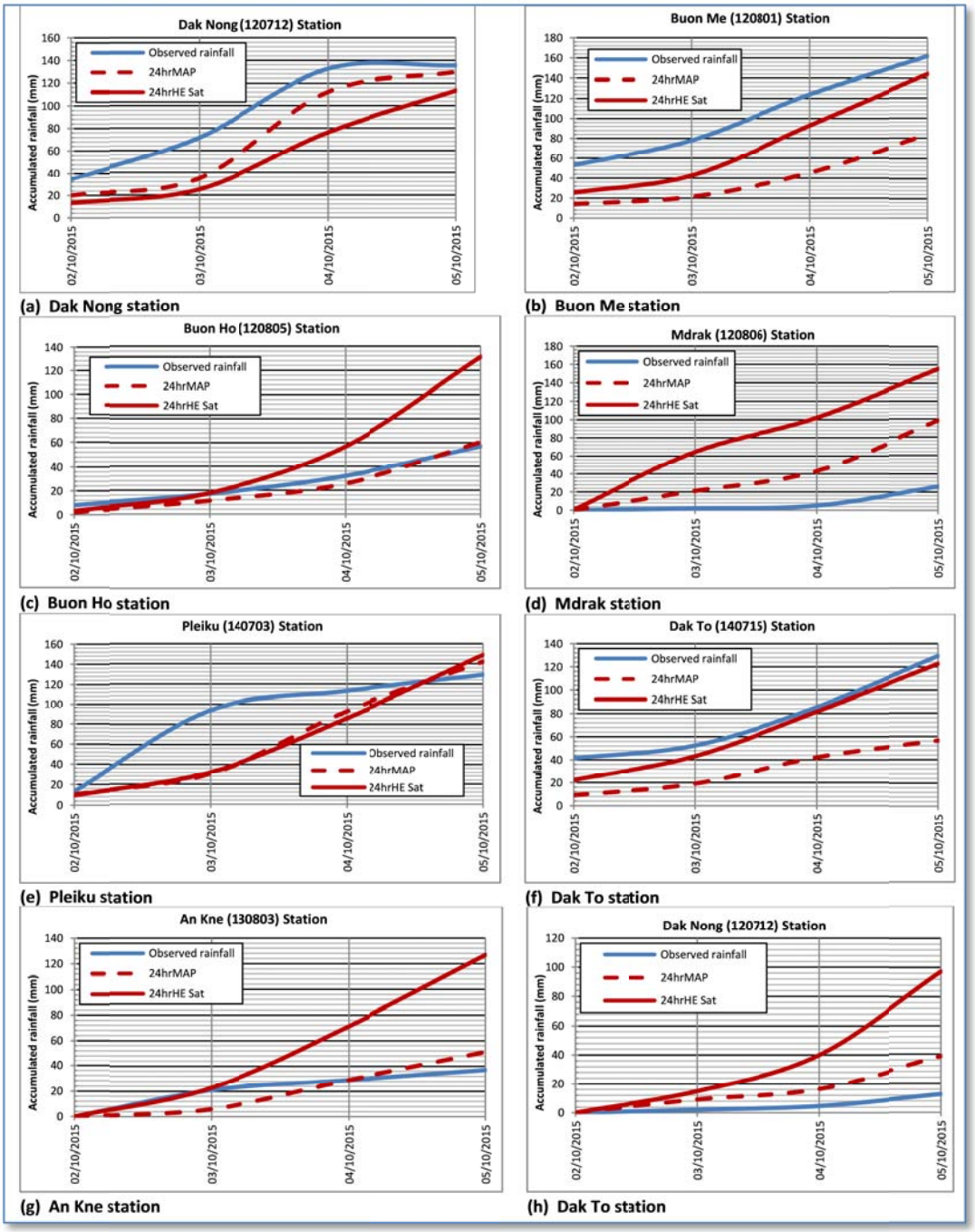


Figure 9-11 Accumulated observed rainfall (mm), 24hr MAP (mm) and 24hr HE-sat (mm) at 8 gauge stations located within the South of Viet Nam

9.4 Summary

During the first week of October 2015 the LMB was covered by low pressure and tropical storm MUJIGAE which affected some areas of the northern and central parts of the Lower Mekong region with clouds and heavy rains (see Figure 9-2 and Figure 9-3).

On 4 and 5 October 2015, according to the media (see appendix 1.1), the storm brought heavy rainfall to the northern provinces Quang Ninh and Hai Phong, and also to the central province Khanh Hoa in Viet Nam. The storm brought torrential rains of 300 to 500 mm to the Northern provinces of Viet Nam.

Meanwhile during the storm MUJIGAE from 2 to 5 October 2015 the MRC-FFG system detected flash flood risk areas and generated warnings for some districts of the provinces Dak Lak, Binh Phuoc, Lam Dong, Kon Tum and Gia Lai in the South of Viet Nam (see Table 9-1 and Figure 9-8 and Figure 9-9). Unfortunately, the FFG results did not correspond with the media information which reported that flash floods hit the northern part of Viet Nam, whereas the MRC-FFG system detected flash flood risk areas and generated warnings for some districts in the southern part of Viet Nam. In summary the MRC-FFG system did not provide good FFG results during the storm MUJIGAE.

10. Conclusions and recommendations

10.1 Conclusions

Flash floods in the Mekong region is a recurrent event which has the potential to adversely affect economic, human, lives, properties, and infrastructures. Currently, the Lower Mekong region have become increasingly more concerned with flash floods, and are looking for ways to improve flood preparedness to limit the extent of damage. According to the media reported (see appendix 1), flash floods and landslides occur very often in mountainous areas of the upper and central of Mekong region.

Since 2010, the MRC-FFG system has been operating successfully. It provides products to support the development of warning and estimate the risk of flash flooding from rainfall events in the sub-basins of the MRC member countries. The main aim of this report is to evaluate the performance of MRC-FFG system in village and district areas of the MRC member countries for the detection of the risk areas of potential flash floods during the 2015 flood season from May until the late of November.

This report is the fifth evaluation report of MRC-FFG system. The report does not cover all of the flash flooding that occurred in 2015 flood season, it is based on the available flash flood information that was collected from the media (see appendix 1). However, it is difficult to evaluate the MRC-FFG results using media information due to the fact that flash floods occurred in areas which are difficult to access and there are no reports available. The MRC-FFG system often indicated a flash flood risk in the flooded areas, but it is lacking an accurate and complete database of flash flood events. This makes it difficult to put a number on the success rate.

There were 30 tropical storms during year 2015 over the Pacific Ocean, and/or the East Sea (see Figure 3-1). There are four tropical storms, namely (1) KUJIRA, (2) KOMEN, (3) VAMCO and (4) MUJIGAE that caused serious flash floods affecting the LMB. Referring to Figure 3-3, heavy rainfall occurred during flood season 2015 over the upper and central parts of LMB, especially in Vientiane, Xaysomboun, Bolikhamxay and Xiangkhouang province in Northern Lao PDR, in Khammouane Province in Central Lao PDR, as well as in Thua Thien Hue Province in Central Viet Nam causing several flash floods hitting these areas, according to media information (see appendix 1).

During the flood season 2015 the MRC-FFG system generated warnings for many village and district risk areas of MRC member countries as is shown in Figure 3-4. The most frequently issued flash flood warning for village risk areas in Lao PDR is Phonxay village in Luang Prabang Province located in the Northern Lao PDR for

which the MRC-FFG system detected about 64 flash flood warnings. The most frequently issued flash flood warning for district risk areas in Viet Nam is Phong Tho district of Lai Chau Province located in the Northern part of Viet Nam for which the MRC-FFG system detected about 77 flash flood warnings. In Thailand, the most frequently issued flash flood warning for district risk areas in Thailand are: about 14 events at Chiang Kham district of Phayao Province, and Thoeng District of Chiang Rai Province, Northern Thailand. During flood season 2015 only 10 events of flash flood warnings were detected by the MRC-FFG system in Cambodia, Chay village of Ratanakiri Province, located in the Northeast of Cambodia, as the most frequently issued flash flood warnings for the last 5 years.

Most of the flash flood risk areas in the Mekong region that were detected by the MRC-FFG system occurred in the northern province of Viet Nam, and in the northern province of Lao PDR (see Figure 3-4). Unfortunately during the flood season 2015 there were numerous periods in which "missing data" were reported, especially at Phongsaly, Muong Namtha, Oudomxay and Moung Ngoy stations located within the northern province of Lao PDR. Limiting the "missing data" in these areas is highly necessary in order to improve the verification of flash floods and getting 'grip' on the accuracy of the system in these areas.

According to the media reports (see appendix 1) several flash floods hit the coastline area during flood season 2015. Unfortunately the present MRC-FFG system is not able to estimate rainfall for coastal areas. Therefore, the FMMT should contact HRC and look into the possibilities to provide flash flood guidance for coastal areas as well.

Finally, it can be stated that the MRC-FFG system performance during flood season 2015 was capable of predicting expected rainfall amounts with reasonable accuracy; the system is potentially a very effective tool for flash flood forecasting in the Mekong region.

10.2 Recommendations

The recommendations would further develop the MRC-FFG system for enhancing the accuracy of flash flood forecasting, and to reduce damage, the risk of lives, properties and also to avoid future catastrophes caused by flash floods are listed below:

1. Based on the results of MRC-FFG system, there are many failing detection flash flood risk areas of the MRC-FFG system (i.e. underestimated and overestimated). It is recommended that to improve the Mean Aerial Precipitation (MAP) product for reliable rainfall measurement needs to be

reviewed the bias correction factor. Once, updated the bias correction factor, should re-run the MRC-FFG system, review and verify the results.

2. In order to develop, implement and operate the MRC-FFG system, the data and information such as daily, and/or hourly, monthly climatological data, precipitation data (hourly, daily, monthly), air temperature (hourly, daily, monthly), soil moisture data, the updated land use/land cover map, streamflow discharge data for tributary streams to Mekong River or upstream (hourly, daily, monthly), stream stage data (hourly, daily, monthly), radiation data for computation of evapotranspiration (daily, monthly), wind and humidity data for computation of potential evapotranspiration (daily, monthly), etc. are needed for system operations and bias correction. It is recommended that this information is significant to review bias correction factor for improving the MAP.

3. For the evaluation of effectively MRC-FFG system and to improve the accuracy of the system, it is recommended that to build confidence in the system a more orderly way to collect the information of flash flood is needed. National flood relief authorities should build up a data base on the exact location of flash floods and the damage occurrences, and report to the RFMMC. Then the effectiveness of the system can be properly evaluated, and weaknesses of the system identified and rectified.

4. GIS database of village, district and province information is a significant input to address the high risk area of flash floods. Since 2010 until present, RFMMC still lack on the information about the village database in GIS format (ArcGIS point file) of Thailand and Viet Nam for the input into GIS database. With this information would help the capability MRC-FFG system to issue a warning on possible flash floods occurrence in Thailand and Viet Nam. It is recommended that to figure it out how to coordinate with the line agencies concerned to provide and support the Thailand and Viet Nam village database (GIS point file).

5. The current GIS database such as the village, district and province name and boundary received from national line agencies in 2003. This information may not consistent and out of date with the current GIS database of each country. It is recommended that the update GIS database is a significant input to issue the warnings on possible flash floods occurrences.

6. According to the flash flood information of the media reported (see appendix 1), flash flooding occurrences at many districts under flash flood watch (yellow color scale) (see Figure 1-2). It is recommended that the routine daily operational flash flood forecasts should also taking into account the flash flood watch warnings.

7. The RFMMC's MRC-FFG system could contribute to the preparedness by offering the training courses in the use of the system and by urging the countries to alert flash flood warnings. It is recommended that to conduct refreshment training courses of MRC-FFG system operation for the purpose to improve on FFG operation, and also to exchange the knowledge and experiences on FFG operation with National Center's and the RFMMC operators.

8. It is recommended that a strengthening of the staff at all levels to be able to handle flash flood forecasting and warnings.

9. For effective disaster flash flood risk reduction, it is recommended that the community awareness of flash flood with user agencies is needed.

10. During the serious weather conditions such as tropical storms, tropical depressions, ITCZ etc. Flash floods can occur at any time at any area of the Mekong region. It is recommended that the daily operational flash flood forecast should update the flash flood warnings on the MRC webpage and publish three times during daytime with 6 hourly intervals, at 07:00 am, 01:00 PM and at 07:00 PM, respectively.

11. Identifying areas prone to significant risk of flash floods requiring the local authorities to conduct flood hazard assessment through hydrological and other technical backup provided by relevant technical agencies.

12. It is recommended that the frequency of flash flood warnings mapping in Mekong region is needed. This information will define the risk areas of flash flooding under several weather conditions.

11. References

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[7] Sperfslage, J., Cristopher, S. and Konstantine, G. (2009). *"Mekong River Commission Flash Flood Guidance System (MRC-FFG) User's Guide."* San Diego, California, USA**:** 156.

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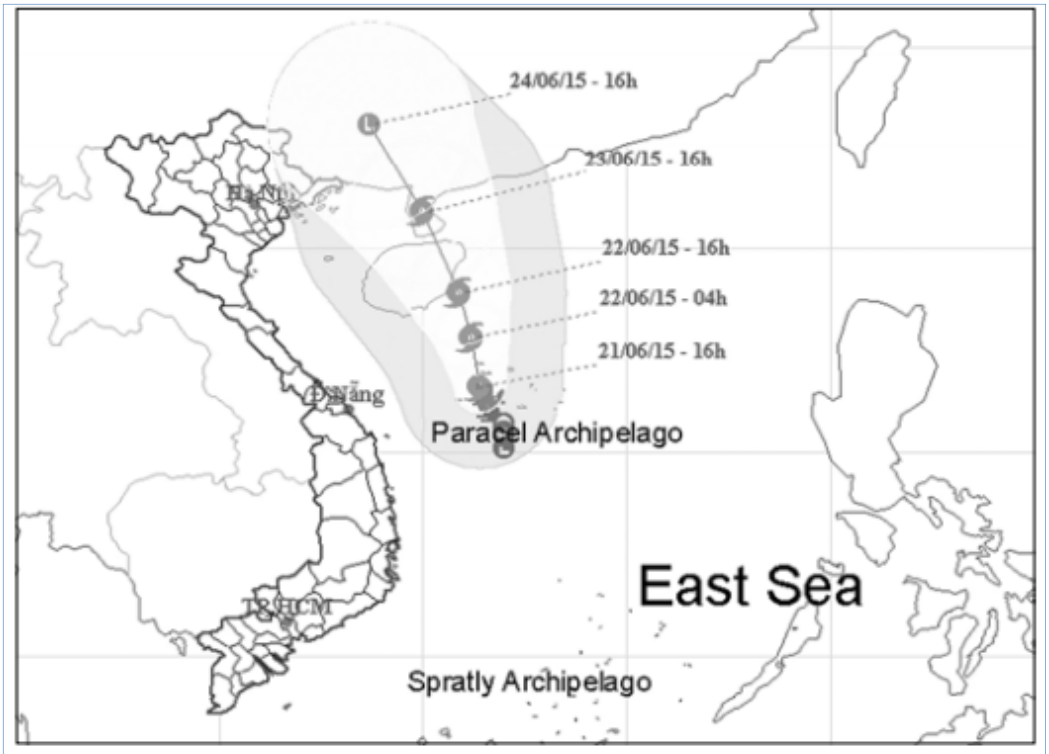
Appendix 1 The source of flash flood information from the media

Appendix 1.1 Viet Nam

During the tropical storm KUJIRA from 20 June to 25 June 2015



Source: National Centre for Hydrometeorological Forecasting

HÀ NỘI — Coastal provinces from Quảng Ninh to Bình Thuận spent the past day preparing for tropical storm *Kujira* (whale in Japanese), which formed yesterday morning above the territorial waters of the *Hoàng Sa* (Paracel) Archipelago.

The storm, with wind speeds of 60-75km per hour by 2pm yesterday, is the first tropical storm in the East Sea this year.

The quick preparations began after the National Committee on Natural Disaster Prevention and Control sent an urgent message yesterday, ordering coastal inhabitants to ready resources for emergencies and offshore fishing vessels to find safe anchorage for shelter.

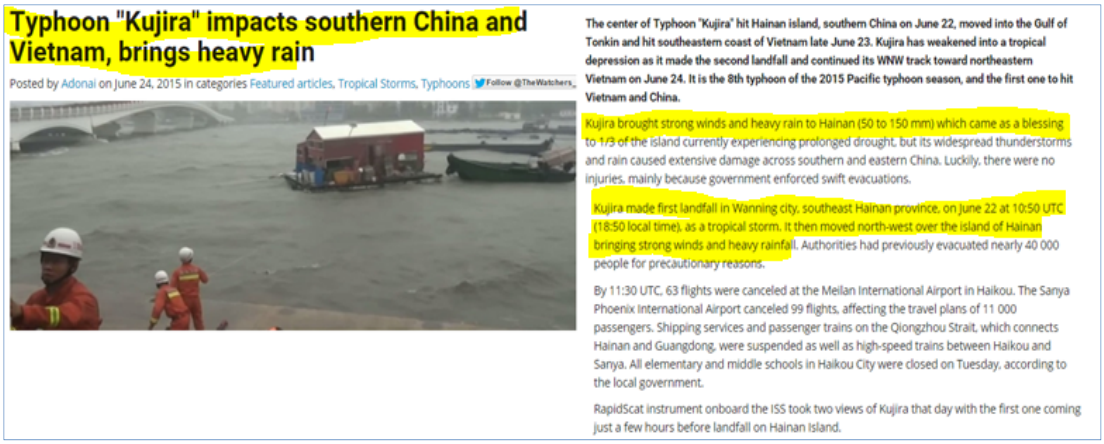
The latest report from the centre said more than 22,650 fishing vessels had been notified about the storm's progress.

The National Centre for Hydro-meteorological Forecasting said the storm was moving north at 10km per hour and gain strength in the next 12 hours.

The eye of the storm is predicted to be at China's Leizhou Peninsula by 4pm tomorrow afternoon. Territories in the northern part of the Paracel Archipelago should expect strong winds and high waves of 3-5 metres.

Due to the storm, torrential rains and thunderstorms will likely affect the seas from Bình Thuận to Cà Mau provinces. — **VNS**

Source: Viet Nam News on 22 June 2015



Typhoon "Kujira" impacts southern China and Vietnam, brings heavy rain

Posted by Adonai on June 24, 2015 in categories Featured articles, Tropical Storms, Typhoons Follow @TheWatchers_

The center of Typhoon "Kujira" hit Hainan island, southern China on June 22, moved into the Gulf of Tonkin and hit southeastern coast of Vietnam late June 23. Kujira has weakened into a tropical depression as it made the second landfall and continued its WNW track toward northeastern Vietnam on June 24. It is the 8th typhoon of the 2015 Pacific typhoon season, and the first one to hit Vietnam and China.

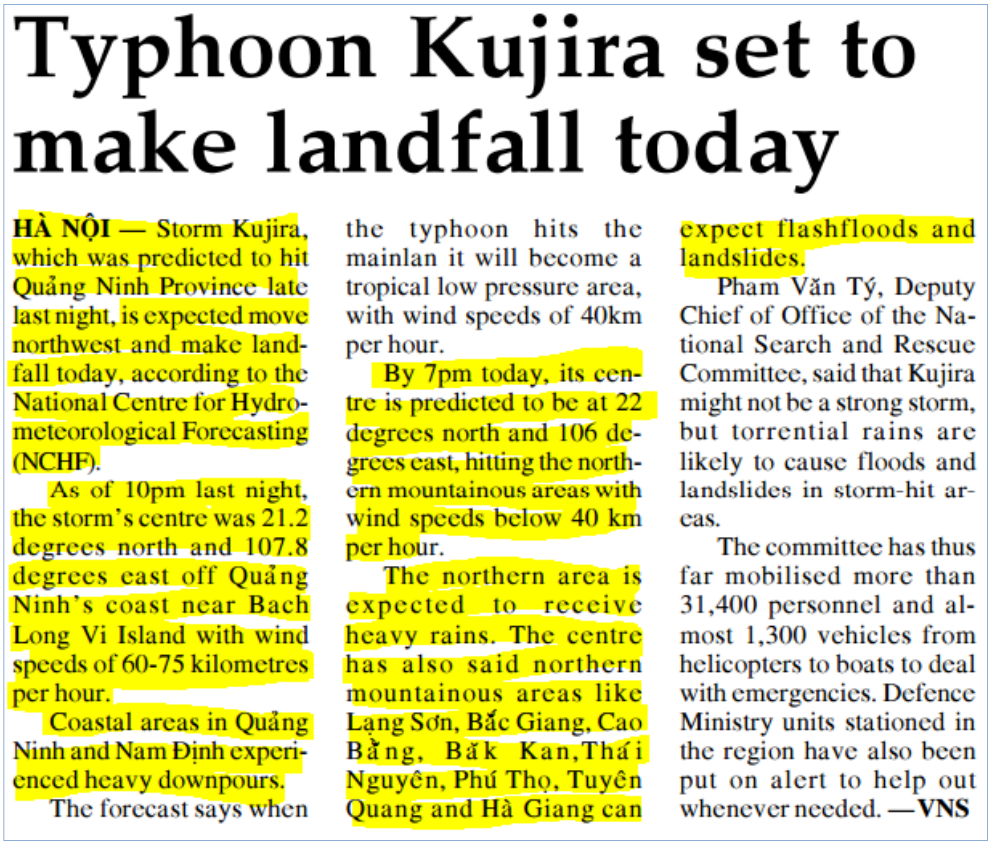
Kujira brought strong winds and heavy rain to Hainan (50 to 150 mm) which came as a blessing to 1/3 of the island currently experiencing prolonged drought, but its widespread thunderstorms and rain caused extensive damage across southern and eastern China. Luckily, there were no injuries, mainly because government enforced swift evacuations.

Kujira made first landfall in Wanning city, southeast Hainan province, on June 22 at 10:50 UTC (18:50 local time), as a tropical storm. It then moved north-west over the island of Hainan bringing strong winds and heavy rainfall. Authorities had previously evacuated nearly 40 000 people for precautionary reasons.

By 11:30 UTC, 63 flights were canceled at the Meilan International Airport in Haikou. The Sanya Phoenix International Airport canceled 99 flights, affecting the travel plans of 11 000 passengers. Shipping services and passenger trains on the Qiongzhou Strait, which connects Hainan and Guangdong, were suspended as well as high-speed trains between Haikou and Sanya. All elementary and middle schools in Haikou City were closed on Tuesday, according to the local government.

RapidScat instrument onboard the ISS took two views of Kujira that day with the first one coming just a few hours before landfall on Hainan Island.

Source: The Watchers website on 24 June 2015 (http://thewatchers.adorraeli.com/2015/06/24/typhoon-kujira-impacts-southern-china-and-vietnam-brings-heavy-rain/)



Typhoon Kujira set to make landfall today

HÀ NỘI — Storm Kujira, which was predicted to hit Quảng Ninh Province late last night, is expected move northwest and make landfall today, according to the National Centre for Hydro-meteorological Forecasting (NCHF).

As of 10pm last night, the storm's centre was 21.2 degrees north and 107.8 degrees east off Quảng Ninh's coast near Bach Long Vi Island with wind speeds of 60-75 kilometres per hour.

Coastal areas in Quảng Ninh and Nam Định experienced heavy downpours.

The forecast says when the typhoon hits the mainlan it will become a tropical low pressure area, with wind speeds of 40km per hour.

By 7pm today, its centre is predicted to be at 22 degrees north and 106 degrees east, hitting the northern mountainous areas with wind speeds below 40 km per hour.

The northern area is expected to receive heavy rains. The centre has also said northern mountainous areas like Lạng Sơn, Bắc Giang, Cao Bằng, Bắk Kan, Thái Nguyên, Phú Thọ, Tuyên Quang and Hà Giang can expect flashfloods and landslides.

Phạm Văn Tý, Deputy Chief of Office of the National Search and Rescue Committee, said that Kujira might not be a strong storm, but torrential rains are likely to cause floods and landslides in storm-hit areas.

The committee has thus far mobilised more than 31,400 personnel and almost 1,300 vehicles from helicopters to boats to deal with emergencies. Defence Ministry units stationed in the region have also been put on alert to help out whenever needed. — **VNS**

Source: Viet Nam News on 24 June 2015

Three die as typhoon hits Việt Nam

QUẢNG NINH — Heavy rain from Typhoon Kujira lifted water levels in rivers in mountainous Sơn La Province yesterday. The storm killed at least three in the province, including a four-year old child.

More than 20 houses were damaged or swept away by flash floods, which also caused extensive damage to provincial infrastructure projects.

Ten crew members on board four barges that lost anchor during the storm were rescued by Vân Đồn District border-patrol force in coastal Quảng Ninh Province. They were taken to the Ngọc Vừng Border Post to receive medical care while soldiers tried to retrieve the barges.

The provincial authority banned all vessels from going out to sea and asked residents to move aquaculture cages.

By early morning yesterday, more than 8,000 vessels...

Soldiers in northern Hải Phòng City's Đồ Sơn District help fishermen anchor their vessels as Typhoon Kujira, the first storm of the year, made landfall on the Quảng Ninh-Thái Bình coast yesterday. — VNA/VNS Photo Lâm Khánh

Three die as...

FROM PAGE 1

... had safely returned to shore. All localities are on alert to minimise damage from possible flash floods and landslides.

Provincial residents were ordered to leave landslide-prone areas for safer places. In Quảng Yên District, the town mobilised thousands of volunteers to place sandbags along the dyke.

In Thái Bình Province, the Border Defence Command told 1,218 vessels still at sea and 3,325 acquaculture workers to return to shore.

Thousands of residents, who lived outside local dykes and by the coast were told to move into storm shelters.

The worst flooding in decades affected many sites in Thái Bình City as well as the districts of Kiến Xương and Tiền Hải. Residents used sandbags and wooden planks to block the water from entering homes.

Nam Định Province ordered 2,000 ships and boats to anchor in safety by 10am yesterday. Owners of aquaculture farms were provided with regular storm information.

The storm brought heavy rains to Hải Phòng City, injuring one and sinking two ships anchored in Bạch Long Vỹ.

The storm weakened into a tropical low pressure late last night.

Floods are forecast for rivers in the Hồng-Thái Bình system today and tomorrow - and in provinces from Thanh Hóa to Hà Tĩnh. — VNS

Source: Viet Nam News on 25 June 2015

A flooded street in Son La, the capital city of Son La Province, on Wednesday. Photo credit: VnE

At least seven people died and four others were reported missing as storm-triggered torrential rains hit the northern mountainous province of Son La on Wednesday evening, news website VnExpress reported.

Typhoon Kujira, the first tropical storm to hit Vietnam this year, made landfall in Quang Ninh Province and Hai Phong City at noon on Wednesday.

The typhoon did not directly cause casualties and much material damage to these localities, but brought torrential rains to nearly all northern provinces, especially flash floods in mountainous provinces.

In Son La, seven people died and four were swept away by flash floods, and yet to be found. The rainfall was measured at 219 mm at 7 p.m. on Wednesday.

Many districts in Son La were submerged in water.

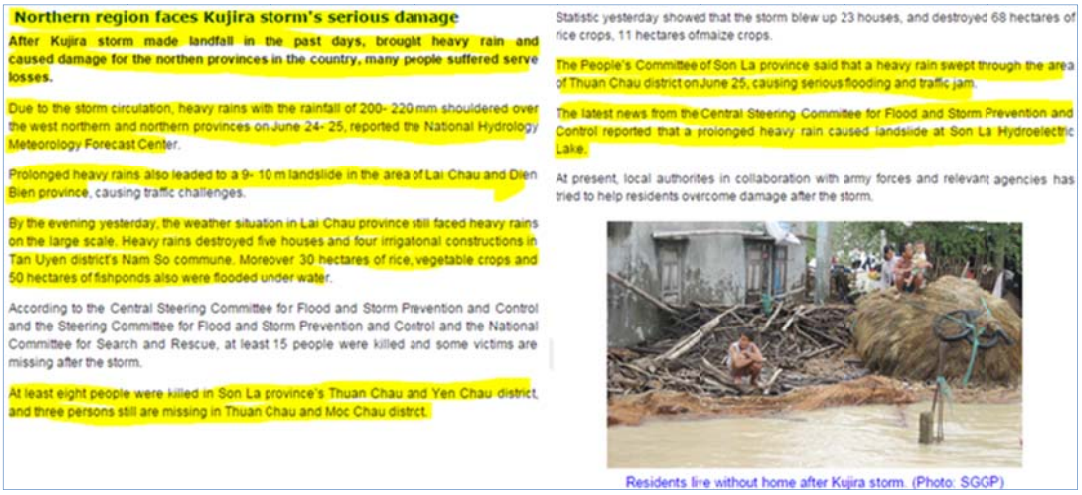
As many as 23 houses were also wiped out by flood waters. The floods also eroded a number of roads, causing traffic congestion.

Typhoon Kujira has weakened into a depression, but heavy rains will still occur in northeastern provinces until Thursday, according to the National Hydro-meteorological Forecast Center.

Source: The Thanhniennews website on 25 June 2015 (http://www.thanhniennews.com/society/7-dead-4-missing-as-typhoon-kujira-hits-northern-vietnam-47108.html)

Source: Viet Nam News on 26 June 2015

Source: The Watchers website on 26 June 2015



Northern region faces Kujira storm's serious damage

After Kujira storm made landfall in the past days, brought heavy rain and caused damage for the northen provinces in the country, many people suffered serve losses.

Due to the storm circulation, heavy rains with the rainfall of 200- 220mm shouldered over the west northern and northern provinces on June 24- 25, reported the National Hydrology Meteorology Forecast Center.

Prolonged heavy rains also leaded to a 9- 10 m landslide in the area of Lai Chau and Dien Bien province, causing traffic challenges.

By the evening yesterday, the weather situation in Lai Chau province still faced heavy rains on the large scale. Heavy rains destroyed five houses and four irrigatonal constructions in Tan Uyen district's Nam So commune. Moreover 30 hectares of rice, vegetable crops and 50 hectares of fishponds also were flooded under water.

According to the Central Steering Committee for Flood and Storm Prevention and Control and the Steering Committee for Flood and Storm Prevention and Control and the National Committee for Search and Rescue, at least 15 people were killed and some victims are missing after the storm.

At least eight people were killed in Son La province's Thuan Chau and Yen Chau district, and three persons still are missing in Thuan Chau and Moc Chau district.

Statistic yesterday showed that the storm blew up 23 houses, and destroyed 68 hectares of rice crops, 11 hectares ofmaize crops.

The People's Committee of Son La province said that a heavy rain swept through the area of Thuan Chau district on June 25, causing serious flooding and traffic jam.

The latest news from the Central Steering Commitee for Flood and Storm Prevention and Control reported that a prolonged heavy rain caused landslide at Son La Hydroelectric Lake.

At present, local authorites in collaboration with army forces and relevant agencies has tried to help residents overcome damage after the storm.

Residents live without home after Kujira storm. (Photo: SGGP)

Source: The Saigon websit on 26 June 2015
(http://www.sggpnews.org.vn/Nature/Weather/2015/6/114265/)

Storm *Kujira* kills eight in Sơn La

More than 70 houses collapsed, nearly 400 were flooded. More than 500ha of crops were inundated; livestock was washed away, and roads seriously damaged.

HÀ NỘI — Deputy Prime Minister Nguyễn Xuân Phúc has asked localities to quickly resolve problems created by tropical storm *Kujira*.

The storm, the first this year, caused at least eight deaths, mostly in mountainous Sơn La Province. Floods swept away many houses in the northern region.

More than 70 houses collapsed and nearly 400 were flooded. More than 500 ha of rice paddies and crops were inundated; livestock was washed away and local irrigation systems and roads were seriously damaged.

Landslides disrupted traffic and brought down power lines in several communes in Mộc Châu, Yên Châu, Mường La and Thuận Châu districts.

Lai Châu suffered severe losses, with one dead, one injured and another person missing. The storm also caused landslides and floods.

The Deputy PM has asked Sơn La Province's People's Committee to continue the search for missing people, to assist families with injured and dead relatives, and to provide water, food and other necessities to those who lost their houses or were seriously affected.

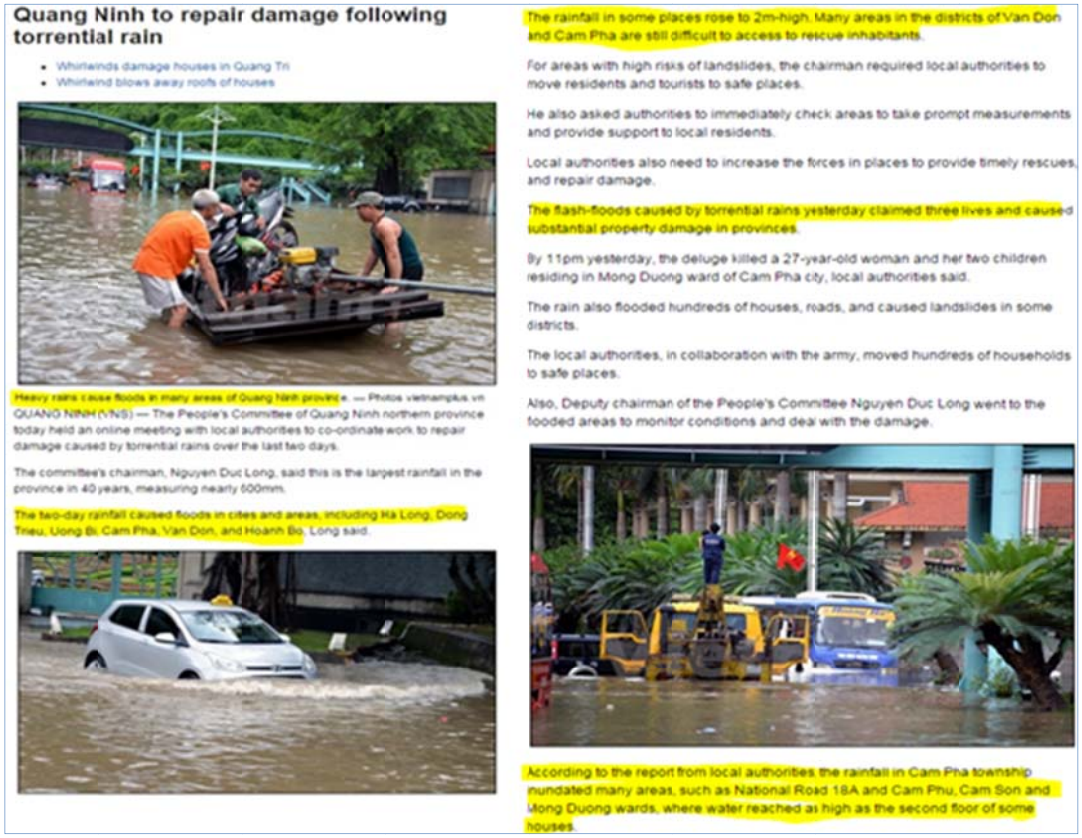
He asked the province to station people on both inland and water traffic routes to ensure safe transport for residents, to continue shifting people living in high-risk areas, and to mobilise youth, army and police forces to help clear the environment and repair houses.

Deputy PM Phúc said the transport ministry should promptly repair the damage caused by the storm to traffic infrastructure.

On Thursday, at a meeting with the Central Steering Committee for Natural Disaster Prevention and Control, Deputy head of the Irrigation Department, Ministry of Agriculture and Rural Development Trần Quang Hoài said special attention should be paid to preventing people from being swept away like in Son La. — **VNS**

Source: Viet Nam News on 27 June 2015

During the heavy monsoon rains and tropical storm KOMEN from 26 July to 6 August 2015



Quang Ninh to repair damage following torrential rain

- Whirlwinds damage houses in Quang Tri
- Whirlwind blows away roofs of houses

Heavy rains cause floods in many areas of Quang Ninh province. — Photos vietnamplus.vn

QUANG NINH (VNS) — The People's Committee of Quang Ninh northern province today held an online meeting with local authorities to co-ordinate work to repair damage caused by torrential rains over the last two days.

The committee's chairman, Nguyen Duc Long, said this is the largest rainfall in the province in 40 years, measuring nearly 600mm.

The two-day rainfall caused floods in cities and areas, including Ha Long, Dong Trieu, Uong Bi, Cam Pha, Van Don, and Hoanh Bo, Long said.

The rainfall in some places rose to 2m-high. Many areas in the districts of Van Don and Cam Pha are still difficult to access to rescue inhabitants.

For areas with high risks of landslides, the chairman required local authorities to move residents and tourists to safe places.

He also asked authorities to immediately check areas to take prompt measurements and provide support to local residents.

Local authorities also need to increase the forces in places to provide timely rescues, and repair damage.

The flash-floods caused by torrential rains yesterday claimed three lives and caused substantial property damage in provinces.

By 11pm yesterday, the deluge killed a 27-year-old woman and her two children residing in Mong Duong ward of Cam Pha city, local authorities said.

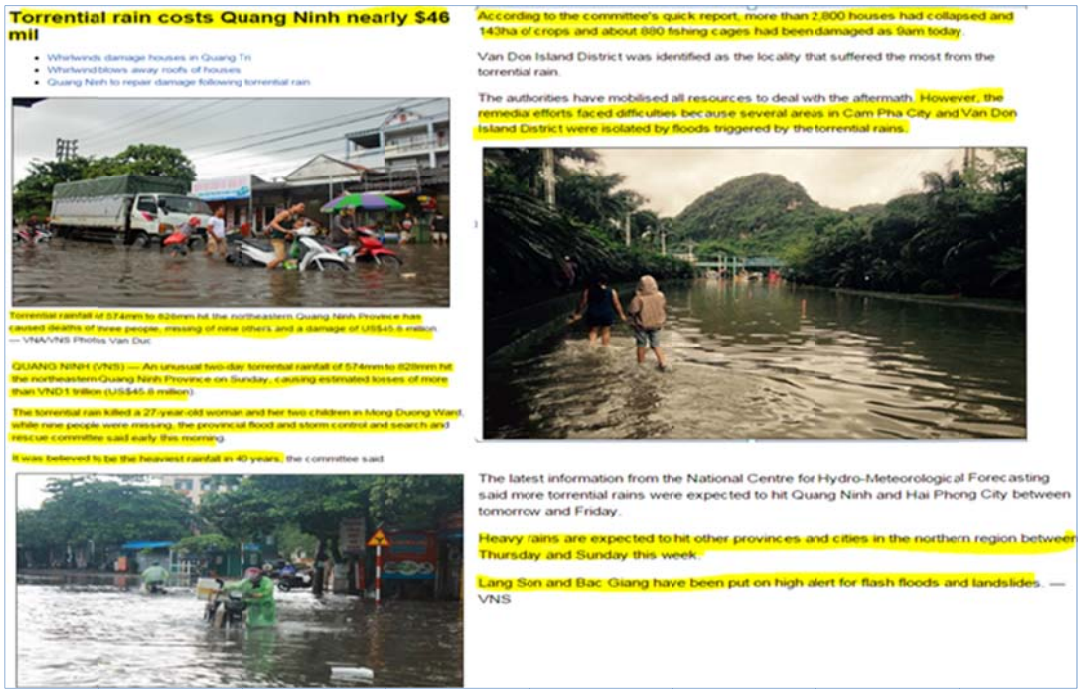
The rain also flooded hundreds of houses, roads, and caused landslides in some districts.

The local authorities, in collaboration with the army, moved hundreds of households to safe places.

Also, Deputy chairman of the People's Committee Nguyen Duc Long went to the flooded areas to monitor conditions and deal with the damage.

According to the report from local authorities the rainfall in Cam Pha township inundated many areas, such as National Road 18A and Cam Phu, Cam Son and Mong Duong wards, where water reached as high as the second floor of some houses.

Source: Viet News online on 27 July 2015



Torrential rain costs Quang Ninh nearly $46 mil

- Whirlwinds damage houses in Quang Tri
- Whirlwind blows away roofs of houses
- Quang Ninh to repair damage following torrential rain

Torrential rainfall of 574mm to 628mm hit the northeastern Quang Ninh Province has caused deaths of three people, missing of nine others and a damage of US$45.6 million — VNA/VNS Photo Van Duc

QUANG NINH (VNS) — An unusual two-day torrential rainfall of 574mm to 628mm hit the northeastern Quang Ninh Province on Sunday, causing estimated losses of more than VND1 trillion (US$45.6 million).

The torrential rain killed a 27-year-old woman and her two children in Mong Duong Ward, while nine people were missing, the provincial flood and storm control and search and rescue committee said early this morning.

It was believed to be the heaviest rainfall in 40 years, the committee said.

According to the committee's quick report, more than 2,800 houses had collapsed and 143ha of crops and about 800 fishing cages had been damaged as 9am today.

Van Don Island District was identified as the locality that suffered the most from the torrential rain.

The authorities have mobilised all resources to deal with the aftermath. However, the remedia efforts faced difficulties because several areas in Cam Pha City and Van Don Island District were isolated by floods triggered by the torrential rains.

The latest information from the National Centre for Hydro-Meteorological Forecasting said more torrential rains were expected to hit Quang Ninh and Hai Phong City between tomorrow and Friday.

Heavy rains are expected to hit other provinces and cities in the northern region between Thursday and Sunday this week.

Lang Son and Bac Giang have been put on high alert for flash floods and landslides. — VNS

Source: Viet New online News on 28 July 2015

Fifteen die in torrential rain

Fifteen die in...

QUẢNG NINH — Fifteen people died and another seven were missing in torrential rain that lasted for three days in northern Quảng Ninh Province.

The rain, the heaviest downpour in 40 years, totalled 828mm in places. It started in the northeastern part of the province on Sunday and caused over VND1trillion (US$45.8 million) in damage by 2pm yesterday.

The provincial People's Committee yesterday said that more than 2,800 houses had collapsed in the deluge and that 143ha of crops and about 880 fishing pens were swamped with water.

Đào Thu Thanh Hương, a resident in Hạ Long City's Hồng Hà Ward, said, "Electricity is on and off while tap water was cut due to the rain."

The Quảng Ninh Water Supply Company has also been forced to stop supplying tap water to homes in Hạ Long and Cẩm Phả cities for up to a fortnight.

Continues Page 2

Rescuers search for nine members of a family buried in the rubble of their home in Cao Thắng Ward, Hạ Long City. Fifteen people died and another seven are missing after torrential rain that lasted for three days. — VNA/VNS Photo Minh Quyết

... because falling trees and landslides broke the main water-pipe system.

The rain also left about 1,500 tourists stranded on two islands in the East Sea, Cô Tô and Quan Lạn. Most of them were on Cô Tô.

Hoàng Bá Nam, chairman of the People's Committee of Cô Tô, asked hotels and guest houses to give stranded tourists 30 to 50 per cent discounts to help them.

Lê Thành Long, a homestay owner in Cô Tô Island, said 11 tourists were still at his home although they were supposed to leave on Monday. Long said the stranded tourists stayed in his house at no extra cost.

Prime Minister Nguyễn Tấn Dũng yesterday ordered the Ministry of Defence and the Ministry of Public Security to mobilise all available manpower and resources in the province to help local residents fight off adversities caused by the historic torrential rain.

Other ministries and Government agencies were ordered to step up their efforts to restore the province's transport, power and communication infrastructure. They were also charged with the task of cleaning up the aftermath and helping local residents sanitise their houses to prevent disease outbreaks.

Deputy Prime Minister Hoàng Trung Hải yesterday ordered the provincial People's Committee to evacuate people living in areas of high alert for flash floods and landslides.

The committee was also told to provide food and water for households in inundated areas, Hải said.

Fishermen lost in whirlwind

THANH HÓA — Seven fishermen on two fishing boats from central Thanh Hóa Province are reported missing while fishing in the territorial waters of Quảng Ninh Province and Hải Phòng City.

The two vessels are believed to have sunk.

Rescuers continue searching for the missing people. — VNS

Hải also asked the National Committee for Research and Rescue to join hands with the ministries of health and transport to provide assistance.

Chairman of the provincial People's Committee Nguyễn Đức Long yesterday visited a landslide site where nine people were buried in three houses in Hạ Long City's Cao Thắng Ward.

More than 200 soldiers, police, and volunteers helped pull the bodies out.

The authorities have mobilised all resources to deal with the situation, but several areas in Cẩm Phả City and Vân Đồn Island District are still isolated by floods.

About 1,000 families in Cẩm Phả City were evacuated to safe places yesterday afternoon.

The city administration said it would spend VND15 billion (US$ 700,000) on remedial activities.

The latest information from the National Centre for Hydro-Meteorological Forecasting is that more torrential rains are expected in the next two days.

Heavy rains are also expected to blanket other provinces and cities in the northern region until Sunday. — VNS

Source: Vientiane Time News on 29 July 2015

Quảng Ninh cleans up after five-day deluge

QUẢNG NINH — Local authorities and people in Quảng Ninh Province are still trying to clean up the severe damage created by five-days of torrential rain.

To date, 23 people have been reported either dead or missing.

The province has spent a total of VNĐ15 billion (US$740,000) on financial assistance to hundreds of families left homeless by the deluge.

Yesterday, most damaged electricity supplies were reconnected as the provincial power company replaced damaged lines and reinforced transmission stations.

The heavy rains destroyed water supply pipes and flooded several water supply stations in Cẩm Phả and Hạ Long cities. However, continuing rain has presented many problems.

Authorities said it might take one or two weeks for supplies to resume.

Workers have been cleaning up the mess to try an prevent any outbreaks of disease.

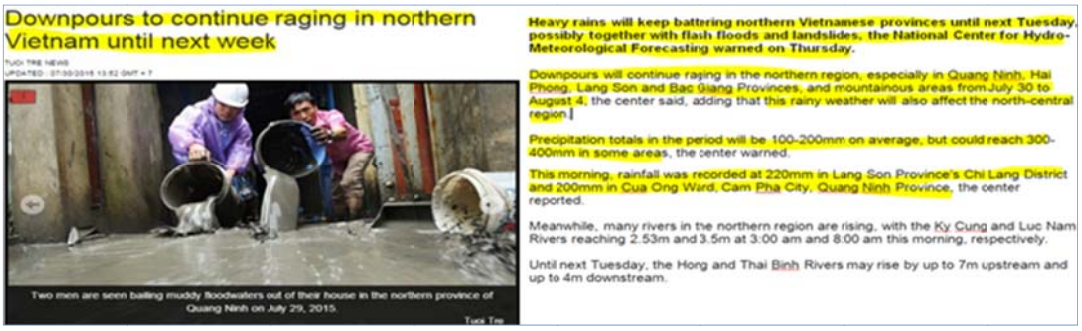
The provincial authority has asked all agencies and residents to help collect waste and debris.

People in Mông Dương Ward of Cẩm Phả City have been told to shift to safe places due to a high risk of landslides and further flooding.

Yesterday, Việt Nam Red Cross donated supplies worth VNĐ160 million ($7,200), to those affected.

The assistance included money, blankets, mosquito nets, water containers and antiseptic medicines. — **VNS**

Source: Vientiane Time News on 30 July 2015



Downpours to continue raging in northern Vietnam until next week

TUOI TRE NEWS

UPDATED : 07/30/2015 13:52 GMT + 7

Two men are seen bailing muddy floodwaters out of their house in the northern province of Quang Ninh on July 29, 2015.

Tuoi Tre

Heavy rains will keep battering northern Vietnamese provinces until next Tuesday, possibly together with flash floods and landslides, the National Center for Hydro-Meteorological Forecasting warned on Thursday.

Downpours will continue raging in the northern region, especially in Quang Ninh, Hai Phong, Lang Son and Bac Giang Provinces, and mountainous areas from July 30 to August 4, the center said, adding that this rainy weather will also affect the north-central region.

Precipitation totals in the period will be 100-200mm on average, but could reach 300-400mm in some areas, the center warned.

This morning, rainfall was recorded at 220mm in Lang Son Province's Chi Lang District and 200mm in Cua Ong Ward, Cam Pha City, Quang Ninh Province, the center reported.

Meanwhile, many rivers in the northern region are rising, with the Ky Cung and Luc Nam Rivers reaching 2.53m and 3.5m at 3:00 am and 8:00 am this morning, respectively.

Until next Tuesday, the Hong and Thai Binh Rivers may rise by up to 7m upstream and up to 4m downstream.

Source: Tuoitrenew5.vn (the news gateway of Viet Nam) on 30 July 2015

North braces for landslides, floods

HÀ NỘI — Heavy rain is forecast to continue in the country's Northeast until at least Saturday night.

"Local authorities must remain vigilant and well prepared to deal with landslides and flooding to ensure the safety of residents," said the head of the Central Steering Committee on Natural Disaster Prevention and Control, Cao Đức Phát, during an online meeting yesterday with regional authorities. Phaut is also Minister of Agriculture and Rural Development.

Hoàng Đức Cường, director of the Centre for Hydro-Meteorological Forecasting, said heavy downpour was expected to continue in Quảng Ninh and Lạng Sơn Provinces until tomorrow.

Heavy rain until Tuesday was also forecast in other provinces, such as Cao Bằng, Bắc Cạn, Hà Giang. Falls could measure 100-300mm.

Landslides and flooding are also expected in lowland cities such as Hải Phòng, Nam Định and Thái Bình, which have already been drenched. At the weekend, floodwaters in neighbouring Quanh Ninh Province wrecked the water-supply system and killed many householders.

Water level in the Hồng-Thái Bình Rivers System is forecast to rise by two to seven metres as the rain continues.

Chairman of the Quảng Ninh People's Committee, Nguyễn Đức Long, said all available manpower and resources were dealing with damage caused by the historic rain.

The chairman said Quảng Ninh authorities had ordered the evacuation of all local residents in areas with high-probability of landslides and established round-the-clock disaster controls.

Lê Thị Thanh Nhàn, director of the Lạng Sơn Department of Agriculture and Rural Development, said the province was compiling a list of areas prone to flash flooding and landslides to plan evacuations if necessary. The province also reported that a 10-year-old went missing during a flood in Chi Lăng District, 350ha of agricultural crops destroyed and numerous roads damaged.

Minister Phát urged local authorities to ensure the safety of people, especially those living beside rivers and streams and areas prone to landslides. — **VNS**

Source: Viet Nam News on 31 July 2015

Lao Cai urgently evacuates residents from danger zones

A landslide occurred in Lao Cai Province due to heavy rainfall. — Photo vov.vn

LAO CAI (VNS) — The chairman of the People's Committee of this northern province has directed authorities in its cities and districts at risk of flash floods and landslides to immediately evacuate all residents.

Nearly 200 households in 75 communes located in the danger zone of potential disasters need to be relocated.

To restrict the damage to people and propety, the chairman today asked the disaster prevention board in various localities to closely monitor weather changes and immediately move people out of the danger zones, especially in areas near rivers and streams.

In addition, local residents have been advised to quickly harvest their crops to minimise losses due to natural disasters.

To ensure the people's safety, the local authorities also need to direct forces that will guide people away from dangerous areas such as flooded roads and roads cutting across streams and wharfs.

Irrigation systems have also been strengthened.

In addition, the chairman requested the board on disaster prevention and search and rescue teams, including soldiers and police, to prepare for emergencies and coordinate with local forces to evacuate local residents, implement measures to prevent flooding and initiate rescue efforts, if necessary.

He also asked transport and construction departments to check on units under construction along rivers and streams to remind them to relocate their camps to safer places and to adopt plans to ensure smooth traffic on the main escape routes, in addition to preparing vehicles and facilities to cope with the storms. — VNS

Source: Viet Nam News on 31 July 2015

Provinces prepare for heavy rain

Provinces prepare...

From Page 1

...of Defence, said that the flood had forced coal mines in the province to halt operations. Anh said that it would likely take one to three months to fix the damage.

As of yesterday, water in Bản Sen Commune in Vân Đồn District had fallen, but in the low-lying area where there are 27 households, it is still 6 metres in depth. District authorities are continuing to supply them with food and clean water.

Chairman Long asked the district to make plans for new residential quarters for local residents and said the water system must be repaired no later than next Wednesday.

The National Steering Committee for Flood and Storm Prevention and Control said yesterday that, so far, 17 people had died and eight were injured in Quảng Ninh Province.

Nearly 4,000 houses were submerged and collapsed, while thousands of hectares of rice and farm produce were destroyed.

The total loss is estimated at VNĐ1.5 trillion (US$68.8 million).

In the northeastern province of Tuyên Quang, authorities have asked its districts to monitor the flood and give timely warnings to local residents, especially those living near rivers, streams, dams and mountains.

Districts must make plans evacuating areas at high risk of flash floods and landslides, specifying that workers should be posted at wharfs, flooded roads and smaller stream and river crossings to assist local residents.

In Lào Cai Province, the chairman of the People's Committee sent a more urgent message directing authorities in cities and districts in high risk areas to quickly move all local residents to safe places. Nearly 200 households in 75 communes are in danger areas and need relocating now.

To reduce damage to property, the chairman today asked other local residents to try to harvest crops quickly to minimise losses.

In addition, the chairman also requested disaster prevention boards, search and rescue teams, soldiers and police to prepare for emergencies and to co-ordinate with local forces.

He also asked transport and construction departments to check up on and remind units at construction sites along rivers and streams to relocate their camps to safe places. He asked for their assistance in ensuring smooth traffic on the main routes.

During the Government's monthly meeting yesterday, the cabinet members pointed out emerging challenges in need of urgent attention.

They expressed concerns over the difficulties facing the agriculture and aquaculture sectors as a result of natural disasters such as droughts and flooding, as well as obstacles facing certain enterprises and people living in mountainous and underprivileged areas that are highly vulnerable to natural disasters. — VNS

Source: Viet Nam News on 1 August 2015

Deadly floods bombard northern region

Severe rainstorms have killed 20 people over the last week in an unpredcted natural disaster

HÀ NỘI — Continuous torrential rains and floods over the weekend have left three people dead and six injured in the northern mountainous provinces of Điện Biên, Lai Châu, Sơn La and Lào Cai. The natural calamity also resulted in the collapse and submergence of hundreds of houses in the northern region.

Earlier, 17 others died and eight were injured in Quảng Ninh Province due to torrential rains that started on July 26 and became the province's worst disaster in the last 40 years.

The Office of the National Steering Committee on Disaster Prevention and Control reported yesterday that besides the aforesaid losses, nearly 2,500 hectares of rice and 680 hectares of other cultivated crops were also submerged, more than 11,500 heads of cattle and poultry have died. About 11 kilometres of canals, six reservoirs and 64 small irrigation systems have been destroyed while various transport systems are facing the brunt of landslides with a total of 120,500 cubic metres of soils and stones piling on these systems.

Risks of flash floods and landslides have prompted the need to raise awareness regarding residents' safety. Bắc Kạn and Lào Cai provinces have taken proactive steps and evacuated more than 107 households in risky areas to safer places.

Continued Page 2

Residents of Tuần Giáo District in Điện Biên Province wade through water to look for furniture that washed away. The district's preliminary estimate of its losses has climbed to about VNĐ110 billion (US$5 million). — VNA/VNS Photo Chu Quốc Hùng

Deadly floods...

From Page 1

Torrential rains also submerged streets and residential areas yesterday, causing heavy traffic jams in cities and provinces of Hà Nội, Hải Dương, Nam Định and Thái Bình.

In the meantime, the province of Quảng Ninh which has remained submerged for a week now, continued to suffer from incessant rain.

More than 500 households in Quảng Ninh's Uông Bí City have remained inundated since yesterday morning. Meanwhile, flood waters rose high and went over the dams in Thượng Yên Công Commune of Uông Bí City, isolating it completely.

Facing a serious situation, authorities of Uông Bí City had to ask the provincial People's Committee for permission to breach the city's key spillway of Sinh River's dam to release water.

"The breaking of the spillway will not affect residents or cause inundation of other areas as water will flow to Đá Bạc reservoir and flow along the big stream," Chairman of the city's People's Committee, Nguyễn Anh Tú, told Dân trí online newspaper.

He also said that the city had decided to buy an additional two lifeboats to rescue people in the affected areas. More than 5,000 people have been mobilised in the city to join in the search and rescue operations.

Meanwhile, all 3,400 people, including stranded tourists and local residents in Quảng Ninh Province's Cô Tô Island, had been brought back to the shore safely by last Saturday.

PM's instructions

In an urgent notice issues yesterday by the Prime Minister, municipal and provincial authorities, ministries and agencies were instructed to implement recovery efforts, including search-and-rescue, food and necessity provisions for affected households, monitoring of landslide and flood-prone areas, and deployment of medical staff for environmental clean-up and epidemic prevention.

The National Committee for Search and Rescue, the Ministry of National Defence and the Ministry of Public Security were asked to direct their units stationed in affected areas to support local residents in the wake of the disaster.

The Ministry of Agriculture and Rural Development is to assist localities with safely operating dams, draining water and protecting agriculture production.

The Ministry of Transport is responsible for ensuring smooth traffic flow along national highways and dealing with possible incidents on major roads.

In collaboration with the Ministry of Labour, Invalids and Social Affairs, the Ministry of Industry and Trade has been asked to come up with a plan to help workers at the Việt Nam National Coal-Mineral Industries Group in resuming work.

More rains to come

According to the National Centre for Hydro-Meteorological Forecasting, moderate-to-heavy rains will continue until tomorrow.

Floods will also occur in the Red River and Thái Bình River system, with a height of up to three to five metres.

There is a high risk of flash floods and landslides in the northern provinces of Quảng Ninh, Hà Giang, Tuyên Quang, Lào Cai, Yên Bái, Phú Thọ, Lai Châu, Điện Biên, Sơn La and Hòa Bình.

Low-lying areas in Quảng Ninh, Hải Phòng, Thái Bình and Nam Định are vulnerable to inundation.

The centre has also forecast three to four spells of hard and medium rains in the north in August as it is normally the main rainy season in the region. It has warned about risks of flash floods and landslides, especially in mountainous areas.

The central region s forecast to have one to two spells of heat but not on a large scale and ones that will not last long as had happened in July. Drought may still happen in some areas in the Central and the South, the centre said.

Lack of electricity

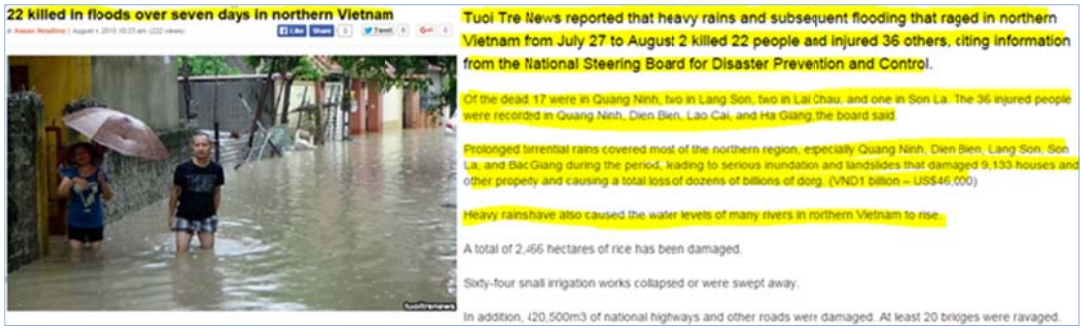
In another news, the Electricity of Việt Nam (EVN) has warned of a possible power shortage since coal mining has been halted currently due to torrential rains and floods.

The announcement came after the Việt Nam National Coal and Mineral Industries Group (TKV) said the supply of coal may run out while the transportation of coal was stopped due to the rains.

According to EVN, the main source of coal supply from Quảng Ninh, which has the biggest reserves of coal in the country, is now inundated. The Quảng Ninh Thermo Power Plant is reported to have just enough coal to keep running for seven more days. The Uông Bí Thermo Power Plant, however, still has coal to run for 20 days.

The EVN called upon people throughout the country to economise the consumption of electricity to reduce pressure on power supply. — VNS

Source: Viet Nam News on 3 August 2015



22 killed in floods over seven days in northern Vietnam

Tuoi Tre News reported that heavy rains and subsequent flooding that raged in northern Vietnam from July 27 to August 2 killed 22 people and injured 36 others, citing information from the National Steering Board for Disaster Prevention and Control.

Of the dead 17 were in Quang Ninh, two in Lang Son, two in Lai Chau, and one in Son La. The 36 injured people were recorded in Quang Ninh, Dien Bien, Lao Cai, and Ha Giang, the board said.

Prolonged torrential rains covered most of the northern region, especially Quang Ninh, Dien Bien, Lang Son, Son La, and Bac Giang during the period, leading to serious inundation and landslides that damaged 9,133 houses and other property and causing a total loss of dozens of billions of dong. (VND1 billion = US$46,000)

Heavy rains have also caused the water levels of many rivers in northern Vietnam to rise.

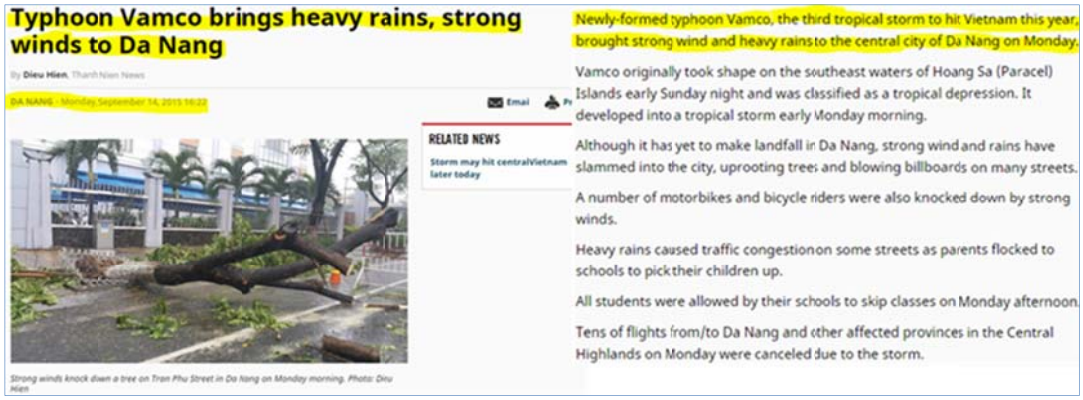
A total of 2,466 hectares of rice has been damaged.

Sixty-four small irrigation works collapsed or were swept away.

In addition, 420,500m3 of national highways and other roads were damaged. At least 20 bridges were ravaged.

Source: Thai PBS NEWS on August 4, 2015

During the tropical storm VAMCO from 13 to 17 September 2015



Typhoon Vamco brings heavy rains, strong winds to Da Nang

By Dieu Hien, Thanh Nien News

DA NANG - Monday, September 14, 2015 16:22

RELATED NEWS

Storm may hit central Vietnam later today

Strong winds knock down a tree on Tran Phu Street in Da Nang on Monday morning. Photo: Dieu Hien

Newly-formed typhoon Vamco, the third tropical storm to hit Vietnam this year, brought strong wind and heavy rains to the central city of Da Nang on Monday.

Vamco originally took shape on the southeast waters of Hoang Sa (Paracel) Islands early Sunday night and was classified as a tropical depression. It developed into a tropical storm early Monday morning.

Although it has yet to make landfall in Da Nang, strong wind and rains have slammed into the city, uprooting trees and blowing billboards on many streets.

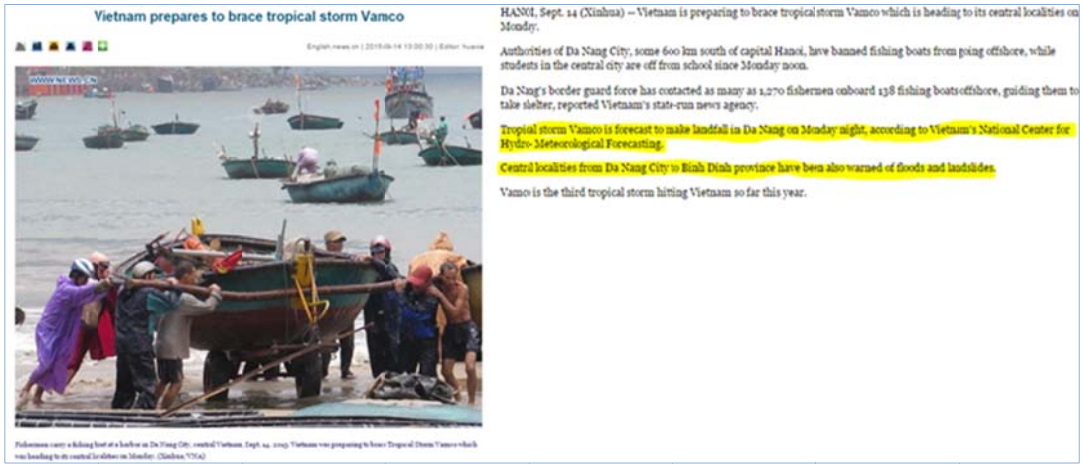
A number of motorbikes and bicycle riders were also knocked down by strong winds.

Heavy rains caused traffic congestion on some streets as parents flocked to schools to pick their children up.

All students were allowed by their schools to skip classes on Monday afternoon.

Tens of flights from/to Da Nang and other affected provinces in the Central Highlands on Monday were canceled due to the storm.

Source: Thanhnien News on 14 September 2015



Vietnam prepares to brace tropical storm Vamco

HANOI, Sept. 14 (Xinhua) -- Vietnam is preparing to brace tropical storm Vamco which is heading to its central localities on Monday.

Authorities of Da Nang City, some 600 km south of capital Hanoi, have banned fishing boats from going offshore, while students in the central city are off from school since Monday noon.

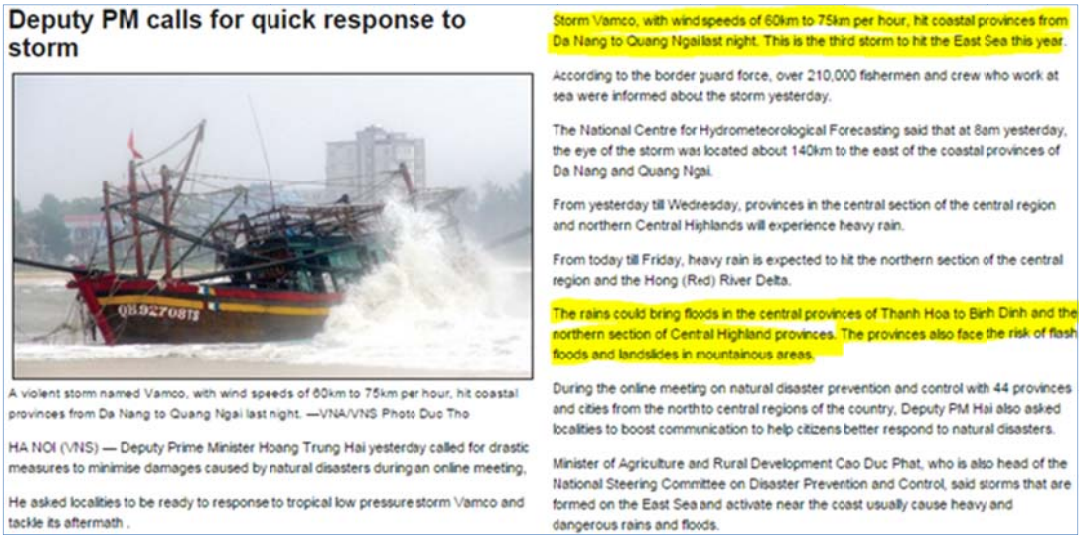
Da Nang's border guard force has contacted as many as 1,270 fishermen onboard 138 fishing boats offshore, guiding them to take shelter, reported Vietnam's state-run news agency.

Tropical storm Vamco is forecast to make landfall in Da Nang on Monday night, according to Vietnam's National Center for Hydro-Meteorological Forecasting.

Central localities from Da Nang City to Binh Dinh province have been also warned of floods and landslides.

Vamco is the third tropical storm hitting Vietnam so far this year.

Source: Xinhuanet News on 14 September 2015



Deputy PM calls for quick response to storm

A violent storm named Vamco, with wind speeds of 60km to 75km per hour, hit coastal provinces from Da Nang to Quang Ngai last night. —VNA/VNS Photo Duc Tho

HA NOI (VNS) — Deputy Prime Minister Hoang Trung Hai yesterday called for drastic measures to minimise damages caused by natural disasters during an online meeting.

He asked localities to be ready to response to tropical low pressure storm Vamco and tackle its aftermath .

Storm Vamco, with wind speeds of 60km to 75km per hour, hit coastal provinces from Da Nang to Quang Ngai last night. This is the third storm to hit the East Sea this year.

According to the border guard force, over 210,000 fishermen and crew who work at sea were informed about the storm yesterday.

The National Centre for Hydrometeorological Forecasting said that at 8am yesterday, the eye of the storm was located about 140km to the east of the coastal provinces of Da Nang and Quang Ngai.

From yesterday till Wednesday, provinces in the central section of the central region and northern Central Highlands will experience heavy rain.

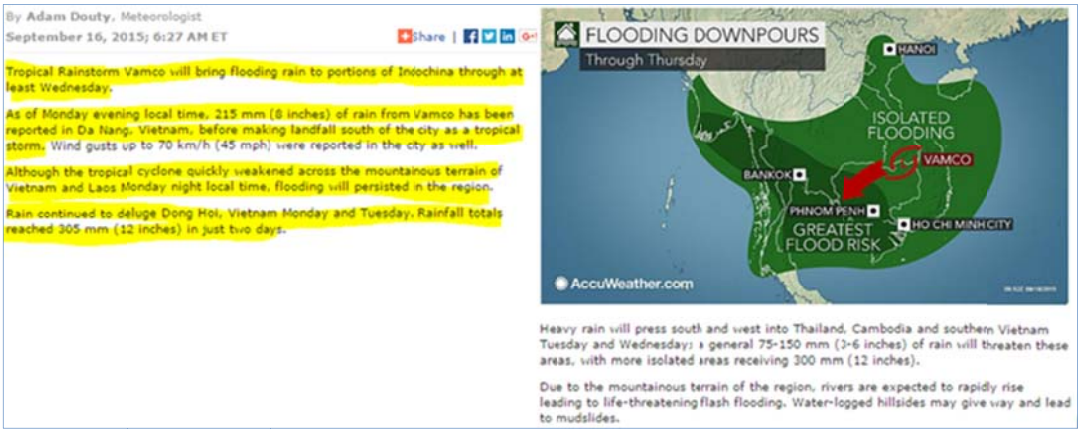
From today till Friday, heavy rain is expected to hit the northern section of the central region and the Hong (Red) River Delta.

The rains could bring floods in the central provinces of Thanh Hoa to Binh Dinh and the northern section of Central Highland provinces. The provinces also face the risk of flash floods and landslides in mountainous areas.

During the online meeting on natural disaster prevention and control with 44 provinces and cities from the north to central regions of the country, Deputy PM Hai also asked localities to boost communication to help citizens better respond to natural disasters.

Minister of Agriculture and Rural Development Cao Duc Phat, who is also head of the National Steering Committee on Disaster Prevention and Control, said storms that are formed on the East Sea and activate near the coast usually cause heavy and dangerous rains and floods.

Source: Viet Nam News on 15 September 2015



By Adam Douty, Meteorologist
September 16, 2015; 6:27 AM ET

Tropical Rainstorm Vamco will bring flooding rain to portions of Indochina through at least Wednesday.

As of Monday evening local time, 215 mm (8 inches) of rain from Vamco has been reported in Da Nang, Vietnam, before making landfall south of the city as a tropical storm. Wind gusts up to 70 km/h (45 mph) were reported in the city as well.

Although the tropical cyclone quickly weakened across the mountainous terrain of Vietnam and Laos Monday night local time, flooding will persisted in the region.

Rain continued to deluge Dong Hoi, Vietnam Monday and Tuesday. Rainfall totals reached 305 mm (12 inches) in just two days.

Heavy rain will press south and west into Thailand, Cambodia and southern Vietnam Tuesday and Wednesday. In general 75-150 mm (3-6 inches) of rain will threaten these areas, with more isolated areas receiving 300 mm (12 inches).

Due to the mountainous terrain of the region, rivers are expected to rapidly rise leading to life-threatening flash flooding. Water-logged hillsides may give way and lead to mudslides.

Source: AccuWeather on 16 September 2015

Tropical Storm Vamco Swamps Heart of Vietnam

September 18, 2015

Central Vietnam was drenched when minimal Tropical Storm Vamco moved ashore from the South China Sea, near Da Nang.

Winds of up to 40 mph and heavy downpours uprooted trees and billboards on many of that city's streets.

Thanh Nien News reports that a number of motorbikes and bicycle riders were also knocked down.

Da Nang was also swamped with more than 12 inches of rainfall during the three days that Vamco's spiraling bands raked the city.

There were reports of flash flooding and mudslides that blocked roads in mountainous areas of Quang Nam province, but officials said there was no major damage.

Tropical Storm Vamco Track

Satellite Loop Data: CIMSS

Poorly organized Tropical Storm Vamco can be seen spinning into the coast of central Vietnam on Monday.

Source: Earthweek on 18 September 2015

Floods destroy crops in Thanh Hóa

THANH HÓA – Prolonged floods have destroyed large areas of vegetable crops in central Thanh Hóa Province.

At least 50ha of crops in Như Xuân District have been waterlogged, while Thanh Lâm Commune villages are cut off by floods.

Offices, health centres and schools in Tĩnh Gia District have been closed temporarily.

Quan Sơn Township was also cut off. The movement of traffic has been seriously affected due to the rising waters of the Lo River and several landslides on the national highway.

The average rainfall was more than 200mm, the department said, with Tĩnh Gia District, Cửa Đạt and Bát Mọt in Thường Xuân District receiving the largest amounts of 260mm, 250mm and 236mm, respectively.

There was continuous rainfall from Tuesday till yesterdayday morning. — VNS

Source: Viet Nam News on 19 September 2015

HCM City struggles to cope with record rainfall, floods

Floodwater hits HCM City's Nguyễn Hữu Cảnh Road in Bình Thạnh District, submerging hundreds of vehicles The city continues to be submerged due to ineffective anti-flooding infrastructure. — VNA/VNS Photo Mạnh Linh

HCM CITY — Heavy rain continued to flood parts of southern HCM City last Saturday as the city's billion dollars worth of anti-flooding infrastructure could not drain the water out fast enough.

Đỗ Tấn Long, a senior official from the HCM City Anti-Flooding Center said the city's sewage systems, which was designed originally for rainfall of 86mm failed to deal with this year's rain, which is the highest recorded level by far at 142 mm.

Numerous streets of HCM City, the country's largest economic hub, turned into rivers in the span of three hours after torrential rain battered the city last Tuesday.

Continued Page 2

HCM City struggles...

From Page 1

Thousands of the city's residents could not go home due to traffic jams and floods.

Traffic jams occurred at many junctions throughout the city, especially at Bình Thạnh District where thousands of vehicles formed a 5km line.

Motorbike drivers had to push their engine-dead vehicles under the rain and rising water. The water level was reported to be as high as 1m at several locations.

Long said that the city's sewage systems, which were built in 2005, are no longer able to handle such a large amount of water within such a short amount of time on top of rising tides of nearby rivers.

He added that the city will continue with its anti-flooding effort by upgrading the current sewage system, which stretches over 200km in length throughout the city, various dredge canals and building at least three more reservoirs in the next five years to effectively end flooding in the city's 13 urban districts.

Experts, however, had little confidence in the city's anti-flooding plan. Asst. Prof Hồ Long Phi, Director of Centre for Water Management and Climate Change under the Việt Nam National University-HCM City told the *Thanh Niên* (Youth) newspaper that the proposed projects with an estimated cost of VND11 trillion (US$ 480 million) barely covered one-fifth of the required investment to put a stop to flooding.

They also brought up the issue of real-estate developers' responsibility to help combat against flooding as rapid expansion of concrete in urban areas has been determined as one of the leading causes of flooding after heavy rains.

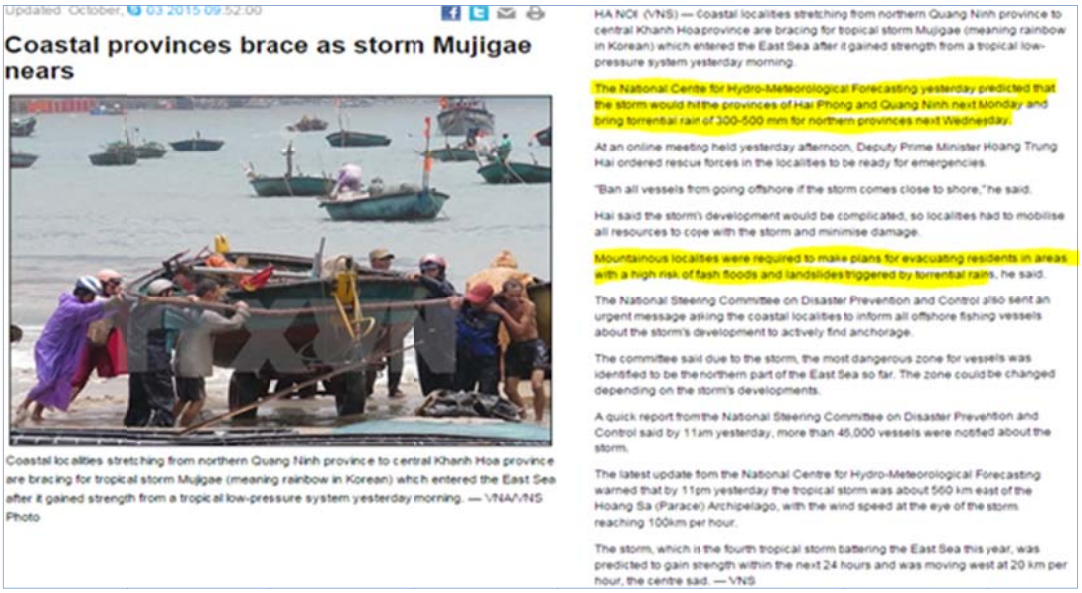
Meanwhile, in central province of Thanh Hóa, the water level on the Bưởi River was reported to reach 12.05m on Saturday.

The province reported two deaths, nearly two thousand houses and more than 7,600ha of agricultural lands flooded.

To date, damage was estimated at $9 million. Three thousand households and 700ha of rice fields ready for harvest along the Bưởi River were still at risk as heavy rains were expected to hit the North this week. — VNS

Source: Viet Nam News on 21 September 2015

During the tropical storm MUJIGAE from 2 to 5 October 2015



Updated: October, 03 2015 09:52:00

Coastal provinces brace as storm Mujigae nears

Coastal localities stretching from northern Quang Ninh province to central Khanh Hoa province are bracing for tropical storm Mujigae (meaning rainbow in Korean) which entered the East Sea after it gained strength from a tropical low-pressure system yesterday morning. — VNA/VNS Photo

HA NOI (VNS) — Coastal localities stretching from northern Quang Ninh province to central Khanh Hoaprovince are bracing for tropical storm Mujigae (meaning rainbow in Korean) which entered the East Sea after it gained strength from a tropical low-pressure system yesterday morning.

The National Cente for Hydro-Meteorological Forecasting yesterday predicted that the storm would hitthe provinces of Hai Phong and Quang Ninh next Monday and bring torrential rain of 300-500 mm for northern provinces next Wednesday.

At an online meeting held yesterday afternoon, Deputy Prime Minister Hoang Trung Hai ordered rescue forces in the localities to be ready for emergencies.

"Ban all vessels from going offshore if the storm comes close to shore," he said.

Hai said the storm's development would be complicated, so localities had to mobilise all resources to cope with the storm and minimise damage.

Mountainous localities were required to make plans for evacuating residents in areas with a high risk of flash floods and landslides triggered by torrential rains, he said.

The National Steering Committee on Disaster Prevention and Control also sent an urgent message asking the coastal localities to inform all offshore fishing vessels about the storm's development to actively find anchorage.

The committee said due to the storm, the most dangerous zone for vessels was identified to be the northern part of the East Sea so far. The zone could be changed depending on the storm's developments.

A quick report from the National Steering Committee on Disaster Prevention and Control said by 11am yesterday, more than 46,000 vessels were notified about the storm.

The latest update from the National Centre for Hydro-Meteorological Forecasting warned that by 11pm yesterday the tropical storm was about 560 km east of the Hoang Sa (Parace) Archipelago, with the wind speed at the eye of the storm reaching 100km per hour.

The storm, which is the fourth tropical storm battering the East Sea this year, was predicted to gain strength within the next 24 hours and was moving west at 20 km per hour, the centre said. — VNS

Source: Viet Nam News on 2 October 2015

Coastal provinces brace as storm *Mujigae* nears

HÀ NỘI — Coastal localities stretching from northern Quảng Ninh province to central Khánh Hòa province are bracing for tropical storm ***Mujigae*** (meaning rainbow in Korean) which entered the East Sea after it gained strength from a tropical low-pressure system yesterday morning.

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Source: Viet Nam News on 3 October 2015

Rain forecast for northeast region as storm Mujigae hits China peninsu

VNA SUNDAY, OCTOBER 04, 2015 - 18:03:46 PRINT

RELATED NEWS

Coastal provinces brace as storm Mujigae nears

Tropical storm Mujigae enters East Sea

Moderate-to-heavy rain is forecast to pour down in northeast Vietnam from Oct. 4 evening (Photo: VNA)

Moderate-to-heavy rain is forecast to pour down in the northeast and northern mountainous areas of Vietnam from October 4 evening as tropical storm Mujigae (meaning rainbow in Korean) made landfall in the north of China's Leizhou Peninsula in the afternoon.

Particularly, Quang Ninh, Lang Son, and Cao Bang provinces need to brace for flashfloods and landslides, according to the National Centre for Hydro-Meteorological Forecasting.

Storm Mujigae, the fourth tropical storm battering the East Sea this year, is predicted to move west northwest in the next 12 hours, about 20km per hour.

In the following 12-24hours, the storm is forecast to move west north and then north northwest at a wind speed of about 10-15km per hour into the mainland, then weakening into a tropical depression.

By 1pm on October 5 the centre of the tropical depression is predicted to be 23.8 degrees north and 107.9 degrees east in the southern part of China's Guangxi province. The maximum wind speed is estimated at 40km per hour.

Given the forecast, the northern province of Quang Ninh decided to stop temporarily all cruise ships from staying overnight on sea and those carrying passengers to Ha Long and Bai Tu Long bays, Van Don and Co To island districts, from October 4.

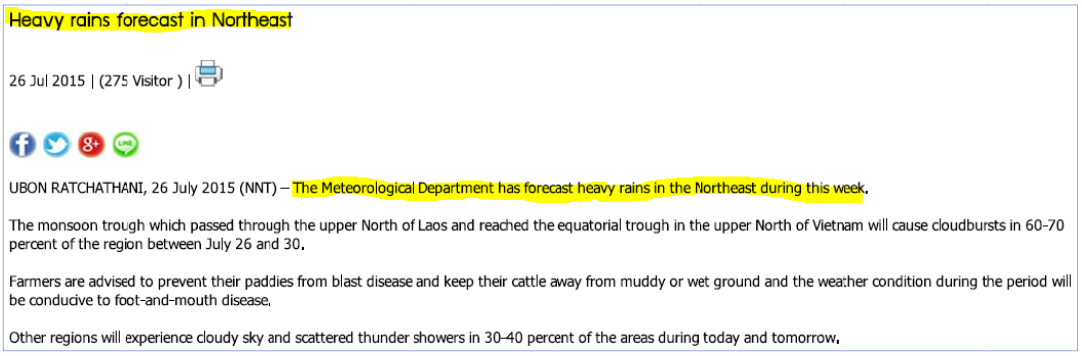
Meanwhile, the Chairman of the Hai Phong municipal People's Committee sent a notice requesting local authorities to promptly inform fishermen about the position movement, and development of the storm, while closely monitoring ships operating at sea.

The city's steering committee for disaster prevention, search and rescue is responsible for setting time for banning vessels from going offshore and halting domestic marine transportation./VNA

Source: VietnamPlus on 4 October 2015

Appendix 1.2 Thailand

During the heavy monsoon rains and tropical storm KOMEN from 26 July to 6 August 2015



Heavy rains forecast in Northeast

26 Jul 2015 | (275 Visitor) |

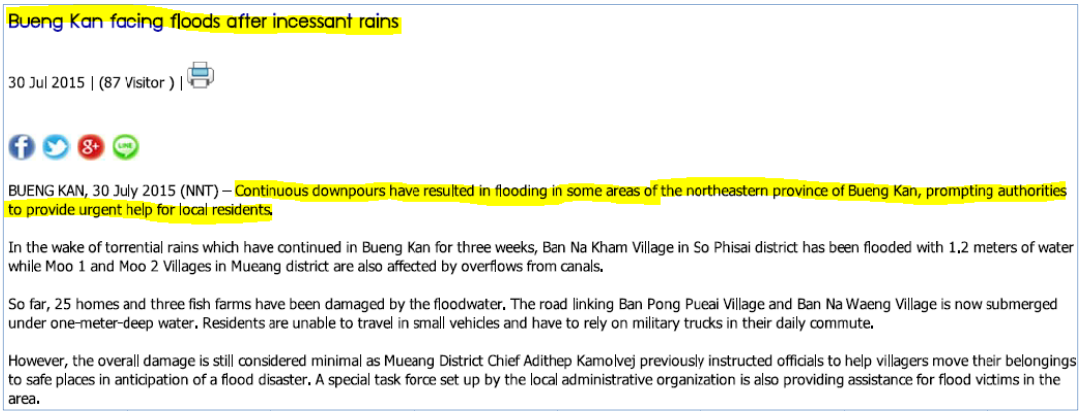
UBON RATCHATHANI, 26 July 2015 (NNT) – The Meteorological Department has forecast heavy rains in the Northeast during this week.

The monsoon trough which passed through the upper North of Laos and reached the equatorial trough in the upper North of Vietnam will cause cloudbursts in 60-70 percent of the region between July 26 and 30.

Farmers are advised to prevent their paddies from blast disease and keep their cattle away from muddy or wet ground and the weather condition during the period will be conducive to foot-and-mouth disease.

Other regions will experience cloudy sky and scattered thunder showers in 30-40 percent of the areas during today and tomorrow.

Source: National News Bureau of Thailand on 26 July 2015



Bueng Kan facing floods after incessant rains

30 Jul 2015 | (87 Visitor) |

BUENG KAN, 30 July 2015 (NNT) – Continuous downpours have resulted in flooding in some areas of the northeastern province of Bueng Kan, prompting authorities to provide urgent help for local residents.

In the wake of torrential rains which have continued in Bueng Kan for three weeks, Ban Na Kham Village in So Phisai district has been flooded with 1.2 meters of water while Moo 1 and Moo 2 Villages in Mueang district are also affected by overflows from canals.

So far, 25 homes and three fish farms have been damaged by the floodwater. The road linking Ban Pong Pueai Village and Ban Na Waeng Village is now submerged under one-meter-deep water. Residents are unable to travel in small vehicles and have to rely on military trucks in their daily commute.

However, the overall damage is still considered minimal as Mueang District Chief Adithep Kamolvej previously instructed officials to help villagers move their belongings to safe places in anticipation of a flood disaster. A special task force set up by the local administrative organization is also providing assistance for flood victims in the area.

Source: National News Bureau of Thailand on 30 July 2015

Friday, July 31st, 2015 | Posted by Editor

Chiang Rai Residents Warned of Flash Floods Due to Heavy Rains

Rainy poring down at the Anantara Hotel Chiang Rai elephant camp

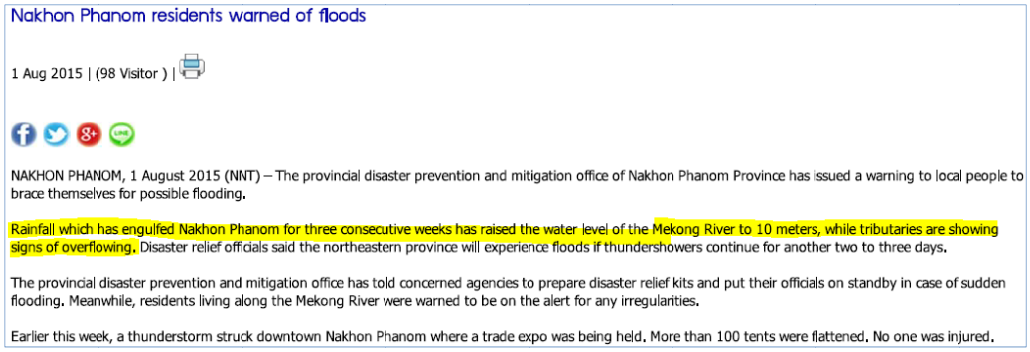
CHIANG RAI – The Meteorological Department has issued warnings for people in Chiang Rai and other Northern Provinces to remain on alert for flash floods, as heavy rain continues in these regions.

According to meteorologists, the monsoon trough is now moving its way across Myanmar and Laos, bringing heavy rain to the upper regions of Thailand.

The southwesterly wind in the Andaman Sea and Gulf of Thailand has also been contributing to a higher amount of rain in the North and Northeast.

Those living in the provinces of Mae Hong Son, Chiang Rai, Tak, Kamphaeng Phet, Udon Thani, Nong Khai, Bueng Kan, Sakon Nakhon and Nakhon Phanom have been told to brace for mudslides and flash floods.

Source: National News Bureau of Thailand on 31 July 2015



Nakhon Phanom residents warned of floods

1 Aug 2015 | (98 Visitor) |

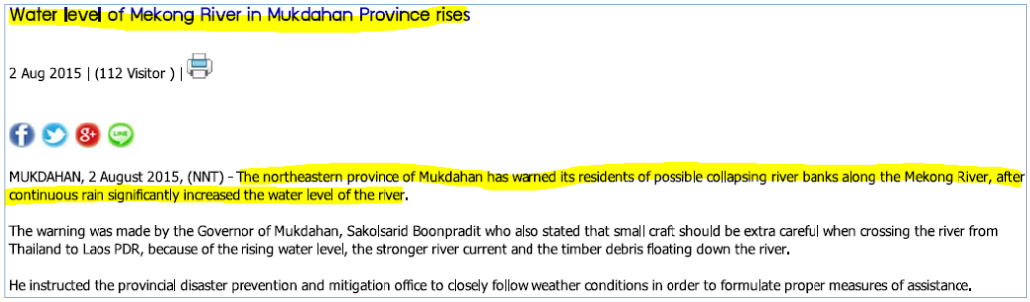
NAKHON PHANOM, 1 August 2015 (NNT) – The provincial disaster prevention and mitigation office of Nakhon Phanom Province has issued a warning to local people to brace themselves for possible flooding.

Rainfall which has engulfed Nakhon Phanom for three consecutive weeks has raised the water level of the Mekong River to 10 meters, while tributaries are showing signs of overflowing. Disaster relief officials said the northeastern province will experience floods if thundershowers continue for another two to three days.

The provincial disaster prevention and mitigation office has told concerned agencies to prepare disaster relief kits and put their officials on standby in case of sudden flooding. Meanwhile, residents living along the Mekong River were warned to be on the alert for any irregularities.

Earlier this week, a thunderstorm struck downtown Nakhon Phanom where a trade expo was being held. More than 100 tents were flattened. No one was injured.

Source: National News Bureau of Thailand on 1 August 2015



Water level of Mekong River in Mukdahan Province rises

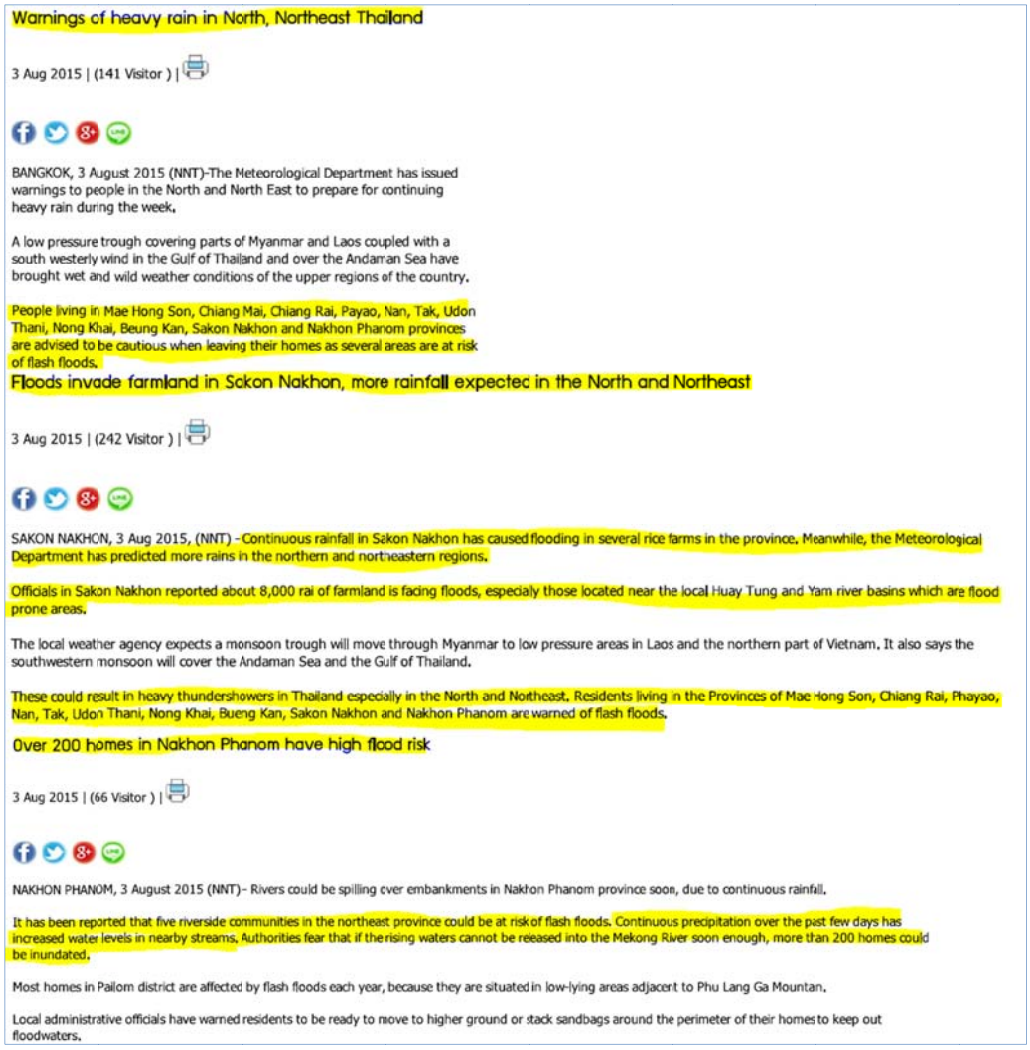
2 Aug 2015 | (112 Visitor) |

MUKDAHAN, 2 August 2015, (NNT) - The northeastern province of Mukdahan has warned its residents of possible collapsing river banks along the Mekong River, after continuous rain significantly increased the water level of the river.

The warning was made by the Governor of Mukdahan, Sakolsarid Boonpradit who also stated that small craft should be extra careful when crossing the river from Thailand to Laos PDR, because of the rising water level, the stronger river current and the timber debris floating down the river.

He instructed the provincial disaster prevention and mitigation office to closely follow weather conditions in order to formulate proper measures of assistance.

Source: National News Bureau of Thailand on 2 August 2015



Warnings of heavy rain in North, Northeast Thailand

3 Aug 2015 | (141 Visitor) |

BANGKOK, 3 August 2015 (NNT)-The Meteorological Department has issued warnings to people in the North and North East to prepare for continuing heavy rain during the week.

A low pressure trough covering parts of Myanmar and Laos coupled with a south westerly wind in the Gulf of Thailand and over the Andaman Sea have brought wet and wild weather conditions of the upper regions of the country.

People living in Mae Hong Son, Chiang Mai, Chiang Rai, Payao, Nan, Tak, Udon Thani, Nong Khai, Beung Kan, Sakon Nakhon and Nakhon Phanom provinces are advised to be cautious when leaving their homes as several areas are at risk of flash floods.

Floods invade farmland in Sckon Nakhon, more rainfall expectec in the North and Northeast

3 Aug 2015 | (242 Visitor) |

SAKON NAKHON, 3 Aug 2015, (NNT) - Continuous rainfall in Sakon Nakhon has caused flooding in several rice farms in the province. Meanwhile, the Meteorological Department has predicted more rains in the northern and northeastern regions.

Officials in Sakon Nakhon reported about 8,000 rai of farmland is facing floods, especialy those located near the local Huay Tung and Yam river basins which are flood prone areas.

The local weather agency expects a monsoon trough will move through Myanmar to low pressure areas in Laos and the northern part of Vietnam. It also says the southwestern monsoon will cover the Andaman Sea and the Gulf of Thailand.

These could result in heavy thundershowers in Thailand especially in the North and Northeast. Residents living in the Provinces of Mae Hong Son, Chiang Rai, Phayao, Nan, Tak, Udon Thani, Nong Khai, Bueng Kan, Sakon Nakhon and Nakhon Phanom are warned of flash floods.

Over 200 homes in Nakhon Phanom have high flood risk

3 Aug 2015 | (66 Visitor) |

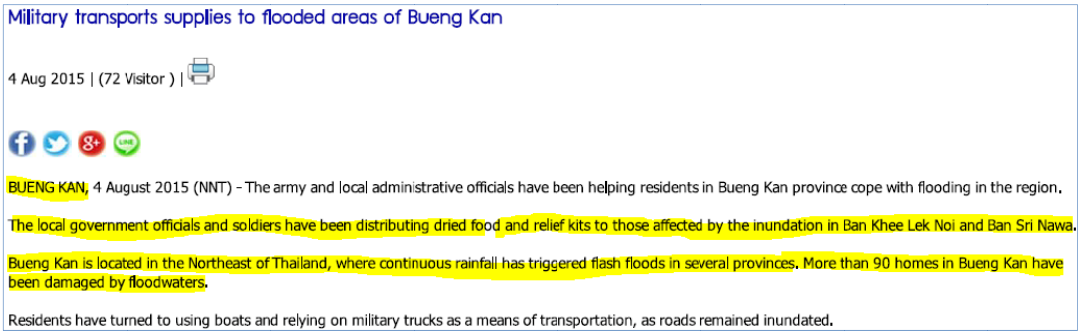
NAKHON PHANOM, 3 August 2015 (NNT)- Rivers could be spilling over embankments in Nakhon Phanom province soon, due to continuous rainfall.

It has been reported that five riverside communities in the northeast province could be at risk of flash floods. Continuous precipitation over the past few days has increased water levels in nearby streams. Authorities fear that if the rising waters cannot be released into the Mekong River soon enough, more than 200 homes could be inundated.

Most homes in Pailom district are affected by flash floods each year, because they are situated in low-lying areas adjacent to Phu Lang Ga Mountan.

Local administrative officials have warned residents to be ready to move to higher ground or stack sandbags around the perimeter of their homes to keep out floodwaters.

Source: National News Bureau of Thailand on 3 August 2015



Military transports supplies to flooded areas of Bueng Kan

4 Aug 2015 | (72 Visitor) |

BUENG KAN, 4 August 2015 (NNT) - The army and local administrative officials have been helping residents in Bueng Kan province cope with flooding in the region.

The local government officials and soldiers have been distributing dried food and relief kits to those affected by the inundation in Ban Khee Lek Noi and Ban Sri Nawa.

Bueng Kan is located in the Northeast of Thailand, where continuous rainfall has triggered flash floods in several provinces. More than 90 homes in Bueng Kan have been damaged by floodwaters.

Residents have turned to using boats and relying on military trucks as a means of transportation, as roads remained inundated.

Source: National News Bureau of Thailand on 4 August 2015

CHIANGRAI TIMES

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Tuesday, August 4th, 2015 | Posted by Editor

Heavy Rains Flood Mae Sai and Tachilek

Flooding on the Thai bank of the Sai River (photo by Chinnapat Chaimol)

CHIANG RAI – After three days of heavy rain in Mae Sai district and Myanmar's Tachilek, floods have spilled into markets on both sides of the Sai River.

Shop owners at the Sailom Joy market on the Mae Sai side of the border, hurriedly moved their merchandise to higher ground as the river level rose about 4.5 meters very quickly.

Floodwater was deeper, about 30 centimeters, at the Tha Lor market in low-lying Tachilek and local authorities feared the water would rise further with the continuing down-pores.

Workers had to remove trapped logs and debris from the pillars of the bridge across the Sai River there to protect its structure.

Abundant rain since last week has made many parts of the Mekong river overflow. In Mae Ngern and Ban Saew sub-districts, farmers have harvested crops urgently after the water flooded their farms.

The water level measured in front of the Chiang Saen district office was 7.30 meters on Tuesday, about one meter higher than the previous day. Riverside residents have been warned to move their belongings to high places and row in the Mekong river with caution.

They have been suggested to closely monitor the water situation during this period.

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River Overflows Flooding Mae Sai-Tachileik Border Areas in Chiang Rai

In September of 2014, Mae Sai's Phahonyothin road, floods left only one traffic lane dry, causing difficulty to and jeopardizing road transportation.

The Chan river in Mae Chan district overflew and caused flooding in the Mae Chan fresh market. More than 500 houses were hit by the flood waters of 30 centimeters to one meter.

Disaster prevention and mitigation officers warned residents in flood-prone areas to brace for overflowing rivers, heavy rains have caused flooding in Chiang Rai especially in Mae Sai and Mae Chan districts.

By Chinnapat Chaimol

Source: ChiangRai Times Provincial and Local News on 4 August 2015

Mae Sai city begins clean up after flood water recedes

5 Aug 2015 | (86 Visitor) |

CHIANG RAI, 5 August 2015 (NNT) – People living in Mae Sai District are now beginning to clean the city, after flooding in the area has receded.

Business operators in Mae Sai District are now beginning to clean their stores, after flood water in the area has receded. Mud and dirt wil have to be taken care of before businesses can resume on both the Thai and Myanmar sides.

The Governor of Chiang Rai Pongsak Wangsamer has assigned the district and local administration to continue to monitor the situation for flash floods in Mae Sai and 18 other districts, such as Mae Fah Luang, Mae Chan, Mae Suai, Wiang Pa Pao, and Chiang Khong.

The public residing along the river areas have been urged to relocate their belongings at high places as a precautionary measure for the time being, as the continuous rains are expected during this time.

The water level in Mae Sai River has already receded down to 2 meters, which is fairly below the critical level of 5 meters.

16 provinces told to brace for flash floods

5 Aug 2015 | (246 Visitor) |

BANGKOK, 5 August 2015 (NNT) - 16 provinces across Thailand have been warned to brace for more heavy rains as monsoons gain strength in the North and South.

A monsoon trough in the North and a southwestern monsoon covering the Gulf of Thailand and the Andaman Sea are set to generate rainstorms in 16 provinces including Chiang Mai, Tak, Nong Khai and Phuket. Flash floods and forest runoffs have been predicted for these provinces and residents advised to exercise extra precaution.

Strong winds in the Andaman Sea will generate up to 3-meter high waves and small boats should be kept ashore.

Typhoon Soudelor is expected to make landfall in China's western coast during August 7-8. Thai travelers planning to visit the area have been urged to closely follow weather updates.

Most parts, up to 70 percent, of Bangkok and its vicinity are set to be lashed with heavy rains and scattered thunder storms. The average temperature is to hover between 25-31 degree.

Flood warnings remain in place for 3 regions

5 Aug 2015 | (68 Visitor) |

BANGKOK, 5 August 2015 (NNT) - Fash flood warnings remain in place for people living in the North, South and Northeast of Thailand, due to continuous rainfall.

According to meteorologists, a low pressure system in the upper parts of Thailand and a southwesterly wind in the Andaman Sea and the Gulf of Thailand have remained in place and are expected to bring heavy rain to the three regions.

Those living in Chiang Mai, Chiang Rai, Phayao, Nan, Phrae, Tak, Phetchabun, Loei, Nong Khai, Bueng Kan, Sakon Nakhon, Nakhon Phanom, Ranong, Phang Nga and Phuket are told to brace for severe weather conditions.

Meanwhile, Typhoon Soudelor, which is moving toward southern China from the Pacific Ocean this Friday, will not have any significant impact on Thailand.

Mekong's water level increases alarmingly

5 Aug 2015 | (130 Visitor) |

CHIANG RAI, 5 August 2015, (NNT) – The Mekong's water level increased alarmingly and damaged farmlands in Chiang Rai. Flood warning has been issued to residents in sub-districts of Mae-ngern, Wiang and Saew in Chiang Saen District.

Farm animals in Chiang Saen were being moved to higher ground. More than 100 ra of chili and corn plantations have been flooded with 2 meters of water, said one of the flood-affected farmers, adding that crops would be obliterated if floods persist for another 3 days.

The water level in the Mekong River in Chiang Saen District increased by 50 centimeters from the early hours of the day and is still rising fast, according to the province's Marine Office, adding that authorities would closely monitor the situation and inform the locals residing along Mekong River immediately at the first sign of danger.

Meanwhile, flash floods occurred in Trat Province's Laem Ngop District after days of continuous rainfalls. Floods submerged 5 residences and several fruit orchards early morning yesterday. Currently, flood water is receding. Officials have already been dispatched to survey the damaged areas, provide assistance to the affected victims, and monitor the situation.

Source: National News Bureau of Thailand on 5 August 2015

NATIONAL

Home » National » Floods hit North, fire in Mae Sai

Floods hit North, fire in Mae Sai

The Nation August 5, 2015 1:00 am

A fire broke out in a commercial building in Nai Boonyeun fresh market in Chiang Rai's Mae Sai district amid rainfal and floods yesterday.

The fire, which caused no njuries, is believed to have stemmed from candles and joss sticks left unattended at a shrine on the second floor. It took two fire engines about half an hour to control the flames and the damages were estimated as Bt500,000.

Meanwhile, Mae Sai residents rushed to fill up sandbags to create flood barriers for their homes and shops as the overflowing Sai River flooded the Sai Lom Joy Market. The Mae Sai-Tachileik Bridge was also close to being flooded, an informed source said yesterday.

Mae Sai district chief Somhai Rungsakhon and mayor Saiyon Srisamut visited the site yesterday.

Meanwhile, in Mae Hon Son's Sop Mei district, the sub-districts of Mae Suad and Mae Sam Lab were cut from the outside world due to heavy rainfall, high floods and a 200-metre-long landslide. In response, officials brought heavy machinery to help clear the roads, provincial disaster prevention and mitigation official Phermwittaya Kanthasong said yesterday.

Separately, Princess Pa Fundation vice president Apai Chandanachulaka presented relief bags to over 400 flood-affected residents at Ban Mae Lui of Mae Suad sub-district, as well as some 140 from nearby villages on behalf of HRH Princess Sonsavali.

In the Northeast, the Mekong River continued to rise closer to the critical point, prompting related agencies at Nakhon Phanom province to call a meeting yesterday to seek measures to tackle possible flooding. About 15,000 rai of farmland in Si Songkhram and Oon river basin areas were already flooded, it was reported yesterday.

Source: National News Online on 5 August 2015

Wednesday, August 5th, 2015 | Posted by Editor

Mae Sai and Tachileik Clean up Mud and Debris after Floods

Businesses on both sides of the Thailand-Myanmar border carried out clean-up operations in marketplaces today

CHIANG RAI – Residents living in Mae Sai and Myanmar's Tachileik province are now beginning to clean their cities after Floods burred both cites in mud and water, Mae Sai municipality remains on high alert.

Business operators in Mae Sai District are now beginning to clean their stores, after flood water in the area has receded. Mud and dirt will have to be taken care of before businesses can resume on both the Thai and Myanmar sides.

The Governor of Chiang RaiPongsak Wangsamer has assigned the district and local administration to continue to monitor the situation for flash floods in Mae Sai and 18 other districts, such as Mae Fah Luang, Mae Chan, Mae Suai, Wiang Pa Pao, and Chiang Khong.

The public residing along the river areas have been urged to relocate their belongings at high places as a precautionary measure for the time being, as the continuous rains are expected during this time.

The water level in Mae Sai River has already receded down to 2 meters, which is fairly below the critical level of 5 meters.
Despite flood waters receding, the Mae Sai district municipality has yet to remove flood walls, warning the locas to stay vigilant. Continued rainfall and high water levels in the Sai River have prompted fears of more flash floods.

The government has been implementing measures to assist flood victims in both Thailand and Myanmar.

meanwhile, The Ministry of Interior has made known that state agencies are prepared to tackle flash floods and landslides in all areas and have been equipped with the necessary tools to assist disaster victims.

Prime Minister General Prayut Chan-o-cha also stated that all provinces should maintain a balance between releasing water to communities and storing water for use during the dry season.

The government earlier announced it is pledging five million baht to flood-stricken Myanmar, where at least 27 people have been killed. Myanmar is in urgent need of water filters, medicine and preserved food.

The Chiang Rai Chamber of Commerce and other private agencies are also collecting donations to send to Thai-Myanmar border authorities to fund disaster mitigation.

Source: ChiangRai Times on 5 August 2015

The Huai Plu Witthayakhom School is flooded on Thursday. (Bangkok Post photo)

About 400 students were evacuated yesterday after flash floods from a heavy downpour blocked the entrance to a school and a road in Chiang Rai. Torrential rainfall in Chiang Rai flooded Huai Plu Witthayakhom School and Mae Fah Luang University in tambon Tha Sut of Muang district yesterday, with water levels reaching as high as 50cm, according Officials from the Chiang Rai Provincial Disaster Prevention and Mitigation Department, soldiers and border patrol police shuttled the 400 students out of the deluge using flat-bottomed boats. No casualties were reported. The school and the university were temporarily closed. The electricity was also cut off to prevent people from being electrocuted. Numerous commuters and broken-down vehicles were also stuck in traffic along 500 metres of flooded Phahon Yothin road. Police and the university's officers pumped floodwater off the road and into the Mae Khao Tom River. Tambon Tha Sut municipality also built sandbag walls in flood-prone areas to try to contain the excess water. Tambon Tha Sut municipality also built sandbag walls in flood-prone areas to try to contain the excess water. Authorities said several days of heavy rainfall triggered the flash floods from Doi San Ton Kok and creeks in Ban Bo Thong, Ban Huai Kian, Ban Si Pa Sang, which inundated many areas in Muang district. The Disaster Prevention and Mitigation Department director-general Chatchai Promlert said if heavy rain falls, residents in the following areas should prepare for the risk of flash floods: Nong Khai, Bung. Waves in the Andaman Sea are likely to reach two to three metres high in upcoming weeks, and ships should proceed with caution while small boats should stay ashore, he added. Meanwhile, the water level in the Mekong River dropped from 7.3 metres to 7.1 metres yesterday, and the water level in the Sai River along the Thai-Myanmar border also fell. Fifteen districts in Sukhothai and Suphan Buri provinces may continue to suffer from drought, Mr Chatchai said.

Source: Bangkok Post News on 7 August 2015

During the tropical storm VAMCO from 13 to 17 September 2015

Floods reported in Nakhon Phanom, water level in Mekon River rises

3 Sep 2015 | 04:57 | (58 Viewer) |

NAKHON PHANOM, 03 September 2015, (NNT) - The northeastern province of Nakhon Phanom is facing a series of flash floods, after heavy rains continue to hammer the area.

Flash floods have reportedly hit Baan Pang District, damaging about 30 homes and 500 rai of rice field. Schools in the district have to temporarily shutdown. Officials have initially been dispatched to help the locals.

Phu Lang Ka National Park has closed its waterfalls to prevent accident.

Meanwhile, in Nong Khai, the level of water in the Mekong River has risen to 6.64 meters, an increase of 42 cm in a short period thanks to the continuous raining; damaging areas on the river banks in Muang Nong Khai District.

As part of flood preventive measures, the Irrigation Office in Udon Thani has dispatched officials to dredge canals in Muang Udon Thani District. However, the amount of rainfall in the province is reportedly 20 percent lower year-on-year. Officials expect the amount of water would only be enough for public consumption after the rainy season is over. They strongly suggested that farmers in the province refrain from doing off-season farming.

Source: National News Bureau of Thailand on 3 September 2015

Rains continue to hammer down the North and Northeast

4 Sep 2015 | 07:44 | (49 Viewer) |

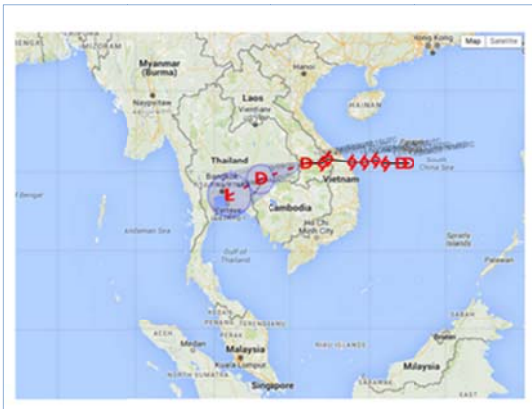
NAN, 04 September 2015, (NNT) - Heavy rain continued to pour in the North and Northeast, increasing Mekong River water levels in Nong Khai and Nakhon Phanom provinces and flooding more than 200 homes in Nan province.

Nan officials distributed drinking water, medicine and leptospirosis vaccines to flood-affected locals in Chiang Klang district. The latest official reports on Thursday showed flood levels were as high 1m. Runoff also damaged more 1,000 rai of farmland.

Several areas in Nong Khai also faced flooding after continuous rain. As much as 200m of Soi Pho Sri 1 and 2 in Mueang district recorded flood levels of 40 - 50cm, cutting off access through both routes.

Repeated rain in Yasothon province has significantly increased water levels behind the province's dam. Officials were forced to release excess water out of the reservoir to maintain balance. The majority of precipitation was reported in Kham Khuan Kaeo, Pa Tiew and Mueang districts.

Source: National News Bureau of Thailand on 4 September 2015



Tropical storm Vamco to bring heavy rain to Thailand

15 Sep 2015 | 09:40 | (408 Viewer) |

BANGKOK, 15 September 2015 (NNT)- It has been forecast that the Northeast of Thailand will experience more rain today until the end of this week as tropical storm Vamco has made landfall in Laos.

According to the Department of Meteorology, the storm, which has recently entered Laos from Vietnam, has the center located only 220 kilometers away from Thailand's Ubon Ratchathani province.

The storm will bring precipitation to the northern provinces of Tak, Kampangpetch, Phichit, Phitsanulok and Petchabun as well as the northeastern provinces of Nakhon Phanom, Mookdahan, Amnaj Charoen, Ubon Ratchathani, Sisaket, Surin, Buriram and Nakhon Ratchasima.

Those living in Nakhon Nayok, Prajinburi, Sakeaw, Chonburi, Chantaburi, Trat, Ranong, Pang Nga and Phuket have also been advised to brace for heavy rain. Bangkok residents will also experience thunderstorms during the same period in most areas of the capital city.

Vamco depression enters Thailand, weakens to thunderstorm

16 Sep 2015 | 06:33 | (125 Viewer) |

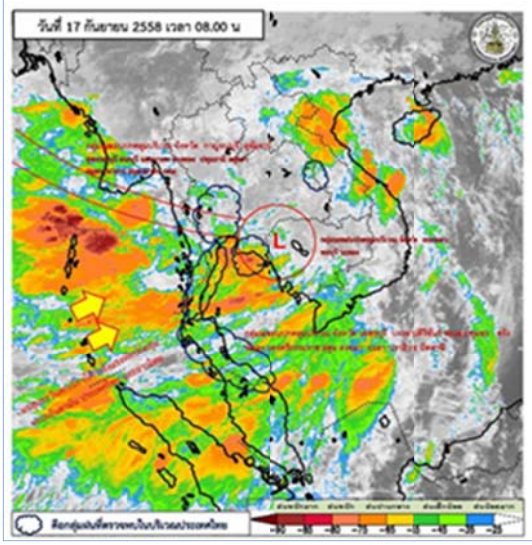
BANGKOK, 16 September 2015 (NNT) - Vamco tropical depression entered Thailand last night and has weakened to clusters of thunderstorms. Residents in northeastern regions are warned of flash floods.

The warning was issued by the national weather agency, Meteorological Department, which stated Vamco left Laos for Thailand through Ubon Ratchathani province late Tuesday morning. The storm moved to Surin, Buriram, Nakhon Ratchasima, Si Sa Ket, and Sa Kaeo, before loosing momentum and became a cluster of thunderstorm this morning.

The storm cause heavy rains along its path. Residents in the aforementioned areas, as well as those in the eastern region and lower part of the central region, are warned of harsh weather conditions with possibility of flash floods.

Bangkok and its vicinity have already been hit with precipitation earlier today. Motorists are urged to plan their travel in advance and follow road safety measures closely.

Source: National News Bureau of Thailand on 16 September 2015



Severe weather warnings remain in place until this weekend

17 Sep 2015 | 10:27 | (93 Viewer) |

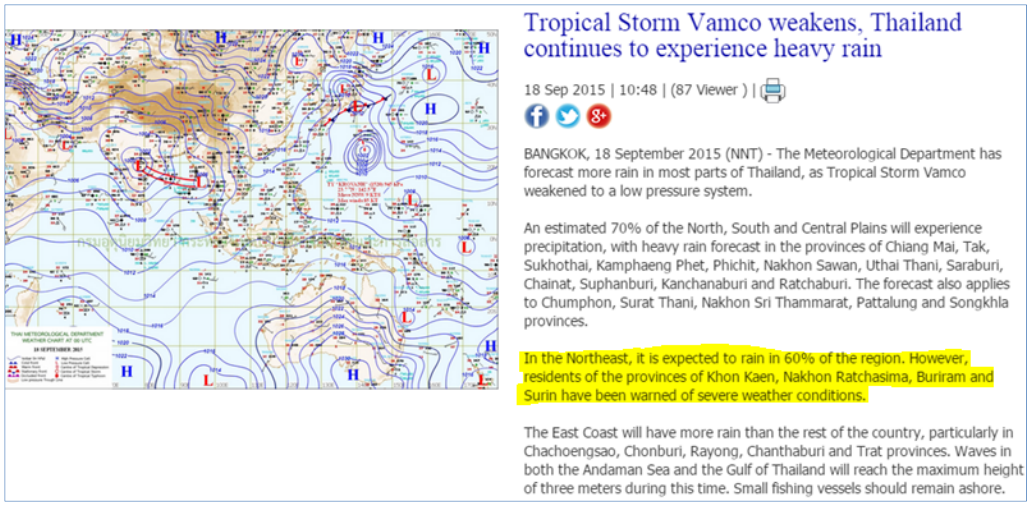
BANGKOK, 17 September 2015 (NNT)-Severe weather warnings have been issued across the country as a low pressure system is still lingering over many regions.

The low pressure system, which was once tropical storm Vamco, has expanded over the Central Plains, the east coast, and the lower region of the Northeast.

It will bring heavy rain until this weekend to the following provinces: Ubon Ratchathani, Si Sa Ket, Surin, Buriram, Nakhon Ratchasrima, Nakhon Sawan, Lopburi, Saraburi, Nakhon Nayok, Prachinburi, Sa Kaeo, Chachoengsao, Chonburi, Rayong, Chanthaburi, Trat, Ranong, Phang Nga and Phuket.

Residents of these provinces have been warned to be cautious when leaving their homes. Waves in the Gulf of Thailand and in the Andaman Sea could reach a maximum height of 3 meters.

Source: National News Bureau of Thailand on 17 September 2015



Tropical Storm Vamco weakens, Thailand continues to experience heavy rain

18 Sep 2015 | 10:48 | (87 Viewer) |

BANGKOK, 18 September 2015 (NNT) - The Meteorological Department has forecast more rain in most parts of Thailand, as Tropical Storm Vamco weakened to a low pressure system.

An estimated 70% of the North, South and Central Plains will experience precipitation, with heavy rain forecast in the provinces of Chiang Mai, Tak, Sukhothai, Kamphaeng Phet, Phichit, Nakhon Sawan, Uthai Thani, Saraburi, Chainat, Suphanburi, Kanchanaburi and Ratchaburi. The forecast also applies to Chumphon, Surat Thani, Nakhon Sri Thammarat, Pattalung and Songkhla provinces.

In the Northeast, it is expected to rain in 60% of the region. However, residents of the provinces of Khon Kaen, Nakhon Ratchasima, Buriram and Surin have been warned of severe weather conditions.

The East Coast will have more rain than the rest of the country, particularly in Chachoengsao, Chonburi, Rayong, Chanthaburi and Trat provinces. Waves in both the Andaman Sea and the Gulf of Thailand will reach the maximum height of three meters during this time. Small fishing vessels should remain ashore.

Source: National News Bureau of Thailand on 18 September 2015

Appendix 1.3 Lao PDR

During the tropical storm KUJIRA from 20 June to 25 June 2015

Worst flood ever hits villages in Huaphan

Phonesavanh Sangsomboun

At least eight houses have been submerged while cattle, animals and some houses have been swept away in the worst flash-flooding to hit Huaphan province, according to village memories.

Persistent heavy rains that began on Tuesday saw flash floods rushing down the river valleys, washing away houses and destroying the properties of the local people.

The worst hit areas were Phongsai and Bangtang villages in Xiengkhor district. Local villagers reported that the flood waters exceeded 30 metres in depth in some areas, constituting the worst floods in living memory.

More than 100 families in the two villages are still on alert even though the water level has started to recede, local officials said.

"The two villages have been severely hit. We have never seen something like this before,fortunately no one has been reported missing or dead," the official said.

Unexpected floodwaters that washed down from the mountains hit the village without warning and local people were completely unprepared for this disaster as it had never happened before.

A strong current in combination with mud and the branchs of trees and wood hit the villagers in the north.

Loal authorities are now on the ground to estimate the initial destrucion, which they described as most destructive.

The flood will also impact on the beginning of planting season in the province.

The flood happened very suddenly last month and early this month and these areas were still dry, said an official from the Huaphan provincial information, Culture and Tourism Department.

"Floods are the worst form of extreme weather. Before the flood, rice and corn crops were suffering from the drought and now they are facing another problem," he said.

The rain is continuing to fall but it is not as heavy as in the previous days, and the authorities are advising people to stay calm and be prepared.

Local villagers described the flood as the worst in history. —Photo Tholakhong

Source: Vientiane Time News on 30 June, 2015

Huaphan floods wash out bridges, paralyse transport

honesavanh Sangsomboun

looding in Huaphan province as damaged two concrete idges that link Xiengkhor nty to the rest of the province d to the Vietnamese border, ralysing transport in and out f the area.

Torrential rains washed way four houses, some milies face rice shortages, d some roads have been ashed out along with the dly damaged bridges.

Last week's flooding Xiengkhor district was ported by local authorities d residents to be the worst living memory.

The flooding also affected e paddies in five villages.

Local officials estimated at more than 30 hectares f paddies won't be able to ow rice because the soil was ashed away.

The 20-minute deluge that aused the flash flooding saw e water originate from a cave that runs into the Huayxai stream, causing it to rise without warning.

In the aftermath, the two bridges are the main concerns and urgently need to be repaired as their inaccessibility has paralysed transport and trade within the province and also that with Vietnam.

Nokpok Bridge, which is 70 metres long, and Kanglhom Bridge at 60 metres in length, are located on the main road which serves as an economic corridor from the province to the Vietnamese border.

The first thing that needs to be done is to repair the two bridges to ease transport access, said a local official who is in charge of estimating the flood damage.

"If the bridges are not urgently fixed it will hurt the local economy and also affect trade to the Vietnamese border," district official Mr Saengdoun Vongvichit said.

Local authorities and other sectors have started to provide assistance to the affected families but it is still not enough, Mr Saengdoun said.

Initial estimates by local authorities put the cos of the damage at more than 6 billion kip.

According to Mr Saengdoun, the immediate flooding forced some families to run for their lives and they did not have time to retrieve anything from inside their houses.

"The flood was so dangerous that even though some families wanted to take what they could from their houses, we didn't allow them to," he said adding that for this reason some families have lost almost everything.

The authorities are trying to help two families after their entire rice stores were washed away.

"Without assistanse from the government and outside help the villagers will definitely face rice shortages and go hungry," he said.

This bridge linking Xiengkhor district to the Vietnamese border needs to be urgently repaired.

Source: Vientiane Times, Tuesday on 30 June 2015

During the ITCZ from 17 July to 21 July 2015

Heavy rain floods Khammuan province

Souknilundon
Southivongnorath

Three days of heavy rain has hit Khammuan from Friday causing flooding in several areas of the province.

According to local people in the province's Thany village of Hinboun district the heavy deluge began on Friday resulting in rising water levels that flooded the bridge crossing the Namkhounkonglae River, cutting off local people's road transport link.

Local villager Ms Sisomphoun Khoundavong said via mobile phone that this was the first time the bridge in her hometown had been submerged with the level water higher than last year's flood.

"I just returned from Vientiane last week for my university vacation after exams and was planning to visit my hometown but the flooding rain has forced me to stay in Khammuan city centre," she explained.

Another villager Mr Khampaseuth Leudsomboun explained by phone that vehicles can't drive across the bridge as the water is chest deep, so people can only use boats to cross the river.

"Last year the water level was only knee high, but this year is up to my chest. This is because of the heavy rain for several days," he said.

The rain also flooded the way to local tourism sites like Nang An cave as well as rice fields of the province. It also affected local people in Vrabouly district of Savannakhet province with flooding cutting some roads there.

The Lao Department of Meteorology and Hydrology last week reported that no major storms would develop in the country but heavy downpours might be experienced associated with tropical storm Halola and other weather systems coming from China and Vietnam.

Heavy rain results in flooding in Thamy village, Hinboun district, Khammuan province on Friday. Photo Ting

Source: Vientiane Times on 21 July 2015

National News

Flash flooding hits many villages in central, southern provinces

Flooding

(KPL) Many villages in low-laying areas in three central and southern provinces have been hit by flash flooding caused by rainfall that lasted for four consecutive days this week.

The Department of Meteorology and Hydrology is forecasting that the rain will end today.

As a result, the department has warned people living in low-laying areas, especially near rivers and valleys nationwide, that unexpected flash flooding is possible and to closely monitor the weather forecast before travelling to other provinces.

The heavy rainfall was forecasted for the provinces of Xieng Khuang, Luang Namtha, Luang Prabang, Vientiane Capital, Savannakhet and Champassak.

Between 19-20 July, many rice fields planted with young saplings, as well as access roads were flooded, especially villages in Thakhek district of Khammuan Province, the tourist destination of Nang Oang Cave, Ban Nong Kadaeng village, Vilaboury district, Savannakhet Province, and the Toumlan district of Saravan Province.

Source: KPL NEWs on 21 July 2015

During the heavy monsoon rains and tropical storm KOMEN from 26 July to 6 August 2015

Weather bureau warns of potential flooding

Some of the 600 hectares of rice fields flooded when the Xebangfay River burst its banks.

Times Reporters

People living in low-lying areas, especially along the Mekong River are being urged by authorities to take precautions against probable rising water levels over the next month with increased rainfall.

Officials at the Ministry of Natural Resource and Environment's Meteorology and Hydrology Department issued the warning bulletin in the wake of recent rains with significant additional falls likely in the next few weeks.

The deputy head of the Weather Forecasting and Aeronautical Department Mr Bounterm Sisouphanthavong told *Vientiane Times* yesterday that water levels are rising because of heavy rains in northern Laos, which could cause flooding in the lowlands of some districts in Borikhamxay and Khammuan provinces.

"When the Mekong level increases above 11 metres a lowland areas in Vientiane, o other extreme weather conditions are forecast, we immediately sen out warnings through various meteorology and hydrology sectors, as well as websites, radio broadcasts, television and media agencies, to let people know what's happening," he said.

The Mekong has recently risen from between 6 and 1 metres above normal levels throughout its length in Lao while some tributaries such as th Xebangfay River in Xebangfa district of Khammuan provinc had peaked around 19 metres last Friday.

As a result, around 600 hectares of rice fields of 404 families in 14 villages living on both sides of the Xebangfay River were flooded, a local official at the district agriculture and forestry office confirmed yesterday.

Only moderate rain was recorded around Vientiane yesterday and the Mekong was at 5.20 metres at Km 4, but there had been heavy rains in some parts of Xieng Khuang, Xayaboury and Huaphan provinces.

The Mekong was recorded yesterday at 11.36 metres in Luang Prabang province, 8.07 metres in Paksan district, Borikhamxay province, 6.73 metres in Pakse, Champassak province, 9.67 metres in Thakhek, Khammuan province, and 7.48 metres in Savannakhet province.

The department's bulletin also noted official danger levels for the Mekong River and its tributaries with the Xebangfay River causing the most concern with its current level still within 1 metre of the danger level.

Today, the department forecast the Mekong River to be 12.60 metres in Luang Prabang, 6.10 metres in Vientiane, 8.25 metres in Paksan, 9.76 metres in Thakhek, 7.84 metres in Savannakhet, and 7.19 metres in Pakse.

However, Mr Bounterm said rainfall had been below average this month, and temperatures had also risen above average for several weeks in northern Laos, adding "Closely following weather forecasts was essential for the public, especially those living along the banks of the Mekong River."

Source: Vientiane Time News on 29 July 2015

Traffic chaos in Vientiane after heavy rains

Khonesavanh Latsaphao

A heavy downpour over Vientiane early yesterday morning caused traffic chaos during the rush hour because of flooded streets and sidewalks.

Queues of motor vehicles over a kilometre long on two sections of Kaysone Phomvihane Road were stuck there from 7:30 am to 10:00 am as drivers tried to ford their way through.

The flooding on these two sections of the road covered an area of Phakhao village and another one after the Dongdok traffic lights on the way to Donnoun junction.

It was not only these two sections of Kaysone Phomvihane Road that were flooded, there were also some sections of North 13 Road in Vientiane and the roads leading into the villages as well.

One motorist living in Donnoun village complained that he set off to work at 8:00 am through Kaysone Phomvihane Road but there was total traffic chaos from Donnoun junction to the Dongdok traffic lights.

"I normally spend about 30 minutes to go from my home to the office, but on that day it took me two hours because of the traffic chaos as cars and motorcycles struggled to travel down the flooded road," he said.

The floodwater on one stretch between the Donnoun junction and Dongdok traffic lights reached knee height, but in Phakhao village it was a bit shallower.

Deputy Director of the Vientiane Urban Development Administration Authority (VUDAA) Mr Khampien Inthaleuxa, told Vientiane Times on Friday that some stretches of road flood when there is a heavy downpour.

The cause is that soil has settled in the storm water drains preventing a rapid draining away and the natural ponds that collect rainwater have been filled up with earth because of developments, he added.

Some places became flooded as a result of flood waters on several roads collecting at junctions where it would normally disappear into large drainage channels.

The flood will normally take around a day to drain away in these areas but if the rain continues heavily it could take several days to clear.

The VUDAA assigns its staff to regularly clean out the storm water drains.

Flooding on the roads is commonly the result of plastic waste and other rubbish getting into the channels and blocking the drains.

Under heavy rain conditions it is usual to see the water level in the city rising quite quickly but it will also recede quickly once the rain stops if plastic waste and other garbage is not blocking the drains.

Residents who live near to these drainage channels can help to solve the problem by making sure they are free from rubbish and obstructions.

During the rainy season last year, the roads in three areas, at the That Luang traffic lights in Xaysettha district, the Chinaimo junction in Hadxaifong district and the Phonthong junction in Chanthabouly district, were heavily inundated.

A section of Kaysone Phomvihane Road in Vientiane flooded after a heavy downpour.

Source: Vientiane Time News on 1 August 2015

Vehicles drive through a flooded section of Road No. 13 South in the Nongmakjup area of Borikhamxay province on Sunday, about 65km from the provincial capital. –Photo Anoulack Chanpasith

Over 30 Borikhamxay families affected by flooding

Times Reporters

Authorities in Borikhamxay province are distributing food to more than 30 families in the Huaylouk village group of Thaphabath district after their homes were flooded following torrential rain on Sunday evening.

Head of Public Works and Transport Department in Borikhamxay province, Mr Nuansavanh Sengtuam, told *Vientiane Times* yesterday that after learning about the flooding, Deputy Governor Mr Bounneng Pathammavong and other officials delivered food to the affected families and checked on their circumstances.

"Since the flooding occurred on Sunday we've been able to move over 30 families to a shelter in Huaylouk village and are providing them with instant noodles, drinking water and other essentials. But they need more help and we will ask for assistance from the central level of government," Mr Nuansavanh said.

"We are collecting information on the extent of the damage caused by the deluge. It's not only Thaphabath district that's affected, the rain has caused flooding on Road No. D1, which runs from Borikhamxay to Xaysomboun province. I suggest that motorists are careful when using this road and that only 4-wheel drive vehicles travel on it."

Flooded areas of Road No. D1 are located in Thuoy and Pakyong areas in Borikhan district, Borikhamxay province, and in the Thathom area of Xaysomboun province. Officials are now helping people in the two affected areas of Borikhan district.

Prolonged rainfall also caused flooding on about 100 metres of Road No. 13 South in a farming area of Nongmakjup, which is about 45km from the provincial capital, Mr Nuansavanh said.

He said the flooding occurred in the Huaylouk village group and on Road No. 13 South because the water was not able to drain away and some of the drainage pipes were too narrow. But the situation is now resolved and the floodwater has subsided.

The Lik River, which runs through the Huaylouk village group, has not risen to a dangerous level but is slowly rising due to the increasing rainfall and because other rivers flow into it, as well as water that runs off from wooded areas.

"We now need support from the private sector, the general public and the government to help the people in our province who are suffering because of the floods," Mr Nuansavanh said.

A motorist passing through the area, Mr Anoulack Chanpasith, said yesterday "Flooding in the Nongmakjup area has caused traffic to back up and it's quite risky to drive along the flooded road. But the police are helping to ensure that vehicles get through safely."

Mr Anoulack was travelling in his office's 4-wheel drive vehicle to the south of Laos. He left Vientiane on Sunday morning and got stuck on the flooded road at about 10:30am when he encountered a section that was under water for a distance of about100 metres.

Heavy rainfall is causing flooding in provinces in the south and north of the country.

Source: Vientiane Time News on 4 August 2015

Flooding puts a stop to tourism in Borikhamxay

Times Reporters

The popular tourist hotspot of Hadkhay village in Thaphabath district, Borikhamxay province, has shut down its activities after the road into the village was flooded when the Mang River overflowed.

Hadkhay village offers more than 10 homestays and visitors can also enjoy trekking around the Phakluang cliff and seeing orchids and other wild flowers as they make their way to the spectacular Xay waterfall.

After the village became inundated on Sunday and Monday, *Vientiane Times* reporters toured flooded areas of Thaphabath district on Tuesday where they interviewed authorities and people who had been affected by the floods.

Head of Tourism in Hadkhay village, Mr Khammoun Chanthalangsy, said "We have had to announce the closure of our tourism services because the water has risen over the bridge that leads to our office. The houses of 35 families have been affected by flooding and three families have moved to higher ground."

"We are now using only boats to get around. We'd like inform tour operators thatthey will have to suspend their programmes for anyone planning to visit the village," he added.

Mr Khammoun said the flooding was the result of torrential rainthat was occurring every day and water was also running down from forested hillsides into the Mang River which runs through the village. The water level is fluctuating, going up when it rains and down when it stops.

Reporters experienced the uncertainty for themselves. When they arrived on Tuesday morning the water level dropped by more than a metre after a period of two hours. It then rose slightly again when it started to rain.

Mr Khammoun said "Roads into the village have been flooded for four days We will certainly lose income from the suspension of tourism but if the water level drops in the next nine or 10 days we will reopen our facilities."

However, the trend has been for tourist numbers to dip in recent years. In 2014 about 400 people came to the village, a drop of more than 10 percent compared to 2013.

No figures have been collated for this year but Mr Khammoun's impression is that numbers have fallen further. He and local authorities are trying to determine thereason for the drop off in visitors.

Village Deputy Head Mr Boundee Thammavong said the village is home to 570 people living in 97 households. There are also 21 tour guides and 32 boats that take visitors on trips.

"The flooding is not only affectingtourism, but more than 100 poultry owned by villagers have been swept away. We are now trying to collect more information about the extent of the losses suffered," he said.

Mr Khammy Panya, 60, said "I lost six chickens in the flooding on Sunday night because my children and I were busy with other things and we didn't notice that the birds were being carried away by the water."

Deputy Head of Huayleuk village Mr Sypaphan Manivong said his village was next to Hadkhay and 67 families living there had been affected by the flooding. Thirty of them had moved into a shelter because they lived in single-storey homes on low-lying ground.

According to a member of the Standing Party Committee in Borikhamxay province, Mr Lamsamay Vorasane, more than 1,400 families and 4,200 hectares of rice fields have been affected by flooding in the districts of Thaphabath, Borikhan, Pakxan and Pakkading.

Highwater has also drowned 56 buffaloes, 84 head of cattle, 79 pigs and 1,400 poultry. In addition, about 60,000 fish have been swept out of ponds by the fast flowing water.

This metal bridge across the Khon River that links the main road leading from the Luang Nantha provincial capital to Nalae district is now impassable. –Photo Pathedlao Lao

Relief workers rushing aid to flood victims

Khonesavanh Latsaphao

Provincial authorities are hurrying to help flood victims and provide them with basic essentials, with everyone thankful that floodwaters did not rise further yesterday.

Some places were deluged with rain on Sunday but observers say floodwaters have been gradually receding since then.

The worst hit provinces are Borikhamxay, Khammuan, Vientiane, Luang Prabang, Luang Namtha, Bokeo and Xaysomboun.

An official from Borikhamxay province, Mr Lamsamay Vorasan, told *Vientiane Times* that on Wednesday the provincial Governor and officials had begun work early in hope of easing people's plight in flooded areas.

Relief workers were unable to use boats to reach the flooded areas, which were inundated on August 2-3, because there was too much debris in the water, mainly in the form of tree trunks.

"Now officials can reach each of the flooded locations and provide stranded people with dried food because most of the wood has drifted downstream," Mr Lamsamay said.

The authorities prepared food and water ahead of the deluge on Sunday, as they knew there would be more heavy rain and more places would be flooded.

More than 1,400 families in four districts of Borikhamxay province were affected by the downpours, while 4,200 hectares of rice seedlings that were planted recently have been submerged.

The authorities are providing relief supplies in flooded areas of Borikhan, Pakxan, Pakkading and Thaphabath districts.

Most people whose houses were flooded went to stay with

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Source: Vientiane Time News on 6 August 2015

flood-related illnesses

Khonesavanh Latsaphao

Borikhamxay health workers have encountered about 200 cases of various illnesses among villagers living in flooded areas of the province.

However, Director of the Borikhamxay provincial Health Department, Dr Somephone Chanthanasouk, told Vientiane Times on Friday there was no outbreak of any serious disease.

Over 1,400 families in the districts of Borikhan, Pakxan, Pakkading and Thaphabath have been affected since torrential rain lashed the area starting on August 2.

"There are no epidemics here and many sacks of medicines are being distributed by our health workers to each flooded area," Dr Somephone said.

Teams of doctors and nurses are visiting flooded areas to provide basic health care.

Some people whose fields have been flooded have developed athlete's foot as a result of standing in water for many hours and have been given medicine to treat it.

Athlete's foot is a common skin infection caused by a fungus that begins on the bottom of the feet.

People living in flooded villages often have wet feet all day, and in places where the floodwaters have subsided the mud inside and outside homes means their feet are always moist.

When the feet or other areas of the body stay moist, warm, and become irritated, the fungus can thrive and infect the upper layers of the skin.

Fungal infections can occur almost anywhere on the body, including the scalp, arms, legs, hands, feet, nails, genitals, mouth and groin.

Health workers are also concerned that people wading in floodwater or using dirty water may become infected with conjunctivitis.

Conjunctivitis, an eye infection, often occurs when people use dirty water from a flooded river to take a shower or wash their faces.

In addition, poor sanitation due to stagnant floodwater can leave communities prone to outbreaks of diseases such as cholera and malaria.

Houses in Borikhamxay province are flooded after heavy rain. --Photo Pong

Dr Somephone said health workers were unable to distribute drinking water and clean water to people in Hadkhay village along the Mekong in Thaphabath district because the river rose again on Friday after receding on Thursday.

According to a bulletin posted on the Meteorology and Hydrology Department's website on Thursday, forecasters are warning many provinces to anticipate flooding on Friday and Saturday, especially Borikhamxay province, as the Mekong is expected to rise above the designated warning level.

In Vientiane the Mekong will rise close to the warning level on Saturday. The river is expected to rise to 11.36 metres while the warning level is 11.50 metres.

Flood victims in need of more support

Times Reporters

Thousands of people affected by flooding in Bokeo, Borikhamxay, Khammouan, Luang Namtha and Xaysomboun provinces are still in need of assistance despite emergency aid already coming from the government, provincial authorities, donors and businesses.

Meanwhile the southern provinces of Attapeu, Champassak, Saravan and Xekong have been spared flooding although river levels are expected to fluctuate and the rainy season is far from over.

Local media reported that more relief supplies are needed in at least 200 villages, where flooding has occurred since the end of last month. Over 10,000 hectares of rice fields have been damaged, along with houses, schools, other property and livestock.

In some areas electricity has been cut and roads are impassable, while a monetary assessment of the damage has yet to be calculated.

The government last week provided funding to local authorities so they could provide assistance for those in need.

The money will be used to provide food and basic health services to people who have been displaced or lost their possessions.

Assistance is also being provided to farming families to ensure their food needs are met.

According to a recent report from Borikhamxay provincial authorities yesterday, Deputy Prime Minister Mr Asang Laoly and his delegation last week visited communities affected by the flooding on a short working visit from August 7-9.

During his visit, Mr Asang handed out clean water, rice, household essentials and other items to authorities for distribution to families whose lives have been disrupted and are unable to obtain supplies.

As part of the provinces' emergency relief programme, the authorities will work with the sectors concerned to distribute other items needed by flood victims, such as blankets, mosquito nets and clothing.

Last week, provincial authorities worked with donors and the public and private sectors to provide relief packages to flood-affected areas. The relief packages included clothes, bed linen and household utensils.

Authorities are now surveying and collecting information in flood-affected areas. Provincial officials from various sectors, including the military, have been dispatched to help those in need.

Meanwhile, road repairs are underway. The electricity grid and telephone network are also in need of repair.

Although water levels in many areas have fallen, provincial authorities are warning riverside villages to be on high alert during further predicted heavy rain this month and to closely follow weather forecasts.

People living along the banks of the Mekong River should especially be on their guard against flooding, according to weather forecasters.

A World Vision team in cooperation with Borikhan and Pakxan district authorities helps villagers in flooded areas of these districts.

Ten villages in Borikhamxay under water

World Vision is supporting Borikhamxay province authorities to respond to mass flooding in the province.

More than 6,300 people in Borikhan and Pakxan districts have seen water pour into their homes in recent days.

The flooding began on Sunday evening on August 2, after several days of heavy rain. An estimated 10 villages have been affected - with 1,238 households in the flooded area.

Homes have been inundated with water, schools closed and rice fields destroyed. Families are now travelling by boat, instead of road.

"The communities are worried about their well-being, especially about water-borne diseases that can be caused from flooding. People were very grateful to receive food but they're concerned about the damage the flooding has caused to their rice fields and to their livestock," said Mr Phet Vathana, World Vision's area programme manager in Pakxan district.

More rain has fallen since Sunday, and more rain is predicted in the days to come.

No deaths have been reported although many people have abandoned their homes, and many houses are totally submerged. Families are seeking shelter in schools and district government offices, where they are waiting out the flood.

"The water has decreased in some villages now, but there is a lot of cleaning up that needs to happen. Another village is still underwater, and people are eager to return home after spending several nights in evacuation centres," said Mr Lamphoun Phonphomphun, World Vision's programme manager in Borikhan district.

Two World Vision projects are affected in Borikhan and Pakxan districts – where World Vision has been working with communities and district authorities to improve livelihoods, education, health and protection of children for the last five years.

To respond to the needs of those affected, World Vision and the district authorities are distributing canned fish, noodles and clean water as complementary food.

"Looking further down the road, World Vision is concerned about flooding that has destroyed many rice fields in these areas. Livestock has been lost as well, but the exact numbers are not available. Many families here live on subsistence farming and loss of agricultural crops or livestock can push already-impoverished families further into poverty and affect household food security," says Jonas David, World Vision's operations director based in Vientiane.

--World Vision Laos

Source: Vientiane Time News on 8 August 2015

Flooding puts a stop to tourism in Borikhamxay

Times Reporters

The popular tourist hotspot of Hadkhay village in Thaphabath district, Borikhamxay province, has shut down its activities after the road into the village was flooded when the Mang River overflowed.

Hadkhay village offers more than 10 homestays and visitors can also enjoy trekking around the Phakluang cliff and seeing orchids and other wild flowers as they make their way to the spectacular Xay waterfall.

After the village became inundated on Sunday and Monday, *Vientiane Times* reporters toured flooded areas of Thaphabath district on Tuesday where they interviewed authorities and people who had been affected by the floods.

Head of Tourism in Hadkhay village, Mr Khammoun Chanthalangsy, said "We have had to announce the closure of our tourism services because the water has risen over the bridge that leads to our office. The houses of 35 families have been affected by flooding and three families have moved to higher ground."

"We are now using only boats to get around. We'd like inform tour operators that they will have to suspend their programmes for anyone planning to visit the village," he added.

Mr Khammoun said the flooding was the result of torrential rain that was occurring every day and water was also running down from forested hillsides into the Mang River which runs through the village. The water level is fluctuating, going up when it rains and down when it stops.

Reporters experienced the uncertainty for themselves. When they arrived on Tuesday morning the water level dropped by more than a metre after a period of two hours. It then rose slightly again when it started to rain.

Mr Khammoun said "Roads into the village have been flooded for four days. We will certainly lose income from the suspension of tourism but if the water level drops in the next nine or 10 days we will reopen our facilities."

However, the trend has been for tourist numbers to dip in recent years. In 2014 about 400 people came to the village, a drop of more than 10 percent compared to 2013.

No figures have been collated for this year but Mr Khammoun's impression is that numbers have fallen further. He and local authorities are trying to determine the reason for the drop off in visitors.

Village Deputy Head Mr Boundee Thammavong said the village is home to 570 people living in 97 households. There are also 21 tour guides and 32 boats that take visitors on trips.

"The flooding is not only affecting tourism, but more than 100 poultry owned by villagers have been swept away. We are now trying to collect more information about the extent of the losses suffered," he said.

Mr Khammy Panya, 60, said "I lost six chickens in the flooding on Sunday night because my children and I were busy with other things and we didn't notice that the birds were being carried away by the water."

Deputy Head of Huayleuk village Mr Sypaphan Manivong said his village was next to Hadkhay and 67 families living there had been affected by the flooding. Thirty of them had moved into a shelter because they lived in single-storey homes on low-lying ground.

According to a member of the Standing Party Committee in Borikhamxay province, Mr Lamsamay Vorasane, more than 1,400 families and 4,200 hectares of rice fields have been affected by flooding in the districts of Thaphabath, Borikhan, Pakxan and Pakkading.

High water has also drowned 56 buffaloes, 84 head of cattle, 79 pigs and 1,400 poultry. In addition, about 60,000 fish have been swept out of ponds by the fast flowing water.

Source: Vientiane Time News on 11August 2015

<u>During the tropical storm VAMCO from 13 to 17 September 2015</u>

Landslide blocks traffic in Xaysomboun

Times Reporters

Traffic on road No.1D in Thathom district, Xaysomboun province came to a halt yesterday after a landslide between Sibounheuang and Phonchaleun villages occurred.

Continuous rainfall in the province brought huge amounts of debris down onto the road in Thathom district, blocking access to the district.

The landslide occurred at around 2am and the national road maintenance project in Region 3 contacted provincial and district public works and transport offices and a contracted company to deploy two excavation vehicles to clear the road.

"We started the work at around 10 and after four hours the road was open for vehicles," said Mr Chanthakham Xayadeth, Head of the National Road Maintenance Project in Region 3 which covers Vientiane and the provinces of Vientiane, Xaysomboun, Borikhamxay and Khammuan.

No deaths or injuries hav been reported because th landslide occurred in the earl hours of yesterday morning whe there was less traffic, he added.

Officials and the contrace companies will continue to cle the roads and canals as rain le continued to fall causing man minor landslides in Xaysombou province.

Besides Xaysombour continuous rain has cause

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The landside on road No.1D in Thathom district.

Source: Vientiane Time News on 4 September 2015

Flood risk returns to Khammuan

Khonesavanh Latsaphao

Flooding is once again threatening districts of Khammuan province with the Mekong River and some of its tributaries reaching danger level.

The provincial Meteorology and Hydrology Department issued a flood alert on Tuesday for people living in the districts of Thakhaek, Hinboun, Nongbok, Mahaxay, Xebangfay and Nhommalath.

Khammuan media reported on Friday afternoon that following official warnings over the last few days water levels in the Mekong and other rivers had reached danger levels.

The provincial Information, Culture and Tourism Department on Friday morning ordered local journalists to increase news coverage to help keep people informed.

Xebangfay district Governor Mr Bounsy Phimmaxay told *Vientiane Times* that the Xebangfay River in Xebangfay district had already topped the official danger mark of 18.5 metres on Thursday, reaching 19.2m.

Mr Bounsy said he was relying on reports from district officials in the field who told him the water had not yet reached 20 metres.

"No village has been inundated yet, only rice fields are swamped," he said.

"But if the river rises to 20 or 21 metres then many homes in Xebangfay district will be flooded right away."

The water has been backing up and rising quickly in the Xebangfay, Mekong and other rivers in the province following almost a week of constant rain.

Some people have speculated that residents in Xebangfay and other districts may be more severely affected than when floods hit the province in late July.

That month, the floodwaters rose to 18.21 metres at the point where the Xebangfay and Mekong rivers meet causing many hectares of farmland to be inundated and

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Floodwaters are rising around villages in Xebangfay district, Khammuan province.

Source: Vientiane Time News on 5 September 2015

Two dead, two missing after flash flood hits Luang Prabang

Khonesavanh Latsaphao

Four people went missing on Tuesday afternoon after a flash flood cascaded without warning through villages in mountainous Nan district, Luang Prabang province.

Nine houses disappeared and 24 others were affected by the torrent of water and the mud it left in its wake. Most of the damage occurred in Fai village.

Luang Prabang authorities said they feared all of the four missing people had died after finding two bodies yesterday.

Director of the provincial National Resources and Environment Department, Mr Chanthavong Phonnachith, told *Vientiane Times* the authorities and soldiers were searching for the two remaining people.

They are scouring an area that is a sea of mud after the cascade poured down a hillside in a forested area.

Flash floods normally occur after heavy rain but no rain fell in the area on Tuesday and no one suspected there would be a sudden surge of water.

Flash floods may take minutes or hours to develop. It is possible to experience a flash flood without witnessing any rain. In this case, however, there would have been heavy rain in areas upstream of the flood.

"The large amount of muddy water that burst from the ground at the top of the Hien waterfall

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Villagers help each other to move furniture from their house after mud poured down a hillside from a forested area into the village.

Source: Vientiane Time News on 10 September 2015