



Mekong River Commission

Weekly Wet Season Situation Report in the Lower Mekong River Basin 06-12 July 2021

Prepared by
The Regional Flood and Drought Management Centre
13 July 2021

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Key Messages

Key messages for this weekly report are presented below.

Rainfall and its forecast

- Rainfall took place from Chiang Sean in Thailand to Pakse in Lao PDR, including the lower part in Cambodia and Viet Nam, varying from 1.70 millimetres (mm) to 218.00 mm.
- No significant rainfall is projected for the next 5 days in the Mekong region from 13 to 19 July 2021.

Water level and its forecast

- The outflows at Jinghong hydrological station decreased over the monitoring period from 30 June to 12 July 2021. It dropped about 1.55 m from 537.15 metres (m) on June 30 to 535.60 m on July 12.
- At Chiang Saen in Thailand, the closest station to the Jinghong hydrological station, the water level decreased by about 0.85 m during the same period.
- The water levels across most monitoring stations were lower than their long-term average.
- The water volume of the Tonle Sap Lake during this reporting period was slightly higher than that in 2020 of the same periods but was still lower than its long-term average.
- Over the next few days, the water levels across most monitoring stations are expected to rise slightly but are forecasted to stay lower than their long-term value.

Drought condition and its forecast

- The LMB did not face any significant threat during July 3-9. The region was mostly at normal conditions except some moderate drought taking place in the central part of the LMB covering some areas of Sakon Nakhon, Roi Et, Yasothon, Surin, Si Saket, Ubon Ratchathani, and Sekong.
- The ensemble prediction model forecasts that in July the LMB is likely to receive from below-average to average rainfall for the entire region; Cambodia, the Central Highlands of Viet Nam, and southern Lao PDR will be the driest areas. In August and September, eastern Cambodia and the Central Highland of Viet Nam are forecasted to experience some meteorological drought, a situation when there is a prolonged period with less than average rainfall. Fortunately, the models show that the LMB might receive much above average of rain during October.

1 Introduction

This Weekly Wet Season Situation Report presents a preliminary analysis of the weekly hydrological and drought situation in the Lower Mekong River Basin (LMB) for the period from **6-12 July 2021**. The trend and outlook for water levels are also presented.

This analysis is based on the daily hydro-meteorological data provided by the Mekong River Commission (MRC) Member Countries (MCs) – Cambodia, Lao PDR, Thailand, and Viet Nam – and on satellite data. All the water level indicated in this report refers to an above zero gauge of each station.

The report covers the following topics that are updated weekly:

- General weather patterns, including rainfall patterns over the LMB
- Water levels in the LMB, including in the Tonle Sap Lake
- Flash flood and drought situation in the LMB
- Weather, water level and flash flood forecast, and
- Possible implications.

Mekong River water levels are updated daily and can be accessed from:
http://ffw.mrcmekong.org/bulletin_wet.php.

Drought monitoring and forecasting information is available at:
<http://droughtforecast.mrcmekong.org>

Flash flood information is accessible at: <http://ffw.mrcmekong.org/ffg.php>

2 General Weather Patterns

The weather outlook bulletins for three months (July, August, and September) and the weather maps issued by the Thai Meteorological Department (TMD) were used to verify weather conditions in the LMB.

The TMD stated that above average rainfall will start from the second week of July and is influenced by the Southwest Monsoon of the rainy season onset. During this time, there will be more thunder rainstorms, wet-season thunderstorms, and low-pressure air mass prevailing over the Mekong region. The TMD also predicted that an influential Southwest Monsoon is likely to occur and may cause more rainfall in the Mekong region between July and August.

[Figure 1](#) presents the weather map of 12 July 2021, showing that a low pressure is dominating the upper part of Lao PDR and Viet Nam, including the 3S area (Sesan, Sre Pok, and Sekong) in Cambodia and Viet Nam of the LMB.

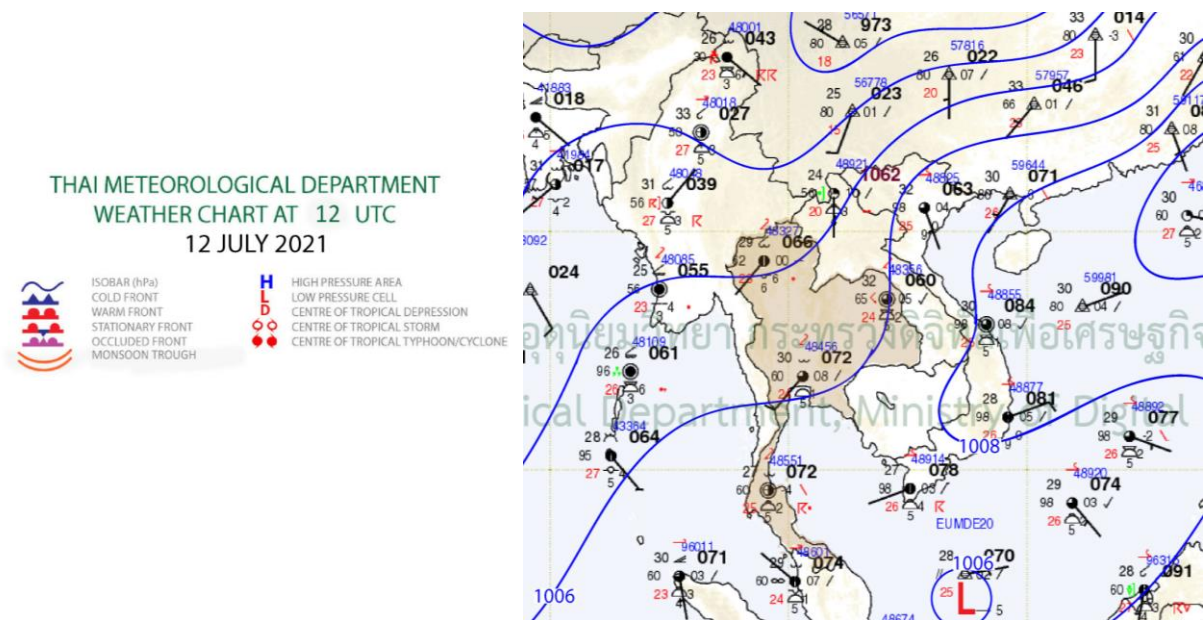


Figure 1. Summary of weather conditions over the LMB.

According to the ASEAN Specialised Meteorological Centre (ASMC), a highest probability of wetter condition is predicted over of the lower part in Mekong region covering Cambodia, and Viet Nam from 12-25 July 2021, during the 2nd and 3rd weeks of July. Nonetheless, the Northern part of Thailand and Lao PDR is likely dominated by wet condition, which may receive average rainfall in general.

[Figure 2](#) shows the outlook of comparative warm conditions from 12-25 July 2021 in Southeast Asia based on results from the NCEP model (National Centres for Environmental Prediction).

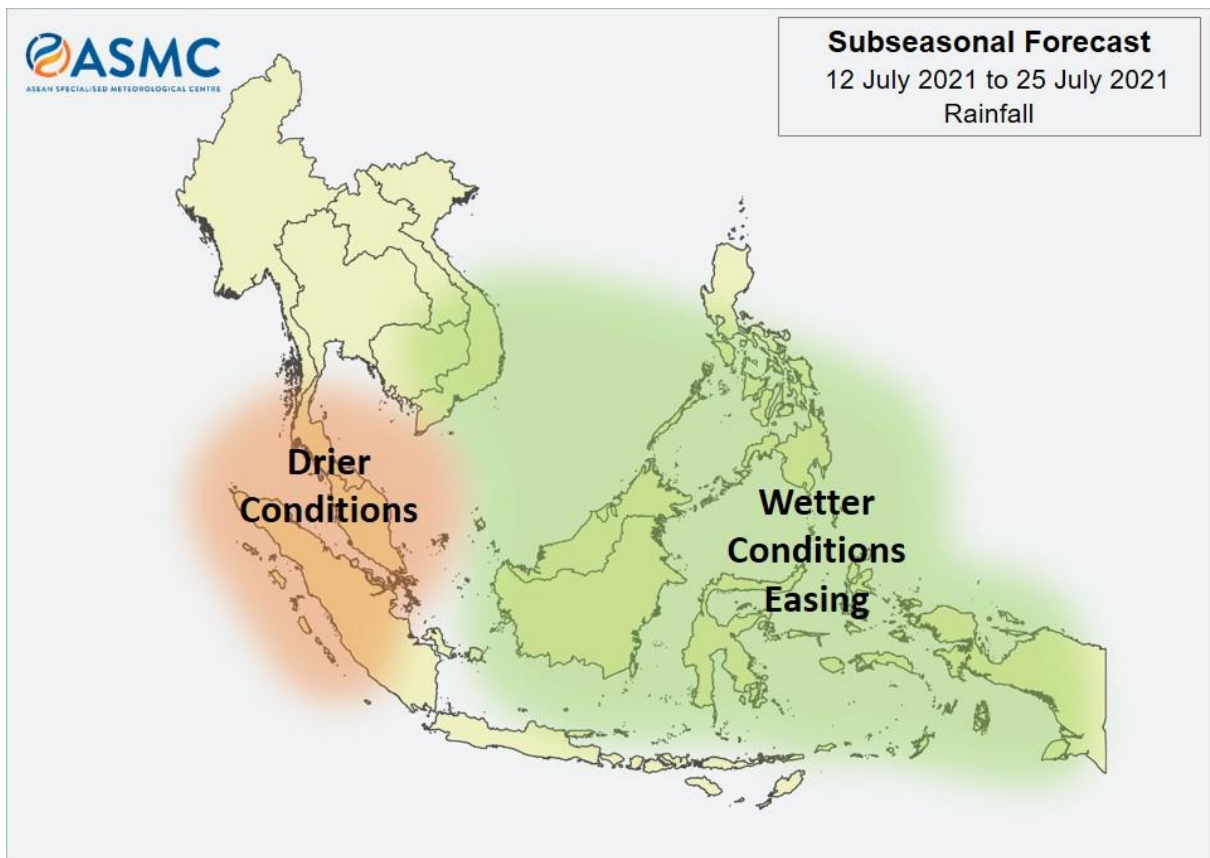


Figure 2. Outlook of wet and dry conditions over the Asian countries by ASMC.

2.1 Tropical depressions (TD), tropical storms (TS) and typhoons (TY)

There were low-pressure lines taking place in the lower part of the LMB during 12 July 2021, as shown in [Figure 1](#), which would bring rain to some areas of the LMB. But based on a Tropical Storm Risk (TSR), as displayed in [Figure 3](#), there was no sign of tropical depression (TD), tropic storm (TS), or typhoon (TY) in the Mekong region up to 12 July 2021.

Active system as of 12 July 2021 6:10 GMT

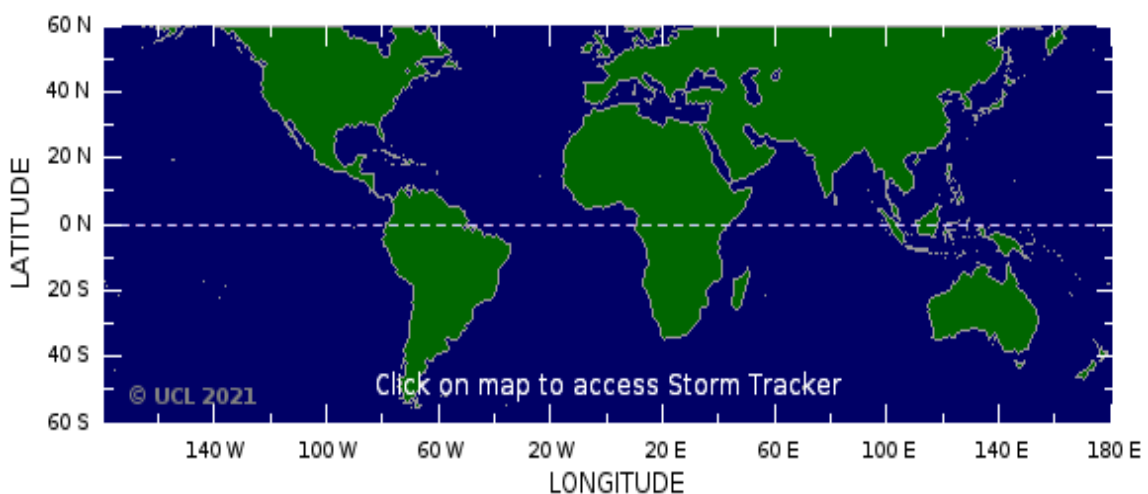


Figure 3. A tropical depression risk observed on 12 July 2021.

2.2 Rainfall patterns over the LMB

This week, rainfall focused in the areas from Chiang Saen in Thailand to Pakse in Lao PDR, including the lower part in Cambodia and Viet Nam, varying from 1.70 millimetres (mm) to 218.00 mm. The weekly total rainfall in this reporting week was considered higher, compared with last week rainfall in the LMB (see [Figure 4](#)).

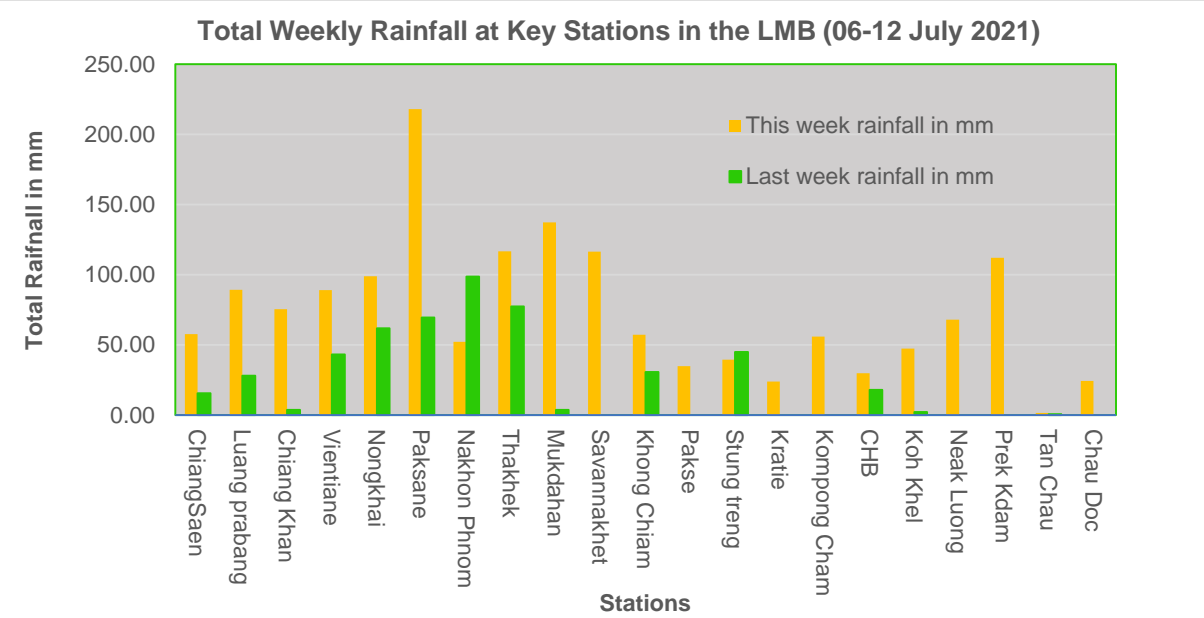


Figure 4. Weekly total rainfall at key stations in the LMB during 6-12 July 2021.

To verify area rainfall distribution, [Figure 5](#) shows a map of the weekly accumulated rainfall based on observed data provided by the MRC MCs – Cambodia, Lao PDR, Thailand, and Viet Nam – from 6 to 12 July 2021.

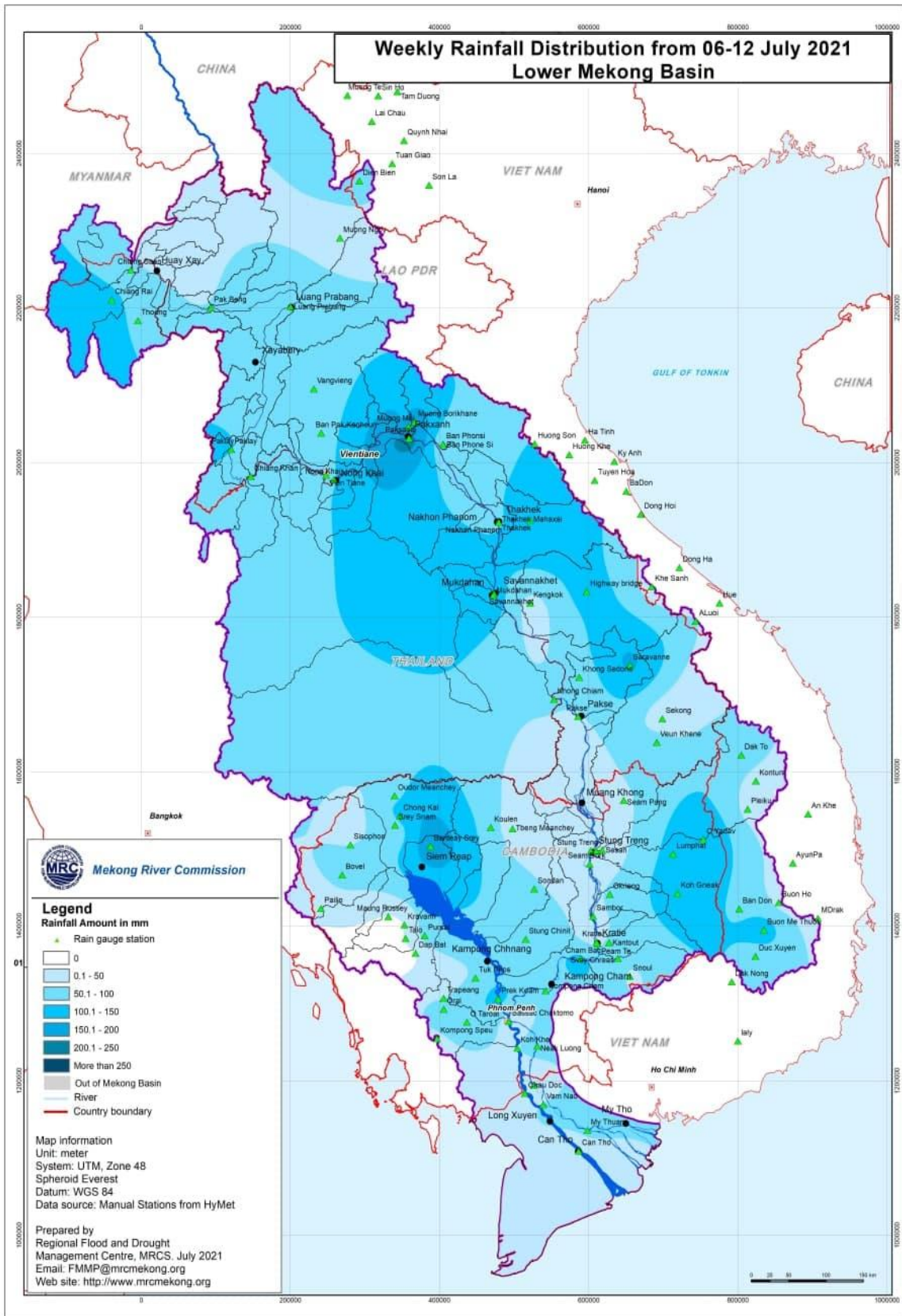


Figure 5. Weekly rainfall distribution over the LMB during 6-12 July 2021.

3 Water Levels in the Lower Mekong River

The hydrological regimes of the Mekong mainstream are illustrated by recorded water levels and flows at key mainstream stations: at Chiang Saen in Thailand to capture mainstream flows entering from the Upper Mekong Basin (UMB); at Vientiane in Lao PDR to present flows generated by climate conditions in the upper part of the LMB; at Pakse in Lao PDR to investigate flows influenced by inflows from the larger Mekong tributaries; at Kratie in Cambodia to capture overall flows of the Mekong Basin; and at Viet Nam’s Tan Chau and Chau Doc to monitor flows to the Delta.

The key stations along the LMB and their respective model application for River Flood Forecasting during the wet season from June to October and River Monitoring during the dry season from November to May are presented in [Figure 6](#). The hydrograph for each key station is available from the MRC’s River Flood Forecasting: <http://ffw.mrcmekong.org/overview.php>. The weekly water levels and rainfall at each key station are summarised in [Annex A](#).

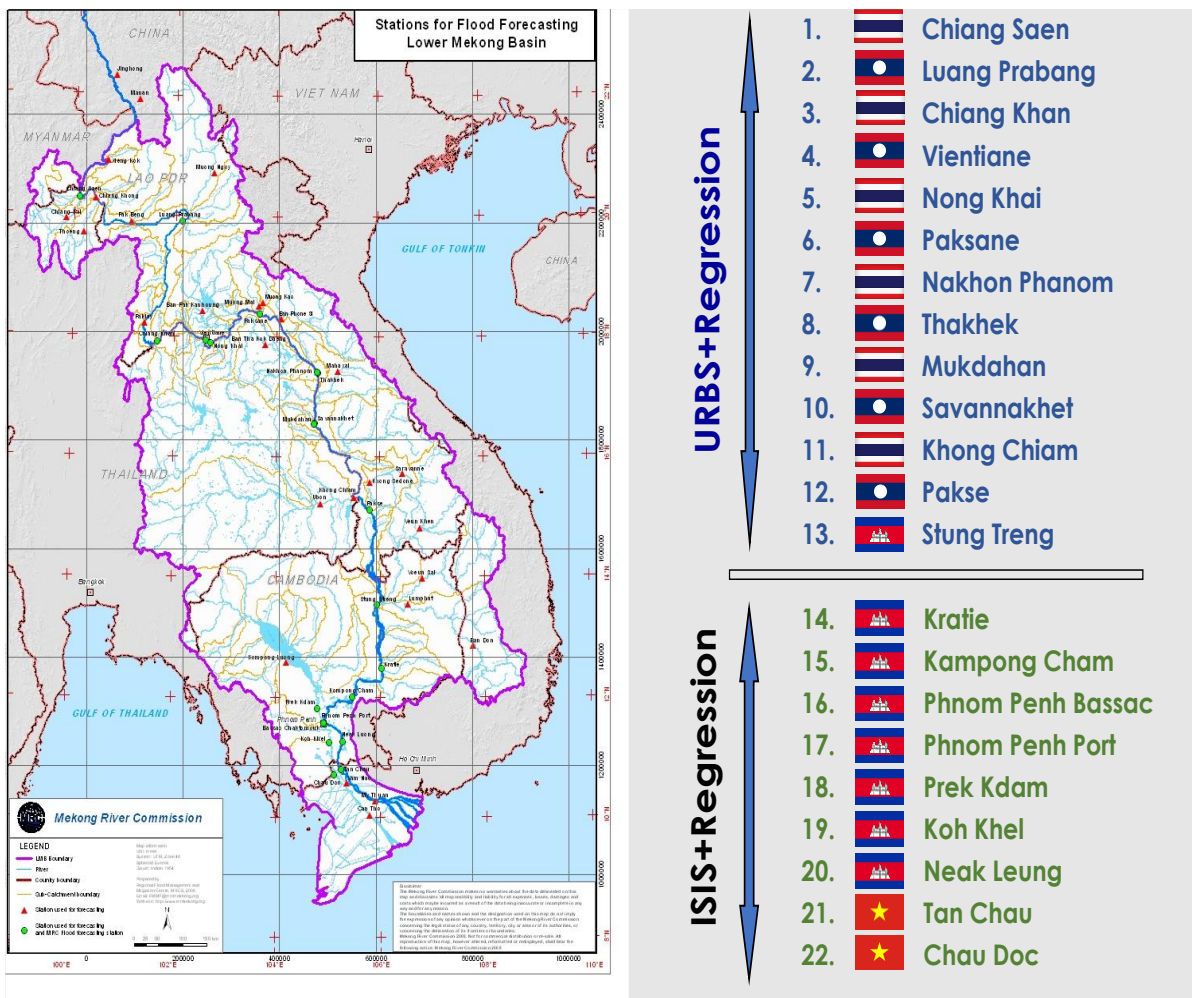


Figure 6. Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC’s observed water level data, the outflows at Jinghong hydrological station showed rapid decrease over the monitoring period from 30 June to 12 July 2021. It dropped about 1.55 m from 537.15 metres (m) on June 30 to 535.60 m on July 12. The outflows decreased from 2,260 cubic metres per second (m³/s) on June 30 to 1,050 m³/s on July 12. [Figure 7](#) below presents water level fluctuations at the Jinghong hydrological station¹ during 1 June – 12 July 2021.

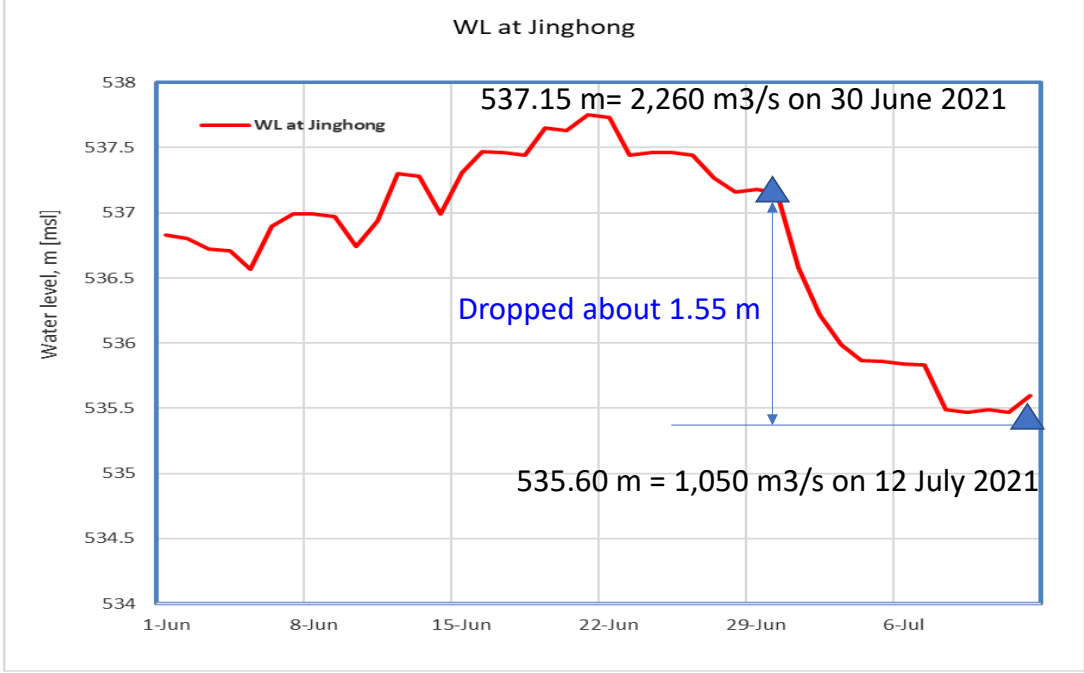


Figure 7. Water level at the Jinghong hydrological station during 1 June – 12 June 2021.

Due to below average rainfall from June 30 to July 12 and decreased flow from Jinghong upstream, water levels across most monitoring stations from Chiang Saen in Thailand to Thakhek in Lao PDR were decreasing, and from the stretches of the river between Stung Treng, Kratie and Kompong Cham in Cambodia were also repeatedly decreasing and staying lower than their LTA.

Based on a hydrological phenomenon, the contribution of inflow water from the upstream of Lancang-Mekong in China to the Mekong mainstream is about 16% in total during the wet season from June to October. The whole inflow of water into the LMB is influenced by rainfall at the Mekong mainstream and its tributaries during the wet season.

Chiang Saen and Luang Prabang

The water level from 6 to 12 July 2021 at Thailand’s Chiang Saen was stable at 2.62 m, showing a 2.01 m lower than its LTA.

¹ Near-real time data of hydro-meteorological monitoring at the Jinghong hydrological station is available at <https://portal.mrcmekong.org/monitoring/river-monitoring-telemetry>.

Similarly, the water level at Luang Prabang station in Lao PDR also slightly declined, dropping from 9.62 m to 9.39 m during the reporting period. This level shows 0.90 m lower than its LTA value. The trend – sometimes higher or closer to its historical maximum value – has been observed since late 2020. The phenomenon was potentially caused by upstream dam operations, downstream Xayaburi dam, and heavy rainfall in the surrounding areas. The water levels at Chiang Saen and Luang Prabang are shown in [Figure 8](#) below.

Being situated between the upstream (Nam Beng, Nam Ou, Nam Suong, and Nam Khan) and downstream (Xayaburi) hydropower dams, the Luang Prabang station has a unique characteristic as it is influenced by the operations of all its surrounding dams. **Thus, the water level at this station can possibly change very rapidly during the early of wet and dry season.**

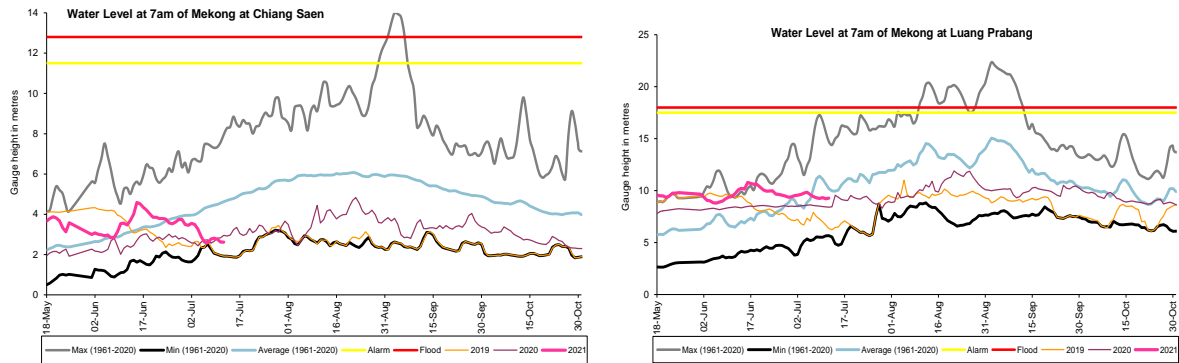


Figure 8. Water levels at Chiang Saen in Thailand and Luang Prabang in Lao PDR.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) slightly increased during the reporting week, July 6 to 12, from 6.74 m to 6.88 m but showing 1.54 m lower than its Long-Term- Average (LTA).

The water level downstream at Vientiane in Lao PDR followed the upstream trend. Water level was stable at 4.08 and was about 1.20 m lower than its LTA from July 6 to 12. At Nong Khai station in Thailand, the water level slightly increased. It rose about 0.02 m, increasing from 3.65 m to 3.67 m and showing 2.31 m lower than its LTA. The water level at Paksane in Lao PDR also increased by about 0.15 m, rising from 4.86 m to 5.01 m. Although, there was a minor increase, the trend of water levels at the mentioned stations was still down. The decreased level was obviously due to less rainfall and together with the effect by the Nam Ngum dam operation located upstream.

The water levels at Vientiane and Paksane are shown in [Figure 9](#) below.

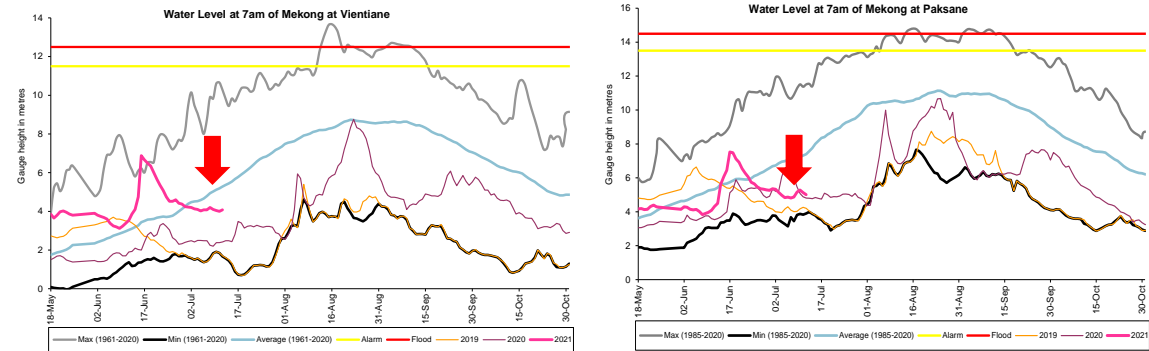


Figure 9. Water levels at Veintiane and Paksane in Lao PDR.

Nakhon Phanom to Pakse

The water levels at Nakhon Phanom in Thailand to Pakse in Lao PDR increased by about 0.35 m but still showing about 2.00 m below their LTA (see [Figure 10](#)).

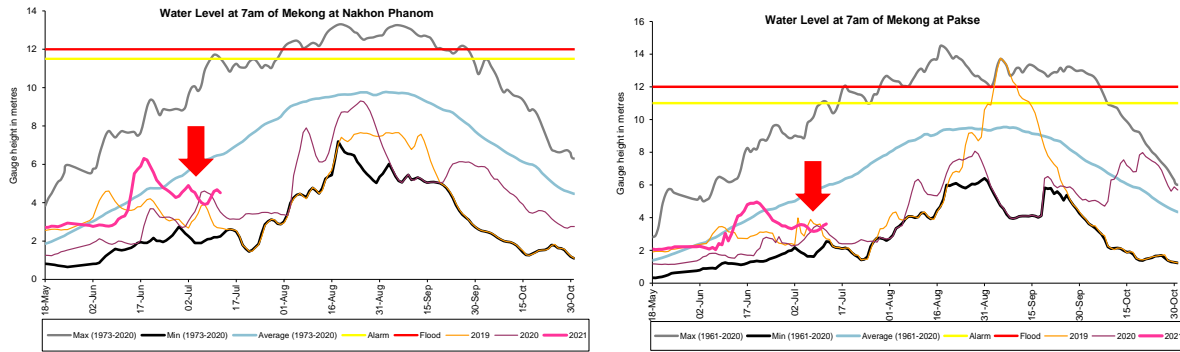


Figure 10. Weekly water levels at Nakhon Phanom in Thailand and Pakse in Lao PDR

Stung Treng to Kampong Cham/Phnom Penh to Koh Khel/Neak Luong

The less contribution of flows and low rainfall from the upstream part of the Mekong River and the 3S river (Sekong, Se San, and Sre Pok) caused the water levels from Stung Treng to Kratie in Cambodia to decline during 29 June-12 July 2021. This week water level at Stung Treng was about 1.88 m and at Kratie was about 3.80 m lower than their LTA (see [Figure 11](#)). The water level at Kompong Cham rose about 0.06 m but still stayed 4.06 m lower than its LTA.

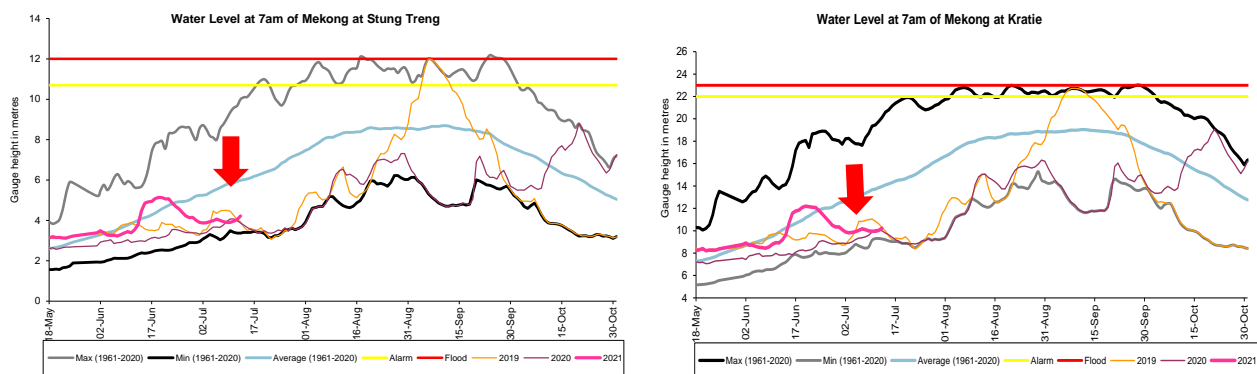


Figure 11. Water levels at Stung Treng and Kratie on the Mekong River.

At Chaktomuk on the Bassac River, the water level increased by about 0.22 m and stayed 2.70 m below its LTA; while at Koh Khel, water level went up 0.25 m but still stayed 1.80 m below its LTA. The water level at Prek Kdam on the Tonle Sap Lake rose about 0.26 m and was about 2.48 m below its LTA. The water level at the Tonle Sap Lake (observed at Kompong Luong) was similar to Prek Kdam station’s water level. The decreased water level was likely due to less

inflow and rainfall contribution from upstream of the Tonle Sap Lake area since early July 2021. The water level at the Tonle Sap Lake (observed at Kompong Luong) followed the same trend of Prek Kdam station’s water level.

Tidal stations at Tan Chau and Chau Doc

Like last week, the water levels from 6 to 12 July 2021 at Viet Nam’s Tan Chau and Chau Doc fluctuated due to daily tidal effects from the sea. The fluctuation levels were between 0.09 m and 1.00 m; they were within the historical range between maximum and minimum levels and **considered normal.**

The Tonle Sap Flow

At the end of the dry season, when water levels along the Mekong River increase, flows of the Mekong River reverse into the Tonle Sap Lake and then to the Delta. This phenomenon normally takes place from June to early August.

[Figure 12](#) shows the seasonal changes of the outflow of the Tonle Sap Lake at Prek Kdam in comparison with the flows of 2018 and 2019, and their LTA levels (1997–2019). Up to 12 July of this reporting period, it was observed that **the main inflow/reverse flow to the Tonle Sap Lake has started since 17 June 2021; however, the inflow seemed to slow down drastically starting since early July as water levels along the Mekong mainstream have dropped significantly below LTA levels.** The inflow into the Tonle Sap Lake condition in 2021 was lower than its average amount and was event lower than the 2020 inflow condition. Fortunately, above average rainfall is forecasted from second week of July for the LMB region; thus, the inflow into the Tonle Sap Lake is likely to rise from the current level.

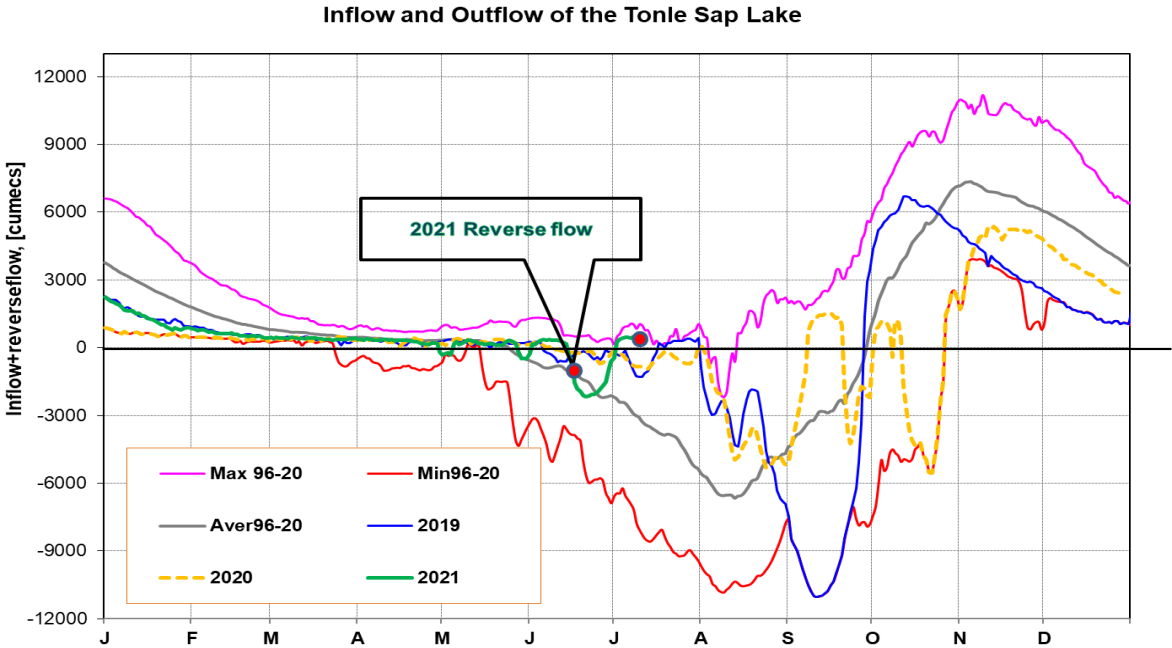


Figure 12. Seasonal change of inflows and outflows of Tonle Sap Lake.

The water volume of the Tonle Sap Lake up to this point has been considered low in comparison with its LTA level. [Figure 13](#) shows seasonal changes in monthly flow volumes up to July 6 for the Lake compared with the volumes in 2018 and 2019, their LTA, and the fluctuation levels (1997–2019). It shows that up to July 6, **the water volume of the Tonle Sap Lake is lower than the level in 2020 during the same period**. This is displayed in [Table 1](#), which indicates that the Tonle Sap Lake has been affected by water levels from the Mekong River, the tributaries, and rainfall in the surrounding sub-catchments.

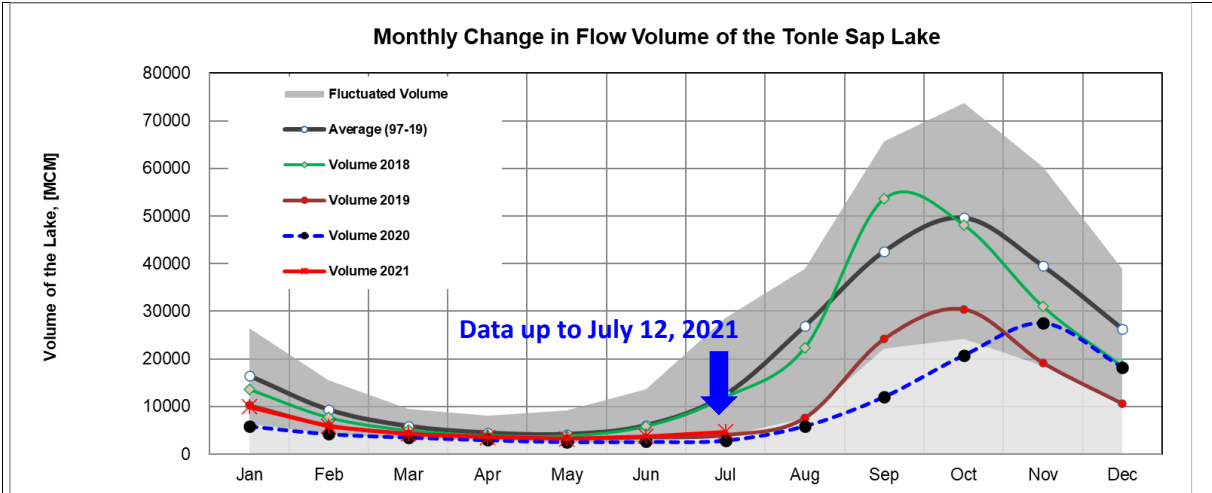


Figure 13. The seasonal change in monthly flow volume of Tonle Sap Lake.

Table 1. The monthly change in the flow volume of Tonle Sap Lake.

Month	Average Volume (97-19) [MCM]	Max Volume [MCM]	Min Volume [MCM]	Volume 2018 [MCM]	Volume 2019 [MCM]	Volume 2020 [MCM]	Volume 2021 [MCM]	Percentage of Volume in 2021 [%]
Jan	16452.95	26357.53	6272.01	13633.41	10285.31	5906.80	9923.80	60.32
Feb	9312.36	15596.22	4281.41	7729.72	6019.30	4264.19	5832.97	62.64
Mar	5868.92	9438.24	3350.92	5037.06	4354.62	3553.99	4264.88	72.67
Apr	4474.98	8009.14	2875.42	3956.47	3667.47	2992.61	3556.68	79.48
May	4166.07	9176.93	2417.81	3864.00	3266.43	2594.92	3240.78	77.79
Jun	6034.10	13635.01	2470.54	5919.18	3517.06	2641.88	3798.29	62.95
Jul	12502.58	28599.56	3832.51	12024.96	4001.99	2925.86	4707.71	
Aug	26934.35	39015.12	7554.93	22399.65	7622.71	5941.07		
Sep	42644.05	65632.35	22180.73	53639.54	24194.19	12105.31		
Oct	49698.19	73757.23	24276.79	48193.08	30358.38	20799.13		
Nov	39542.58	60367.33	18576.01	31036.07	19112.65	27546.80		
Dec	26325.13	38888.95	10869.43	18469.21	10577.29	18251.65		
	Critical situation, compared with historical Min values							
	Normal condition, compared with LTA (Long term average)							
	Low volume situation, compared with LTA values							
Unit: Million Cubic Meter (1 MCM= 0.001 Km ³)								

The significant increase on flows of the Mekong River and tributaries during early (1-20) June 2021 have potentially contributed to the reverse flow into the Tonle Sap Lake in the middle of wet season of 2021. This demonstrates the influence of the relationships between the reverse flows, water levels of the Mekong River, inflows from tributaries, and the flow direction in the complex hydraulic environment of the Tonle Sap Lake during the wet and dry seasons. The data show that about half of the annual inflow volume into the Tonle Sap Lake has originated


from the Mekong mainstream. Thus, flow alterations in the mainstream could have direct impact on the Tonle Sap Lake water levels and on its hydrology.


4 Flash Flood in the Lower Mekong Basin

From July 6 to 12, the LMB was affected by two weather factors including (i) The monsoon trough laying across the northern and north-eastern parts toward the active low-pressure cell during the first half of the week then the mentioned low-pressure cell moved into the gulf of Tonkin and covered the coast of upper Viet Nam on 8 July. Subsequently, the monsoon trough continued downward lying across the northern, north-eastern, middle, and eastern parts of the LMB during the second half of the week, and (ii) the moderate Southwest Monsoon which prevailed over the LMB. These conditions caused moderate rainfall in some areas of the LMB during the beginning of the week and the weekend.

According to the MRC-Flash Flood Guidance System (MRC- FFGS) and analysis, flash flood events were detected during the reporting period in several areas of the north central parts of Viet Nam and central-eastern parts of Lao PDR on July 8, and some areas of south-coast parts of Thailand and southwestern part of Cambodia on July 11 with the impacts ranging from low to high level as shown in [Figure 14](#) and [Table 2](#).

Table 2. Detected flash flood in Viet Nam and Lao PDR on July 8 and in Thailand and Cambodia on 11 July

 Rate-risk and location of the flash flood may occur in the next 1, 3, and 6 hours in Viet Nam												
Date of FFG products 08/07/2021 06:00 UTC time												
01-Hour Flash Flood Risk and Location				3-Hour Flash Flood Risk and Location in Vietnam				6-Hour Flash Flood Risk and Location in Vietnam				
Provinces	Districts	Region	Level Risks	Provinces	Districts	Region	Level Risks	Provinces	Districts	Region	Level Risks	
Nghe An	Tuong Duong	North Central	Moderate-Risk	Nghe An	Con Cuong	North Central	Low-Risk	Nghe An	Tuong Duong	North Central	Moderate-Risk	
Nghe An	Con Cuong	North Central	Low-Risk	Nghe An	Con Cuong	North Central	Low-Risk	Nghe An	Con Cuong	North Central	Low-Risk	
Nghe An	Thanh Chuong	North Central	Moderate-Risk	Nghe An	Thanh Chuong	North Central	Low-Risk	Nghe An	Con Cuong	North Central	Low-Risk	
Ha Tinh	Huong Son	North Central	Low-Risk	Nghe An	Thanh Chuong	North Central	Low-Risk	Nghe An	Thanh Chuong	North Central	Moderate-Risk	
Lao Cai	Bat Xat	Northwest	Low-Risk	Ha Tinh	Huong Son	North Central	Low-Risk	Nghe An	Thanh Chuong	North Central	Low-Risk	
Hoa Binh	Da Bac	Northwest	Low-Risk	Lao Cai	Bat Xat	Northwest	Low-Risk	Ha Tinh	Huong Son	North Central	Low-Risk	
Son La	Moc Chau	Northwest	Low-Risk	Hoa Binh	Da Bac	Northwest	Low-Risk	Lao Cai	Bat Xat	Northwest	Low-Risk	
Hoa Binh	Mai Chau	Northwest	Low-Risk	Son La	Moc Chau	Northwest	Low-Risk	Hoa Binh	Da Bac	Northwest	Low-Risk	
Hoa Binh	Lac Son	Northwest	Low-Risk	Hoa Binh	Lac Son	Northwest	Low-Risk	Hoa Binh	Da Bac	Northwest	Low-Risk	
Nghe An	Que Phong	North Central	High-Risk	Nghe An	Que Phong	North Central	Moderate-Risk	Lao Cai	Sa Pa	Northwest	Low-Risk	
Nghe An	Que Phong	North Central	Moderate-Risk	Nghe An	Tuong Duong	North Central	Low-Risk	Lao Cai	Than Uyen	Northwest	Low-Risk	
Thanh Hoa	Quan Son	North Central	Moderate-Risk	Nghe An	Que Phong	North Central	Low-Risk	Lao Cai	Bat Xat	Northwest	Low-Risk	
Thanh Hoa	Muong Lat	North Central	High-Risk	Thanh Hoa	Quan Son	North Central	Low-Risk	Son La	Moc Chau	Northwest	Low-Risk	
Thanh Hoa	Quan Son	North Central	High-Risk	Thanh Hoa	Quan Son	North Central	Low-Risk	Son La	Moc Chau	Northwest	Low-Risk	
Nghe An	Que Phong	North Central	High-Risk	Thanh Hoa	Quan Son	North Central	Low-Risk	Hoa Binh	Mai Chau	Northwest	Low-Risk	
Nghe An	Con Cuong	North Central	High-Risk	Thanh Hoa	Muong Lat	North Central	Moderate-Risk	Hoa Binh	Lac Son	Northwest	Low-Risk	
Hoa Binh	Ky Son	Northwest	Low-Risk	Thanh Hoa	Quan Son	North Central	Moderate-Risk	Thanh Hoa	Thuong Xuan	North Central	Low-Risk	
Nghe An	Quy Chau	North Central	Low-Risk	Nghe An	Que Phong	North Central	High-Risk	Nghe An	Que Phong	North Central	Moderate-Risk	
Nghe An	Tuong Duong	North Central	Low-Risk	Nghe An	Tuong Duong	North Central	Low-Risk	Nghe An	Que Phong	North Central	Low-Risk	
Nghe An	Que Phong	North Central	Moderate-Risk	Nghe An	Con Cuong	North Central	Moderate-Risk	Nghe An	Tuong Duong	North Central	Moderate-Risk	
Nghe An	Quy Hop	North Central	Low-Risk	Hoa Binh	Ky Son	Northwest	Low-Risk	Nghe An	Que Phong	North Central	Moderate-Risk	
Ha Tinh	Huong Son	North Central	Low-Risk	Hoa Binh	Ky Son	Northwest	Low-Risk	Nghe An	Que Phong	North Central	Low-Risk	
Nghe An	Anh Son	North Central	Moderate-Risk	Nghe An	Con Cuong	North Central	Low-Risk	Thanh Hoa	Muong Lat	North Central	Low-Risk	
Nghe An	Thanh Chuong	North Central	Moderate-Risk	Nghe An	Quy Chau	North Central	Low-Risk	Son La	Song Ma	Northwest	Low-Risk	

 Rate-risk and location of the flash flood may occur in the next 1, 3, and 6 hours in Lao PDR														
Date of FFG products 08/07/2021 06:00 UTC time														
01-Hour Flash Flood Risk and Location					03-Hour Flash Flood Risk and Location					06-Hour Flash Flood Risk and Location				
Provinces	Districts	Villages	Region	Level Risk	Provinces	Districts	Villages	Region	Level Risk	Provinces	Districts	Villages	Region	Level Risk
Xiengkhuang	Morkmay	KHANGVIENG	Northeast	Moderate-Risk	Xiengkhuang	Morkmay	KHANGVIENG	Northeast	Moderate-Risk	Xiengkhuang	Morkmay	KHANGVIENG	Northeast	Moderate-Risk
Bolikhamxay	Viengthon	VANGPHAE	Central Laos	Low-Risk	Bolikhamxay	Viengthon	PHAXING	Central Laos	Low-Risk	Xiengkhuang	Morkmay	NAMBUAK	Northeast	Low-Risk
Bolikhamxay	Viengthon	PHAXING	Central Laos	Low-Risk	Bolikhamxay	Viengthon	VANGPENE	Central Laos	Low-Risk	Bolikhamxay	Viengthon	PHAXING	Central Laos	Low-Risk
Bolikhamxay	Viengthon	VANGPENE	Central Laos	Moderate-Risk	Xiengkhuang	Khoune	POUNG	Northeast	Low-Risk	Bolikhamxay	Viengthon	PHAPHIENG	Central Laos	Low-Risk
Bolikhamxay	Viengthon	YORTKAEB	Central Laos	Low-Risk	Bolikhamxay	Pakxanh	XAYSAVANG	Central Laos	Low-Risk	Bolikhamxay	Viengthon	VANGPENE	Central Laos	Moderate-Risk
Xiengkhuang	Khoune	POUNG	Northeast	Low-Risk	Huaphanh	Xamtay	HINTANG	Eastern	Moderate-Risk	Bolikhamxay	Viengthon	YORTKAEB	Central Laos	Low-Risk
Bolikhamxay	Pakxanh	XAYSAVANG	Central Laos	Low-Risk	Huaphanh	Xamtay	GNORT-INN	Eastern	Moderate-Risk	Xiengkhuang	Khoune	MEUANG	Northeast	Low-Risk
Huaphanh	Xamtay	HINTANG	Eastern	Moderate-Risk	Huaphanh	Xamtay	NAMMORN	Eastern	Moderate-Risk	Xiengkhuang	Khoune	POUNG	Northeast	Low-Risk
Huaphanh	Xamtay	GNORT-INN	Eastern	Moderate-Risk	Huaphanh	Xamtay	LONGKUANG	Eastern	Low-Risk	Bolikhamxay	Pakxanh	XAYSAVANG	Central Laos	Low-Risk
Huaphanh	Xamtay	NAMMORN	Eastern	Moderate-Risk	Huaphanh	Xamtay	PHALOM	Eastern	Low-Risk	Vientiane	Kasy	PHONENGAM	Northwest	Low-Risk
Huaphanh	Xamtay	LONGKUANG	Eastern	Low-Risk	Huaphanh	Xamtay	PHAKHAO	Eastern	Moderate-Risk	Khammuane	Hinboon	MOUANG NAM SANG	Center of Laos	Low-Risk
Huaphanh	Viengxay	HOUAYTHONG	Eastern	Low-Risk						Xayaboury	Hongsa	NAM LEUAK	Northwest	Low-Risk
Huaphanh	Xamtay	PHALOM	Eastern	Low-Risk						Huaphanh	Xamtay	HINTANG	Eastern	Moderate-Risk
Huaphanh	Xamtay	PHAKHAO	Eastern	High-Risk						Huaphanh	Xamtay	GNORT-INN	Eastern	Moderate-Risk
										Huaphanh	Xamtay	NAMMORN	Eastern	Moderate-Risk
										Huaphanh	Xamtay	LONGKUANG	Eastern	Low-Risk
										Huaphanh	Viengxay	TA-AN	Eastern	Low-Risk
										Huaphanh	Viengxay	HOUAYTHONG	Eastern	Low-Risk
										Huaphanh	Xamtay	PHALOM	Eastern	Low-Risk
										Huaphanh	Xamtay	PHAKHAO	Eastern	Moderate-Risk

Rate-risk and location of the flash flood may occur in the next 1, 3, and 6 hours in Thailand												
Date of FFG products 11/07/2021 00:00 UTC time												
01-Hour Flash Flood Risk and Location				03-Hour Flash Flood Risk and Location				06-Hour Flash Flood Risk and Location				
Provinces	Districts	Region	Level Risk	Provinces	Districts	Region	Level Risk	Provinces	Districts	Region	Level Risk	
Rayong	Klaeng	Eastern	Low-Risk	Rayong	Klaeng	Eastern	Low-Risk	Rayong	Muang Rayong	Eastern	Low-Risk	
Rayong	Muang Rayong	Eastern	Low-Risk	Chumphon	Muang Chumphon	Southern-East Coast	Low-Risk	Chumphon	Muang Chumphon	Southern-East Coast	Low-Risk	
Chumphon	Muang Chumphon	Southern-East Coast	Low-Risk	Ranong	La-un	Southern-West Coast	Low-Risk	Ranong	La-un	Southern-West Coast	Low-Risk	
Ranong	La-un	Southern-West Coast	Low-Risk	Chumphon	Phato	Southern-East Coast	Moderate-Risk	Chumphon	Phato	Southern-East Coast	Moderate-Risk	
Chumphon	Phato	Southern-East Coast	Moderate-Risk	Surat Thani	Chaiya	Southern-East Coast	Low-Risk	Surat Thani	Chaiya	Southern-East Coast	Low-Risk	
Surat Thani	Chaiya	Southern-East Coast	Low-Risk	Surat Thani	Thachang	Southern-East Coast	Low-Risk	Surat Thani	Thachang	Southern-East Coast	Low-Risk	
Chumphon	Phato	Southern-East Coast	Low-Risk	Phangnga	Khura Buri	Southern-West Coast	Moderate-Risk	Surat Thani	Phanom	Southern-East Coast	Low-Risk	
Surat Thani	Thachang	Southern-East Coast	Moderate-Risk	Thai Island			High-Risk	Surat Thani	Ban Takhun	Southern-East Coast	Low-Risk	
Phangnga	Khura Buri	Southern-West Coast	High-Risk					Phangnga	Khura Buri	Southern-West Coast	Moderate-Risk	
Surat Thani	Phanom	Southern-East Coast	Low-Risk					Surat Thani	King Amphoe Wipawadi	Southern-East Coast	Low-Risk	
Surat Thani	Ban Takhun	Southern-East Coast	Low-Risk					Thai Island			High-Risk	
Thai Island			High-Risk					Phangnga	Thai Muang	Southern-West Coast	Low-Risk	
Phangnga	Thai Muang	Southern-West Coast	Low-Risk					Phangnga	Muang Phangnga	Southern-West Coast	Low-Risk	
Phangnga	Muang Phangnga	Southern-West Coast	Low-Risk					Phangnga	Takua Thung	Southern-West Coast	Low-Risk	
								Satun	La Ngu	Southern-West Coast	Low-Risk	

Rate-risk and location of the flash flood may occur in the next 1, 3, and 6 hours in Cambodia														
Date of FFG products 11/07/2021 00:00 UTC time														
01-Hour Flash Flood Risk and Location				03-Hour Flash Flood Risk and Location				06-Hour Flash Flood Risk and Location						
Provinces	Districts	Villages	Region	Level Risk	Provinces	Districts	Villages	Region	Level Risk	Provinces	Districts	Villages	Region	Level Risk
Koh Kong	Botum Sakor	Bak Ronoas	Southwestern	Low-Risk	NO ANY DETECTION OF FLASH FLOOD WITHIN NEXT 03-HOUR				Koh Kong	Botum Sakor	Bak Ronoas	Southwestern	Low-Risk	

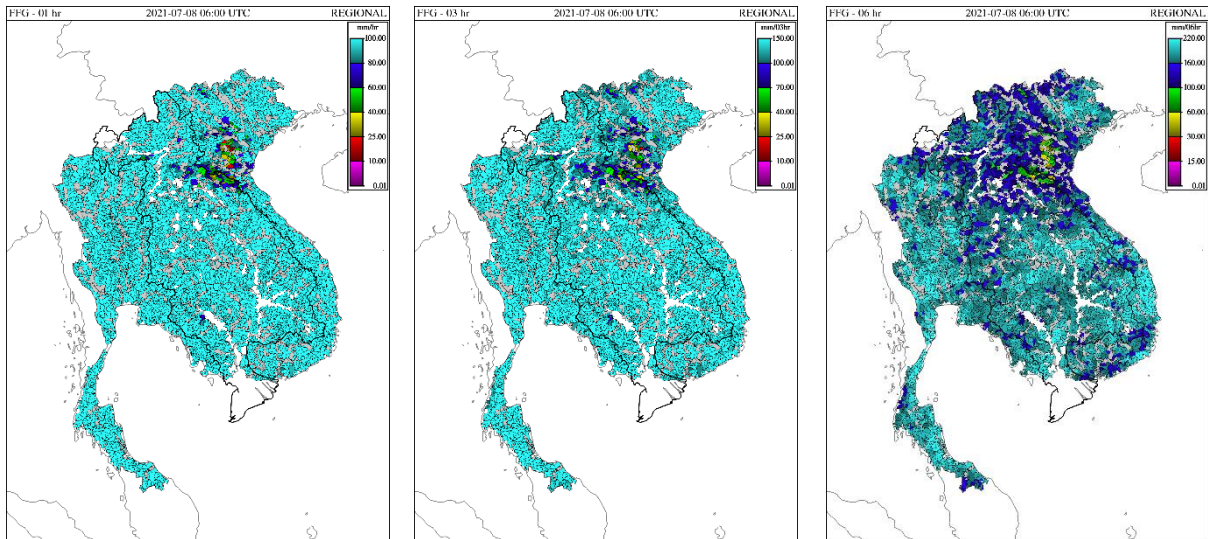


Figure 14. Flash Flood Guidance for the next 1 hour, 3 hours and 6 hours on July 8.

5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 3 to 9 July 2021

Drought monitoring data for 2021 are available from Saturday to Friday every week; thus, the reporting period is normally delayed by three days compared to Flood and Flash Flood reports. We adopt the Index of Soil Water Fraction (ISWF) data obtained from FFGS to represent soil moisture of agricultural indicator for both dry and wet seasons.

- **Weekly Standardised Precipitation Index (SPI1)**

The meteorological indicator through weekly SPI from July 3 to 9 was relatively better than the previous week (June 26 to July 2), as shown in [Figure 15](#). Meteorological drought, moderate and severe levels, remained an issue in some areas of the central part of the LMB covering Thailand’s Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nakhon Phanom, Kalasin, Roi Et, Yasothon, Amnat Charoen, Buriram, Surin, Si Saket, and Ubon Ratchathani. Additionally, moderate meteorological drought also took place in some areas of the upper and lower parts of the region including Lao PDR’s Phonesaly, Xayaburi, Luang Prabang, Sekong, and Xieng Khuang; Cambodia’s Kampot, Kampong Cham, Kampong Thom, Mondul Kiri, and Svay Rieng; and Viet Nam’s Tay Ninh and Ca Mau.

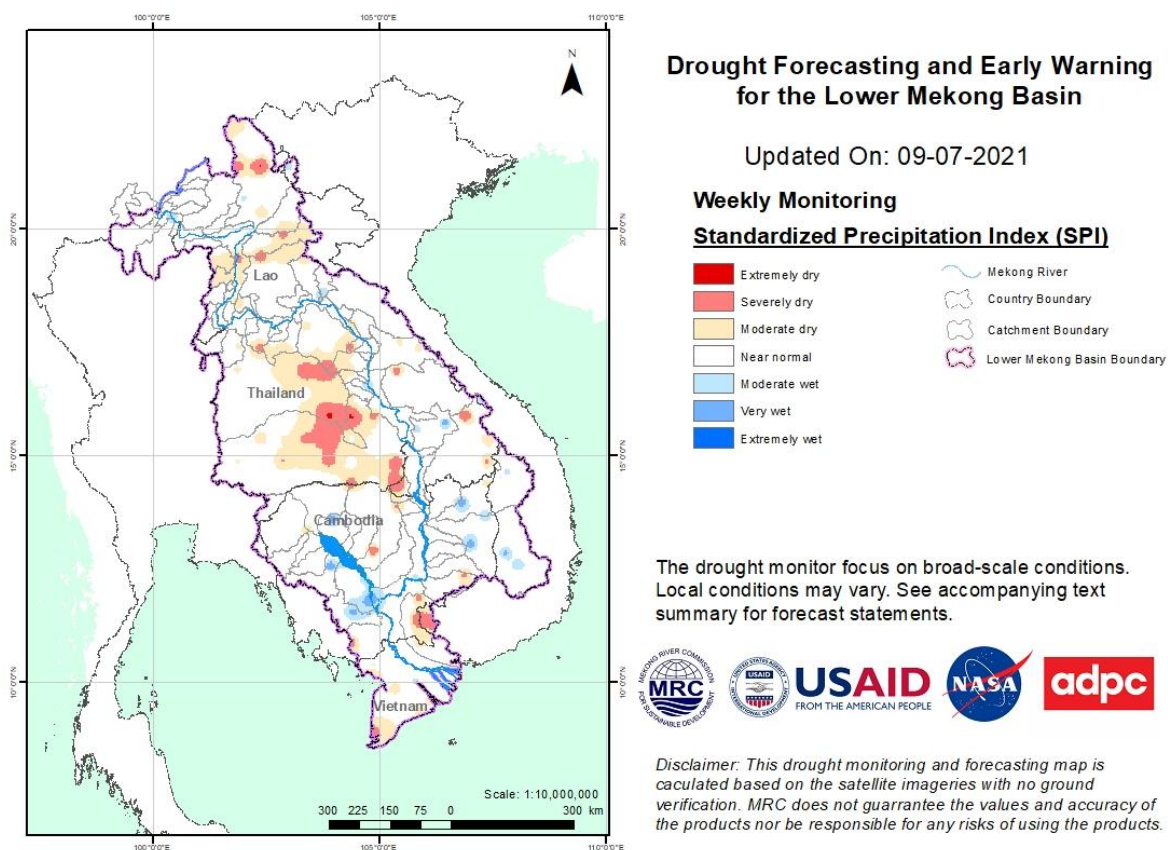


Figure 15. Weekly standardized precipitation index from 03 to 09 July 2021.

- **Weekly Index of Soil Water Fraction (ISWF)**

Soil water fraction from July 3 to 9, as displayed in [Figure 16](#), shows that the LMB region was mostly normal with some little moderate agricultural drought spots but not significant. The conditions were much better compared to the previous week (from June 26 to July 2).

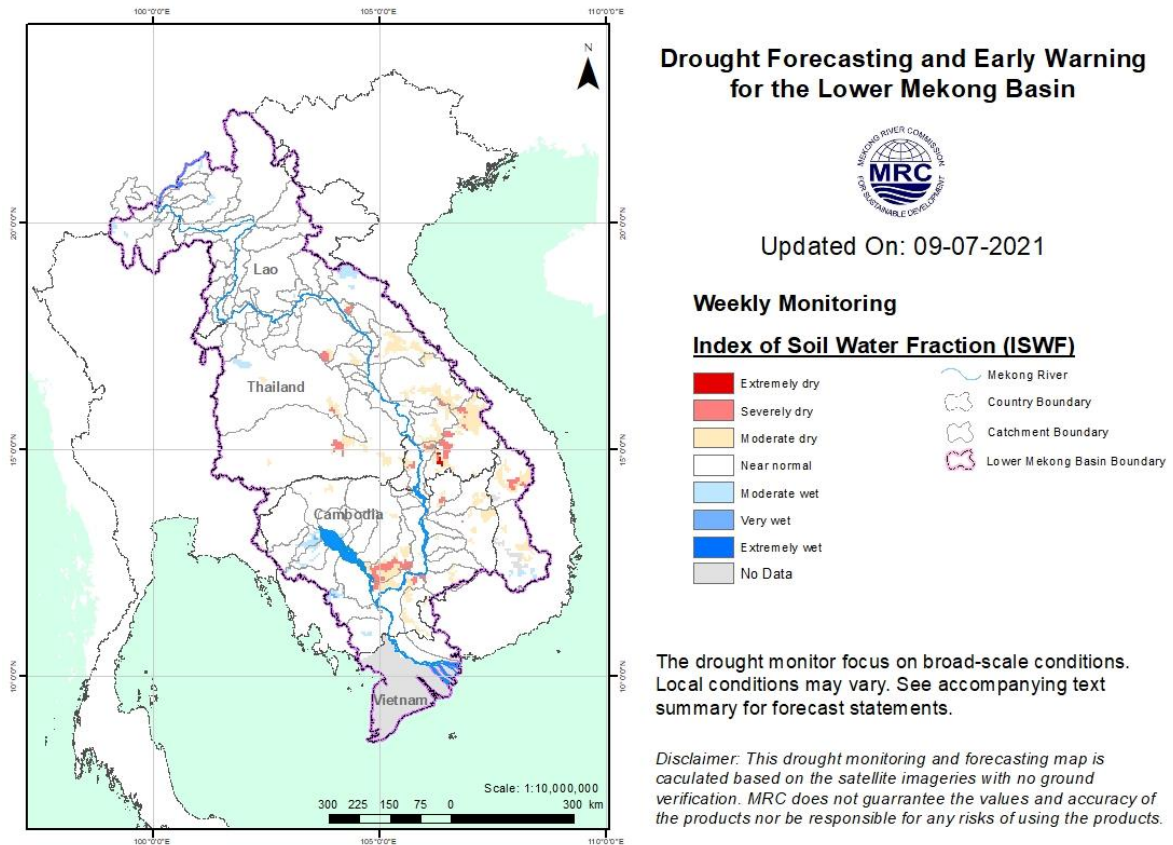


Figure 16. Weekly Soil Moisture Anomaly from 03 to 09 July 2021.

- **Weekly Combined Drought Index (CDI)**

With a better condition of meteorological and agricultural indicators, the LMB did not face any significant threat during July 3-9. The weekly combined drought indicator, as displayed in [Figure 16](#), shows that the LMB was mostly at normal conditions except some moderate spots mainly in the central part of the region covering some areas of Sakon Nakhon, Roi Et, Yasothon, Surin, Si Saket, Ubon Ratchathani, and Sekong.

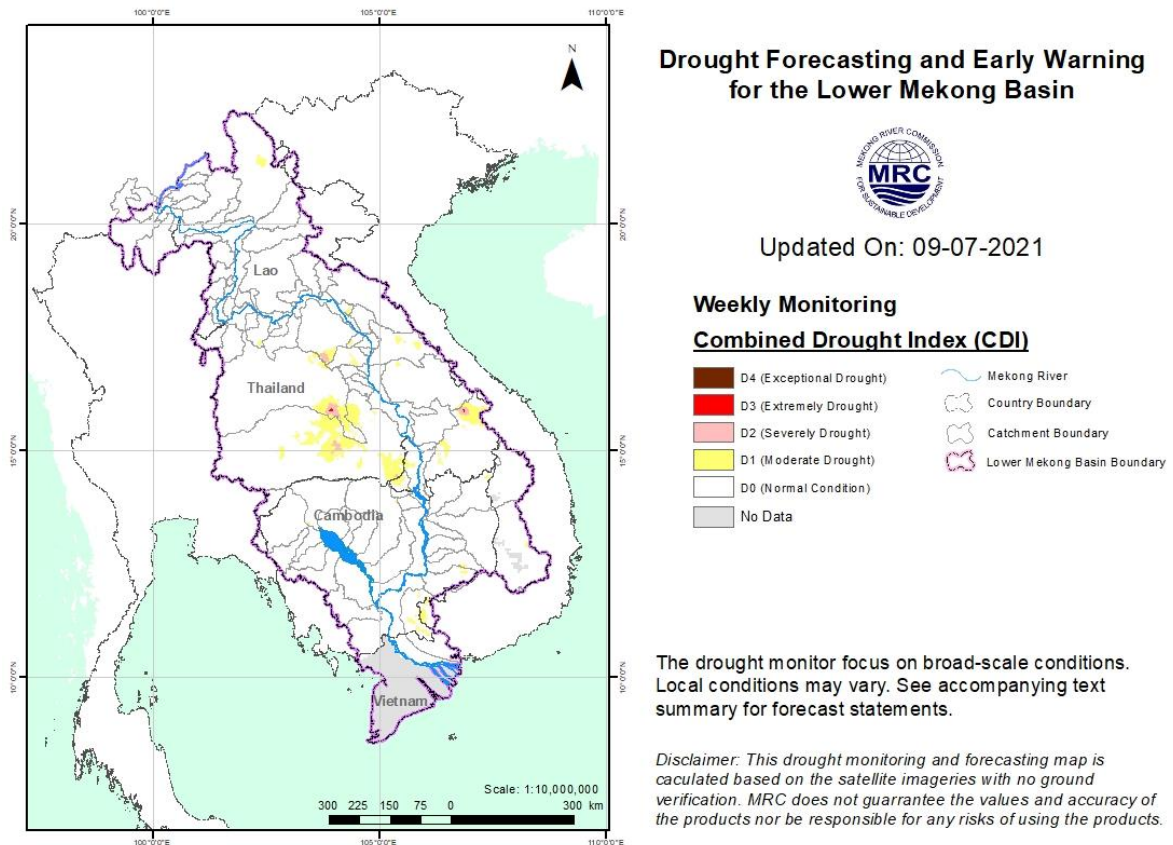


Figure 17. Weekly Combined Drought Index from 03 to 09 July 2021.

More information on Drought Forecasting and Early Warning (DFEW) as well as the explanation is available here: <http://droughtforecast.mrcmekong.org/templates/view/our-product>. DFEW provides not only weekly monitoring and forecasting information but also a three-month forecast of drought indicators with seasonal outlook which are updated every month based on international weather forecast models. Details on drought forecast are described in section [6.4](#) of this report.

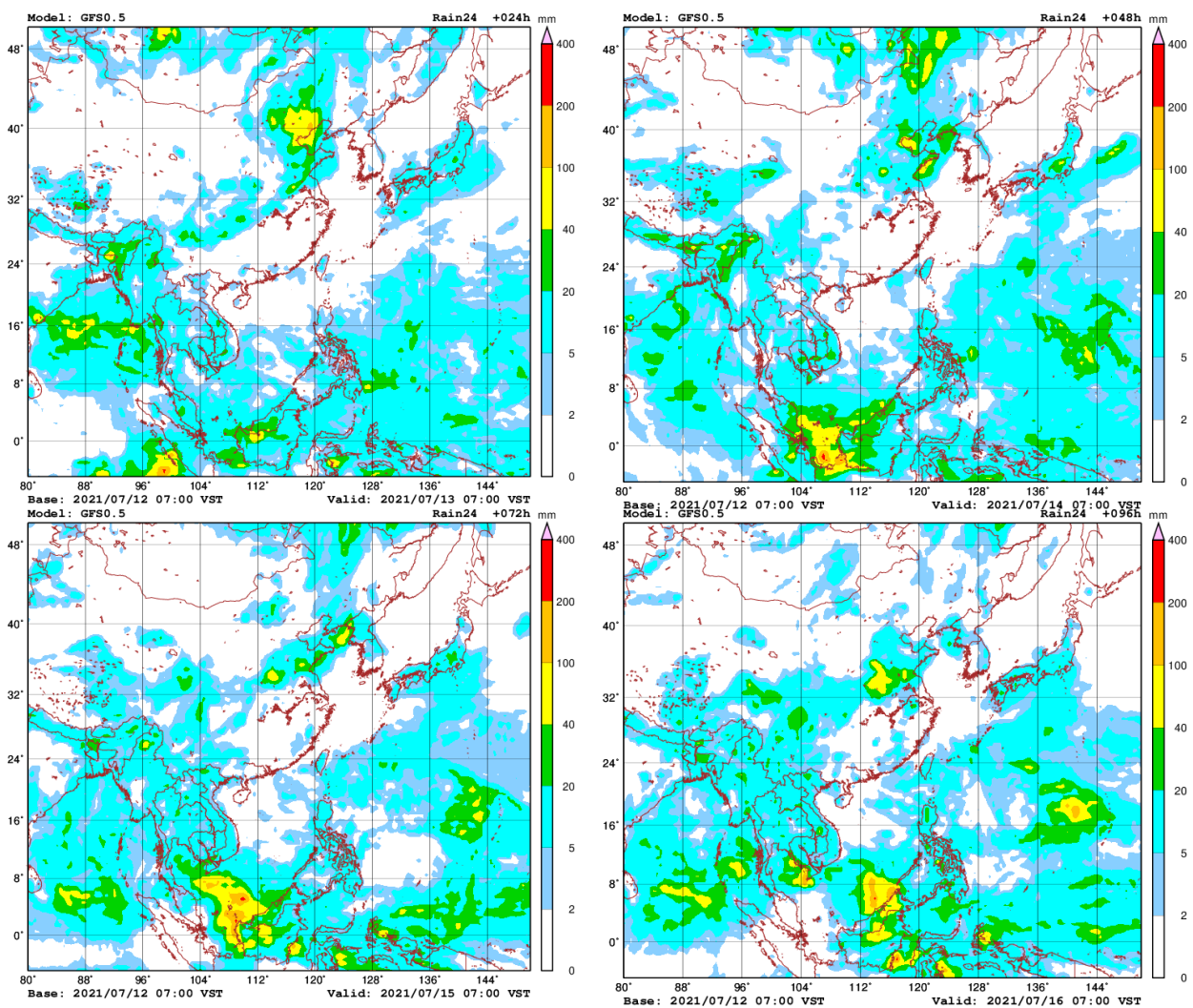
6 Weather and Water Level Forecast and Flash Flood Information

6.1 Weather and rainfall forecast

Based on the analysis of the synoptic meteorological information and result from the Global Forecast System (GFS) model, in the coming week, the moderate Southwest Monsoon and low-pressure cell will continue prevailing over the LMB.

From July 13-19, small rainfall (5–10 mm/24 h) and moderate rainfall (20 – 50 mm/24h) will likely occur in some parts of the LMB.

[Figure 18](#) shows accumulated rainfall forecast (24 h) of the GFS model from July 13-19.



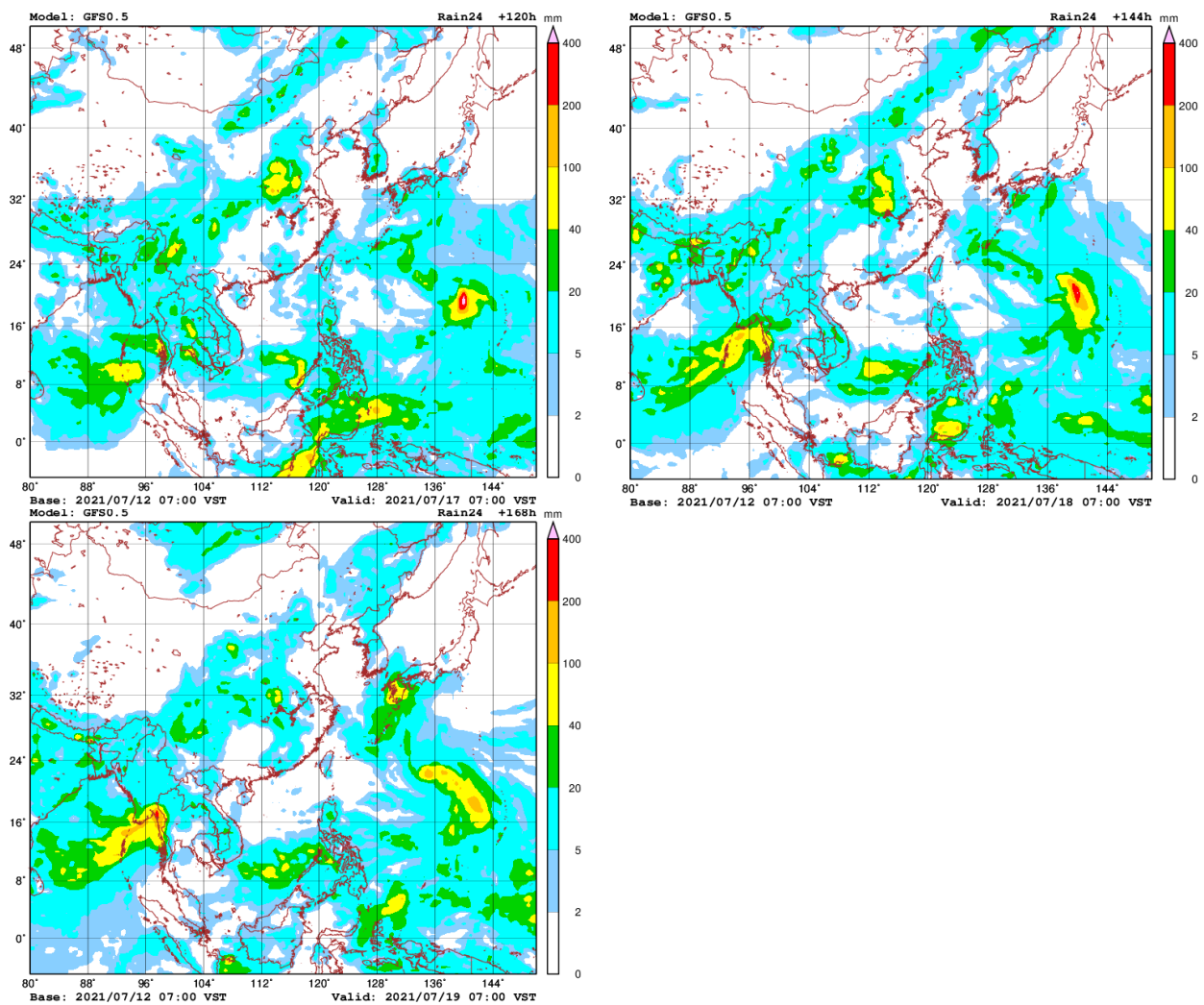


Figure 18. Accumulated rainfall forecast (24 h) based on a GFS model.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on July 13's daily flood forecasting bulletin, the daily forecasted water level at Chiang Saen in Thailand is expected to slightly increase from 2.46 m to 2.77 m over the next five days. The trend will keep the water level at this station below its LTA.

For Luang Prabang in Lao PDR, the water level will slightly increase from 9.39 m to 9.55 m during the next five days. The current water level is lower than its LTA. Precipitation is forecasted for the area between Chiang Saen and Luang Prabang next week.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand is forecasted to slightly increase about 0.02 m, while water level at Vientiane in Lao PDR will also decrease about 0.14 m. From Nong Khai in Thailand to Paksane in Lao PDR, the water levels will drop by about 0.05 m over the next five days. Rainfall is forecasted for the area between Chiang Khan and Paksane next week.

The water levels are expected to go down lower than their LTA at Chiang Khan, Vientiane, Nong Khai, and Paksane.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Savannakhet in Lao PDR are forecasted to decrease by about 0.10 m over the next seven days. From Khong Chiam in Thailand to Pakse in Lao PDR, the stations will likely experience a 0.15 m decrease. The water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR will stay lower than their LTA, with some forecasted rainfall for the areas next week.

Stung Treng to Kampong Cham/Phnom Penh to Koh Khel/Neak Luong

From Stung Treng to Kampong Cham along the Mekong River in Cambodia, the water levels will slightly go up by about 0.15 m over the next seven days. Precipitation is forecasted for the area between Stung Treng and Kompong Cham during next week.

The water levels of the Tonle Sap Lake at Prek Kdam and Phnom Penh Port, as well as at Phnom Penh's Chaktomuk on the Bassac River will increase by about 0.35 m over the next seven days.

Water levels at these stations will continue to stay lower than their LTA values, particularly from the Bassac at Phnom Penh to Koh Khel as well as from Tonle Sap at Prek Kdam to Phnom Penh Port, including the Tonle Sap Lake. Precipitation is forecasted for the low-lying area of Cambodia next week.

Tidal stations at Tan Chau and Chau Doc

For Viet Nam's Tan Chau on the Mekong River and Chau Doc on the Bassac River, the water levels will be fluctuating below their LTA, following daily tidal effects from the sea. Rainfall is forecasted for the Delta area next week.

The performance of the weekly flood forecast, with an accuracy and data input evaluation from 6 to 12 July 2021, is presented in **Annex 1**.

[Table 2](#) shows the daily flood forecasting Bulletin issued on July 13. Results of the weekly river monitoring bulletin are also available at http://ffw.mrcmekong.org/bulletin_wet.php.

6.3 Flash Flood Information

With small and moderate rainfall forecasted for next week, flash floods are not expected to take place in the LMB. However, local heavy rain in a short period of time is possible with unexpected short flash floods. The information on flash flood guidance for the next one, three, and six hours is updated twice daily at: <http://ffw.mrcmekong.org/ffg.php>.

Detailed information on Flash Flood Warning Information as well as on its explanation is available for download [here](#).

6.4 Drought forecast

There are several climate-prediction models with different scenarios on the upcoming months until September 2021. The MRC’s DFEWS adopts an ensemble model called the North America Multi-Model Ensemble (NMME), which averages all scenarios.

The global scale of rainfall prediction is used to see how the rain distribution looks like for the coming months. Figure 18 shows the ensemble mean of daily average precipitation (mm/day) each month from July to October 2021 produced by the NMME.

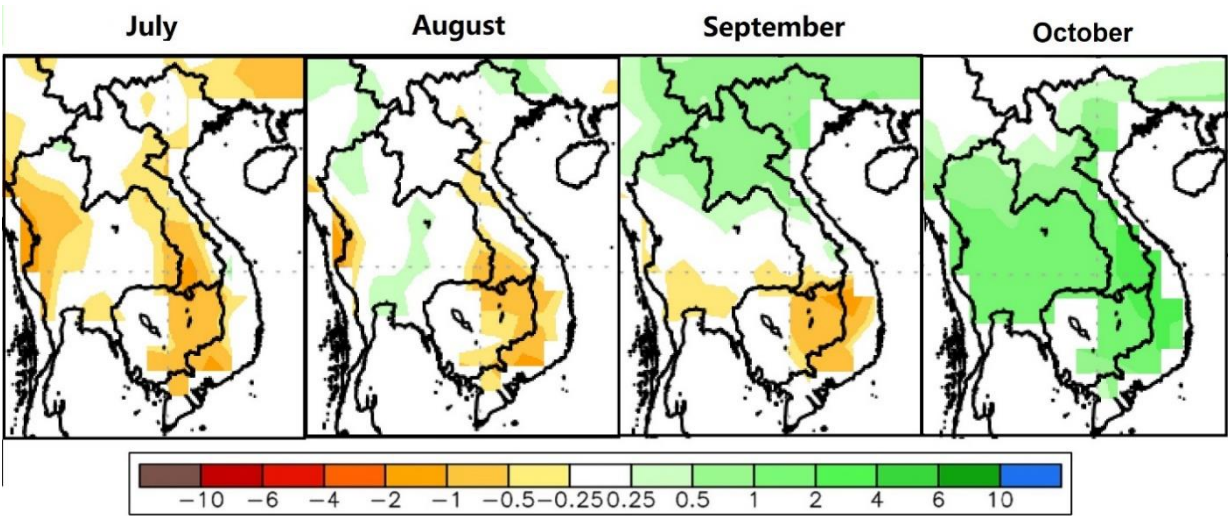


Figure 19. Daily average of monthly rainfall anomaly forecast from June to September 2021.

The ensemble prediction model forecasts that in July the LMB is likely to receive from below-average to average rainfall for the entire region; Cambodia, the Central Highlands of Viet Nam, and southern Lao PDR will be the driest areas. In August and September, eastern Cambodia and the Central Highland of Viet Nam are forecasted to experience some meteorological drought, a situation when there is a prolonged period with less than average rainfall. Fortunately, the models show that the LMB might receive much above average of rain during October.

The 2021 dry season is relatively wetter than that of 2020 and the monsoon rain in the 2021 wet season has arrived earlier than it did in 2019 and 2020 especially over the upper and central parts of the LMB.

Table 2. Weekly River Monitoring Bulletin.



Mekong Bulletin

Mekong River Commission Secretariat (MRCS)
Regional Flood and Drought Management Centre (RFDMC)
P.O. Box 623 #576, National Road #2, Chak Angre Krom, Meanchey, Phnom Penh, Cambodia
Tel: (855-23) 425353, Fax: (855-23) 425363, Email: floodforecast@mrcmekong.org

River Flood Forecast: 14 July - 18 July 2021

Date: 13 July 2021

Location	Country	24-hr Observed Rainfall (mm)	Zero gauge above M.S.L (m)	Flood level (m)	Alarm level (m)	Observed W. level against zero gauge (m)		Forecasted Water Levels (m)					There is currently no flood warning in place at monitoring sites on the Mekong										
						12-Jul	13-Jul	14-Jul	15-Jul	16-Jul	17-Jul	18-Jul	13	14	15	16	17	18					
Jinghong		0.0				535.60	535.74										↑	×	×	×	×	×	
Chiang Saen		0.5	357.110	12.80	11.50	2.62	2.46	2.50	2.57	2.65							↓					★	★
Luang Prabang		0.0	267.195	18.00	17.50	9.28	9.39	9.42	9.27	9.35	9.45	9.55					↑		↓				↑
Chiang Khan		9.6	194.118	16.00	14.50	6.88	6.69	6.62	6.55	6.57							↓					★	★
Vientiane		0.0	158.040	12.50	11.50	4.08	4.25	4.13	4.08	4.03	4.05	4.10					↑	↓					
Nongkhal		4.0	153.648	12.20	11.40	3.67	3.92	3.80	3.74	3.69							↑	↓				★	★
Paksane		0.0	142.125	14.50	13.50	5.01	5.01	5.15	5.08	5.05	5.02	5.05					↓	↑					
Nakhon Phanom		28.5	130.961	12.00	11.50	4.52	4.37	4.33	4.41	4.36							↓					★	★
Thakhek		56.9	129.629	14.00	13.00	5.70	5.58	5.53	5.63	5.57	5.52	5.50					↓						
Mukdahan		3.3	124.219	12.50	12.00	4.68	4.38	4.22	4.15	4.22							↓	↓				★	★
Savannakhet		0.0	125.410	13.00	12.00	2.75	2.88	2.95	2.92	2.90	2.95	2.97					↑						
Khong Chiam		11.5	89.030	14.50	13.50	5.11	5.17	5.06	4.86	4.76							↓	↓	↓	↓		★	★
Pakse		0.0	86.490	12.00	11.00	3.62	3.72	3.75	3.65	3.60	3.67	3.70					↑		↓			↑	
Stung Treng		66.0	36.790	12.00	10.70	4.05	4.22	4.35	4.40	4.34	4.30	4.35					↑	↑	↑	↑			
Kratie		27.0	-0.101	23.00	22.00	10.04	10.23	10.48	10.63	10.71	10.63	10.58					↑	↑	↑	↑	↓		↓
Kompong Cham		2.0	-0.930	16.20	15.20	4.70	4.80	5.00	5.25	5.42	5.51	5.43					↑	↑	↑	↑	↑		↓
Phnom Penh (Bassac)		0.0	-1.020	12.00	10.50	2.63	2.77	2.93	3.05	3.15	3.21	3.19					↑	↑	↑	↑	↑		
Phnom Penh Port		-	0.070	11.00	9.50	1.65	1.79	1.95	2.08	2.19	2.26	2.26					↑	↑	↑	↑	↑		
Koh Khel (Bassac)		83.9	-1.000	8.40	7.90	2.64	2.76	2.87	2.97	3.05	3.09	3.07					↑	↑	↑	↑	↑		
Neak Luong		0.0	-0.330	8.00	7.50	1.76	1.86	1.92	2.02	2.15	2.25	2.29					↑	↑	↑	↑	↑		
Prek Kdam		nr	0.080	10.00	9.50	1.78	1.83	1.92	2.01	2.11	2.18	2.21					↑	↑	↑	↑	↑		
Tan Chau		0.0	0.000	4.50	3.50	0.26	0.15	0.07	0.02	-0.02	-0.09	-0.02					↓	↓	↓	↓	↓	↓	↑
Chau Doc		nr	0.000	4.00	3.00	0.10	0.00	-0.13	-0.22	-0.28	-0.38	-0.28					↓	↓	↓	↓	↓	↓	↑

REMARKS:

-: not available.
nr: no rain.

LEGEND	
rising water level	↑
stable water level	↔
falling water level	↓
alarm stage	■ (yellow)
alarm situation	■ (orange)
flood stage	■ (red)
no data available	×
as suggested by Thailand, forecasted values are not displayed pending further improvement of the system	★

Note: Stable water level is defined as a daily change of less than 10cm from Chiang Saen to Savannakhet; less than 5cm at Pakse and Stung Treng; and no more than 3cm cm from Kratie downstream.
Flood stage is when the flood level exceeds. A flood level is determined by each Member Country.
Alarm stage is when the water level ranges between alarm and flood levels.
Alarm situation is when the water level is forecasted to reach the flood stage within the next three days.

River Flood Forecaster

KHEM Sothea

NOTE: Discharge at Luang Prabang may be influenced by hydropower operations (at both upstream and downstream).
For more info, please refer to this link:
<http://www.mrcmekong.org/>; http://fw.mrcmekong.org/bulletin_wet.php; <http://fw.mrcmekong.org/reportflood.php>

7 Summary and Possible Implications

7.1 Rainfall and its forecast

Rain was observed from Chiang Saen in Thailand to Pakse in Lao PDR during July 6-12, including the lower part in Cambodia and Viet Nam, varying from 1.70 millimetres (mm) to 218.00 mm.

Based on the forecasted satellite data, rainfall is forecasted for some areas of the LMB with value ranging from 10 mm to 100 mm for the next seven days. The forecasting model using GFS data, on the other hand, shows that no significant rainfall (>100 mm) is likely to take place in the Mekong region from 13 to 19 July 2021.

7.2 Water level and its forecast

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed rapid decrease over the monitoring period from 30 June to 12 July 2021. It dropped about 1.55 m from 537.15 metres (m) on June 30 to 535.60 m on July 12. The outflows decreased from 2,260 cubic metres per second (m³/s) on June 30 to 1,050 m³/s on July 12.

Due to the influence of below average rainfall from June 30 to July 12, water levels across most monitoring stations from Chiang Saen in Thailand to Thakhek in Lao PDR, including the stretches of the river between Stung Treng, Kratie and Kompong Cham in Cambodia water levels were decreasing and were lower than their LTA.

Over the next few days, the water levels from Chiang Khan to Vientiane and from Nakhon Phanom to Pakse are expected to slightly drop by about 0.05 m and 0.24 m, respectively.

The flow volume of the Tonle Sap Lake is lower than its LTA. From next week, the flow might increase due to forecasted rainfall in the inflow catchments and the increased water levels along the lower part of the Mekong and Bassac rivers.

From Stung Treng to Kampong Cham, the water levels will slightly increase but remain lower than their LTA. The water levels – at Neak Luong on the Mekong River, from Prek Kdam to Phnom Penh Port on the Tonle Sap, and from Chaktomuk to Koh Khel on the Bassac – are forecasted to remain lower than their LTA.

The situation in Tan Chau on the Mekong River and Chau Doc on the Bassac River is expected to remain unchanged.

Since the early of July 2021, water levels across most monitoring stations in the LMB have dropped lower than their LTA (from upper to lower stretches within the LMB) but are likely to start increasing again from July 15 to 31 based on the predicted rainfall from satellite. For a more complete preliminary analysis of the hydrological conditions in the LMB over July–December 2020 and November 2020 to May 2021 see this [Situation Report](#).

The contribution to the Mekong River's flow from the UMB in China (Yunnan component) is about 16% by the time the river discharges through the Mekong Delta into the Sea. By far the major contribution comes from the two major 'left-bank' (Eastern) tributaries between Vientiane – Nakhon Phanom and Pakse – Stung Treng, which together contribute more than 40% of the flows.

7.3 Flash flood and its trends

With the predicted small amount of rainfall for the coming week as mentioned earlier in [section 6.1](#), no major flash floods are expected in the LMB during next week. However, local heavy rain in a short period of time is possible with unexpected short flash floods.

7.4 Drought condition and its forecast

With a better condition of meteorological and agricultural indicators, the LMB did not face any significant threat during July 3-9. The LMB was mostly at normal conditions except some moderate drought taking place in the central part of the region covering some areas of Sakon Nakhon, Roi Et, Yasothon, Surin, Si Saket, Ubon Ratchathani, and Sekong.

The ensemble prediction model forecasts that in July the LMB is likely to receive from below-average to average rainfall for the entire region; Cambodia, the Central Highlands of Viet Nam, and southern Lao PDR will be the driest areas. In August and September, eastern Cambodia and the Central Highland of Viet Nam are forecasted to experience some meteorological drought, a situation when there is a prolonged period with less than average rainfall. Fortunately, the models show that the LMB might receive much above average of rain during October.

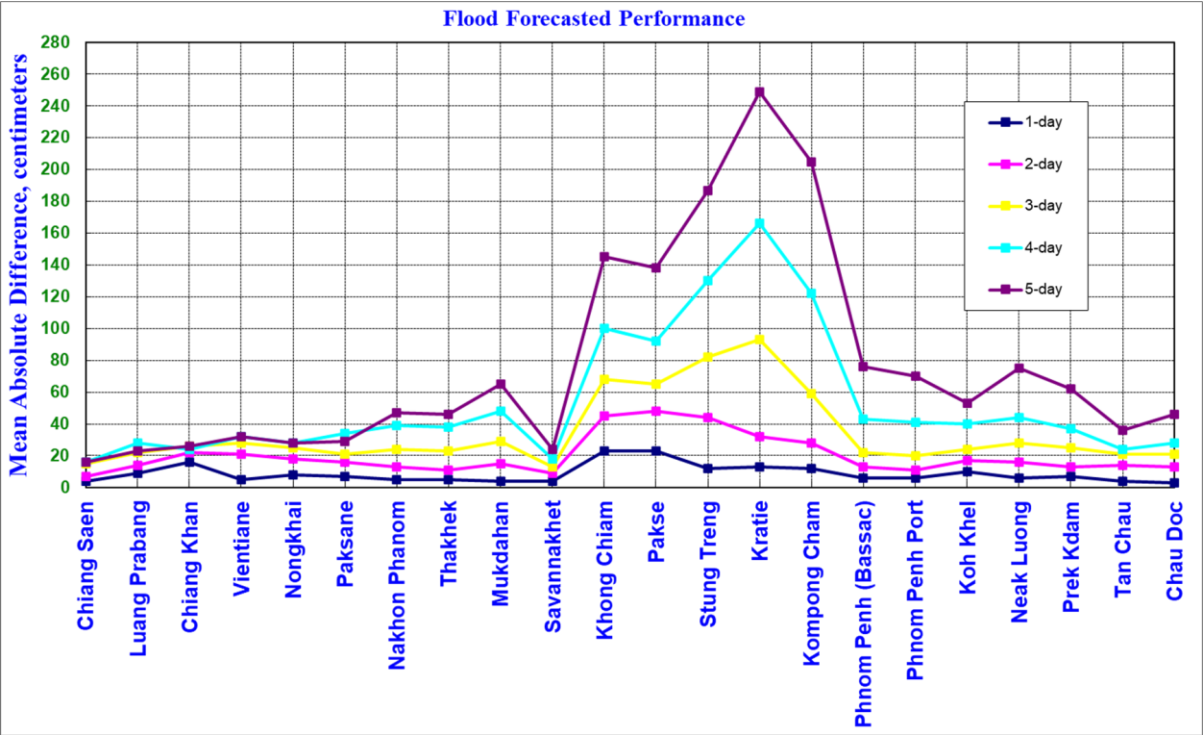
Annex 1: Performance of the weekly flood forecasting

Accuracy

“Accuracy” here refers to the state where data recorded in the MRC’s Mekong River Flood Forecasting System are cleaned and verified.

The adjustment of flood forecasting outcomes from the flood forecasting system requires flood forecasters to have extensive knowledge in hydrology and statistical modelling for estimating the relationships between stations upstream and downstream in the Mekong River Basin. Flood forecasting performance presented in the graph below shows the average flood forecasting accuracy at each key station along the Mekong mainstream from 6-12 July 2021.

The forecasting values from 6-12 July show that the overall accuracy is fair for a one-day to three-day forecast in lead time at stations in the middle to the lower parts of the Mekong River from Khong Chiam to Kompong Cham due to the effect of rain in this area during the report period.



Note: The higher percentage of flood forecasting accuracy is due to several key factors as follows:

- Missing rainfall in Cambodia (DOM) data and data input are not sufficient to be used for inputting into the flood forecasting model system.
- The influence of heavy rainfall caused by storms and hydropower operations from upstream, tributaries inflows and the lower part of the Mekong floodplain.
- Luang Prabang, Chiang Khan, Paksane and Savannakhet stations have been affected by

hydropower operations of Xayaburi and Nam Nguem (water retention and release). Rainfall always accumulates at this spot, which could be causing rapidly high-water levels.

- Rapid fluctuations of the water levels at Tan Chau and Chau Doc stations due to daily tidal effects of the sea in the Mekong Delta.
- Satellite rainfall data was not representative of the actual rainfall at ground stations in some areas of the Mekong region.

Performance based on data from the Member Countries

Flood forecasting performance is based on the hydro-met data received from the Member Countries. The flood forecasting achievement indicated in (%) and (cm) from 1 day to 5 days at each key station, against with Old Benchmark are presented in Table B1 and Table B2.

The evaluation of performance indicators, missing data and completion time for flood forecasting are presented in Table B3 and Figures B4, B5 and B6, respectively from 6-12 July, 2021.

Table B1: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 6-12 July, 2021 in cm

Lead-time Forecasted	Chiang Saen	Luang Prabang	Chiang Khan	Vientiane	Nongkhai	Paksane	Nakhon Phanom	Thakhek	Mukdahan	Savannakhet	Khong Chiam	Pakse	Stung Treng	Kratie	Kompong Cham	Phnom Penh (Bassac)	Phnom Penh Port	Koh Khel	Neak Luong	Prek Kdam	Tan Chau	Chau Doc
1-day	15	9	<u>21</u>	7	10	19	12	11	12	6	14	9	7	4	3	5	5	5	6	4	7	14
2-day	<u>23</u>	15	<u>24</u>	15	19	<u>28</u>	<u>30</u>	<u>26</u>	<u>26</u>	8	<u>26</u>	14	14	9	7	8	7	7	12	3	15	20
3-day	<u>26</u>	<u>23</u>	<u>38</u>	<u>21</u>	<u>21</u>	<u>32</u>	<u>36</u>	<u>31</u>	<u>34</u>	8	<u>31</u>	<u>20</u>	<u>23</u>	<u>22</u>	12	9	9	7	16	5	<u>22</u>	<u>21</u>
4-day	<u>21</u>	<u>20</u>	<u>28</u>	<u>34</u>	<u>34</u>	<u>26</u>	<u>33</u>	<u>22</u>	<u>30</u>	12	17	<u>23</u>	<u>25</u>	<u>30</u>	<u>25</u>	13	13	7	19	5	<u>31</u>	<u>30</u>
5-day	<u>25</u>	<u>25</u>	<u>34</u>	<u>39</u>	<u>40</u>	<u>40</u>	<u>24</u>	15	<u>26</u>	19	<u>20</u>	<u>22</u>	<u>26</u>	<u>36</u>	<u>35</u>	16	18	4	19	8	51	61

Table B2: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 6-12 July, 2021 in %

Lead-time Forecasted	Chiang Saen	Luang Prabang	Chiang Khan	Vientiane	Nongkhai	Paksane	Nakhon Phanom	Thakhek	Mukdahan	Savannakhet	Khong Chiam	Pakse	Stung Treng	Kratie	Kompong Cham	Phnom Penh (Bassac)	Phnom Penh Port	Koh Khel	Neak Luong	Prek Kdam	Tan Chau	Chau Doc	Average	
1-day	57.1	57.1	<u>42.9</u>	57.1	57.1	71.4	57.1	<u>42.9</u>	57.1	57.1	71.4	<u>42.9</u>	<u>42.9</u>	<u>42.9</u>	<u>42.9</u>	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	<u>54.5</u>
2-day	<u>50.0</u>	<u>50.0</u>	83.3	<u>33.3</u>	66.7	66.7	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	83.3	66.7	<u>50.0</u>	66.7	66.7	<u>33.3</u>	<u>50.0</u>	66.7	66.7	66.7	<u>33.3</u>	<u>50.0</u>	<u>50.0</u>	<u>56.8</u>
3-day	80.0	60.0	<u>40.0</u>	<u>40.0</u>	<u>40.0</u>	60.0	<u>40.0</u>	<u>40.0</u>	60.0	60.0	60.0	<u>40.0</u>	60.0	60.0	60.0	<u>20.0</u>	60.0	60.0	80.0	<u>40.0</u>	<u>40.0</u>	<u>40.0</u>	<u>40.0</u>	<u>51.8</u>
4-day	<u>50.0</u>	75.0	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>25.0</u>	75.0	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>25.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>25.0</u>	<u>50.0</u>	75.0	<u>50.0</u>	75.0	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>51.1</u>
5-day	66.7	<u>33.3</u>	<u>33.3</u>	66.7	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	66.7	<u>33.3</u>	66.7	<u>33.3</u>	<u>33.3</u>	66.7	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	66.7	66.7	66.7	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>45.5</u>

Table B3: Overview of performance indicators for the past 7 days from 6-12 July 2021

	FF time sent				Arrival time of input data								Missing data (number-mainstream and trib.st.)								
	FF completed and sent (time)	Stations without forecast	FF2 completed and sent (time)	Weather data available (time)	NOAA data	China	Cambodia - DHRW	Cambodia - DOM	Lao PDR - DMH	Thailand - DWR	Viet Nam - SRHMC	Viet Nam - HMS	NOAA data/2dataset	China/2	Cambodia - DHRW/15	Cambodia - DOM/34	Lao PDR - DMH/32	Thailand - DWR/13	Viet Nam - SRHMC/6	Viet Nam - HMS/39	
2021																					
<i>week</i>	10:37	00:00	-	-	08:15	07:10	07:17	08:25	08:11	08:17	07:01	08:03	0	0	0	0	60	14	1	0	
<i>month</i>	10:30	00:00	-	-	08:15	07:10	07:21	08:36	08:26	08:14	07:17	08:01	0	0	14	272	116	48	7	38	

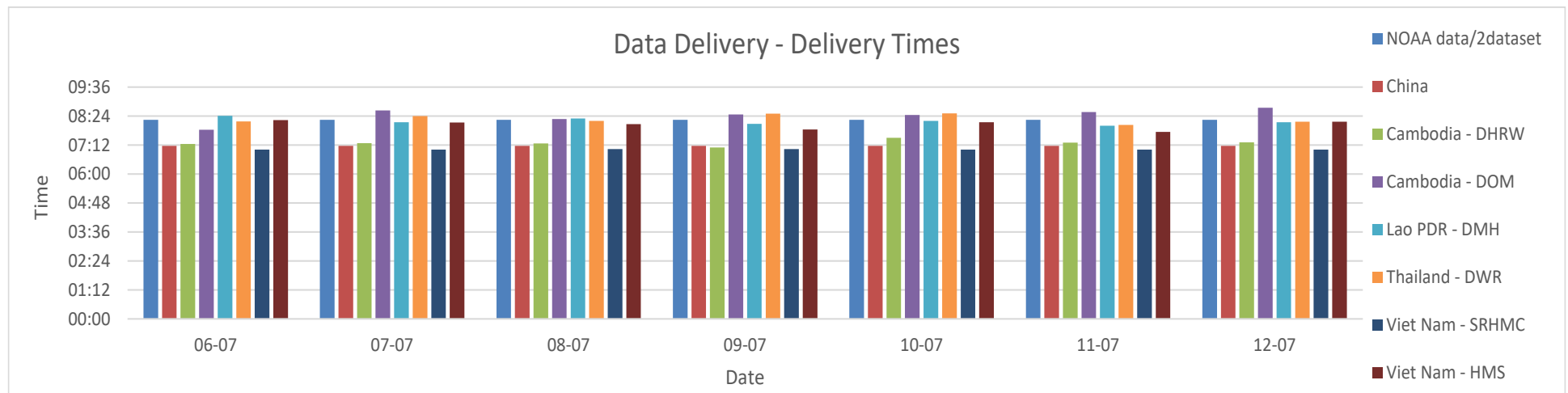


Fig. B4: Data delivery times for the past 7 days from 6-12 July 2021

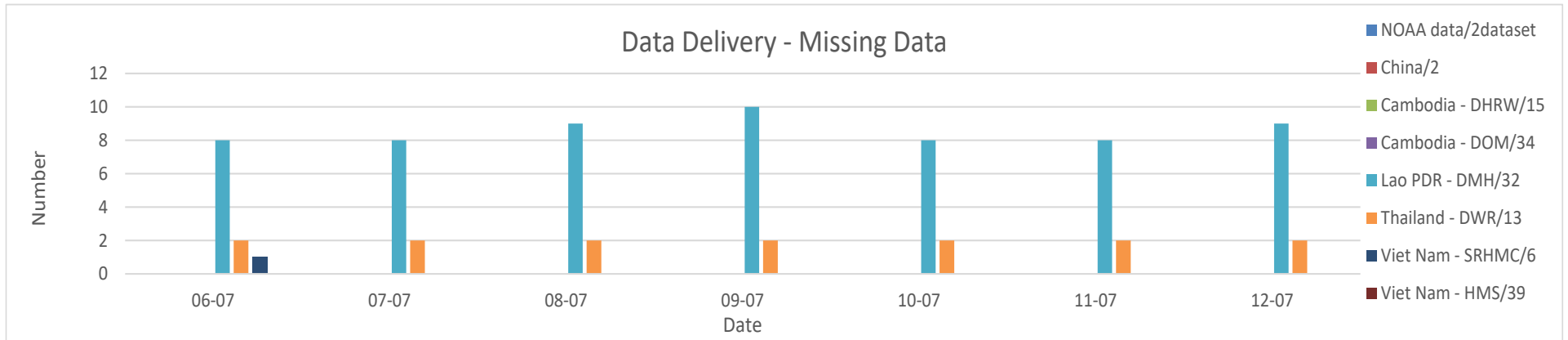


Fig. B5: Missing data for the past 7 days from 6-12 July 2021

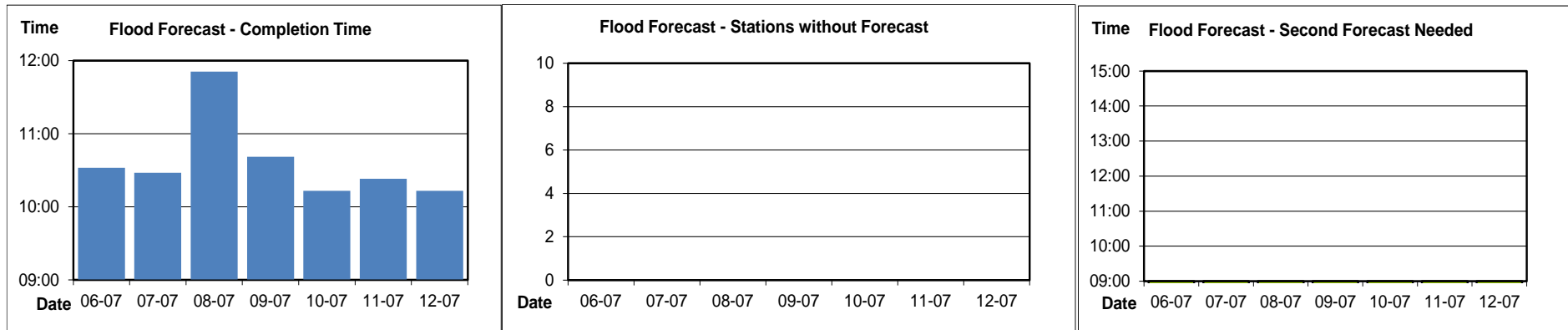


Fig. B6: Flood forecast completion time, stations without forecasts, and second forecasts need from 6-12 July 2021



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