Mekong River Commission

Weekly Wet Season Situation Report in the Lower Mekong River Basin

27 July-2 August 2021

Prepared by
The Regional Flood and Drought Management Centre
3 August 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 3.90 millimetres (mm) to 126.00 mm.
- There will be significant rainfall for the next 5 days over the Mekong region from 04 to 08 August 2021 due to low-pressure dominating the Mekong region.

Water level and its forecast

- The outflows at Jinghong hydrological station showed slightly decrease during the monitoring period from 27 July to 2 August 2021, down about 0.56 m from 536.10 metres (m) on July 27 to 535.54 m on August 2. The outflows decreased from 1,404 cubic metres per second (m^3/s) on July 27 to 1,010 m^3/s on August 2.
- Due to less inflow and rainfall from July 27 to August 2 in the LMB could not bring the water levels across most monitoring stations from Chiang Saen in Thailand to Thakhek in Lao PDR and from the stretches of the river between Stung Treng, Kratie and Kompong Cham in Cambodia up and, thus, making the water levels of those stations stay lower than their LTA.
- The water volume of the Tonle Sap Lake during this reporting period was slightly higher than that in 2019 and 2020 of the same period 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 and are forecasted to continue staying below their long-term value in some stations.

Drought condition and its forecast

- Drought conditions of the LMB from July 24 to 30 were normal and wet in all over the region. No drought threat was found during the monitoring week.

- For the upcoming thee-month forecast, the LMB is likely to receive much below average rainfall in August mainly in the central and southern parts of the region; September is forecasted to be extremely wet in the north, moderately wet and normal in the middle, and normal and moderately dry in southern areas of the region. Like 2020, the forecast shows that October is likely the wettest month of the year. November is forecasted to receive from average to above average rainfall throughout the LMB.

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 **27 July-2 August 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 (August, September, and October) and the weather maps issued by the Thai Meteorological Department (TMD) were used to verify weather conditions in the LMB.

The TMD stated that average rainfall will continue from August which is influenced by the Southwest Monsoon of the rainy season period. 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 August and September.

Figure 1 presents the weather map of 2 August 2021, showing that a low pressure is dominating the upper part of Lao PDR and Viet Nam and might affect the 3S area (Sesan, Sre Pok, and Sekong) in Cambodia and Viet Nam of the LMB.

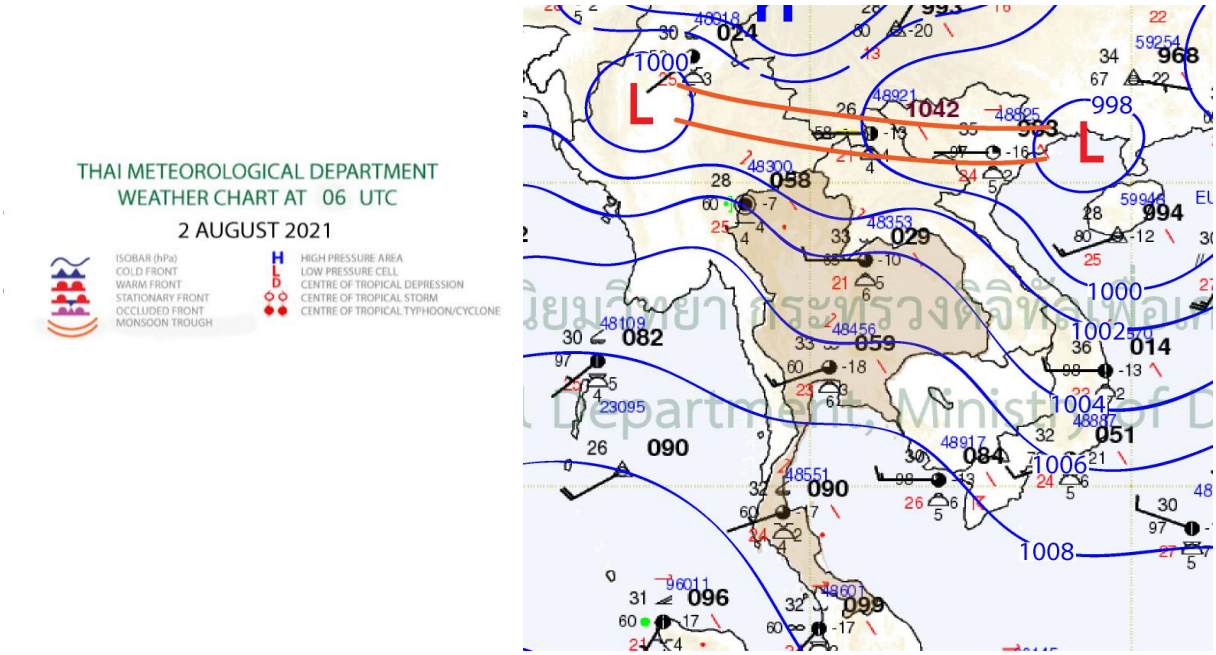


Figure 1. Summary of weather conditions over the LMB.

According to the ASEAN Specialised Meteorological Centre (ASMC), a highest probability of drier condition is predicted over of the lower part in Mekong region covering Cambodia and Viet Nam from 26 July to 8 August 2021, during the 4th week of July and 1st week of August. Nonetheless, the Northern part of Thailand and Lao PDR are likely dominated by warm condition, which may receive average rainfall in general.

Figure 2 shows the outlook of comparative warm conditions from 12-25 July 2021 covered the whole LMB region based on results from the NCEP model (National Centres for Environmental Prediction).

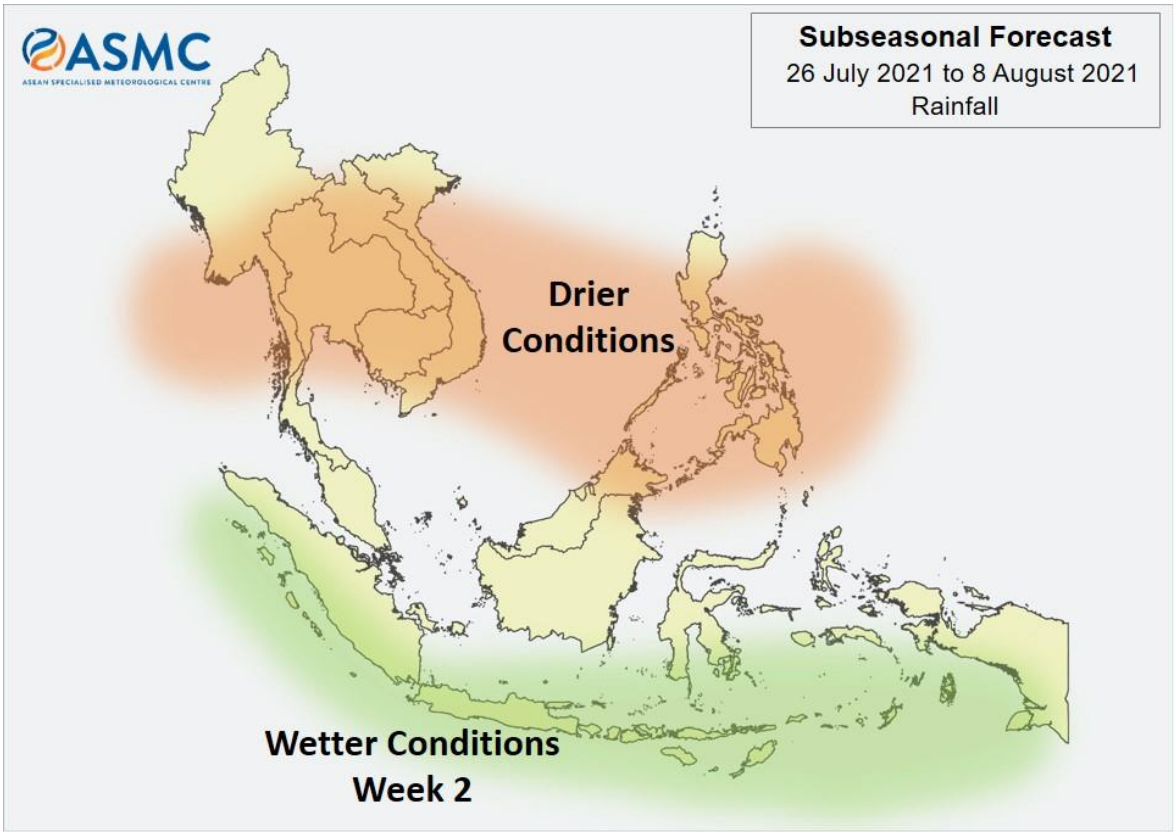


Figure 2. Outlook of wet and dry conditions over the Asian countries by ASMC.

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 3 August 2021, as shown in Figure 1, which would bring rain to some areas of the LMB. But based on the Tropical Strom 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 3 August 2021.

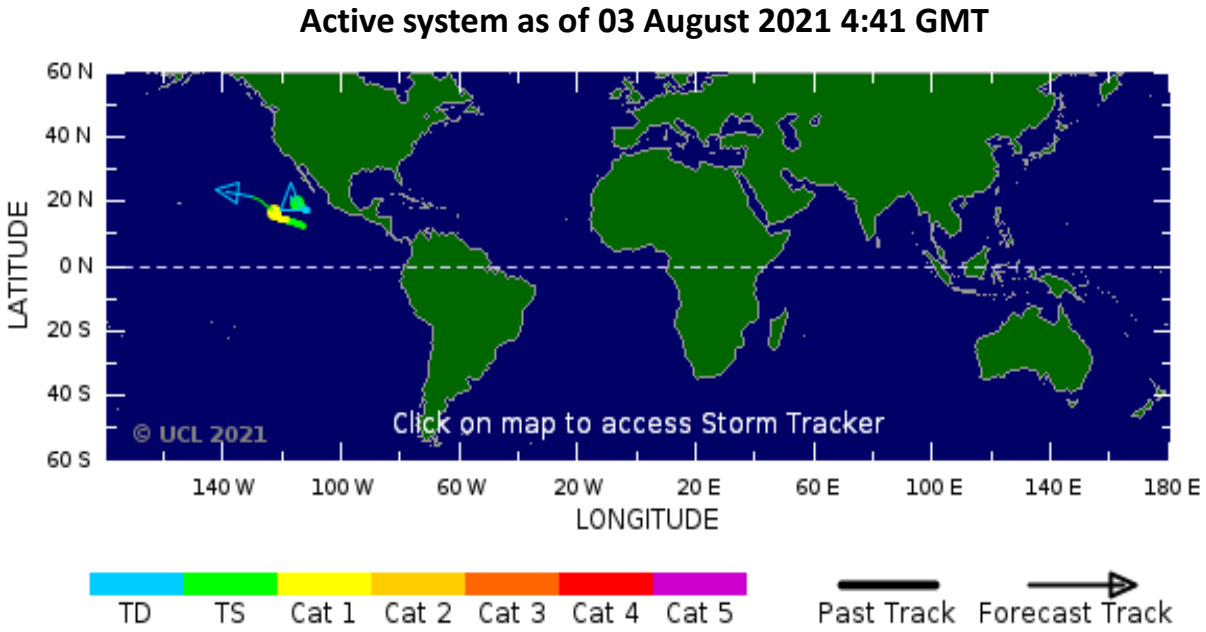


Figure 3. A tropical depression risk observed on 3 Augurt 2021.

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 3.90 mm to 126.00 mm. The weekly total rainfall from 27 July to 2 August 2021 in this reporting week was considered higher, compared with last week rainfall in the Lower part of the LMB (see Figure 4).

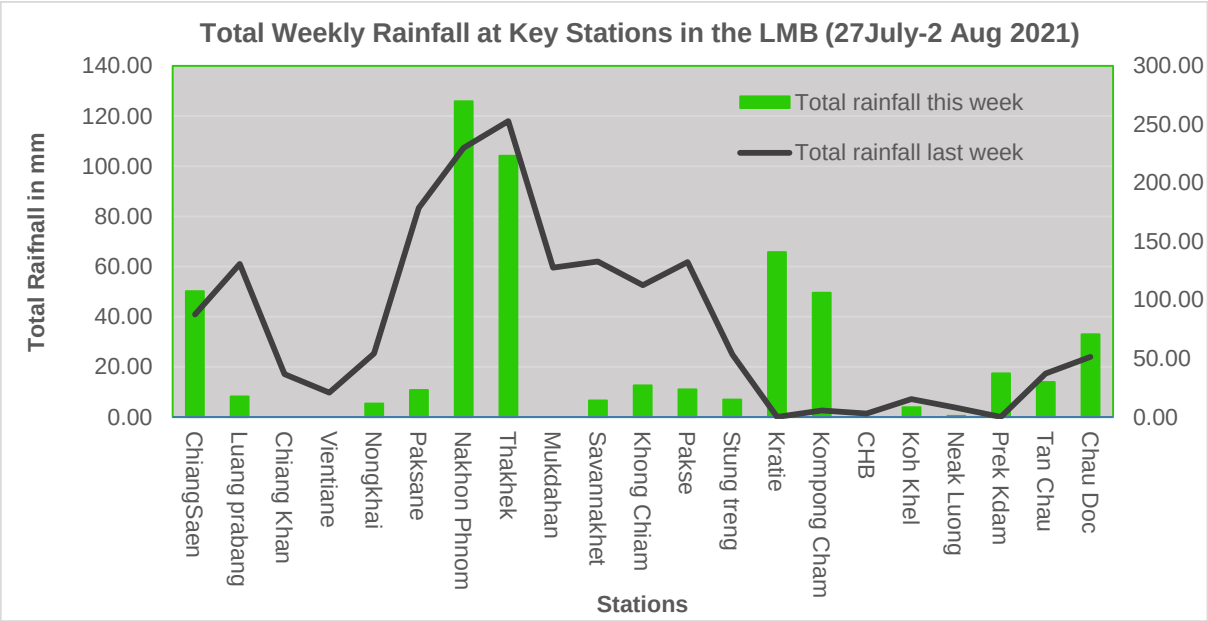


Figure 4. Weekly total rainfall at key stations in the LMB during 27 July-2 August 2021.

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 27 July to 2 August 2021.

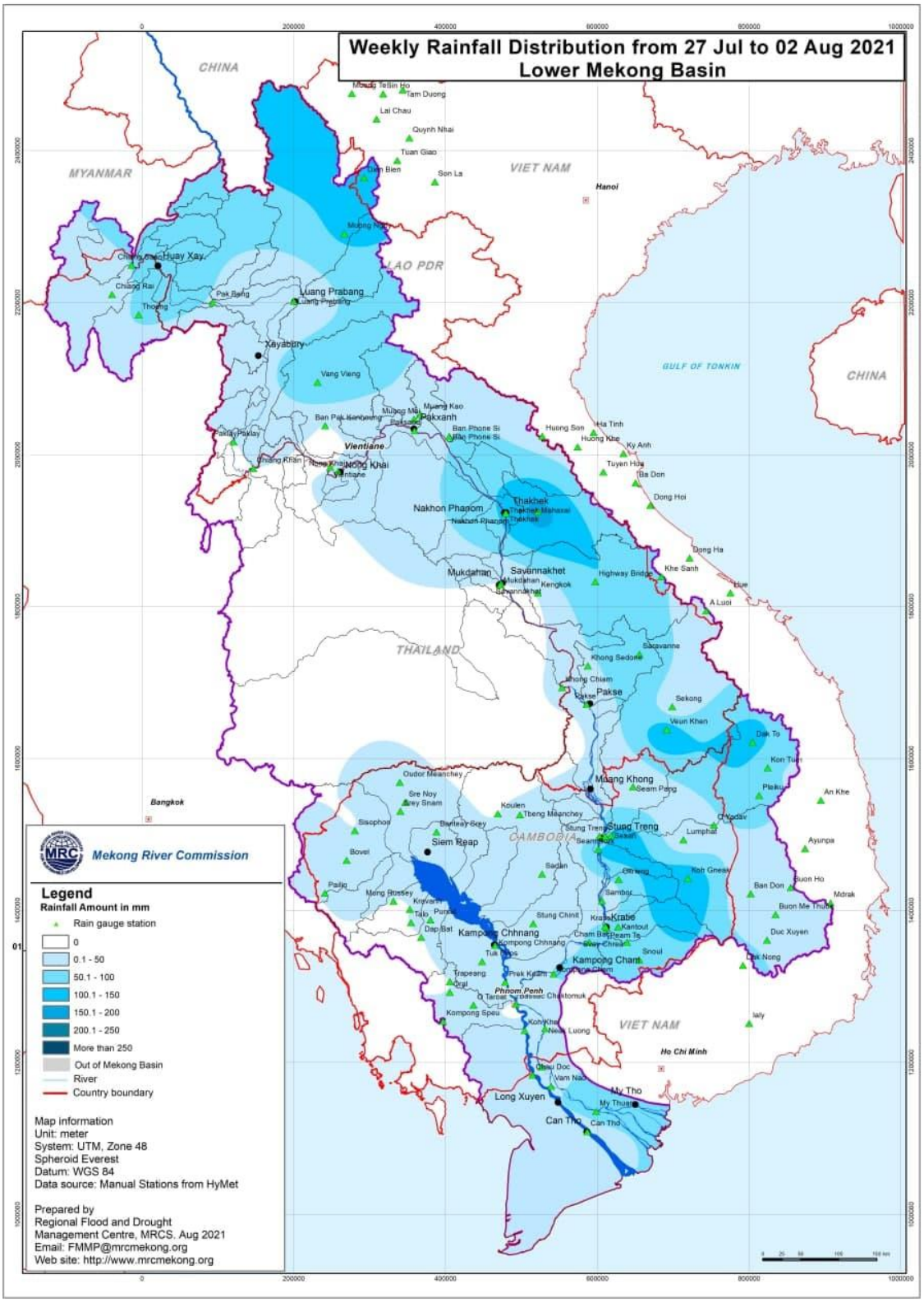


Figure 5. Weekly rainfall distribution over the LMB during 27 July-2 August 2021.

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.

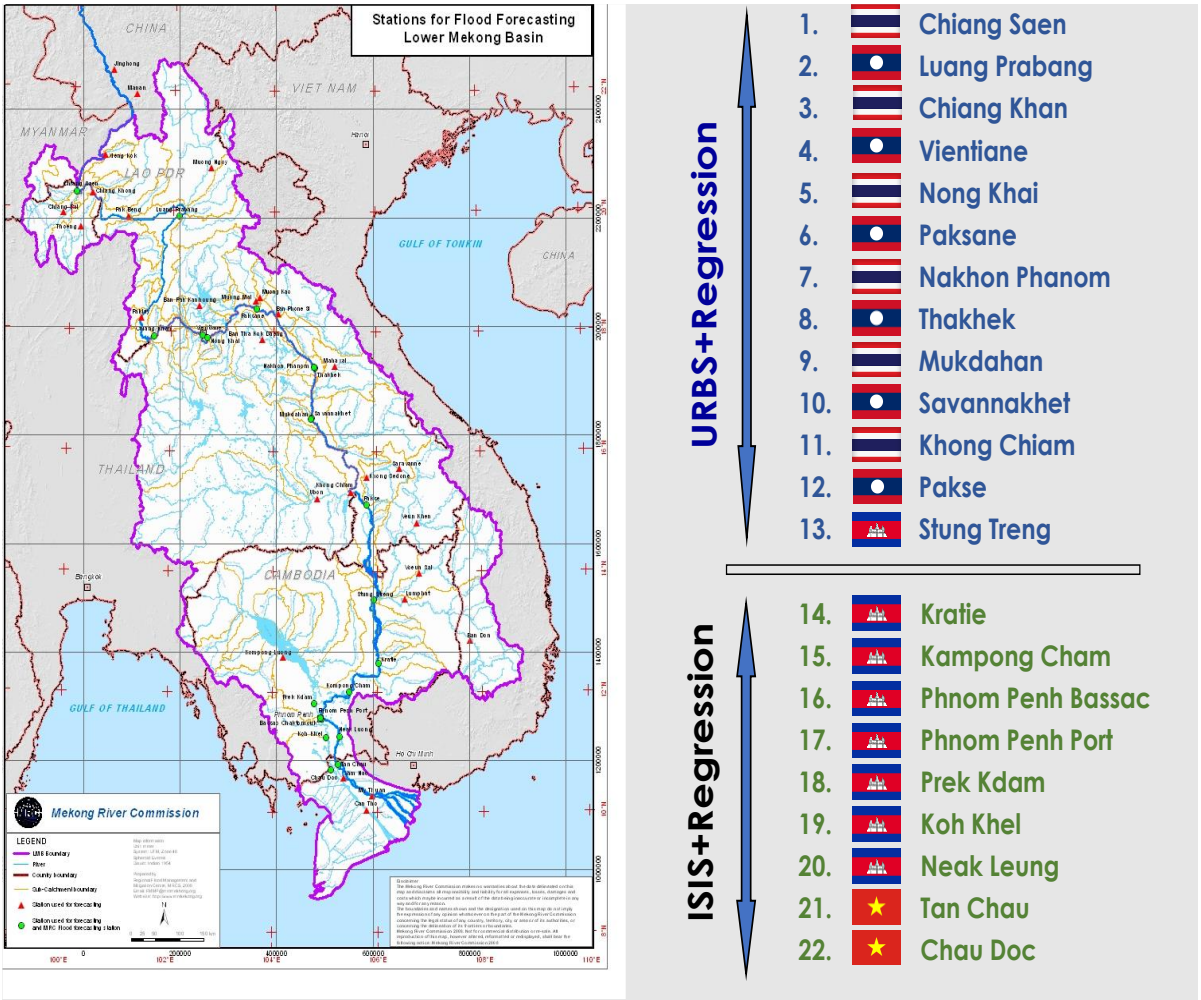


Figure 6. Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed a decrease over the monitoring period from 27 July to 2 August 2021. It was down about 0.56 m from 536.10 metres (m) on July 27 to 535.54 m on August 2. The outflows decreased from 1,404 cubic metres per second (m^3/s) on July 27 to 1,010 m^3/s on August 2. Figure 7 below presents water level fluctuations at the Jinghong hydrological station[1], showing the levels from 27 July to 2 August 2021 are lower than its minimum level.

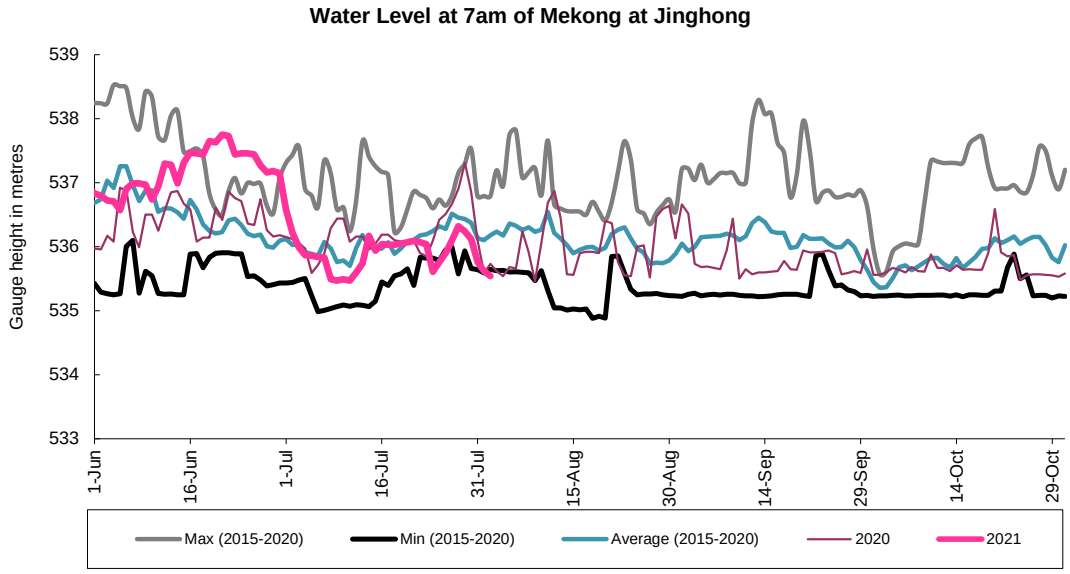


Figure 7. Water level at the Jinghong hydrological station during 1 July-2 Aug 2021.

Due to low outflow from Jinghong upstream, the less rainfall from July 27 to August 2 in the LMB could not bring the water levels across most monitoring stations from Chiang Saen in Thailand to Thakhek in Lao PDR and from the stretches of the river between Stung Treng, Kratie and Kompong Cham in Cambodia up and, thus, making the water levels of those stations stay 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 27 July to 2 August 2021 at Thailand's Chiang Saen decreased from 4.23 metres (m) to 3.30 m, showing about 2. 40 m lower than its LTA.
Similarly, the water level at Luang Prabang station in Lao PDR also decreased, dropping from 11.66 m to 10.78 m during the reporting period. This level shows 1.21 m lower than its LTA value. The trend – sometimes higher or lower to its historical maximum and LTA values – has

[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.

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**.

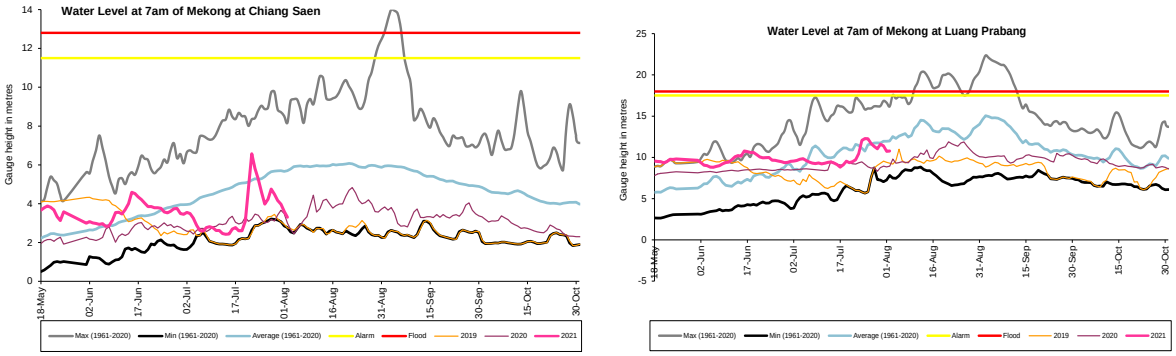


Figure 8. Water levels at Chiang Saen in Thailand and Luang Prabang in Lao PDR.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) significantly decreased from 10.50 m to 8.58 m during the reporting week, after a sudden increase on 26 July about 1.73 m. This decrease showed 2.16 m lower than its Long-Term- Average (LTA).

The water level downstream at Vientiane in Lao PDR followed the upstream trend. Water level also decreased from 7.96 m to 6.23 m and was about 1.32 m lower than its LTA from July 27 to Aug 2. At Nong Khai station in Thailand, the water level decreased rapidly. It was down about 1.44 m, decreasing between 7.64 m and 6.20 m and showing 2.26 m lower than its LTA. The water level at Paksane in Lao PDR also decreased by about 0.84 m, dropping from 7.79 m down to 6.95 m. The WL at this station is about 3.40 m lower than its LTA. The decreased level was obviously due to absent of rainfall together with less inflow from upstream and the effect of the Nam Ngum dam operation located upstream.

The water levels at Chiang Khan and Vientiane are shown in Figure 9 below.

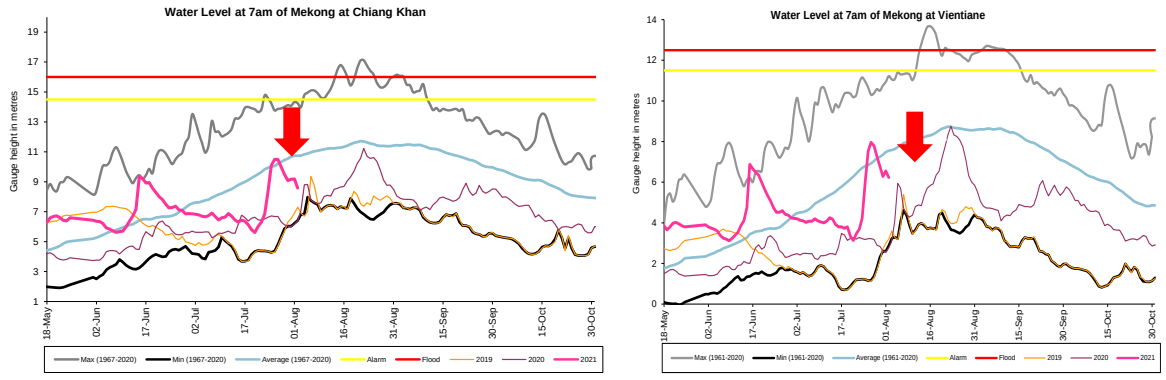


Figure 9. Water levels at Chiang Khan in Thailand and Veintiane in Lao PDR.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand and Thakhek in Lao PDR also decreased following the trend from upstream. The WL decreased by about 0.25 m, while those from Mukdahan in Thailand to Pakse in Lao PDR speedily decreased about 0.85 m. These stations were about 1.35 m lower than their LTA. Figure 10 shows the water levels at Khong Chiam and Pakse.

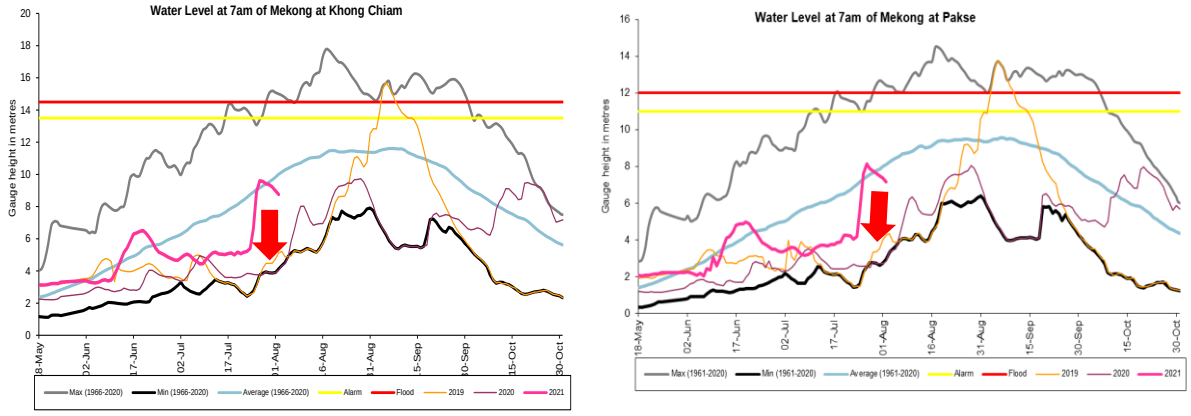


Figure 10. Weekly water levels at Khong Chiam in Thailand and Pakse in Lao PDR

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

Due to less contribution of flows and rainfall from the upstream part of the Mekong River and the 3S river (Sekong, Se San, and Sre Pok), the water levels from Stung Treng to Kratie in Cambodia decreased during 27 July-2 August 2021. This week water level at Stung Treng and Kratie decreased about 1.23 m and 2.08 m, respectively, but still showing about 0.80 lower than their LTA (see Figure 11). The water level at Kompong Cham dropped about 1.52 m and stayed 1.03 m lower than its LTA.

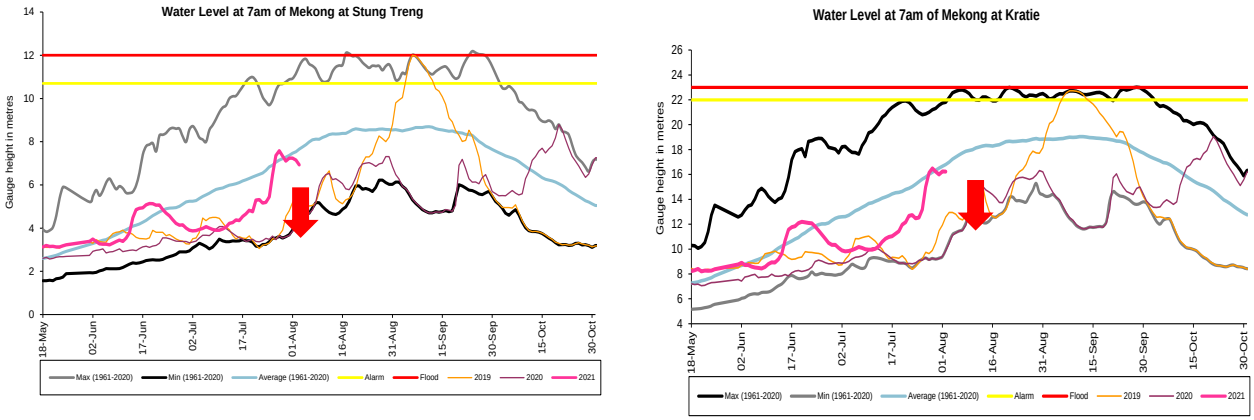


Figure 11. Water levels at Stung Treng and Kratie on the Mekong River.

At Chaktomuk on the Bassac River, the water level decreased by about 1.45 m and stayed 1.27m below its LTA; while at Koh Khel, water level went down 1.28 m but still stayed 1.50 m below its LTA. The water level at Prek Kdam on the Tonle Sap Lake dropped about 1.50 m and was still about 1.21 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 during the report period. 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 27 July to 2 August 2021 at Viet Nam's Tan Chau and Chau Doc fluctuated due to daily tidal effects from the sea. The fluctuation levels were between 0.33 m and 1.25 m; they were in between historical range of minimum and LTA 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 the 2nd of August of this reporting period, **it was observed that the main inflow/reverse flow to Tonle Sap Lake resumed on 01 August 2021, despite the fact that water levels along the Mekong mainstream had significantly decreased due to less inflow from upstream**. The slightly increased inflow of Tonle Sap Lake was most likely caused by inflows from the catchment area. The inflow into the Tonle Sap Lake condition in 2021 was match with its average amount and higher than the 2019 and 2020 inflow condition. Fortunately, above average rainfall is forecasted from in August for the Tonle Sap area; thus, the inflow into the Tonle Sap Lake is likely to rise from the current level.

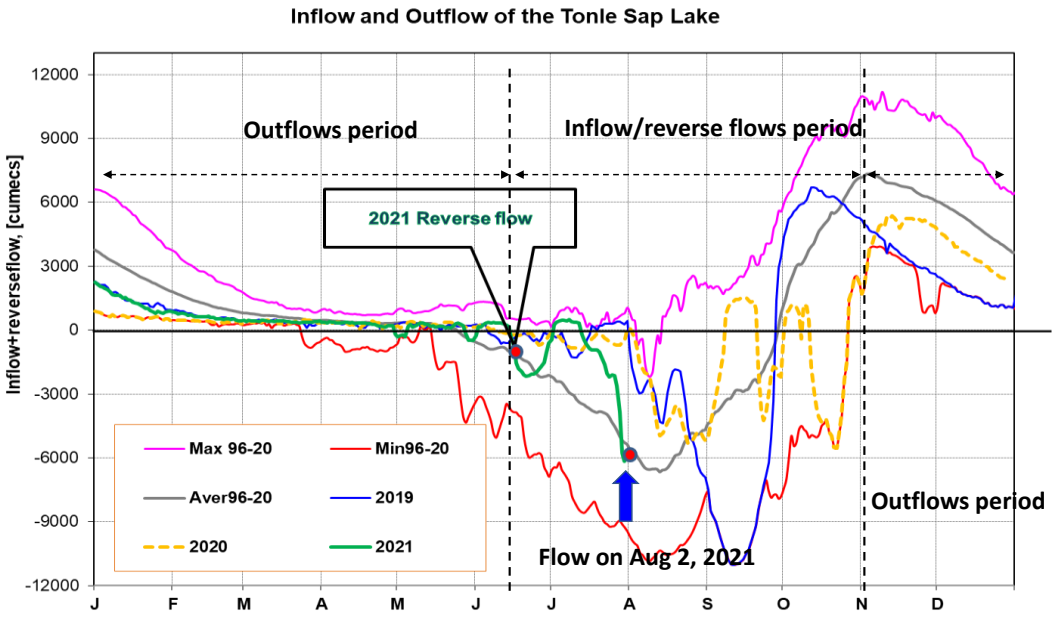


Figure 12. Seasonal change of inflows and outflows of Tonle Sap Lake.

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 August 2 for the Lake compared with the volumes in 2018 and 2019, their LTA, and the fluctuation levels (1997–2019). It shows that up to August 2, **the water volume of the Tonle Sap Lake is higher than the levels in 2019 and 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.

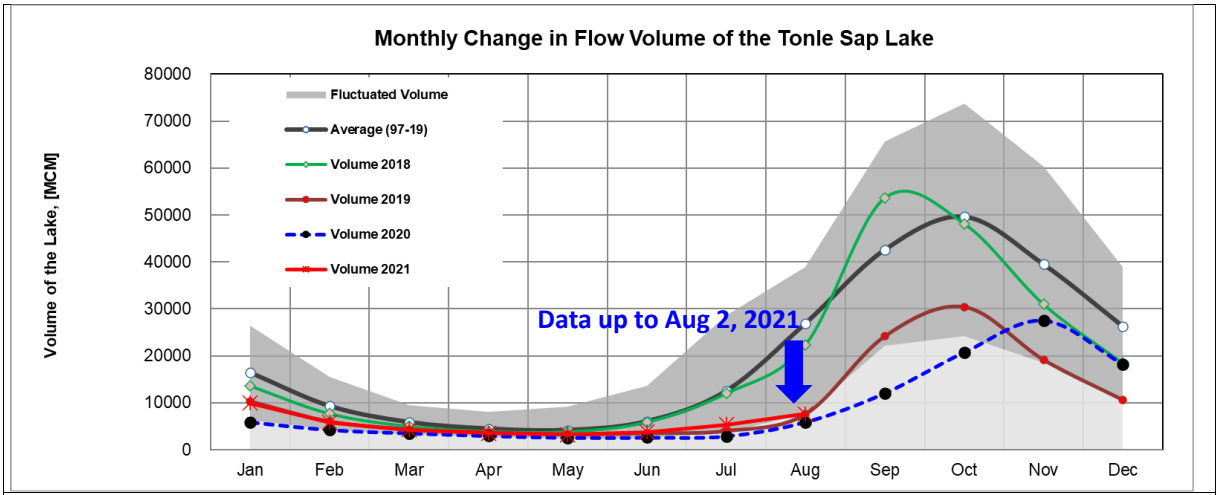


Figure 13. The seasonal change in monthly flow volume of Tonle Sap Lake.

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

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 27 to August 2, the LMB was affected by three weather factors including (i) the active southwest monsoon prevailed over the Gulf of Thailand almost the whole week, (ii) the monsoon trough laid across upper northern Thailand and Lao PDR toward the low pressure cell over the coast of the SEA on the first day of the week then moved northward the upper part of the northern Thailand, Lao PDR and upper Viet Nam on 27-29 Jul, and (iii) the low pressure cell covered upper Viet Nam during the weekend. These conditions caused moderate and heavy rainfall from upper to middle parts of the LMB almost the entire week.

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 LMB, especially at areas in northeast Viet Nam and north Lao PDR with ranging from low to high level as shown in Figure 14 and Table 2.

Table 2. Detected flash flood in Thailand, Lao PDR, Cambodia, and Viet Nam on August 1.

Rate-risk and location of the flash flood may occur in the next 1, 3, and 6 hours in Thailand

Date of FFG products 01/08/2021 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
Nakhon Si Thammarat	Phromkhili	Southern-East Coast	Low-Risk	Nakhon Si Thamm	Phromkhili	Southern-East Coast	Low-Risk	Surat Thani	Thachang	Southern-East Coa	Low-Risk
Trang	Palian	Southern-West Coast	Low-Risk					Phangnga	Khura Buri	Southern-West Co	Low-Risk
								Nakhon Si Thamm	Phromkhili	Southern-East Coa	Low-Risk
								Trang	Palian	Southern-West Co	Low-Risk
								Songkhla	Sadao	Southern-East Coa	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 01/08/2021 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
Savannakhet	Atsaphone	NA KHAM	Southern	Low-Risk	Phongsaly	Bounneua	KIMKO	North	Low-Risk	Savannakhet	Vilabuly	NAKAPHOUNG	Southern	Low-Risk
Savannakhet	Atsaphang	NAMOUANG	Southern	Low-Risk	Phongsaly	Phongsaly	SAMMEUNGLOUANG	North	Low-Risk	Savannakhet	Atsaphang	DONGKEUM	Southern	Low-Risk
Phongsaly	Bounneua	KIMKO	North	Low-Risk	Phongsaly	Nhot ou	XICHACHAY KAO	North	Low-Risk	Savannakhet	Atsaphone	NA KHAM	Southern	Low-Risk
Phongsaly	Phongsaly	SAMMEUNGLOUANG	North	Low-Risk	Phongsaly	Phongsaly	TASENPHONG	North	Low-Risk	Savannakhet	Atsaphang	XIENGLENAM	Southern	Low-Risk
Phongsaly	Nhot ou	XICHACHAY KAO	North	Low-Risk	Phongsaly	Phongsaly	HOUAYLOU	North	Low-Risk	Savannakhet	Atsaphang	NAMOUANG	Southern	Low-Risk
Phongsaly	Nhot ou	TANG	North	Low-Risk	Bolikhamxay	Pakkading	THONGNAMI	Central Laos	Low-Risk	Xiengkhuang	Morkmay	KHANGVIENG	Northeast	Low-Risk
Phongsaly	Phongsaly	TASENPHONG	North	Moderate-Risk	Khammuane	Hinboon	VANG TA KHONG	Center of Laos	Moderate-Risk	Bolikhamxay	Khamkheut	NAPHOUANG	Central Laos	Low-Risk
Phongsaly	Phongsaly	LAFUCHAI	North	Low-Risk	Khammuane	Hinboon	MOUANG NAM SANG	Center of Laos	Moderate-Risk	Phongsaly	Bounneua	KIMKO	North	Low-Risk
Phongsaly	Phongsaly	HOUAYLOU	North	Low-Risk	Khammuane	Thakhek	LAO PHO XAI	Center of Laos	Low-Risk	Phongsaly	Phongsaly	SAMMEUNGLOUANG	North	Low-Risk
Bolikhamxay	Pakkading	THONGNAMI	Central Laos	Low-Risk	Huaphanh	Xamtay	HINTANG	Eastern	Low-Risk	Phongsaly	Nhot ou	PEULAOXOU MAI	North	Low-Risk
Khammuane	Hinboon	NA KHAK	Center of Laos	Low-Risk	Huaphanh	Xamtay	HOUAYSAMONG	Eastern	Low-Risk	Phongsaly	Nhot ou	KOUNGCHI	North	Low-Risk
Khammuane	Hinboon	VANG TA KHONG	Center of Laos	Moderate-Risk	Huaphanh	Xamtay	GNORT-INN	Eastern	Low-Risk	Phongsaly	Nhot ou	XICHACHAY KAO	North	Low-Risk
Khammuane	Hinboon	PHON PHENG	Center of Laos	Low-Risk	Huaphanh	Xamtay	NAMMORN	Eastern	Low-Risk	Phongsaly	Nhot ou	TANG	North	Low-Risk
Khammuane	Hinboon	MOUANG NAM SANG	Center of Laos	Moderate-Risk	Huaphanh	Viengxay	TA-AN	Eastern	Low-Risk	Phongsaly	Nhot ou	HOUAYKAM KAO	North	Low-Risk
Khammuane	Thakhek	LAO PHO XAI	Center of Laos	Low-Risk	Huaphanh	Xamtay	PHAKHAO	Eastern	Low-Risk	Phongsaly	Phongsaly	TASENPHONG	North	Moderate-Risk
Khammuane	Xebangfay	NOI	Center of Laos	Low-Risk	Xiengkhuang	Nonghed	SUAN OI	Northeast	Low-Risk	Phongsaly	Phongsaly	LAFUCHAI	North	Low-Risk
Khammuane	Bualapha	SENE PHANH	Center of Laos	Low-Risk	Xiengkhuang	Nonghed	DAN	Northeast	Low-Risk	Phongsaly	Phongsaly	HOUAYLOU	North	Low-Risk
Khammuane	Bualapha	VANG KHON	Center of Laos	Low-Risk						Phongsaly	khoua	PHIA	North	Low-Risk
Khammuane	Bualapha	MAI VANG KOUAN	Center of Laos	Low-Risk						Bolikhamxay	Pakkading	THONGNAMI	Central Laos	Low-Risk
Khammuane	Xaybouath	PHA KHART	Center of Laos	Low-Risk						Khammuane	Hinboon	PHON XAI	Center of Laos	Low-Risk
Khammuane	Xaybouath	PA KA SA	Center of Laos	Low-Risk						Khammuane	Hinboon	NA KHAK	Center of Laos	Low-Risk
Savannakhet	Atsaphone	SOB SE	Southern	Low-Risk						Khammuane	Hinboon	VANG TA KHONG	Center of Laos	Moderate-Risk
Savannakhet	Xaybuly	NONGSAPHANG	Southern	Low-Risk						Khammuane	Hinboon	PHON PHENG	Center of Laos	Low-Risk
Huaphanh	Xamtay	HINTANG	Eastern	Low-Risk						Khammuane	Hinboon	MOUANG NAM SANG	Center of Laos	Moderate-Risk
Huaphanh	Xamtay	NAMOUANG	Eastern	Low-Risk						Khammuane	Thakhek	LAO PHO XAI	Center of Laos	Low-Risk
Huaphanh	Xamtay	HOUAYSAMONG	Eastern	Low-Risk						Khammuane	Xebangfay	NOI	Center of Laos	Low-Risk
Huaphanh	Xamtay	GNORT-INN	Eastern	Moderate-Risk						Khammuane	Bualapha	SENE PHANH	Center of Laos	Low-Risk
Huaphanh	Xamtay	NAMMORN	Eastern	Low-Risk						Khammuane	Bualapha	VANG KHON	Center of Laos	Low-Risk
Huaphanh	Viengxay	TA-AN	Eastern	Low-Risk						Khammuane	Bualapha	MAI VANG KOUAN	Center of Laos	Low-Risk
Huaphanh	Xamtay	PHALOM	Eastern	Low-Risk						Khammuane	Xaybouath	PHA KHART	Center of Laos	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 24/07/2021 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
Ratana Kiri	Ou Chum	Tun	Northeast	Low-Risk	NO ANY DETECTION OF FLASH FLOOD WITHIN NEXT 03-HOUR					Ratana Kiri	Ou Chum	Tun	Northeast	Low-Risk
Ratana Kiri	Veun Sai	Tiem Kraom	Northeast	Low-Risk						Ratana Kiri	Veun Sai	Tiem Kraom	Northeast	Low-Risk
Ratana Kiri	Koun Mom	Ko Hokseb	Northeast	Low-Risk						Ratana Kiri	Koun Mom	Ko Hokseb	Northeast	Low-Risk

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 01/08/2021 00:00 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
Lai Chau	Muong Te	Northwest	Low-Risk	Lai Chau	Muong Te	Northwest	Moderate-Risk	Ha Tinh	Huong Son	North Central	Low-Risk
Cao Bang	Quang Hoa	Northeast	Low-Risk	Cao Bang	Hoa An	Northeast	Moderate-Risk	Lai Chau	Muong Te	Northwest	Moderate-Risk
Cao Bang	Ha Lang	Northeast	Low-Risk	Cao Bang	Ha Quang	Northeast	Low-Risk	Quang Binh	Minh Hoa	North Central	Low-Risk
Cao Bang	Hoa An	Northeast	High-Risk	Cao Bang	Nguyen Binh	Northeast	Moderate-Risk	Cao Bang	Quang Hoa	Northeast	Low-Risk
Cao Bang	Ha Quang	Northeast	Low-Risk	Cao Bang	Thach An	Northeast	Low-Risk	Cao Bang	Ha Lang	Northeast	Low-Risk
Cao Bang	Nguyen Binh	Northeast	High-Risk	Bac Kan	Ngan Son	Northeast	Moderate-Risk	Cao Bang	Hoa An	Northeast	Moderate-Risk
Cao Bang	TX. Cao Bang	Northeast	Low-Risk	Lang Son	Trang Dinh	Northeast	Low-Risk	Cao Bang	Ha Quang	Northeast	Low-Risk
Bac Kan	Ngan Son	Northeast	High-Risk	Bac Kan	Na Ri	Northeast	Low-Risk	Cao Bang	Nguyen Binh	Northeast	Moderate-Risk
Cao Bang	Thach An	Northeast	Low-Risk	Lang Son	Binh Gia	Northeast	Low-Risk	Cao Bang	TX. Cao Bang	Northeast	Low-Risk
Lang Son	Trang Dinh	Northeast	Low-Risk	Lang Son	Bac Son	Northeast	Low-Risk	Bac Kan	Ngan Son	Northeast	Moderate-Risk
Bac Kan	Na Ri	Northeast	Low-Risk	Lang Son	Dinh lap	Northeast	Low-Risk	Cao Bang	Thach An	Northeast	Low-Risk
Lang Son	Binh Gia	Northeast	Low-Risk	Lang Son	Loc Binh	Northeast	High-Risk	Lang Son	Trang Dinh	Northeast	Low-Risk
Thai Nguyen	Vo Nhai	Northeast	Low-Risk	Hai Phong	An Hai	Red River Delta	Low-Risk	Lang Son	Binh Gia	Northeast	Low-Risk
Lang Son	Bac Son	Northeast	Low-Risk	Bac Kan	Cho Don	Northeast	Low-Risk	Bac Kan	Na Ri	Northeast	Low-Risk
Lang Son	Chi Lang	Northeast	Low-Risk	Yen Bai	Tram Tau	Northwest	Moderate-Risk	Thai Nguyen	Vo Nhai	Northeast	Low-Risk
Lang Son	Dinh lap	Northeast	Low-Risk	Lao Cai	Bat Xat	Northwest	High-Risk	Lang Son	Chi Lang	Northeast	Low-Risk
Quang Ninh	Tien Yen	Northeast	Low-Risk	Lao Cai	Than Uyen	Northwest	Moderate-Risk	Lang Son	Dinh lap	Northeast	Low-Risk
Lang Son	Loc Binh	Northeast	High-Risk	Lao Cai	Van Ban	Northwest	High-Risk	Quang Ninh	Tien Yen	Northeast	Low-Risk
Bac Kan	Cho Don	Northeast	Moderate-Risk	Yen Bai	Mu Cang Chai	Northwest	High-Risk	Lang Son	Loc Binh	Northeast	High-Risk
Yen Bai	Tram Tau	Northwest	High-Risk	Yen Bai	TX. Nghia Lo	Northwest	Low-Risk	Cao Bang	Tra Linh	Northeast	Low-Risk
Lao Cai	Bat Xat	Northwest	High-Risk	Son La	Bac Yen	Northwest	Low-Risk	Hai Phong	An Hai	Red River Delta	Low-Risk
Lao Cai	Van Ban	Northwest	High-Risk	Phu Tho	Thanh Son	Northeast	Low-Risk	Bac Kan	Cho Don	Northeast	Low-Risk
Yen Bai	TX. Nghia Lo	Northwest	Low-Risk	Son La	Muong La	Northwest	Moderate-Risk	Yen Bai	Tram Tau	Northwest	Moderate-Risk
Yen Bai	Van Chan	Northwest	Low-Risk	Lao Cai	Sa Pa	Northwest	High-Risk	Lao Cai	Bat Xat	Northwest	High-Risk
Son La	Bac Yen	Northwest	Low-Risk	Son La	Quynh Nhai	Northwest	Moderate-Risk	Lao Cai	Sa Pa	Northwest	Low-Risk
Phu Tho	Thanh Son	Northeast	Low-Risk	Son La	Muong La	Northwest	High-Risk	Lao Cai	Van Ban	Northwest	Moderate-Risk
Hoa Binh	Da Bac	Northwest	Moderate-Risk	Lai Chau	Sin Ho	Northwest	Low-Risk	Yen Bai	Mu Cang Chai	Northwest	High-Risk
Son La	Muong La	Northwest	High-Risk	Lai Chau	Phong Tho	Northwest	High-Risk	Yen Bai	TX. Nghia Lo	Northwest	Low-Risk
Lao Cai	Sa Pa	Northwest	High-Risk	Lai Chau	Phong Tho	Northwest	Low-Risk	Yen Bai	Van Chan	Northwest	Low-Risk
Lao Cai	Than Uyen	Northwest	Extreme-Risk	Lai Chau	Sin Ho	Northwest	Low-Risk	Son La	Bac Yen	Northwest	Low-Risk

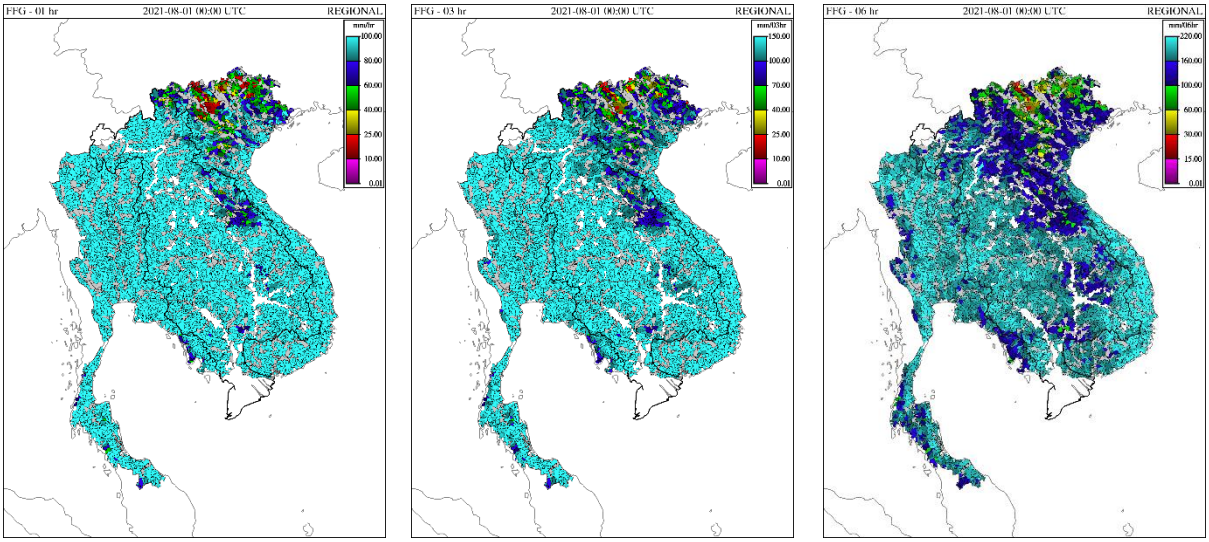


Figure 14. Flash Flood Guidance for the next 1 hour, 3 hours and 6 hours on August 1.

5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 24 to 30 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)**

Meteorological indicator of SPI from July 24 to 30, as shown in Figure 15, shows that the LMB was moderately and severely dry in some areas in the north and central part of the region including Luangnamtha, Luang Prabang, Xayaburi, and Xieng Khuang of Lao PDR; Chiang Rai, Chiang Mai, Phayao, Loei, Nong Bua Lampu, Udon Thani, Sakon Nakhon, Kalasin, Nakhon Ratchasima, Maha Sarakham, Khon Kaen, Surin, and Si Saket of Thailand; and Oddar Meanchey and Preah Vihea of Cambodia. The conditions, however, were not significant as they took place in small extent and scattered in different locations. Other areas were normal during the reporting week.

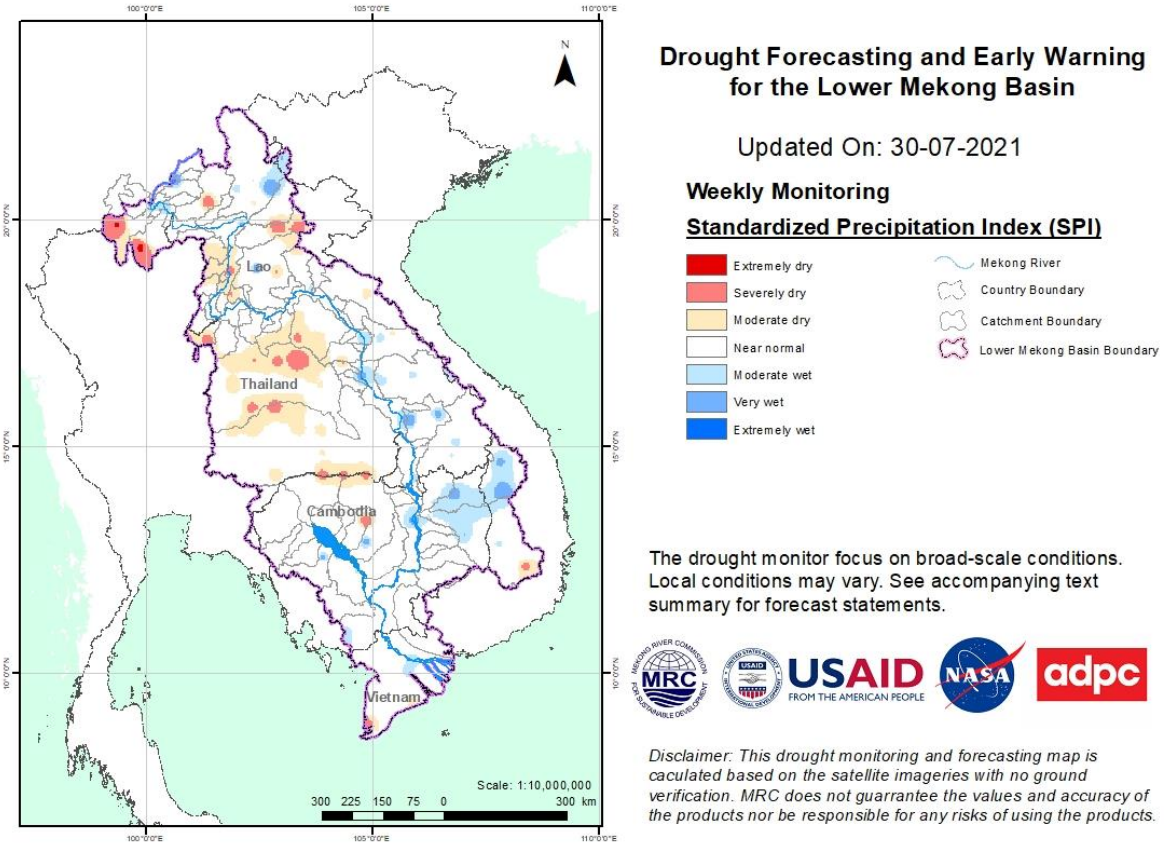


Figure 15. Weekly standardized precipitation index from 24 to 30 July 2021.

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

Soil water fraction from July 24 to 30, as displayed in Figure 16, shows that the LMB region was normal and extremely wet in most parts of the LMB except Dak Lak of Viet Nam where soil moisture was moderately and severely dry.

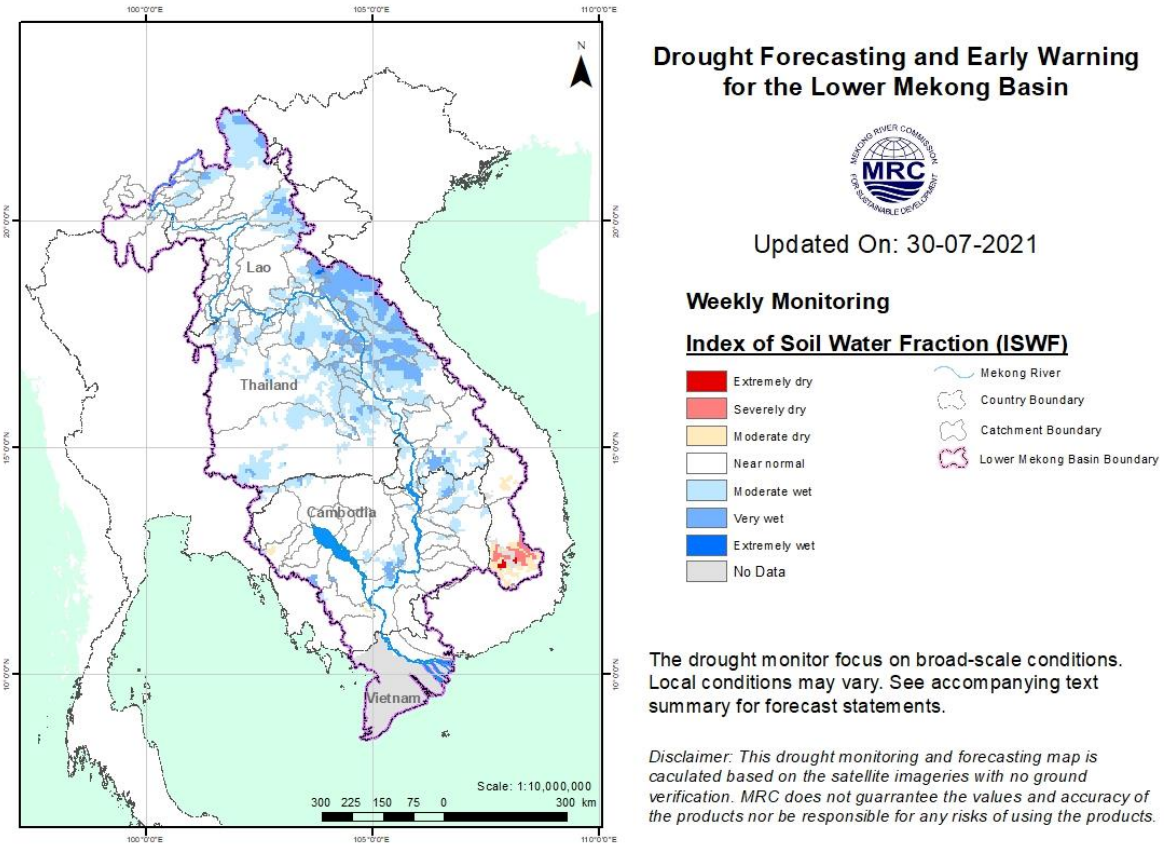


Figure 16. Weekly Soil Moisture Anomaly from 24 to 30 July 2021.

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

With such preferable conditions of both SPI and ISWF, the combined drought indicator shows that the LMB were normal all over the place. This means that the region did not face any drought threat throughout the monitoring week from July 24 to 30, as displayed in Figure 17.

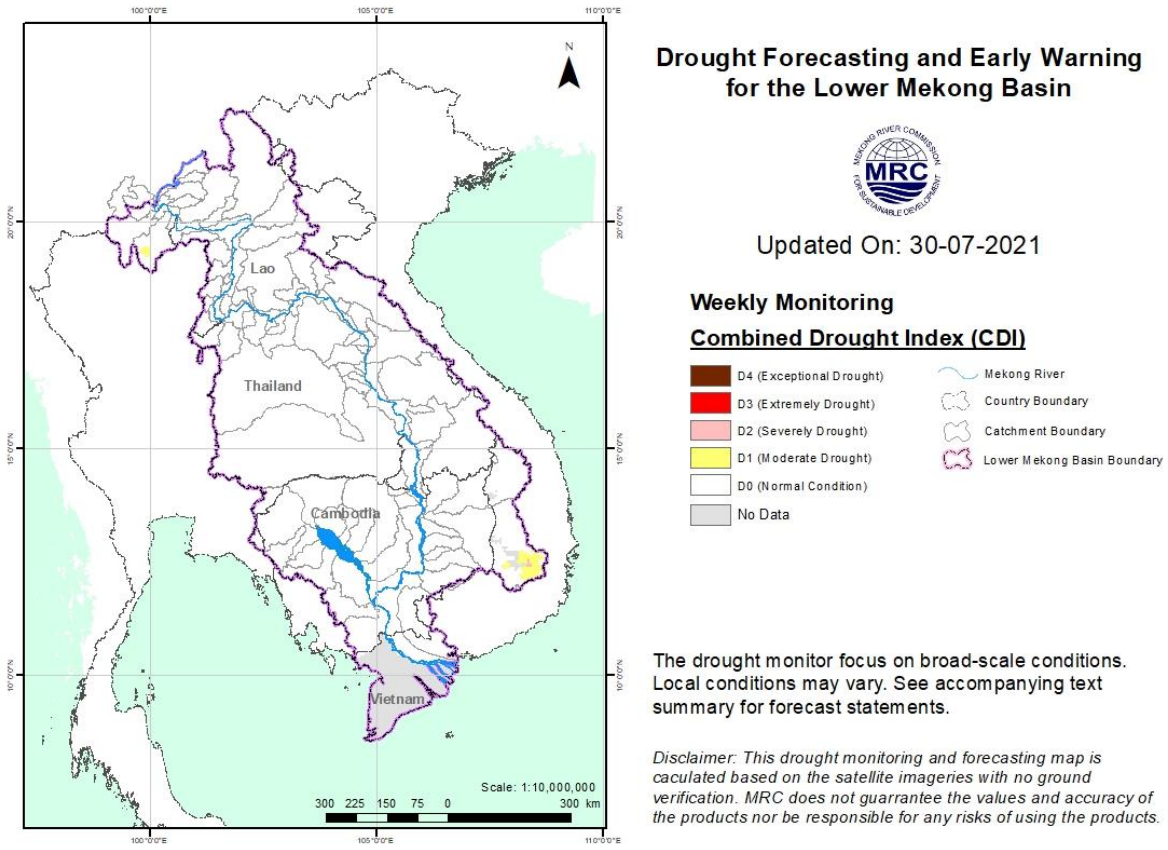


Figure 17. Weekly Combined Drought Index from 24 to 30 July 2021.

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.

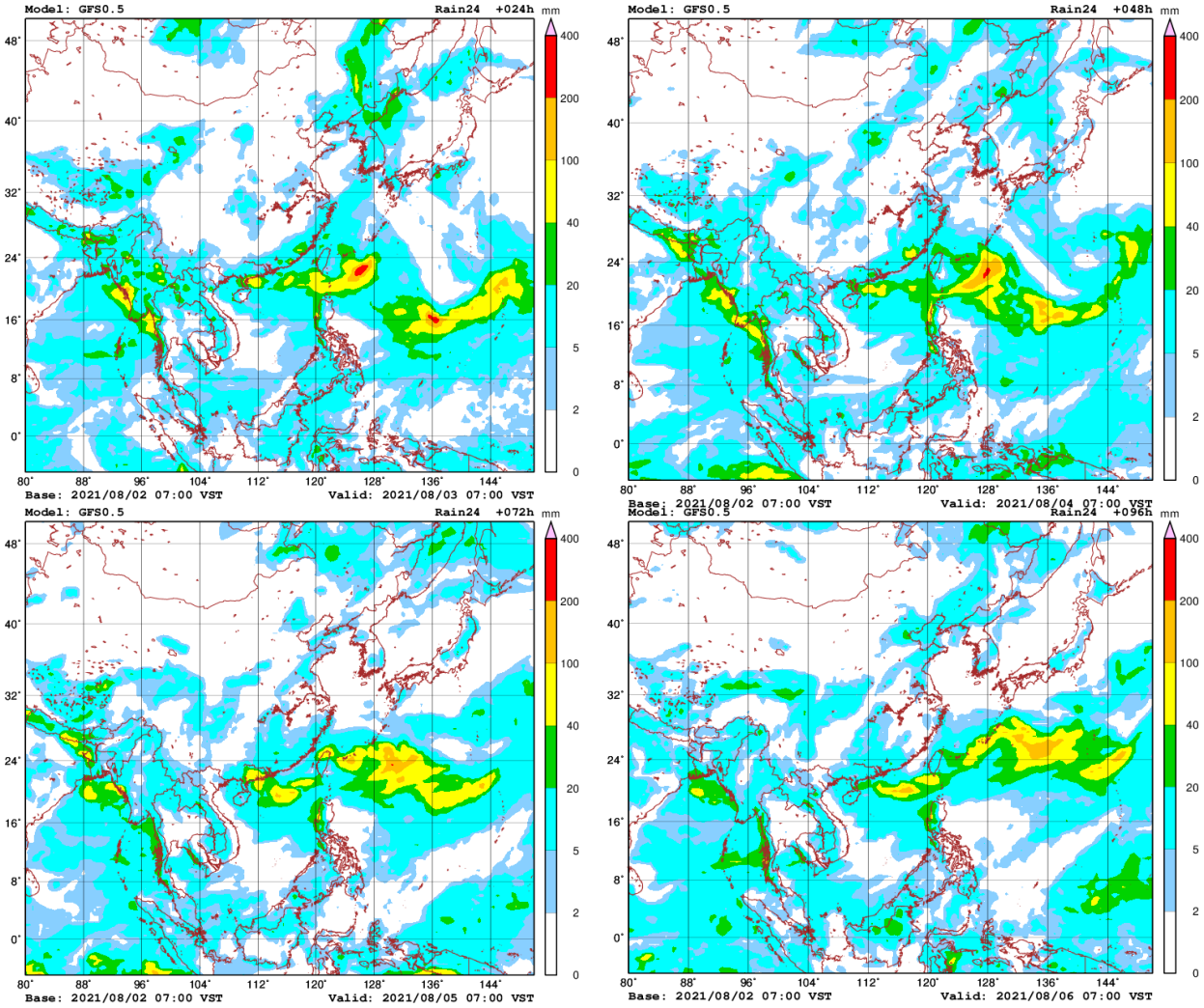
6 Weather and Water Level Forecast and Flash Flood Information

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 southwest monsoon and low-pressure cell will continue prevailing over the LMB.

From August 3-9, small rainfall (0 -20 mm/24h) will likely occur in some parts of the LMB.

Figure 18 shows accumulated rainfall forecast (24 h) of the GFS model from August 3-9.



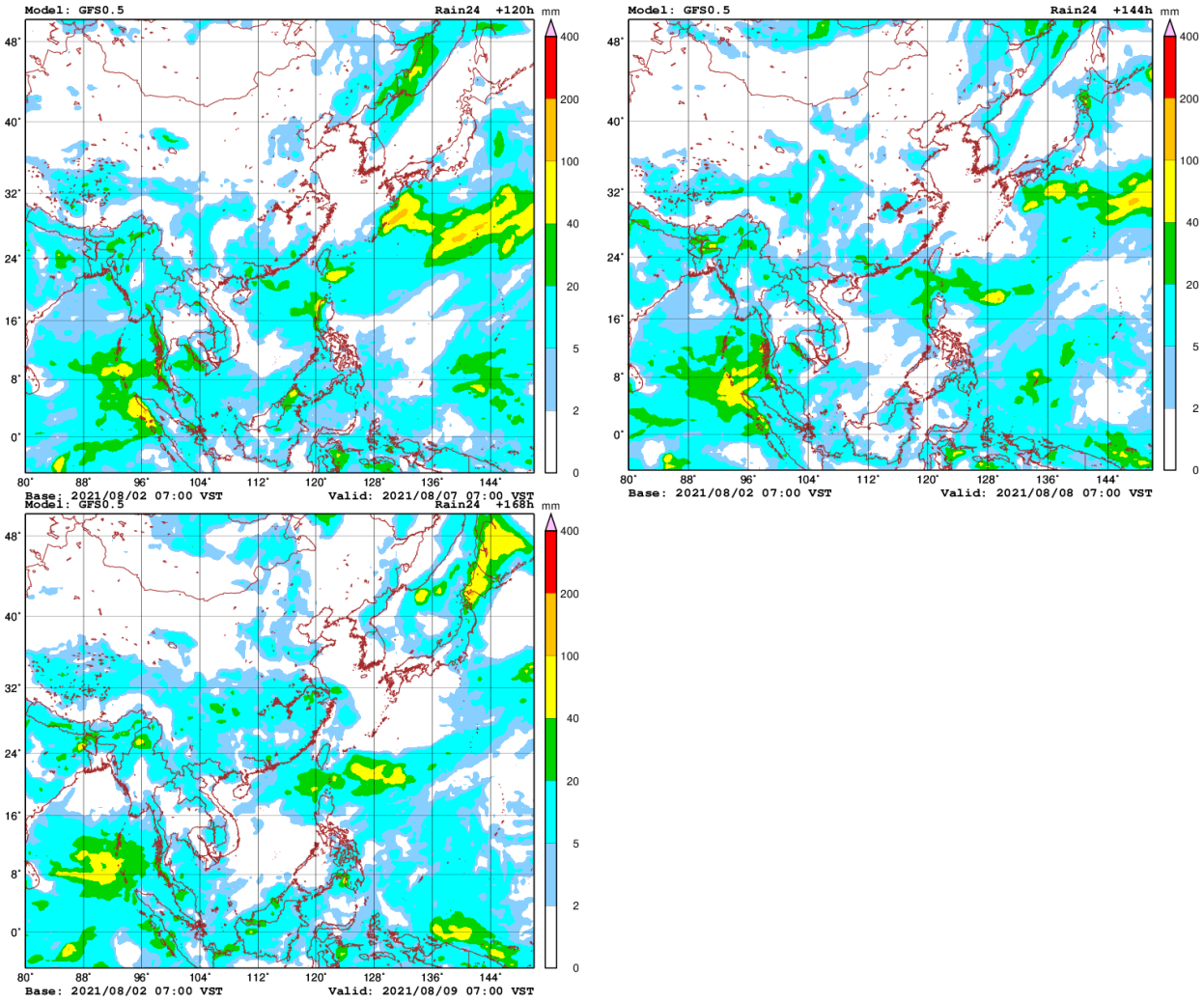


Figure 18. Accumulated rainfall forecast (24 h) based on a GFS model.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on August 2's daily flood forecasting bulletin, the daily forecasted water level at Chiang Saen in Thailand is expected to slightly decrease from 3.43 m to 3.40 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 increase from 11.94 m to 12.33 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 increase about 0.60 m, while water level at Vientiane in Lao PDR will increase about 0.55 m. But from Nong Khai in Thailand to

Paksane in Lao PDR, the water levels will rise by about 0.65 m over the next five days. Rainfall is forecasted for the area of Paksane next week.

The water levels are expected to go 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 0.65 m over the next seven days. From Khong Chiam in Thailand to Pakse in Lao PDR, the stations will likely decrease about 0.75 m. The water levels from Nakhon Phanom in Thailand to Savannakhet 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 go down by about 0.65 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 decrease by about 0.30 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 27 July to 2 August 2021, is presented in **Annex 1**.

Table 2 shows the daily flood forecasting Bulletin issued on August 2. 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 rainfall forecasted for next week, flash floods with high level 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 August to November 2021 produced by the NMME.

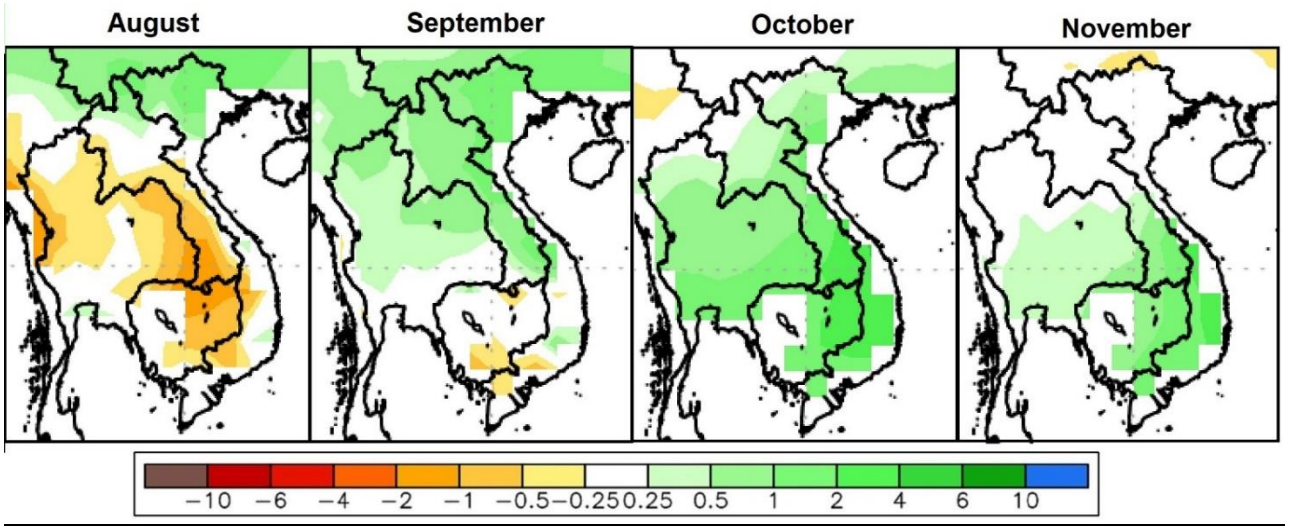


Figure 19. Daily average of monthly rainfall anomaly forecast from August to November 2021.

The ensemble prediction model based on the initial conditions in July reveals that the LMB is likely to receive much below average rainfall in August mainly in the central and southern parts of the region; September is forecasted to be extremely wet in the north, moderately wet and normal in the middle, and normal and moderately dry in southern areas of the region. Like 2020, the forecast shows that October is likely the wettest month of the year. November is forecasted to receive from average to above average rainfall throughout the LMB.

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: 03 August - 07 August 2021

Date: 02 August 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					
		01-Aug				01-Aug	02-Aug	03-Aug	04-Aug	05-Aug	06-Aug	07-Aug	02	03	04	05	06	07
Jinghong		55.5				535.62	535.54							×	×	×	×	×
Chiang Saen		0.5	357.110	12.80	11.50	3.60	3.30	3.20	3.15	3.17	3.18	3.20	↓					
Luang Prabang		0.0	267.195	18.00	17.50	10.74	10.78	10.90	10.65	10.60	10.56	10.60		↑	↓			
Chiang Khan		0.0	194.118	16.00	14.50	9.19	8.58	8.41	8.30	8.20	8.16	8.15	↓	↓	↓	↓		
Vientiane		0.0	158.040	12.50	11.50	6.55	6.23	5.81	5.67	5.56	5.46	5.41	↓	↓	↓	↓		
Nongkhai		0.0	153.648	12.20	11.40	6.21	6.20	5.85	5.76	5.70	5.63	5.60		↓				
Paksane		0.0	142.125	14.50	13.50	7.09	6.95	6.82	6.55	6.48	6.44	6.40	↓	↓	↓			
Nakhon Phanom		5.0	130.961	12.00	11.50	7.26	7.00	6.91	6.83	6.66	6.62	6.59	↓			↓		
Thakhek		3.2	129.629	14.00	13.00	8.37	8.12	8.04	7.96	7.79	7.74	7.70	↓			↓		
Mukdahan		0.0	124.219	12.50	12.00	7.56	7.32	7.17	7.12	7.07	7.00	6.97	↓	↓				
Savannakhet		0.0	125.410	13.00	12.00	5.99	5.75	5.65	5.62	5.60	5.57	5.55	↓					
Khong Chiam		2.0	89.030	14.50	13.50	8.98	8.75	8.54	8.37	8.28	8.21	8.12	↓	↓	↓			
Pakse		6.6	86.490	12.00	11.00	7.38	7.14	6.96	6.82	6.77	6.73	6.68	↓	↓	↓	↓		↓
Stung Treng		nr	36.790	12.00	10.70	7.24	7.15	7.01	6.93	6.84	6.81	6.78	↓	↓	↓	↓		
Kratie		nr	-0.101	23.00	22.00	16.25	16.23	16.12	15.96	15.87	15.77	15.72		↓	↓	↓	↓	↓
Kompong Cham		3.3	-0.930	16.20	15.20	9.97	10.12	10.08	9.97	9.80	9.71	9.60	↑	↓	↓	↓	↓	↓
Phnom Penh (Bassac)		nr	-1.020	12.00	10.50	5.65	5.71	5.72	5.67	5.58	5.54	5.48	↑		↓	↓	↓	↓
Phnom Penh Port		-	0.070	11.00	9.50	4.67	4.72	4.73	4.67	4.58	4.54	4.48	↑		↓	↓	↓	↓
Koh Khel (Bassac)		nr	-1.000	8.40	7.90	5.17	5.24	5.26	5.23	5.17	5.15	5.12	↑		↓	↓		↓
Neak Luong		nr	-0.330	8.00	7.50	3.98	4.04	4.11	4.09	4.04	3.98	3.95	↑	↑		↓	↓	↓
Prek Kdam		nr	0.080	10.00	9.50	4.55	4.63	4.66	4.62	4.56	4.52	4.48	↑	↑	↓	↓	↓	↓
Tan Chau		0.1	0.000	4.50	3.50	1.17	1.25	1.29	1.32	1.23	1.10	0.89	↑	↑	↑	↓	↓	↓
Chau Doc		0.8	0.000	4.00	3.00	0.91	0.99	1.04	1.08	0.98	0.85	0.65	↑	↑	↑	↓	↓	↓

REMARKS:

-: not available.

nr: no rain.

LEGEND	
rising water level	↑
stable water level	
falling water level	↓
alarm stage	
alarm situation	
flood stage	
no data available	×

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://ffw.mrcmekong.org/bulletin_wet.php; http://ffw.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 27-August 2, including the lower part in Cambodia and Viet Nam, varying from 3.90 mm to 126.00 mm.

Based on the forecasted satellite data, rainfall is forecasted for some areas of the LMB with value ranging from 10 mm to 150 mm for the next seven days. The forecasting model using GFS data, moreover, shows that significant rainfall (<100 mm) is likely to take place in the Mekong region from 4 to 8 August 2021.

7.2 Water level and its forecast

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed a slight decrease over the monitoring period from 27 July to 2 August 2021. It was down about 0.56 m from 536.10 metres (m) on July 27 to 535.54 m on August 2. The outflows decreased from 1,404 cubic metres per second (m^3/s) on July 27 to 1,010 m^3/s on August 2.

Due to low flow from Jinghong upstream, the above average rainfall from 27 July to 2 August in the LMB has made water levels across most monitoring stations from Chiang Saen in Thailand to Thakhek in Lao PDR decrease; 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.

Over the next few days, the water levels from Chiang Khan to Vientiane and from Nakhon Phanom to Pakse are expected to increase by about 0.60 m and 0.55 m, respectively.

The flow volume of the Tonle Sap Lake is lower than its LTA. From next week, the flow will increase due to the 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 still continue below 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 rising from July 27 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

Drought conditions of the LMB from July 24 to 30 were normal and wet in all over the region. No drought threat was found during the monitoring week.

For the upcoming thee-month forecast, the LMB is likely to receive much below average rainfall in August mainly in the central and southern parts of the region; September is forecasted to be extremely wet in the north, moderately wet and normal in the middle, and normal and moderately dry in southern areas of the region. Like 2020, the forecast shows that October is likely the wettest month of the year. November is forecasted to receive from average to above average rainfall throughout the LMB.

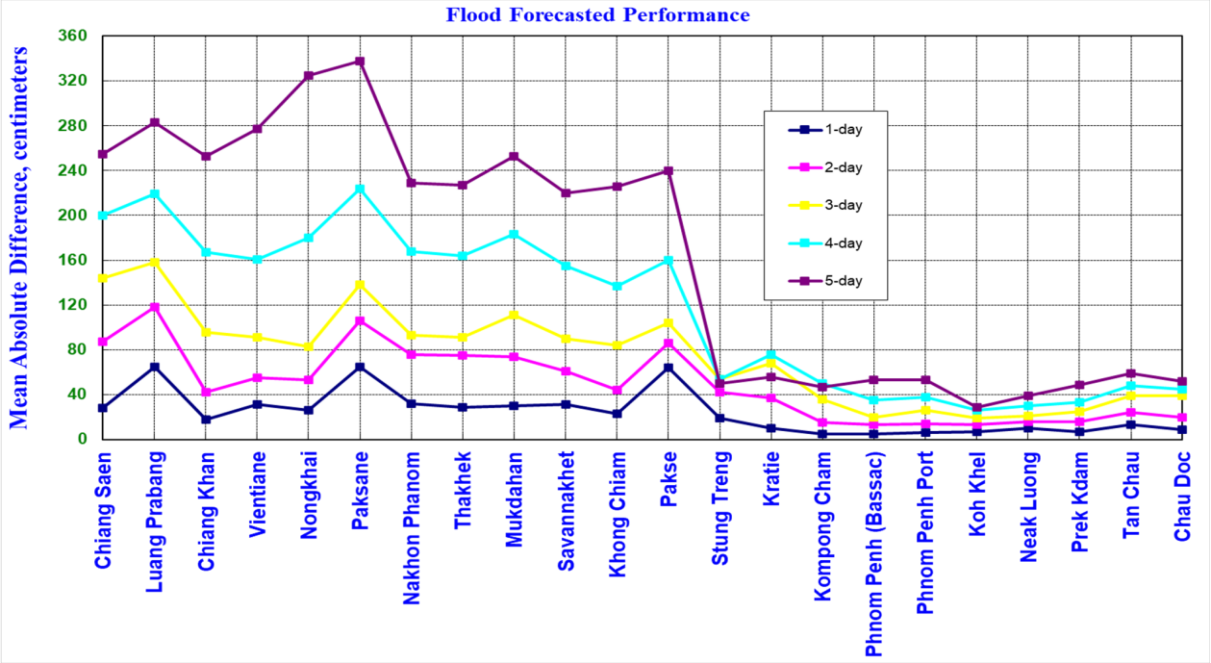
Annex 1: Performance of the weekly flood forecasting

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 27 July to 2 August 2021.

The forecasting values from 27 July to 2 August 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 Chiang Khan to Khong Chiam due to the effect of rain and dams operation 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 27 July to 2 August, 2021.

Table B1: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 27 July to 2 August, 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	28	65	18	31	26	65	32	29	30	31	23	64	19	10	5	5	6	7	10	7	13	9
2-day	87	118	42	55	53	106	76	75	74	61	44	86	42	37	15	13	14	13	16	16	24	20
3-day	144	158	96	91	83	138	93	91	111	90	84	104	54	68	36	20	26	19	21	25	39	39
4-day	200	219	167	161	180	224	168	164	183	155	137	160	54	76	50	35	38	26	30	33	48	45
5-day	255	283	253	277	325	338	229	227	253	220	226	240	50	56	47	53	53	29	39	49	59	52

Table B2: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 27 July to 2 August, 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	42.9	57.1	42.9	57.1	71.4	71.4	71.4	57.1	71.4	71.4	57.1	57.1	57.1	57.1	57.1	85.7	57.1	42.9	71.4	57.1	71.4	***61.0***
2-day	50.0	66.7	66.7	66.7	50.0	66.7	50.0	50.0	50.0	66.7	66.7	66.7	50.0	50.0	50.0	66.7	66.7	50.0	50.0	50.0	66.7	50.0	***57.6***
3-day	60.0	40.0	60.0	60.0	60.0	40.0	40.0	40.0	40.0	60.0	60.0	80.0	60.0	60.0	20.0	40.0	40.0	60.0	60.0	60.0	40.0	40.0	***50.9***
4-day	50.0	50.0	50.0	50.0	50.0	50.0	25.0	25.0	50.0	50.0	50.0	75.0	50.0	50.0	75.0	50.0	50.0	50.0	50.0	50.0	50.0	75.0	***51.1***
5-day	66.7	66.7	66.7	33.3	33.3	33.3	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	33.3	33.3	33.3	33.3	66.7	33.3	66.7	***54.5***

Table B3: Overview of performance indicators for the past 7 days from 27 July to 2 August 2021

	FF time sent				Arrival time of input data								Missing data (number-mainstream and trib.st.)							
2021	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
week	*10:39*	*00:00*	-	-	*08:15*	*07:10*	*07:08*	*08:42*	*08:06*	*08:16*	*07:01*	*08:07*	*0*	*0*	*0*	*136*	*59*	*15*	*0*	*0*
month	*10:30*	*00:00*	-	-	*08:15*	*07:10*	*07:21*	*08:36*	*08:26*	*08:14*	*07:17*	*08:07*	*0*	*0*	*14*	*272*	*302*	*48*	*7*	*38*

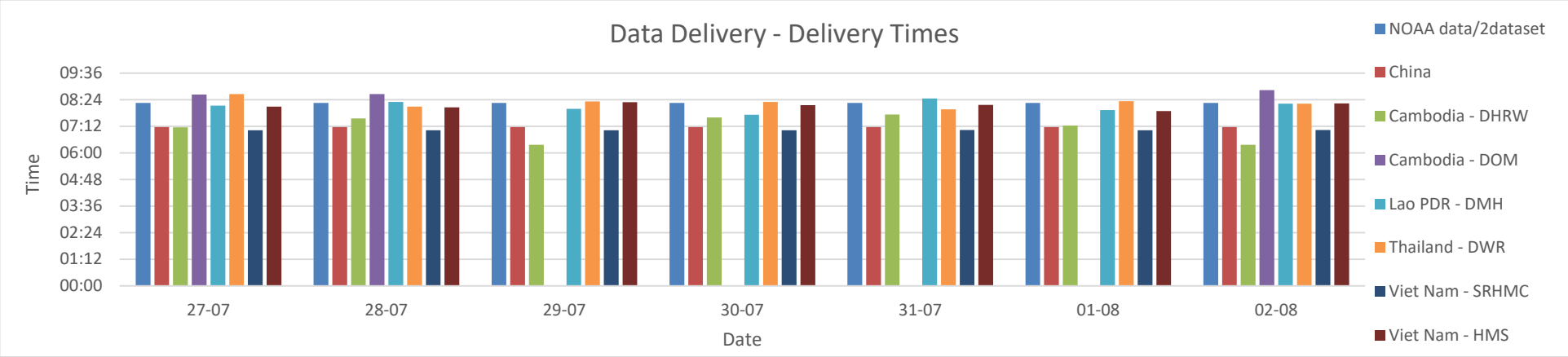


Fig. B4: Data delivery times for the past 7 days from 27 July to 2 August 2021

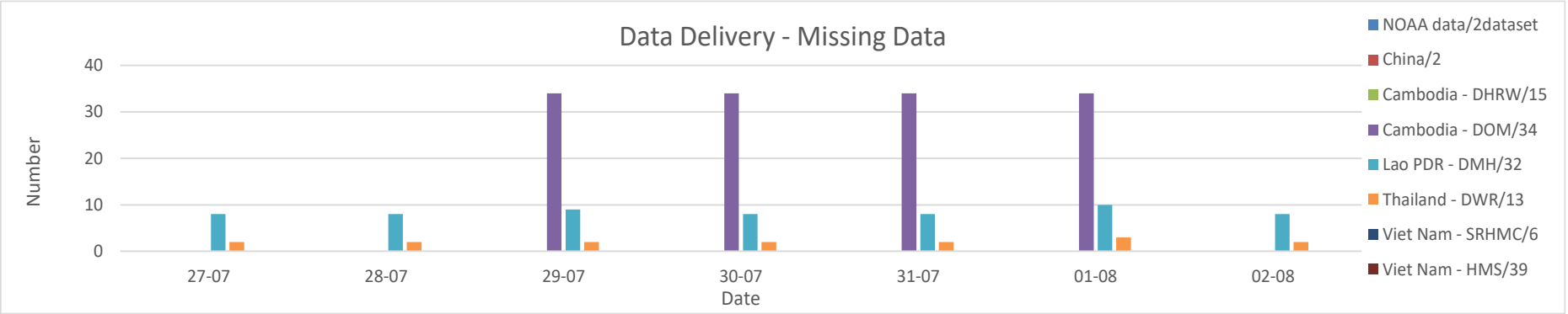


Fig. B5: Missing data for the past 7 days from 27 July to 2 August 2021

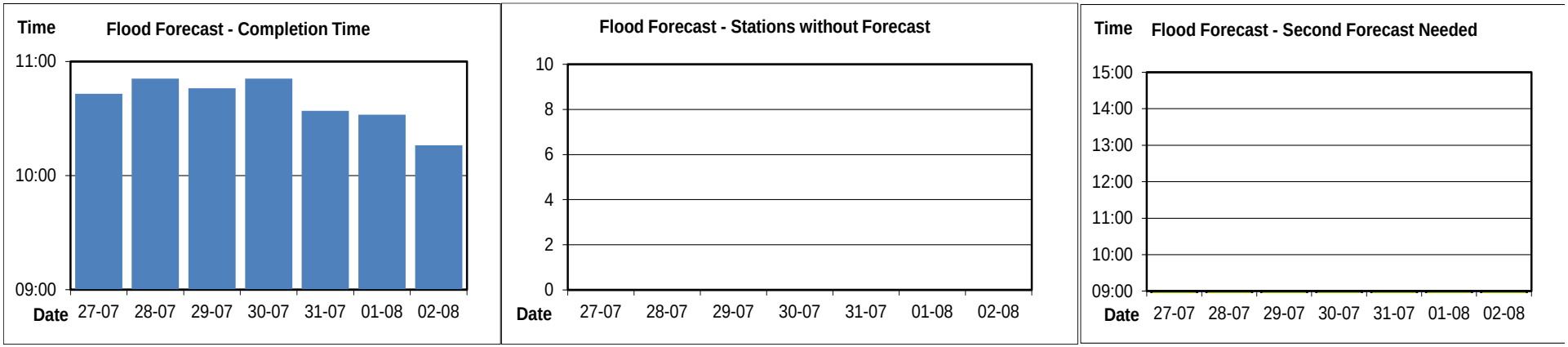


Fig. B6: Flood forecast completion time, stations without forecasts, and second forecasts need from 27 July to 2 August 2021

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