Mekong River Commission

Weekly Wet Season Situation Report in the Lower Mekong River Basin

7-13 September 2021

Prepared by
The Regional Flood and Drought Management Centre
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Key Messages

Key messages for this weekly report are presented below.

Rainfall and its forecast

- 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 4.10 millimetres (mm) to 328.80 mm.
- There will be above-average rainfalls for the next 5 days over the Mekong region from 14 to 18 September 2021 due to low-pressure dominating the Mekong region.

Water level and its forecast

- According to MRC's observed water level data, the outflows at Jinghong hydrological station showed significantly decrease over the monitoring period from 7 to 13 September 2021. It dropped about **0.78 m from 535.98 m on 10 Sept to 535.20 on 13 Sept 2021**. The outflows decreased from 1,318 cubic metres per second (m^3/s) on Sept 10 to 790 m^3/s on Sept 13, 2021.

- Amid the significant low outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand also decreased about 0.55 m from 7 to 13 September 2021. From Chiang Khan in Thailand to Vientiane in Lao PDR, water levels decreased during 7-13 September due to below-average rainfall in the area. However, water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR were increasing. Water levels from the stretches of the river from Stung Treng to Kratie and at Kampong Cham in Cambodia were also increasing, following the same trend of the upstream flow and staying lower than their LTA.

- The water volume of the Tonle Sap Lake is lower than its LTA but higher than the levels in 2019 and 2020 during the same period.

- Over the next few days, the water levels across most monitoring stations are expected to increase but remain lower than their long-term value in most stations.

Drought condition and its forecast

- During the monitoring week from September 4 to 9, the LMB was experiencing some moderate and severe meteorological and agricultural droughts. However, the conditions were not serious enough to post any threat for agriculture and water use in the region. The overall drought conditions through combined drought index shows normal conditions for the entire LMB.

- For the upcoming thee-month forecast, the LMB is likely to receive above average rainfall in September and October mainly in the central and southern parts 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 **7-13 September 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 levels indicated in this report refer 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 (September, October and November) 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 September which is influenced by the Southwest Monsoon of the rainy season period. During this time, there will be more rainstorms, some tropical storms, 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 September and October.

Figure 1 presents the weather map on 12 September 2021, showing that a low pressure with the Tropical Storm CONSON is moving and dominating the northern part of Thailand, Lao PDR and Viet Nam and might affect the 3S area (Sesan, Sre Pok, and Sekong) in Cambodia and Viet Nam of the LMB.

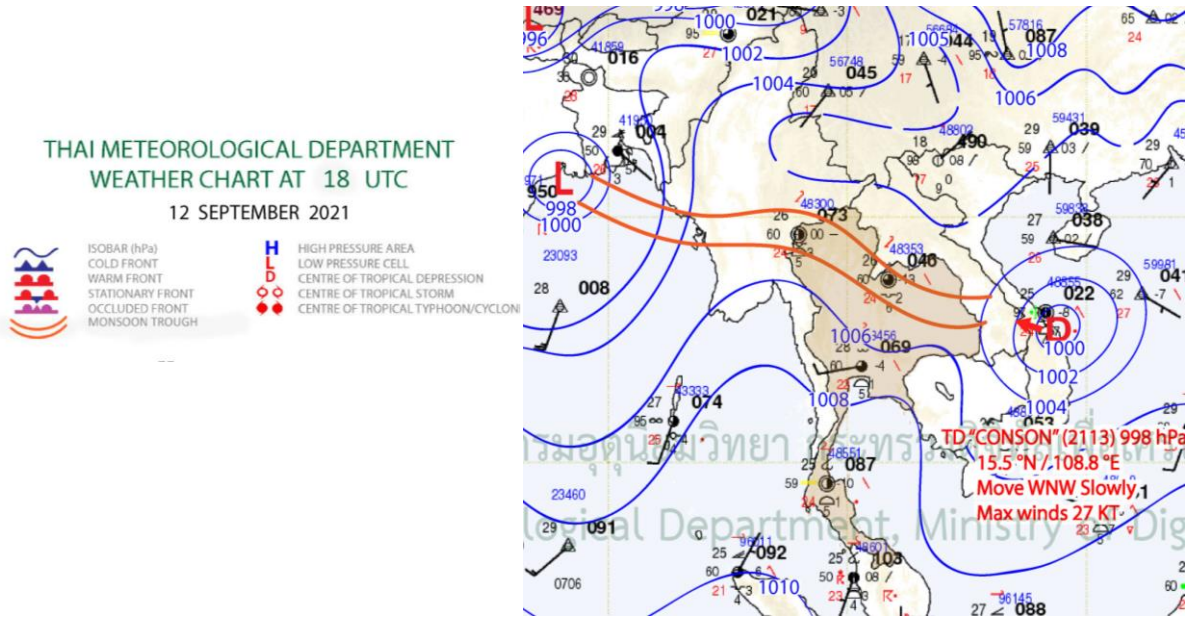


Figure 1. Summary of weather conditions over the LMB.

According to the ASEAN Specialised Meteorological Centre (ASMC), a highest probability of wetter condition is predicted over of the lower part of the Mekong region covering Lao PDR and Thailand from 6 to 19 September 2021, during the 1st and 2nd week of September. Nonetheless, LMB is likely dominated by wetter condition, which may receive above average rainfall in general.

Figure 2 shows the outlook of comparative wet conditions from 6 to 19 September 2021 covering the whole LMB region, based on results from the NCEP model (National Centres for Environmental Prediction).

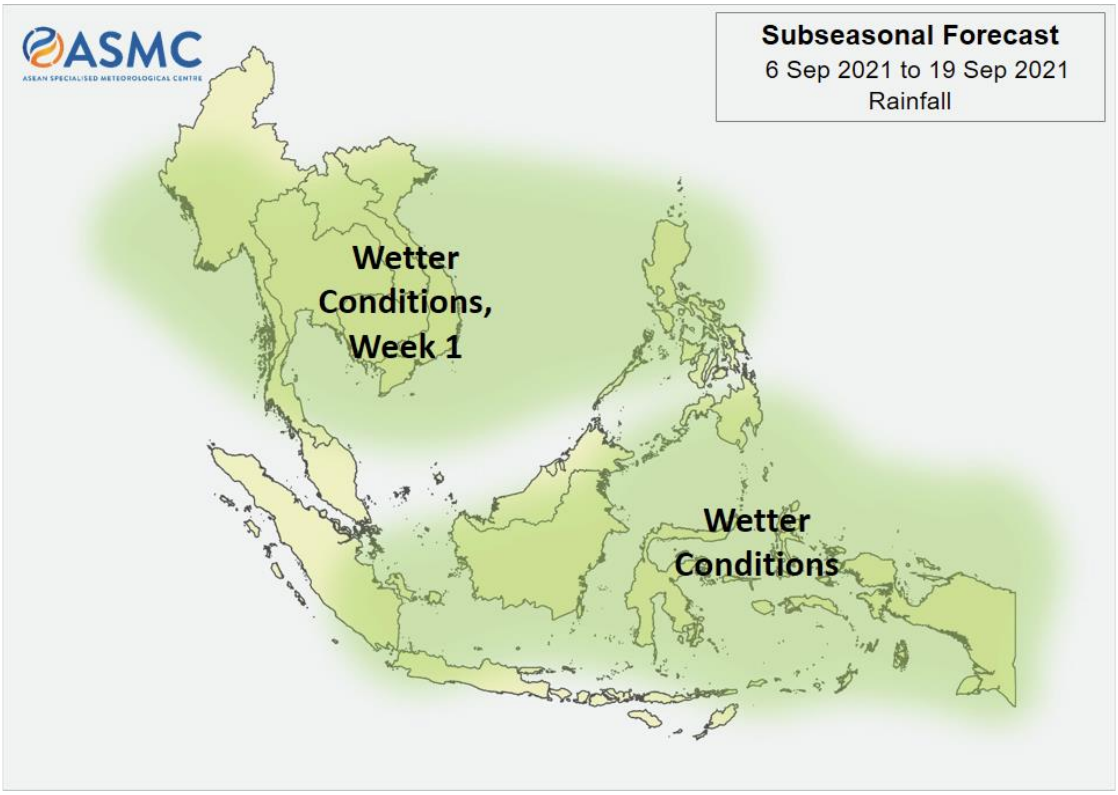


Figure 2. Outlook of wet and dry conditions over the Asian countries by ASMC.

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 on 12 September 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 a sign of tropical depression (TD) CONSON moving to the Mekong region up to 13 September 2021.

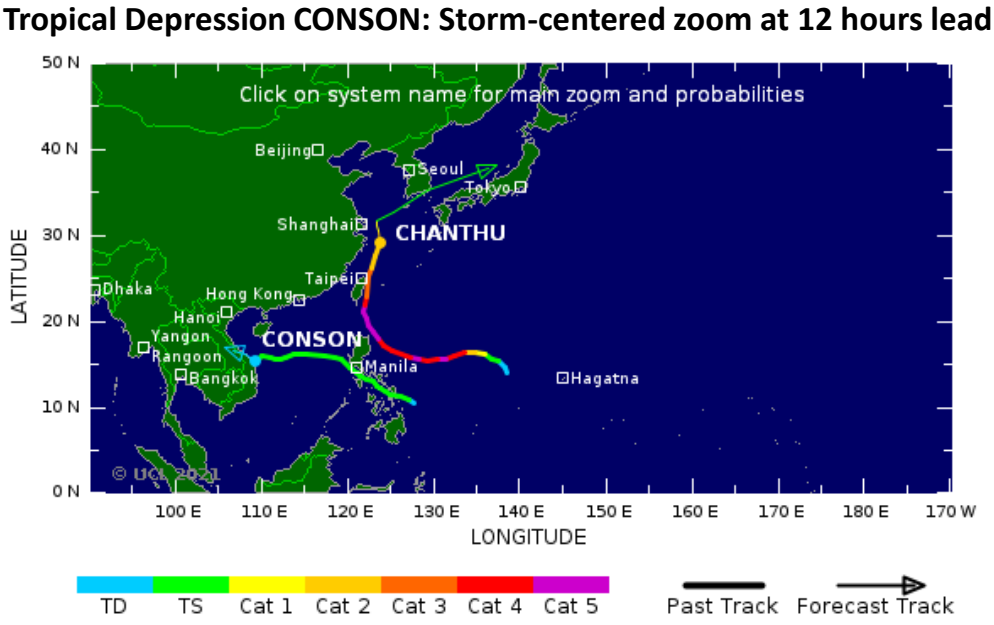


Figure 3. A tropical depression risk observed on 13 September 2021.

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 4.10 mm to 328.80 mm. The weekly total rainfall from 7 to 13 September 2021 in this reporting week was considered high from Khong Chaim in Thailand to Pakse in Lao PDR, compared with last week rainfall in the Lower part of the LMB (see Figure 4).

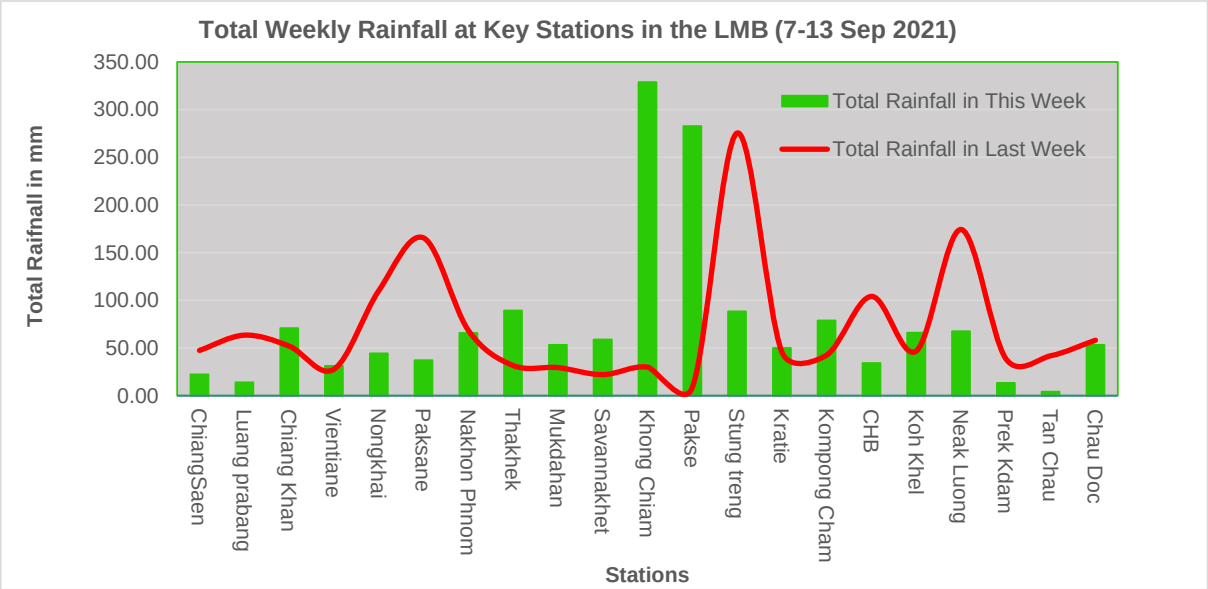


Figure 4. Weekly total rainfall at key stations in the LMB during 7 - 13 September 2021.

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 7-13 September 2021.

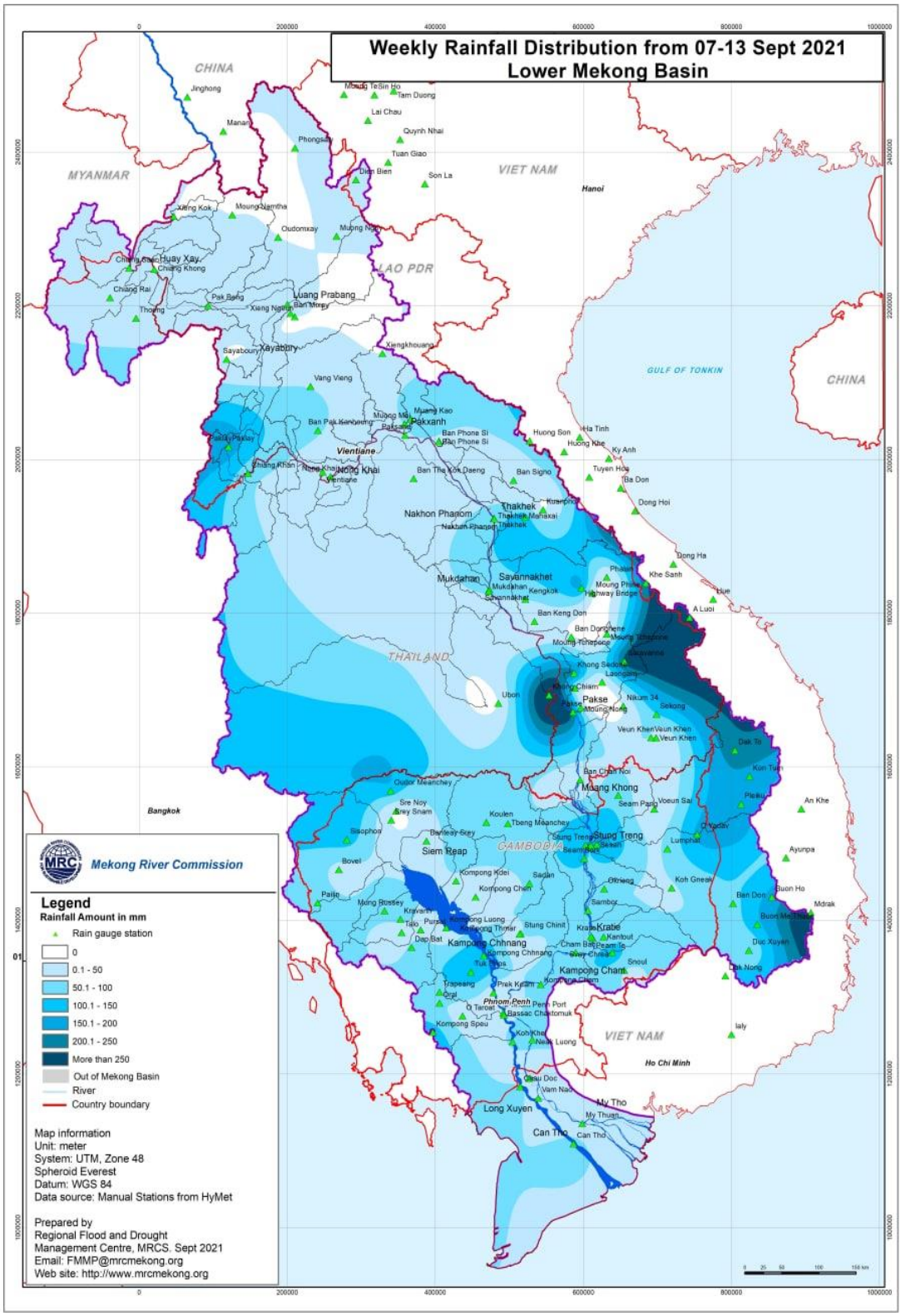


Figure 5. Weekly rainfall distribution over the LMB during 7-13 September 2021.

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.

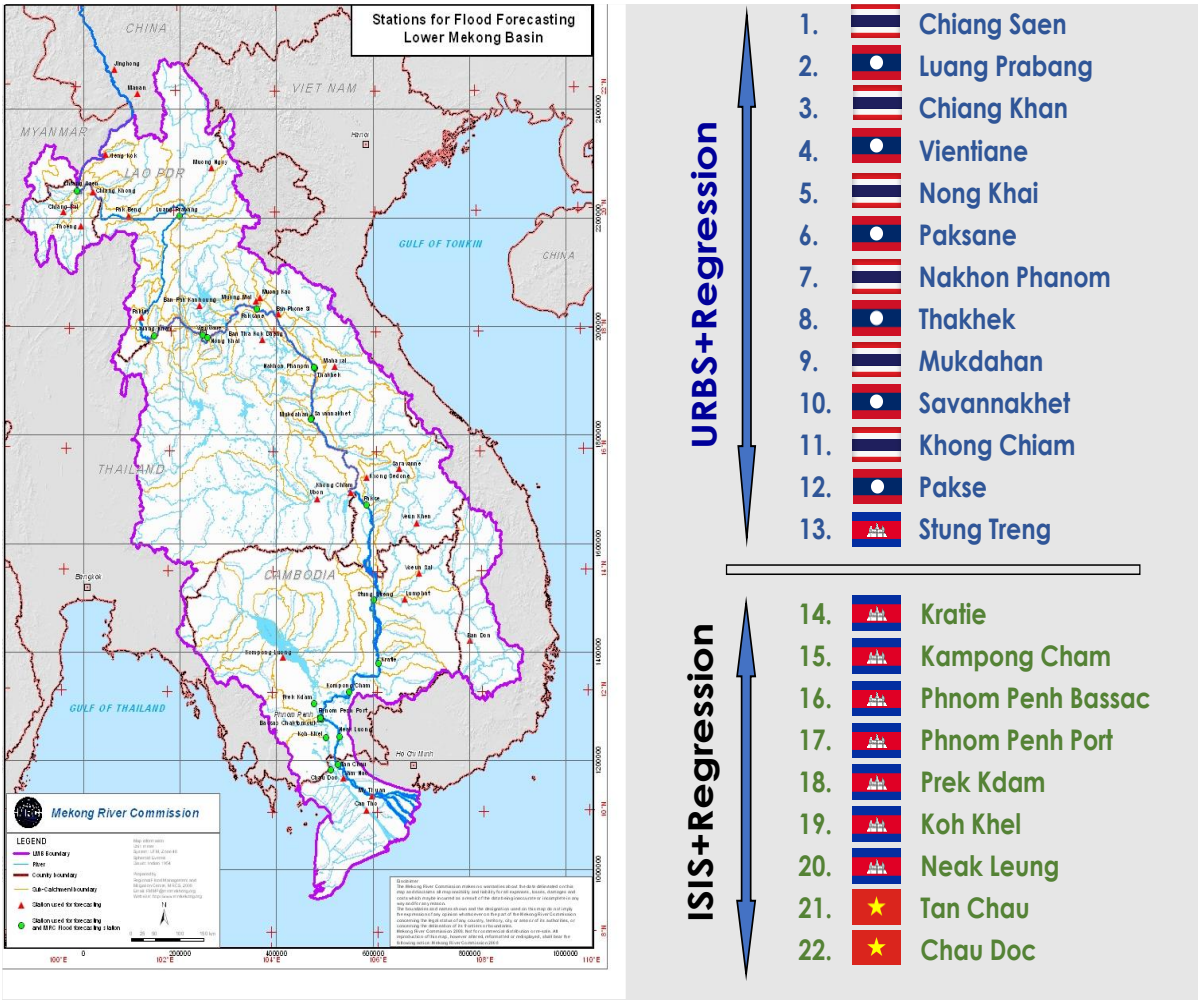


Figure 6. Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed significantly decrease over the monitoring period from 7 to 13 September 2021. It dropped **about 0.78 m from 535.98 m on 10 Sept to 535.20 on 13 Sept 2021**. The outflows decreased from 1,318 m^3/s on Sept 10 to 790 m^3/s on Sept 13, 2021.
Figure 7 below presents water level decreasing at the Jinghong hydrological station[1], indicating that the trend of decreased water level from 10 to 13 September 2021 is in between its LTA and minimum levels.

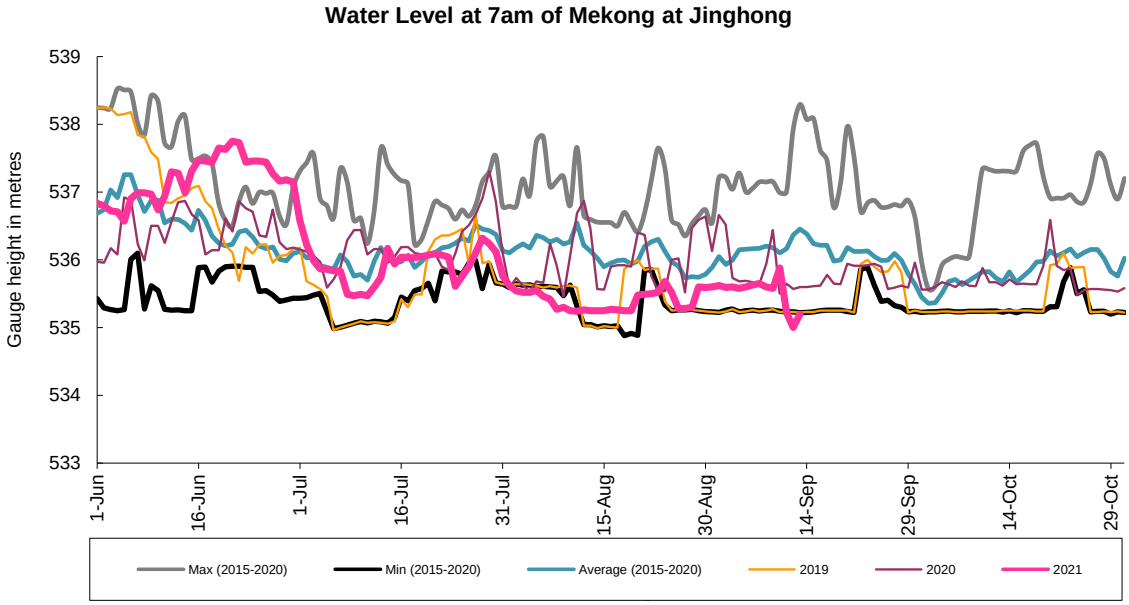


Figure 7. Water level at the Jinghong hydrological station during 1 July-13 September 2021.

Amid the significant low outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand also decreased about 0.55 m from 7 to 13 September 2021. From Chiang Khan in Thailand to Vientiane in Lao PDR, water levels decreased during 7-13 September due to below-average rainfall in the area. However, water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR were increasing. Water levels from the stretches of the river from Stung Treng to Kratie and at Kampong Cham in Cambodia were also increasing, following the same trend of the upstream flow and staying lower than their LTA.

Based on 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 7 to 13 September 2021 at Thailand's Chiang Saen slightly decreased from 3.30 m to 2.75 m, showing 0.55 m down and was about 0.35 m lower than its historical minimum level. Similarly, the water level at Luang Prabang station in Lao PDR also decreased

[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.

from 10.28 m to 9.70 m during the reporting period. This level shows 2.54 m lower than its LTA value. The trend – sometimes higher or lower to its historical maximum and LTA values – has been observed since early 2021. 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**.

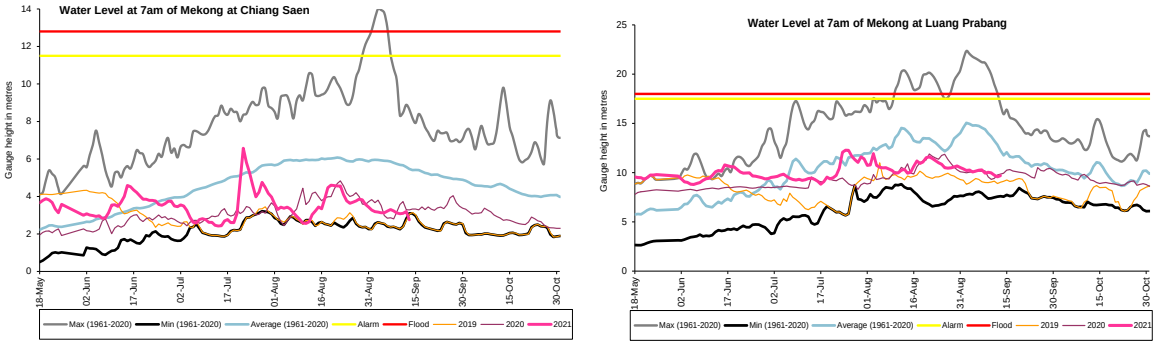


Figure 8. Water levels at Chiang Saen in Thailand and Luang Prabang in Lao PDR.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) slightly increased from 8.10 m to 8.30 m during the reporting week. This increase showed 2.88 m lower than its Long-Term- Average (LTA). The water level downstream at Vientiane in Lao PDR followed the upstream trend. It went up from 5.14 m to 6.06 m and was about 2.39 m lower than its LTA during 7-13 September. At Nong Khai station in Thailand, the water level also increased during the reporting period. It was up about 1.02 m, significantly rising from 5.13 m to 6.15 m and showing 3.10 m lower than its LTA. Due to above-average rainfall, water level at Paksane in Lao PDR increased about 0.45 m, rising from 6.69 m to 7.14 m. The WL at this station was still about 3.58 m lower than its LTA. The recent increased water levels were obviously due to the rainfall caused by low pressure in the sub-catchment area, although less inflow from upstream and the influence of the Nam Ngum dam operation located upstream (see figure 1). The water levels at Vientiane and Paksane are shown in Figure 9 below.

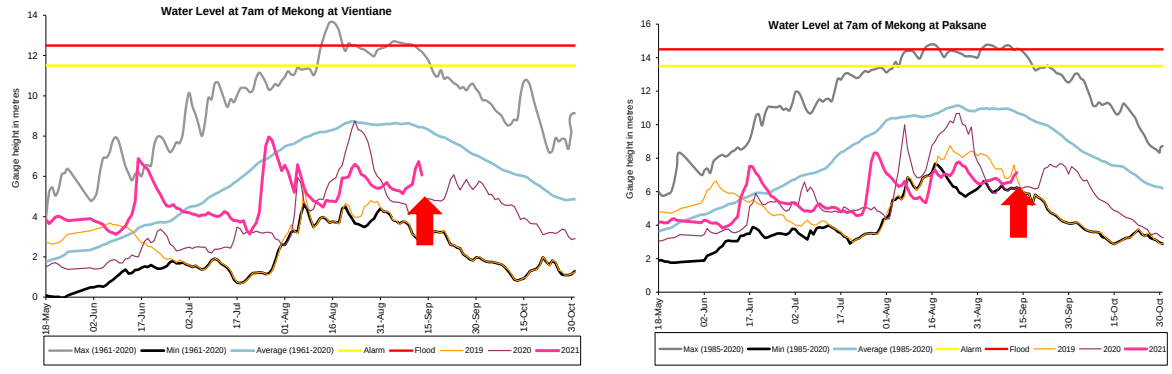


Figure 9. Water levels Veintiane and Paksane in Lao PDR.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom to Mukdahan in Thailand increased about 0.23 m due to some rainfall and inflow from upstream. Further downstream from Savannakhet to Pakse in Lao PDR enormously increased from 0.89 m to 2.37 m due to heavy rainfall which was influenced by the Tropical Storm CONSON. **However, water levels at these stations (Nakhon Phanom to Pakse) were staying below their LTA level, which still considered critical**. Figure 10 shows the water levels at Nakhon Phanom and Pakse stations.

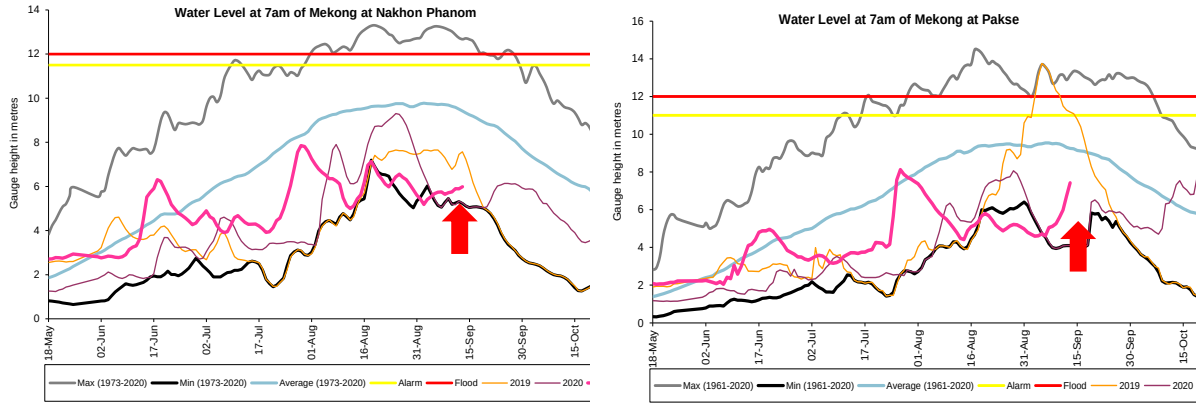


Figure 10. Weekly water levels at Nakhon Phanom in Thailand and Pakse in Lao PDR

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

Due to above-average 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 significantly went up during 7-13 September 2021. This week water level at Stung Treng and Kratie increased about 1.72 m and 1.73 m, respectively, moving towards their LTA level (as showed in Figure 11). Also, the water level at Kompong Cham remarkably increased about 1.35 m but still remained about 3.69 m lower than its LTA. **Water levels at these stations were still staying lower than their LTA level, which considered critical**.

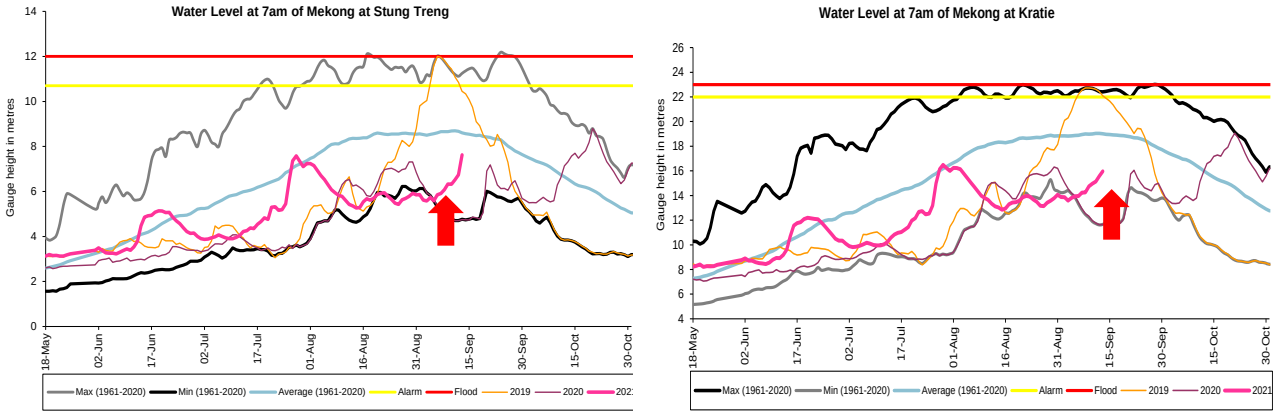


Figure 11. Water levels at Stung Treng and Kratie on the Mekong River.

At Chaktomuk on the Bassac River, due to heavy rain in catchment inflow, the water level increased by about 0.75 m and stayed 3.36 m lower than its LTA value; while at Koh Khel, water level went up 0.59 m, staying 1.68 m lower than its LTA value. The water level at Prek Kdam on the Tonle Sap Lake increased about 0.65 m and was about 3.27 m lower than its LTA value. The water level at the Tonle Sap Lake (observed at Kompong Luong) was similar to Prek Kdam station's water level. The increased water level was because of more inflow and rainfall contributed from upstream of the Tonle Sap Lake area during the reporting period. The water level at the Tonle Sap Lake (observed at Kompong Luong) followed the same trend of Prek Kdam station's water level. **Water levels at these stations were staying lower than their LTA level, which still considered critical**.

Tidal stations at Tan Chau and Chau Doc

Like last week, the water levels from 7 to 13 September 2021 at Viet Nam's Tan Chau and Chau Doc were fluctuating due to daily tidal effects from the sea. The fluctuation levels were between 1.18 m and 1.62 m; they were in between the range of their LTA and historical minimum levels and **considered critical**.

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 September 13 of this reporting period, **it was observed that the main inflow/reverse flow to Tonle Sap Lake increased due to above average-rainfall from upstream**. This increased inflow of Tonle Sap Lake was also most likely caused by more inflows from the catchment area. The inflow into the Tonle Sap Lake condition in 2021 was higher than 2019 and 2020 inflow conditions. For next week, the above average rainfall is forecasted for the Tonle Sap area; thus, the inflow into the Tonle Sap Lake is likely to continue rising from the current level.

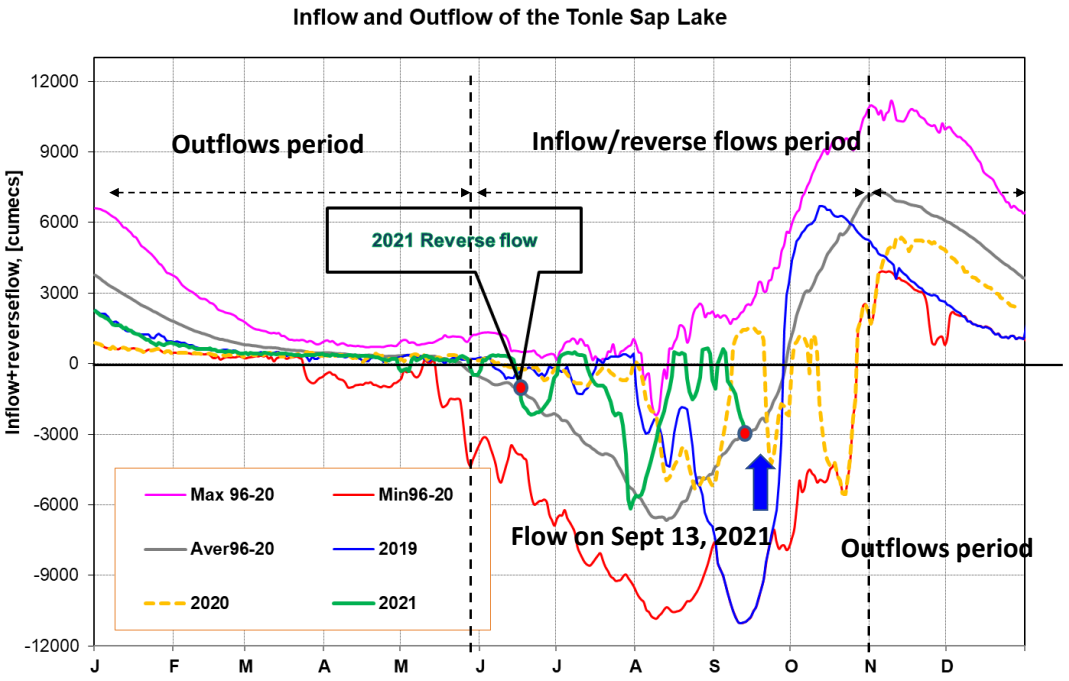


Figure 12. Seasonal change of inflows and outflows of Tonle Sap Lake

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 September 13 for the Lake compared with the volumes in 2018, 2019 and 2020, their LTA, and the fluctuation levels (1997–2019). It shows that up to September 13, **the water volume of the Tonle Sap Lake is lower than its LTA but higher than the levels in 2019 and 2020 during the same period**. The figure 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.

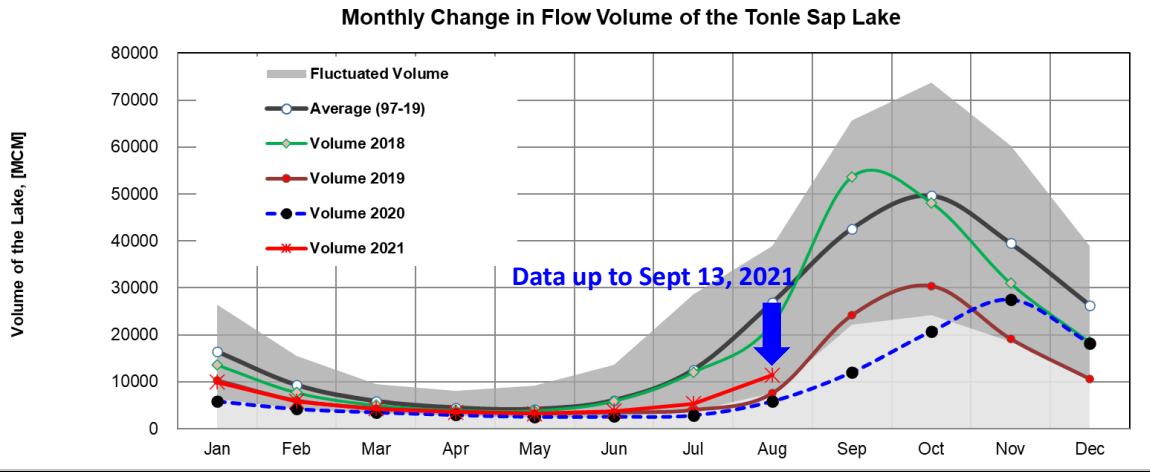


Figure 13. The seasonal change in monthly flow volume of Tonle Sap Lake.

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]
Jan	16452.95	26357.53	6272.01	13633.41	10285.31	5906.80	9923.80
Feb	9312.36	15596.22	4281.41	7729.72	6019.30	4264.19	5832.97
Mar	5868.92	9438.24	3350.92	5037.06	4354.62	3553.99	4264.88
Apr	4474.98	8009.14	2875.42	3956.47	3667.47	2992.61	3556.68
May	4166.07	9176.93	2417.81	3864.00	3266.43	2594.92	3240.78
Jun	6034.10	13635.01	2470.54	5919.18	3517.06	2641.88	3798.29
Jul	12502.58	28599.56	3832.51	12024.96	4001.99	2925.86	5346.73
Aug	26934.35	39015.12	7554.93	22399.65	7622.71	5941.07	11436.52
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, comapred with historical Min values						
	Normal condition, compared with LTA (Long term average)						
	Low volume situation, comapred with LTA values						
Unit: Million Cubic Meter (1 MCM= 0.001 Km^3)							

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 September 7 to 13, the LMB was affected by three weather factors including (i) the monsoon trough which lay across the lower northern and north-eastern parts towards the low-pressure cell over the east sea on the first day of the week then moved southward to cover the central, eastern, and lower north-eastern parts during 7-8 Sep; (ii) the tropical storm "Conson" which took place over the upper east sea and intensified into the severe tropical storm in the evening of 9 Sep. It then travelled to the middle east sea in the morning of September 10 before downgrading into the tropical storm over the south-central coast of Viet Nam in the evening of September 11. Finally, it downgraded into a tropical depression and made landfall at Quang Ngai, Viet Nam in the early morning of September 12. The "Conson" moved west-northwest slowly and later covered the south-central coast of Viet Nam; and (iii) the active southwest monsoon which prevailed over the Gulf of Thailand almost the entire week. These conditions caused heavy and very heavy rainfall from the middle to the lower parts of the LMB (including parts of Thailand, Lao PDR, Cambodia, and Viet Nam).

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, ranging from low risk to extreme level, as shown in Figure 14 and Table 2.

Table 2. Detected flash flood in Thailand, Lao PDR, Cambodia, and Viet Nam on September 12.

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

Date of FFG products 12/09/2021 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
Ubon Ratchathani	Buntharik	Northeastern	Low-Risk	Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk	Chanthaburi	Pong Nam Ron	Eastern	Low-Risk
Ubon Ratchathani	Buntharik	Northeastern	Low-Risk	Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk	Chanthaburi	Khlung	Eastern	Low-Risk
Ubon Ratchathani	Buntharik	Northeastern	Low-Risk	Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk	Ubon Ratchathani	Nam Yun	Northeastern	Low-Risk
Ubon Ratchathani	Buntharik	Northeastern	Low-Risk	Ubon Ratchathani	Khong Chiam	Northeastern	Low-Risk	Ubon Ratchathani	Buntharik	Northeastern	Low-Risk
Ubon Ratchathani	Sirinthon	Northeastern	Moderate-Risk	Ubon Ratchathani	Lao Sua Kok	Northeastern	Low-Risk	Ubon Ratchathani	Buntharik	Northeastern	Low-Risk
Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk	Ubon Ratchathani	Buntharik	Northeastern	Low-Risk	Ubon Ratchathani	Buntharik	Northeastern	Low-Risk
Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk	Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk	Ubon Ratchathani	Buntharik	Northeastern	Low-Risk
Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk	Trad	Muang Trat	Eastern	Low-Risk	Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk
Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk	Phangnga	Khura Buri	Southern-West Coast	Low-Risk	Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk
Ubon Ratchathani	Khong Chiam	Northeastern	Low-Risk	Thai Island			Low-Risk	Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk
Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk					Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk
Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk					Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk
Ubon Ratchathani	Si Muang Mai	Northeastern	Low-Risk					Ubon Ratchathani	Khong Chiam	Northeastern	Low-Risk
Ubon Ratchathani	Tansum	Northeastern	Low-Risk					Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk
Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk					Ubon Ratchathani	Tansum	Northeastern	Low-Risk
Ubon Ratchathani	Trakan Phutphon	Northeastern	Low-Risk					Ubon Ratchathani	Sirinthon	Northeastern	Low-Risk
Ubon Ratchathani	Lao Sua Kok	Northeastern	Low-Risk					Ubon Ratchathani	Trakan Phutphon	Northeastern	Low-Risk
Ubon Ratchathani	Lao Sua Kok	Northeastern	Low-Risk					Ubon Ratchathani	Lao Sua Kok	Northeastern	Low-Risk
Ubon Ratchathani	Muang Samsip	Northeastern	Low-Risk					Ubon Ratchathani	Lao Sua Kok	Northeastern	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 12/09/2021 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
Champasak	Khong	THAHIN TAI	Southwestern	Low-Risk	Savannakhet	Nong	TALING	Southern	Low-Risk	Champasak	Khong	THAHIN TAI	Southwestern	Low-Risk
Savannakhet	Sepone	THAKHONG	Southern	Low-Risk	Savannakhet	Nong	GNANG	Southern	Low-Risk	Savannakhet	Sepone	THAKHONG	Southern	Low-Risk
Savannakhet	Sepone	SALOUNG	Southern	Low-Risk	Savannakhet	Nong	LAGNENG KHOK	Southern	Low-Risk	Savannakhet	Sepone	SALOUNG	Southern	Low-Risk
Sekong	Kaleum	TIN	Southeast	High-Risk	Saravane	Ta oi	TUMLEKHAO	South	Low-Risk	Saravane	Samuoi	ATUK	South	Low-Risk
Sekong	Kaleum	STTHORN	Southeast	High-Risk	Saravane	Ta oi	PHOR SANH	South	High-Risk	Savannakhet	Nong	TALING	Southern	Low-Risk
Savannakhet	Nong	GNANG	Southern	Low-Risk	Bolikhamxay	Khamkheut	PHAPOUN	Central Laos	Low-Risk	Savannakhet	Nong	GNANG	Southern	Low-Risk
Savannakhet	Nong	LAGNENG KHOK	Southern	Low-Risk	Bolikhamxay	Khamkheut	PHONESI	Central Laos	Low-Risk	Savannakhet	Nong	LAGNENG KHOK	Southern	Low-Risk
Savannakhet	Nong	PASANEIR TAI	Southern	Low-Risk	Bolikhamxay	Khamkheut	NAMSANGIN	Central Laos	Low-Risk	Savannakhet	Nong	PASANEIR TAI	Southern	Low-Risk
Saravane	Ta oi	TUMLEKHAO	South	Low-Risk	Bolikhamxay	Khamkheut	NAPHOUANG	Central Laos	Low-Risk	Saravane	Ta oi	TUMLEKHAO	South	Low-Risk
Saravane	Ta oi	PHOBEUI	South	Low-Risk	Khammuane	Hinboon	MOUANG NAM SANG	Center of Laos	Low-Risk	Saravane	Ta oi	PHOBEUI	South	Low-Risk
Saravane	Ta oi	PHOR SANH	South	High-Risk	Champasak	Pathoomph	NAMPHAAK	Southwestern	Low-Risk	Saravane	Ta oi	PHOR SANH	South	High-Risk
Saravane	Ta oi	TUMLE KAO	South	Low-Risk	Attapeu	Xaysetha	XENOI	Sotheast	Low-Risk	Saravane	Ta oi	TUMLE KAO	South	Low-Risk
Bolikhamxay	Khamkheut	PHAPOUN	Central Laos	Low-Risk	Champasak	Paksong	THONGYAO	Southwestern	Low-Risk	Saravane	Ta oi	KANG	South	Low-Risk
Bolikhamxay	Khamkheut	PHONESI	Central Laos	Low-Risk	Sekong	Kaleum	PRO	Southeast	Moderate-Risk	Savannakhet	Phine	PHAY	Southern	Low-Risk
Bolikhamxay	Khamkheut	NAMSANGIN	Central Laos	Moderate-Risk	Sekong	Kaleum	AR-HOR NEUA	Southeast	Low-Risk	Bolikhamxay	Viengthon	KOKKIENG	Central Laos	Low-Risk
Khammuane	Nakai	PUU	Center of Laos	Low-Risk	Sekong	Kaleum	KA-OUANG	Southeast	Moderate-Risk	Bolikhamxay	Khamkheut	PHAPOUN	Central Laos	Low-Risk
Bolikhamxay	Khamkheut	NAPHOUANG	Central Laos	Moderate-Risk	Sekong	Kaleum	PANORM	Southeast	Low-Risk	Bolikhamxay	Khamkheut	PHONESI	Central Laos	Low-Risk
Khammuane	Hinboon	MOUANG NAM SANG	Center of Laos	Low-Risk	Sekong	Kaleum	AR-PEUANG	Southeast	Low-Risk	Bolikhamxay	Khamkheut	NAMSANGIN	Central Laos	Moderate-Risk
Khammuane	Bualapha	SENE PHANH	Center of Laos	Low-Risk	Sekong	Kaleum	PALAENG	Southeast	Moderate-Risk	Khammuane	Nakai	PUU	Center of Laos	Low-Risk
Khammuane	Bualapha	VANG KHON	Center of Laos	Low-Risk	Sekong	Kaleum	VAK TAI	Southeast	Low-Risk	Bolikhamxay	Khamkheut	PAUNGLAN	Central Laos	Low-Risk
Khammuane	Bualapha	MAI VANG KOUAN	Center of Laos	Low-Risk	Sekong	Kaleum	TIN	Southeast	Moderate-Risk	Bolikhamxay	Khamkheut	NAPHOUANG	Central Laos	Moderate-Risk
Champasak	Pathoomph	NAMPHAAK	Southwestern	Moderate-Risk	Sekong	Kaleum	STTHORN	Southeast	Moderate-Risk	Bolikhamxay	Khamkheut	PAKHA	Central Laos	Low-Risk
Attapeu	Xaysetha	XENOI	Sotheast	Low-Risk	Sekong	Lamarm	KANONG MAI	Southeast	Moderate-Risk	Khammuane	Hinboon	VANG TA KHONG	Center of Laos	Low-Risk
Champasak	Paksong	KEOKHOUNMOUANG	Southwestern	Low-Risk	Sekong	Lamarm	TAVI	Southeast	Low-Risk	Khammuane	Hinboon	MOUANG NAM SANG	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 12/09/2021 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
Stung Treng	Siem Pang	Kham Phouk	Northeast	Low-Risk	Stung Treng	Siem Pang	Kham Phouk	Northeast	Low-Risk	Stung Treng	Siem Pang	Kham Phouk	Northeast	Low-Risk
Preah Vihear	Chhaeb	KAANLEUANG	North	Low-Risk	Ratana Kiri	Ou Chum	Tun	Northeast	Low-Risk	Stung Treng	Siem Pang	Kiri Bas Kraom	Northeast	Low-Risk
Ratana Kiri	Ta Veaeng	Phlueu Thum	Northeast	Low-Risk	Ratana Kiri	Veun Sai	Tiem Kraom	Northeast	Low-Risk	Preah Vihear	Chhaeb	KAANLEUANG	North	Low-Risk
Ratana Kiri	Ta Veaeng	Ta Veaeng	Northeast	Low-Risk	Ratana Kiri	Koun Mom	Ko Hokseb	Northeast	Low-Risk	Ratana Kiri	Ta Veaeng	Phlueu Thum	Northeast	Low-Risk
Ratana Kiri	Ou Chum	Tun	Northeast	Low-Risk	Ratana Kiri	Lumphat	Sakmotr Kraom	Northeast	Low-Risk	Ratana Kiri	Ta Veaeng	Ta Veaeng	Northeast	Low-Risk
Ratana Kiri	Veun Sai	Pa Daeng	Northeast	Low-Risk	Kampong Cham	Stueng Trang	Veal Preah	Central Lowland	Low-Risk	Ratana Kiri	Ou Chum	Tun	Northeast	Low-Risk
Stung Treng	Siem Pang	Chantuh	Northeast	Low-Risk	Kampong Cham	Stueng Trang	Sampieng Kraom	Central Lowland	Low-Risk	Ratana Kiri	Veun Sai	Pa Daeng	Northeast	Low-Risk
Stung Treng	Siem Pang	Peam Khes	Northeast	Low-Risk	Kampong Thom	Baray	Kokir Thum	Nothwest	Low-Risk	Stung Treng	Siem Pang	Chantuh	Northeast	Low-Risk
Stung Treng	Siem Pang	Srae Ruessei	Northeast	Low-Risk	Kampong Cham	Cheung Prey	Kngaok	Central Lowland	Low-Risk	Stung Treng	Siem Pang	Peam Khes	Northeast	Low-Risk
Ratana Kiri	Veun Sai	Kang Nak	Northeast	Low-Risk	Tboung Khmum	Memot	Kantuot	Central Lowland	Low-Risk	Stung Treng	Siem Pang	Srae Ruessei	Northeast	Low-Risk
Ratana Kiri	Veun Sai	Tiem Kraom	Northeast	Low-Risk	Tboung Khmum	Memot	Chamkar Thmei	Central Lowland	Low-Risk	Ratana Kiri	Veun Sai	Kang Nak	Northeast	Low-Risk
Ratana Kiri	Ou Ya Dav	Un	Northeast	Low-Risk	Sihanouk Ville	Prey Nob	Veal Thum	Southwest	Low-Risk	Ratana Kiri	Veun Sai	Tiem Kraom	Northeast	Low-Risk
Ratana Kiri	Ou Chum	Meh	Northeast	Low-Risk	Sihanouk Ville	Prey Nob	Chumpu Khmau	Southwest	Low-Risk	Ratana Kiri	Ou Ya Dav	Un	Northeast	Low-Risk
Ratana Kiri	Ou Chum	Cha Ung Kau	Northeast	Low-Risk						Ratana Kiri	Ou Chum	Meh	Northeast	Low-Risk
Ratana Kiri	Koun Mom	Ko Hokseb	Northeast	Low-Risk						Ratana Kiri	Ou Chum	Cha Ung Kau	Northeast	Low-Risk
Ratana Kiri	Lumphat	Cheng Ra	Northeast	Low-Risk						Ratana Kiri	Koun Mom	Ko Hokseb	Northeast	Low-Risk
Stung Treng	Sesan	Chrab	Northeast	Low-Risk						Stung Treng	Thala Barivat	Anlong Kramuon	Northeast	Low-Risk
Ratana Kiri	Lumphat	Sakmotr Kraom	Northeast	Low-Risk						Ratana Kiri	Lumphat	Cheng Ra	Northeast	Low-Risk
Otdar Meanchey	Banteay Ampil	Pou Chas	North	Low-Risk						Stung Treng	Sesan	Chrab	Northeast	Low-Risk
Ratana Kiri	Ou Ya Dav	Peak	Northeast	Low-Risk						Ratana Kiri	Lumphat	Ka Chanh	Northeast	Low-Risk
Banteay Meanchey	Preah Netr Preah	Thma Dab	Northwest	Low-Risk						Ratana Kiri	Lumphat	Sakmotr Kraom	Northeast	Low-Risk
Battambang	Batdambang	Tumpung Cheung	Northwest	Low-Risk						Siem Reap	Varin	Kouk Voat	Northwest	Low-Risk
Siem Reap	Svay Leu	Bet Phka	Northwest	Low-Risk						Otdar Meanchey	Banteay Ampil	Pou Chas	North	Low-Risk
Preah Vihear	Sangkom Thmei	koukThkov	North	Low-Risk						Ratana Kiri	Ou Ya Dav	Peak	Northeast	Low-Risk
Kampong Chhnang	Kampong Leaeng	Kandal	Central	Low-Risk						Banteay Meanchey	Preah Netr Preah	Thma Dab	Northwest	Low-Risk
Kampong Cham	Stueng Trang	Veal Preah	Central Lowland	Low-Risk						Battambang	Batdambang	Tumpung Cheung	Northwest	Low-Risk
Kampong Cham	Stueng Trang	Sampieng Kraom	Central Lowland	Low-Risk						Siem Reap	Svay Leu	Bet Phka	Northwest	Low-Risk
Kampong Thom	Kampong Svay	Kaoh Krob Bay	Nothwest	Low-Risk						Preah Vihear	Sangkom Thmei	koukThkov	North	Low-Risk
Kampong Thom	Stoung	Slak Kranh	Nothwest	Low-Risk						Pursat	Veal Veaeng	Chamka Chrey Khang Tbong	Western	Low-Risk
Preah Vihear	Rovieng	Tuol Rovieng	North	Low-Risk						Kampong Chhnang	Kampong Leaeng	Kandal	Central	Low-Risk
Kampong Thom	Sandan	Srae Veal Khang Kaeut	Nothwest	Low-Risk						Kampong Cham	Stueng Trang	Veal Preah	Central Lowland	Low-Risk
Kampong Thom	Sandan	Srae Pring	Nothwest	Low-Risk						Kampong Cham	Stueng Trang	Sampieng Kraom	Central Lowland	Low-Risk
Kampong Cham	Stueng Trang	Phum Chetseb	Central Lowland	Low-Risk						Kampong Thom	Kampong Svay	Kaoh Krob Bay	Nothwest	Low-Risk
Kampong Thom	Baray	Kokir Thum	Nothwest	Low-Risk						Kampong Thom	Stoung	Slak Kranh	Nothwest	Low-Risk
Kampong Thom	Baray	Pongro Ling	Nothwest	Low-Risk						Preah Vihear	Chhaeb	Praeus K'ak	North	Low-Risk
Kampong Cham	Basttheay	Rout	Central Lowland	Low-Risk						Preah Vihear	Choam Khsant	Krala Peas	North	Low-Risk
Kampong Thom	Baray	Khnhaom	Nothwest	Low-Risk						Preah Vihear	Rovieng	Tuol Rovieng	North	Low-Risk
Kampong Cham	Cheung Prey	Ruessei Lor	Central Lowland	Low-Risk						Kampong Thom	Sandan	Srae Veal Khang Kaeut	Nothwest	Low-Risk
Kampong Cham	Cheung Prey	Kngaok	Central Lowland	Low-Risk						Kampong Thom	Sandan	Chhuk	Nothwest	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 12/09/2021 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
Kon Tum	Sa Thay	Central Highlands	High-Risk	Kon Tum	Sa Thay	Central Highlands	Moderate-Risk	Gia Lai	Ia Grai	Central Highlands	Moderate-Risk
Gia Lai	Ia Grai	Central Highlands	High-Risk	Gia Lai	Ia Grai	Central Highlands	Moderate-Risk	Gia Lai	Duc Co	Central Highlands	Low-Risk
Gia Lai	Chu Prong	Central Highlands	Low-Risk	Gia Lai	Chu Se	Central Highlands	Low-Risk	Gia Lai	Chu Prong	Central Highlands	Low-Risk
	Dak To	Central Highlands	Extreme-Risk	Quang Ngai	Ba To	South Central Coast	High-Risk	Gia Lai	Ayun Pa	Central Highlands	Low-Risk
Gia Lai	Chu Se	Central Highlands	Low-Risk	Dak Lak	Ea Sup	Central Highlands	Low-Risk	Gia Lai	Chu Se	Central Highlands	Low-Risk
Dak Lak	Ea Sup	Central Highlands	Low-Risk	Dak Lak	TX. Buon Ma Thuot	Central Highlands	Low-Risk	Quang Tri	Huong Hoa	North Central	Moderate-Risk
Dak Lak	Ea Sup	Central Highlands	Low-Risk	Nghe An	Thanh Chuong	North Central	Low-Risk	Dak Lak	Ea Sup	Central Highlands	Low-Risk
Dak Lak	Cu Jut	Central Highlands	Low-Risk	Quang Tri	Huong Hoa	North Central	Moderate-Risk	Dak Lak	Cu Jut	Central Highlands	Low-Risk
Dak Lak	TX. Buon Ma Thuot	Central Highlands	Low-Risk	Ha Tinh	Huong Son	North Central	Moderate-Risk	Dak Lak	TX. Buon Ma Thuc	Central Highlands	Low-Risk
Dak Lak	Dak Mil	Central Highlands	Low-Risk	Gia Lai	Duc Co	Central Highlands		Dak Lak	Dak Mil	Central Highlands	Low-Risk
Dak Lak	Ea Sup	Central Highlands	Low-Risk	Thua Thien Hue	A Luoi	North Central		Nghe An	Thanh Chuong	North Central	Low-Risk
Dak Lak	Ea Sup	Central Highlands	Low-Risk	Quang Nam	Nam Giang	South Central Coast		Thua Thien Hue	A Luoi	North Central	Moderate-Risk
Gia Lai	Duc Co	Central Highlands	Moderate-Risk	Quang Nam	Nam Giang	South Central Coast		Quang Binh	Bo Trach	North Central	Low-Risk
Quang Nam	Nam Giang	South Central Coast	High-Risk	Quang Binh	Bo Trach	North Central	Moderate-Risk	Quang Nam	Nam Giang	South Central Coa	Moderate-Risk
Quang Binh	Quang Ninh	North Central	Moderate-Risk	Quang Binh	Quang Ninh	North Central	Moderate-Risk	Quang Binh	Quang Ninh	North Central	Moderate-Risk
Quang Binh	Le Thuy	North Central	Moderate-Risk	Quang Binh	Le Thuy	North Central	High-Risk	Quang Binh	Le Thuy	North Central	Moderate-Risk
Quang Tri	Da Krong	North Central	High-Risk	Quang Tri	Da Krong	North Central	Moderate-Risk	Quang Tri	Da Krong	North Central	Moderate-Risk
Quang Binh	Bo Trach	North Central	Low-Risk	Thua Thien Hue	Phong Dien	North Central	Moderate-Risk	Thua Thien Hue	Phong Dien	North Central	Moderate-Risk
Quang Tri	Vinh Linh	North Central	Low-Risk	Quang Nam	Hien	South Central Coast	High-Risk	Thua Thien Hue	Nam Dong	North Central	Moderate-Risk
Ha Tinh	Huong Son	North Central	High-Risk	Thua Thien Hue	Nam Dong	North Central	Moderate-Risk	Quang Nam	Que Son	South Central Coa	Moderate-Risk
Thua Thien Hue	A Luoi	North Central	High-Risk	Da Nang	Hoa Vang	South Central Coast	Low-Risk	Da Nang	Lien Chieu	South Central Coa	Low-Risk
Nghe An	Thanh Chuong	North Central	Low-Risk	Da Nang	Hoa Vang	South Central Coast	Moderate-Risk	Kon Tum	Dak Glei	Central Highlands	High-Risk
Quang Tri	Huong Hoa	North Central	Moderate-Risk	Da Nang	Hoa vang	South Central Coast	Moderate-Risk	Quang Nam	Hien	South Central Coa	Moderate-Risk
Thua Thien Hue	Phong Dien	North Central	High-Risk	Quang Nam	Dai Loc	South Central Coast	High-Risk	Da Nang	Hoa vang	South Central Coa	Moderate-Risk
Quang Nam	Hien	South Central Coast	High-Risk	Quang Nam	Tra My	South Central Coast	Moderate-Risk	Quang Nam	Dai Loc	South Central Coa	Moderate-Risk
Thua Thien Hue	Nam Dong	North Central	Moderate-Risk	Quang Nam	Tra My	South Central Coast	High-Risk	Quang Nam	Phuoc Son	South Central Coa	Moderate-Risk
Da Nang	Lien Chieu	South Central Coast	Low-Risk	Kon Tum	Dak Glei	Central Highlands	High-Risk	Quang Nam	Tien Phuoc	South Central Coa	Low-Risk
Da Nang	Hoa vang	South Central Coast	High-Risk	Quang Nam	Que Son	South Central Coast	Moderate-Risk	Quang Nam	Tra My	South Central Coa	Moderate-Risk
Quang Nam	Dai Loc	South Central Coast	High-Risk	Quang Ngai	Son Tay	South Central Coast	High-Risk	Kon Tum	Dak To	Central Highlands	High-Risk
Kon Tum	Dak To	Central Highlands	High-Risk	Quang Ngai	Tra Bong	South Central Coast	High-Risk	Quang Nam	Nui Thanh	South Central Coa	Low-Risk

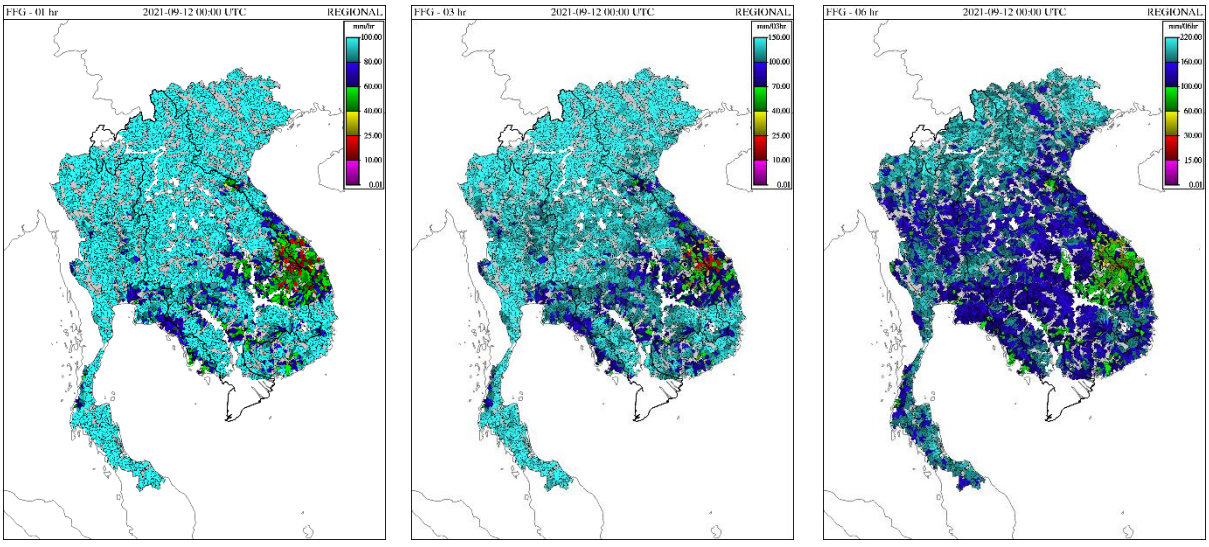


Figure 14. Flash Flood Guidance for the next 1 hour, 3 hours and 6 hours on Sep 12.

5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 04 to 10 September 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 September 4 to 10, as shown in Figure 15, shows that the LMB was experiencing some moderate and severe meteorological droughts in the upper part of the region covering Chiang Mai, Chiang Rai, and Phayao of Thailand and Luangnamtha, Phongsaly, Luang Prabang, Xiengkhuang, and Xayaburi of Lao PDR. The conditions were not serious, however. The middle part of the region was at normal while the southern part was ultimately wet.

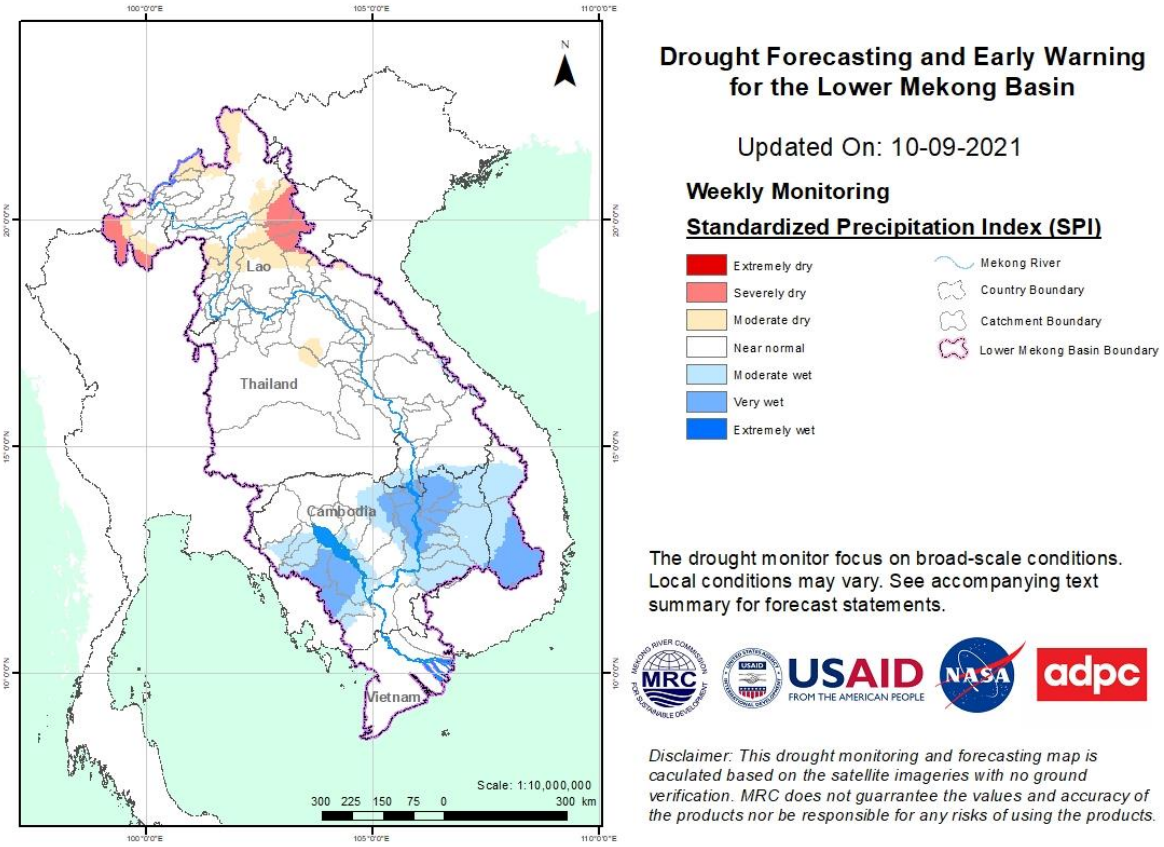


Figure 15. Weekly standardized precipitation index from 04 to 10 September 2021.

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

Soil water fraction from September 4 to 10, as displayed in Figure 16, was quite similar to the conditions of the meteorological indicator. It shows that the LMB region was relatively dry in the north and very wet in the south. Anomaly dry with moderate and severe droughts took place in Phongsaly, Xiengkhuang, Borikhamxay, Xaysomboun, and Vientiane of Lao PDR.

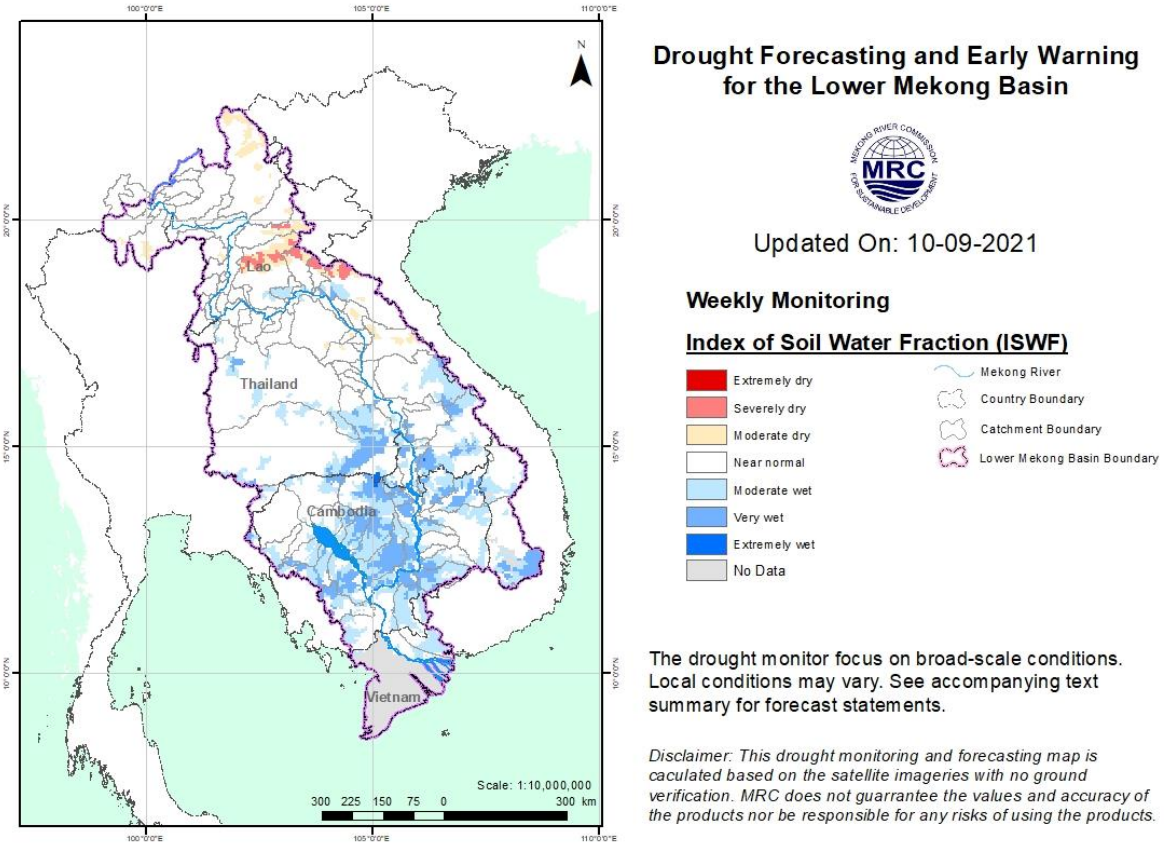


Figure 16. Weekly Soil Moisture Anomaly from 04 to 10 September 2021.

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

With a better condition of both rainfall and soil moisture, the LMB was not facing any drought threat over the monitoring period from September 4 to 10, as displayed in Figure 17. The overall drought conditions were normal all over the LMB.

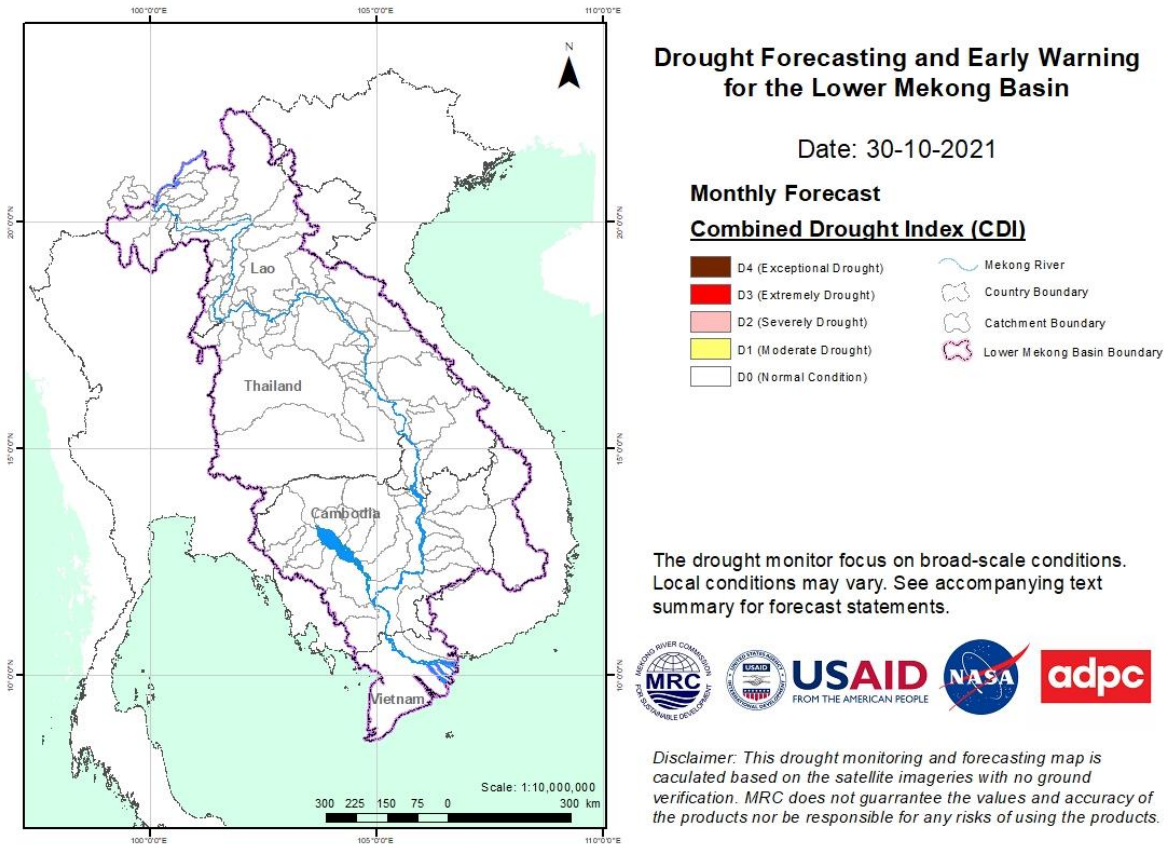


Figure 17. Weekly Combined Drought Index from 04 to 10 September 2021.

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.

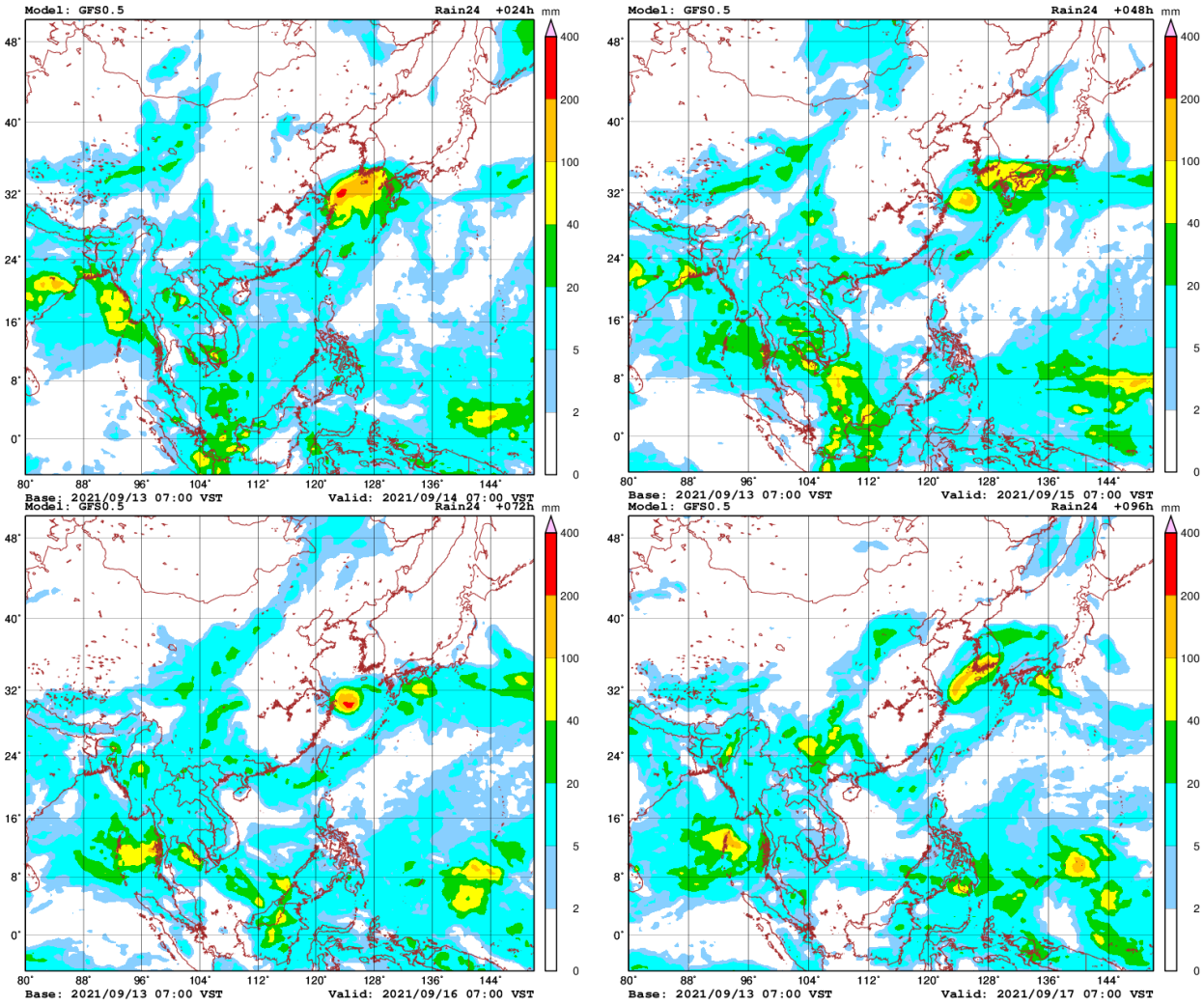
6 Weather and Water Level Forecast and Flash Flood Information

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 September 14 to 20, small rainfall (5 -20 mm/24h) will likely occur from upper to middle part of the LMB and moderate rainfall (20 – 50 mm/24h) will likely occur in some areas of the lower part of the LMB (including Cambodia and Viet Nam).

Figure 18 shows accumulated rainfall forecast (24 h) of the GFS model from September 14 to 20.



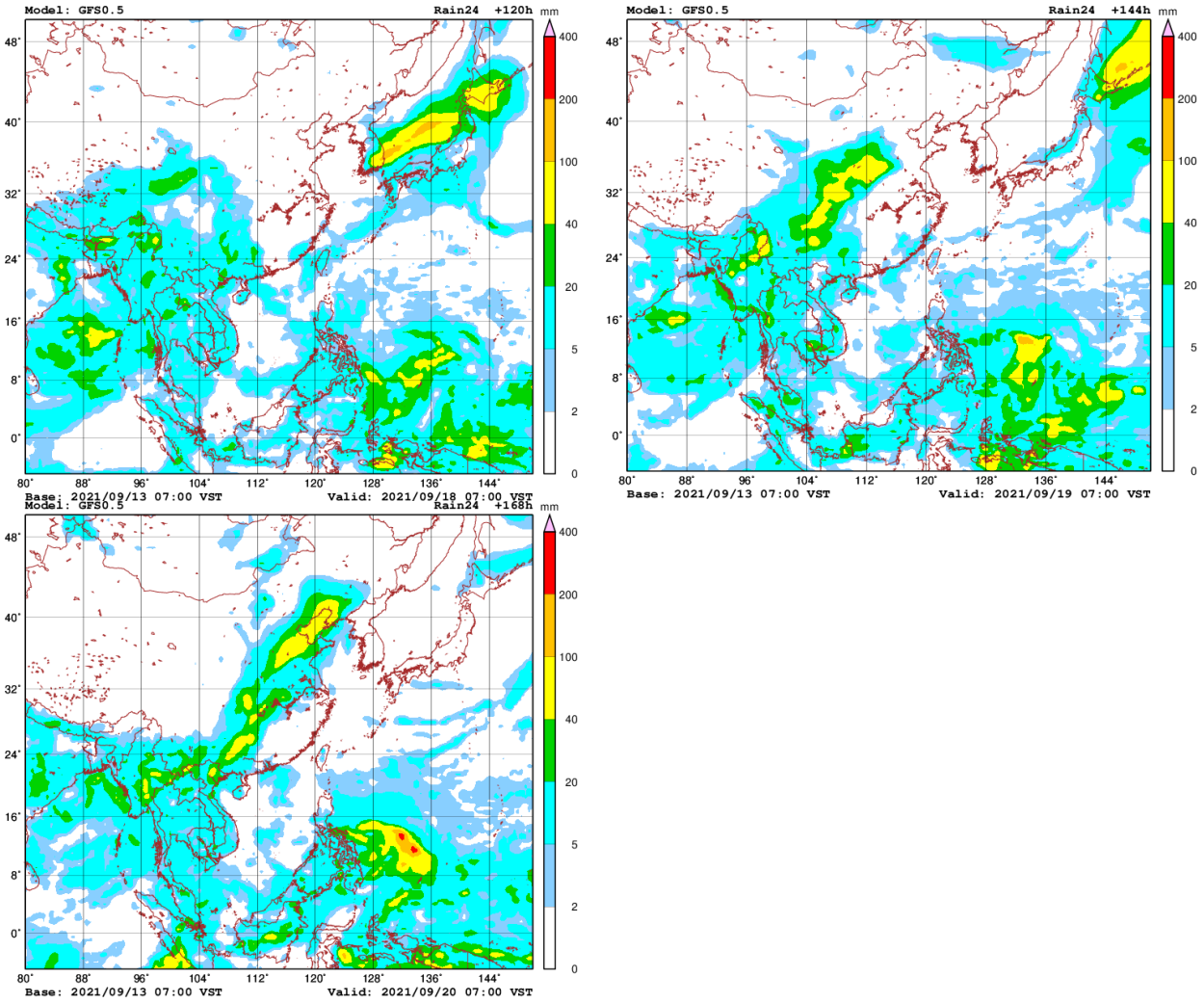


Figure 18. Accumulated rainfall forecast (24 h) based on a GFS model.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on September 13's daily flood forecasting bulletin, the daily forecasted water level at Chiang Saen in Thailand is expected to increase from 3.75 m to 3.80 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 10.24 m to 11.00 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 decrease about 0.45 m, while water level at Vientiane in Lao PDR will also decrease about 1.06 m. Furthermore, from Nong Khai in Thailand, the water level will increase about 1.09 m over the next five days and at Paksane in Lao PDR water level will also decrease about 0.67 m due to low forecasted rainfall in the upper catchments. Rainfall is forecasted for the area of Paksane next week.

The water levels at these stations are remaining lower than their LTA.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Thakhek in Lao PDR are forecasted to decrease about 0.15 m over the next five days, while water levels from Mukdahan in Thailand to Pakse in Lao PDR will increase in between 0.20 m and 0. 75 m. Water level at these stations will stay higher than their LTA level. Rainfall is forecasted for the area 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 up from 1.67 m to 2.90 m over the next five days. Precipitation is forecasted for the area between Stung Treng and Kampong 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 1.37 m over the next five days.

Water levels at most of the stations will continue to stay lower than their LTA value, particularly in the lower part of the region 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 above their minimum level, 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 7 to 13 September 2021, is presented in **Annex 1**.

Table 2 shows the daily flood forecasting Bulletin issued on September 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 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 a day 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 November 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 September to November 2021 produced by the NMME.

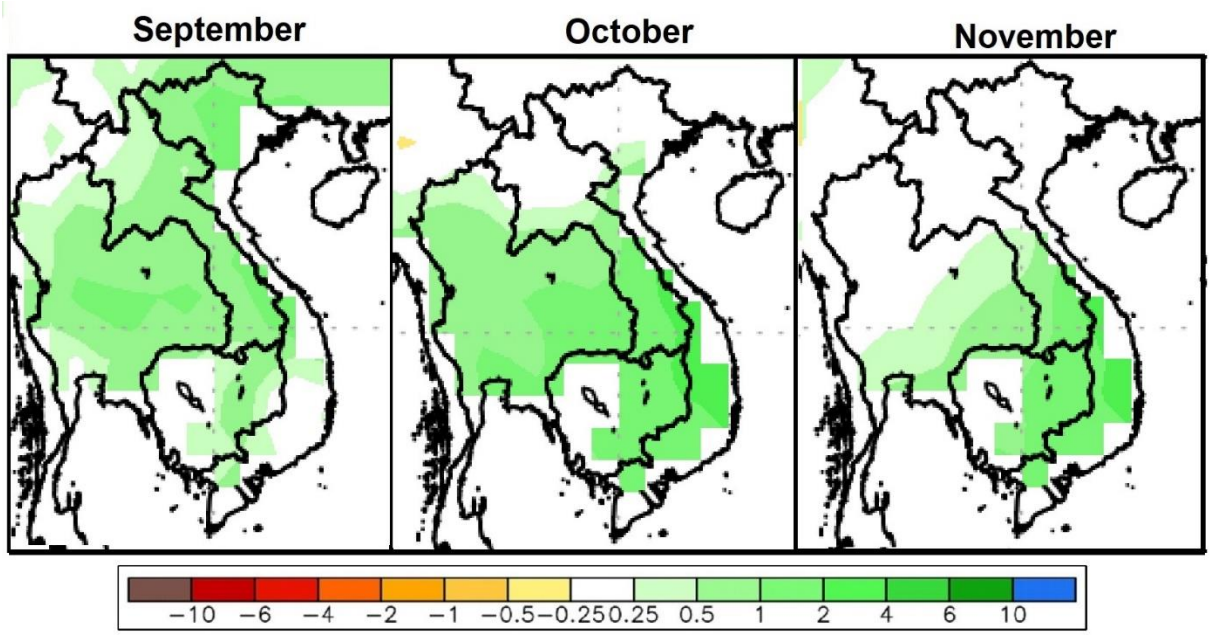


Figure 19. Daily average of monthly rainfall anomaly forecast from August to November 2021.

The ensemble prediction model based on the initial conditions in August reveals that the LMB is likely to receive above average rainfall in September and October mainly in the central and southern parts 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: 14 September - 18 September 2021

Date: 13 September 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-Sep				12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep	18-Sep	13	14	15	16	17	18
Jinghong		0.0				535.00	535.20						↑	×	×	×	×	×
Chiang Saen		0.0	357.110	12.80	11.50	3.20	2.75	2.58	2.66	2.71	2.77	2.80	↓	↓				
Luang Prabang		0.0	267.195	18.00	17.50	9.58	9.70	9.85	9.50	9.35	9.42	9.50	↑	↑	↓	↓		
Chiang Khan		0.0	194.118	16.00	14.50	8.79	8.30	8.15	8.07	7.90	7.80	7.85	↓	↓		↓	↓	
Vientiane		0.0	158.040	12.50	11.50	6.74	6.06	5.51	5.30	5.20	5.05	5.00	↓	↓	↓		↓	
Nongkhai		0.0	153.648	12.20	11.40	6.84	6.15	5.59	5.38	5.28	5.12	5.06	↓	↓	↓		↓	
Paksane		6.4	142.125	14.50	13.50	6.95	7.14	6.91	6.70	6.62	6.56	6.47	↑	↓	↓			
Nakhon Phanom		2.1	130.961	12.00	11.50	5.89	5.99	6.10	5.99	5.90	5.86	5.83	↑	↑	↓			
Thakhek		3.7	129.629	14.00	13.00	7.03	7.11	7.21	7.10	7.00	6.96	6.92		↑	↓			
Mukdahan		8.0	124.219	12.50	12.00	5.94	5.84	5.89	5.96	5.90	5.86	5.86	↓					
Savannakhet		8.4	125.410	13.00	12.00	4.36	4.27	4.30	4.35	4.33	4.30	4.31						
Khong Chiam		80.0	89.030	14.50	13.50	8.22	8.20	8.60	8.73	8.85	8.90	8.85		↑	↑	↑		
Pakse		43.6	86.490	12.00	11.00	6.74	7.42	7.88	8.03	8.15	8.20	8.15	↑	↑	↑	↑		
Stung Treng		3.0	36.790	12.00	10.70	6.74	7.63	8.55	8.95	9.13	9.25	9.30	↑	↑	↑	↑	↑	↑
Kratie		nr	-0.101	23.00	22.00	15.58	15.97	17.15	18.10	18.53	18.73	18.87	↑	↑	↑	↑	↑	↑
Kompong Cham		nr	-0.930	16.20	15.20	9.36	9.70	10.13	11.13	12.00	12.40	12.60	↑	↑	↑	↑	↑	↑
Phnom Penh (Bassac)		3.0	-1.020	12.00	10.50	5.56	5.75	6.00	6.45	6.85	7.03	7.12	↑	↑	↑	↑	↑	↑
Phnom Penh Port		-	0.070	11.00	9.50	4.57	4.76	5.02	5.48	5.88	6.06	6.16	↑	↑	↑	↑	↑	↑
Koh Khel (Bassac)		0.0	-1.000	8.40	7.90	5.09	5.23	5.43	5.82	6.17	6.29	6.35	↑	↑	↑	↑	↑	↑
Neak Luong		52.2	-0.330	8.00	7.50	3.97	4.08	4.31	4.52	4.90	5.28	5.43	↑	↑	↑	↑	↑	↑
Prek Kdam		7.2	0.080	10.00	9.50	4.62	4.76	4.98	5.35	5.70	5.86	5.95	↑	↑	↑	↑	↑	↑
Tan Chau		0.0	0.000	4.50	3.50	1.25	1.40	1.47	1.52	1.55	1.60	1.67	↑	↑	↑	↑	↑	↑
Chau Doc		nr	0.000	4.00	3.00	1.08	1.18	1.23	1.26	1.27	1.30	1.35	↑	↑	↑		↑	↑

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 September 7-13, including the lower part in Cambodia and Viet Nam, varying from 4.10 mm to 328.80 mm, and considered high compared with last week.

Based on the forecasted satellite data, rainfall is forecasted for some areas of the LMB with value ranging from 50 mm to 200 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 14-18 September 2021.

7.2 Water level and its forecast

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed significantly decrease over the monitoring period from 7 to 13 September 2021. It went down **about 0.78 m from 535.98 m on 10 Sept to 535.20 on 13 Sept 2021**. The outflows decreased from 1,318 m^3/s on Sept 10 to 790 m^3/s on Sept 13, 2021.

Amid the significant low outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand also decreased about 0.55 m from 7 to 13 September 2021. From Chiang Khan in Thailand to Vientiane in Lao PDR, water levels decreased during 7-13 September due to below-average rainfall in the area. However, water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR were increasing. Water levels from the stretches of the river from Stung Treng to Kratie and at Kampong Cham in Cambodia were also increasing, following the same trend of the upstream ones and staying lower than their LTA.

Over the next five days, the water levels from Khong Chiam to Pakse and from Stung Treng to the lower part at key stations in Cambodia are expected to increase between 0.25 m and 2.90 m.

The flow volume of the Tonle Sap Lake is lower than its LTA. From next week, the flow is expected to increase due to the above-average rainfall forecasted in the inflow catchments of the Tonle Sap Lake.

From Stung Treng to Kampong Cham, the water levels will continue staying 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 fourth week of July 2021, water levels across most monitoring stations in the LMB have significantly dropped to the level lower than their LTA (from upper to lower stretches

within the LMB) but are likely to start rising by the 3rd week of August 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 amount of rainfall for the coming week as mentioned earlier in section 6.1, the major flash floods are not 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 both rainfall and soil moisture, the LMB was not facing any drought threat over the monitoring period from September 4 to 10. The overall drought conditions were normal all over the LMB.

For the upcoming thee-month forecast, the LMB is likely to receive above average rainfall in September and October mainly in the central and southern parts 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.

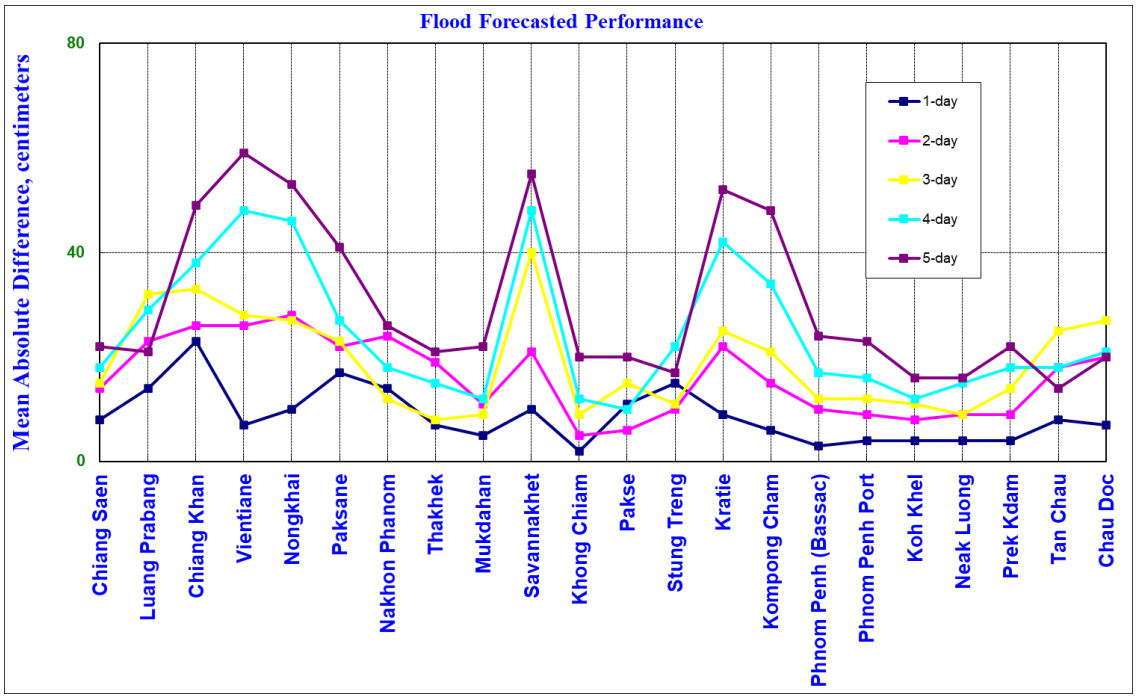
Annex 1: Performance of the weekly flood forecasting

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 7 to 13 September 2021.

The forecasting values from 7 to 13 September 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 Luang Prabang to Khong Chiam due to the effect of heavy rainfall 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, including the 3S (Stung Treng and Kratie).
- 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 7 to 13 September, 2021.

Table B1: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 7 to 13 September, 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	8	14	23	7	10	17	14	7	5	10	2	11	15	9	6	3	4	4	4	4	8	7
2-day	12	17	27	22	11	5	12	12	11	11	18	25	19	11	12	3	3	3	3	4	7	8
3-day	40	26	93	95	60	15	24	31	56	46	40	66	47	46	25	12	11	8	7	7	21	26
4-day	45	31	82	96	76	27	24	33	67	57	72	92	46	75	30	19	16	14	13	14	34	32
5-day	57	45	32	69	66	35	28	27	55	56	93	143	78	110	38	31	28	23	16	23	45	37

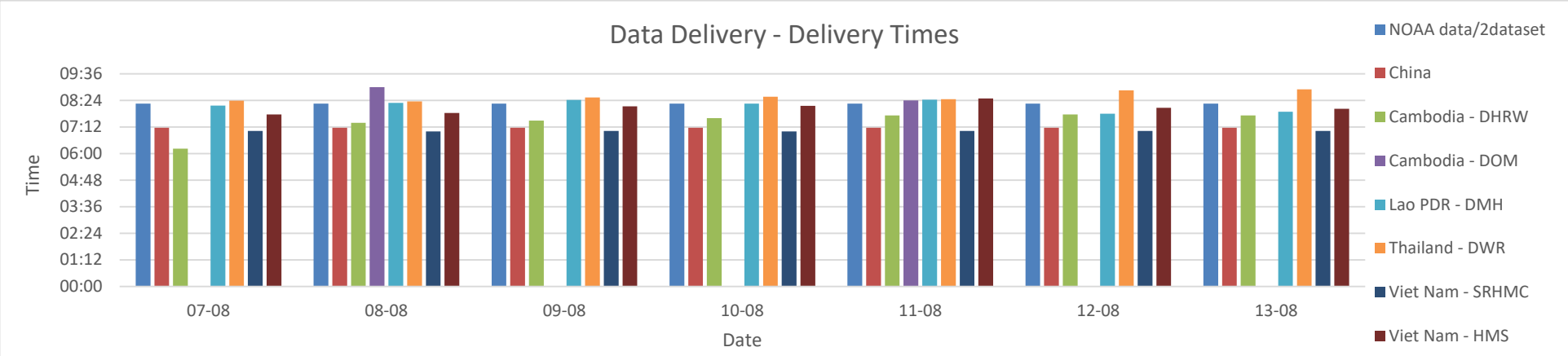
Table B2: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 7 to 13 September, 2021 in %

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	71.4	57.1	42.9	71.4	42.9	71.4	57.1	57.1	71.4	71.4	71.4	42.9	71.4	71.4	57.1	71.4	71.4	42.9	85.7	71.4	71.4	***63.6***
2-day	66.7	83.3	33.3	50.0	66.7	33.3	66.7	66.7	66.7	66.7	50.0	66.7	50.0	50.0	50.0	83.3	83.3	83.3	66.7	66.7	83.3	33.3	***62.1***
3-day	40.0	80.0	60.0	40.0	40.0	80.0	40.0	40.0	60.0	40.0	60.0	60.0	60.0	80.0	60.0	40.0	60.0	60.0	60.0	60.0	60.0	40.0	***55.5***
4-day	50.0	75.0	50.0	50.0	75.0	25.0	50.0	50.0	75.0	50.0	50.0	25.0	50.0	75.0	75.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	***53.4***
5-day	33.3	66.7	66.7	33.3	33.3	66.7	66.7	66.7	66.7	66.7	66.7	33.3	33.3	33.3	33.3	66.7	66.7	33.3	33.3	33.3	66.7	66.7	***51.5***

Table B3: Overview of performance indicators for the past 7 days from 7 to 13 September 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	*10:22*	*00:00*	-	-	*08:15*	*07:10*	*07:24*	*08:42*	*08:10*	*08:34*	*07:00*	*08:03*	*0*	*0*	*0*	*170*	*56*	*14*	*0*	*0*
month	*10:30*	*00:00*	-	-	*08:15*	*07:10*	*07:21*	*08:36*	*08:26*	*08:14*	*07:17*	*08:06*	*0*	*0*	*14*	*272*	*334*	*48*	*7*	*38*

Fig. B4: Data delivery times for the past 7 days from 7 to 13 September 2021



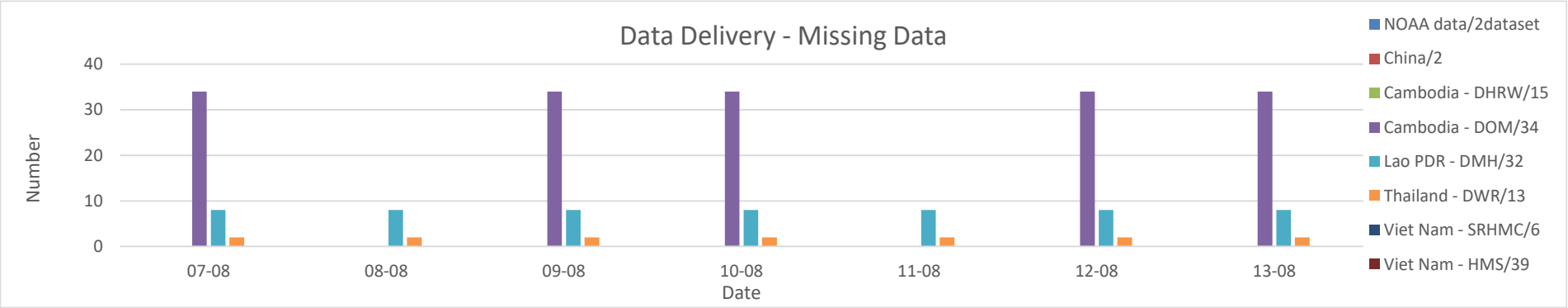


Fig. B5: Missing data for the past 7 days from 7 to 13 September 2021

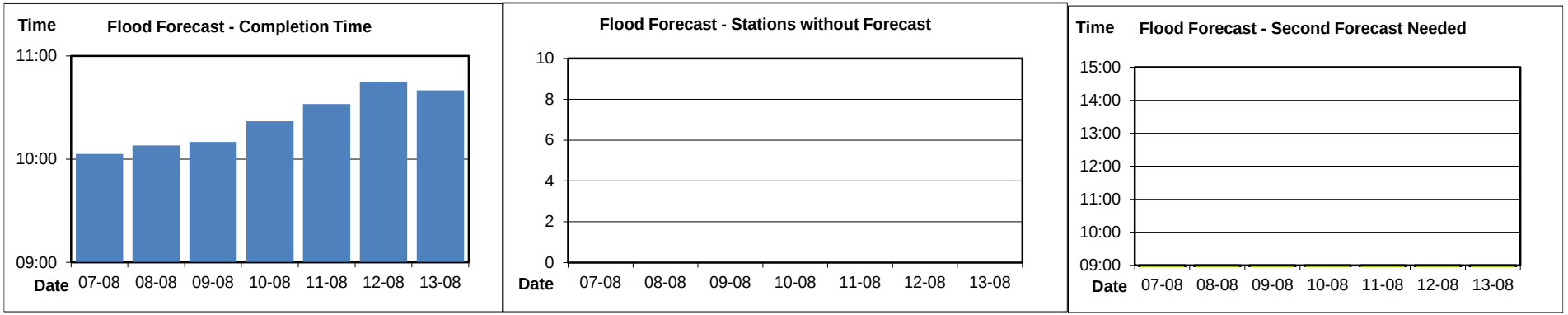


Fig. B6: Flood forecast completion time, stations without forecasts, and second forecasts need from 7 to 13 September 2021

Mekong River Commission Secretariat

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