



Mekong River Commission

Weekly Wet Season Situation Report in the Lower Mekong River Basin 14-20 September 2021

Prepared by
The Regional Flood and Drought Management Centre
21 September 2021

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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 16.60 millimetres (mm) to 182.00 mm.
- There will be average rainfalls for the next 5 days over the Mekong region from 21 to 25 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 a significant decrease over the monitoring period from 10 to 20 September 2021. It dropped **about 0.89 m from 535.98 m on 10 Sept to 535.09 on 13 Sept 2021 (recorded on 7:00 am)**. The outflows decreased from 1,318 m³/s on Sept 10 to 727 m³/s on Sept 20, 2021. Water level was 0.14 m lower than its minimum level during 19-20 September 2021.
- Along with the significant low outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand also decreased about 0.48 m from 7 to 20 September 2021. From Chiang Khan in Thailand to Vientiane in Lao PDR, water levels decreased during 14-20 September due to below-average rainfall in the area. However, water levels from Nakhon Phanom in Thailand to Savannakhet in Lao PDR slightly increased. Water levels from the stretches of the river from Stung Treng to Kratie and at Kampong Cham in Cambodia also dropped, following the same trend of the upstream flow (at Pakse) 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 slightly increase but remain lower than their long-term average value in most stations.

Drought condition and its forecast

- Some areas of the upper part of the LMB were moderately dry during the reporting week due to moderately dry meteorological and agricultural indicators. Those areas cover Chiang Rai and Phayao of Thailand and Phongsal and Xiengkhuang of Lao PDR. The rest of the region was normal. No significant threat was found from 11 to 17 September 2021.
- For the upcoming three-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 **14-20 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 20 September 2021, showing the 2 lines of low pressure are 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.

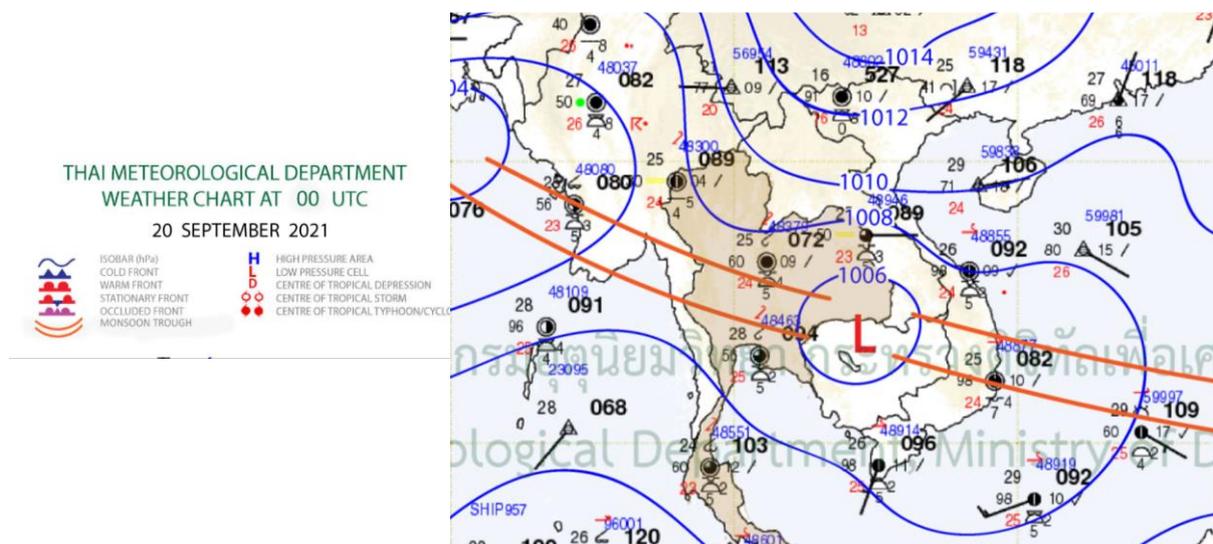


Figure 1. Summary of weather conditions over the LMB.

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 20 September to 3 October 2021, during the 3rd and 4th week of September. Nonetheless, LMB is likely dominated by wetter condition, which may receive more rainfall in general (above-average rainfall).

[Figure 2](#) shows the outlook of comparative wet conditions from 20 September to 3 October 2021 covering the whole LMB region, based on results from the NCEP model (National Centres for Environmental Prediction).

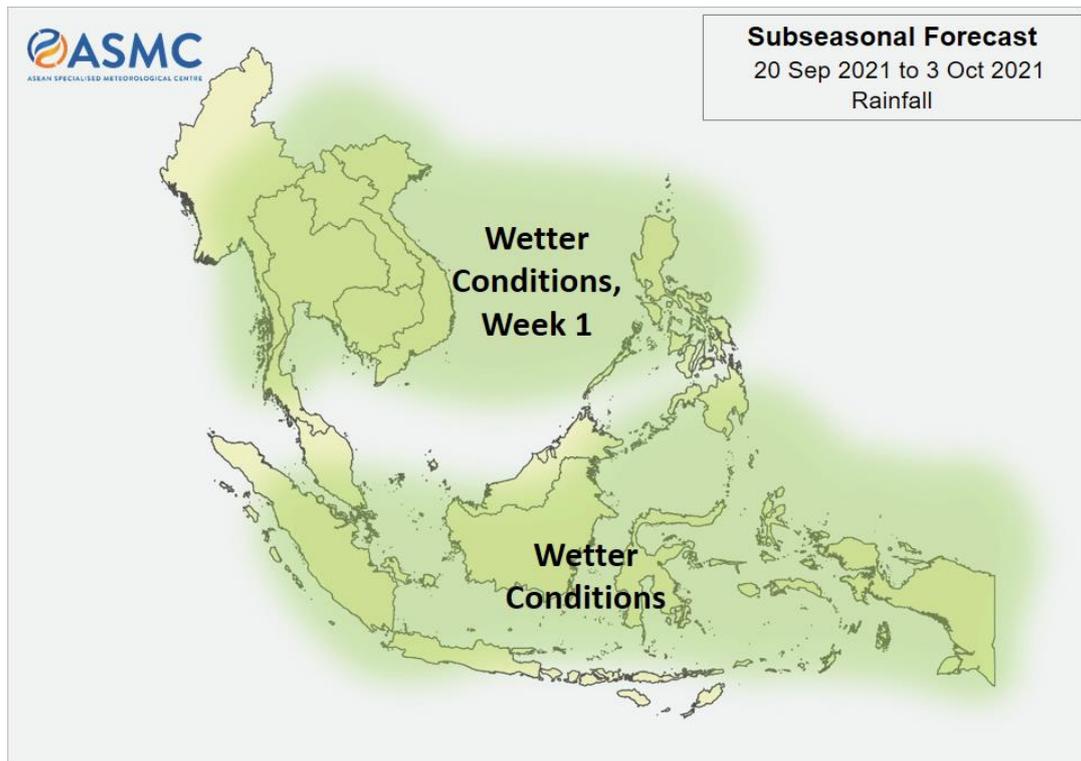


Figure 2. Outlook of wet and dry conditions over the Asian countries by ASMC.

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 20 September 2021, as shown in [Figure 1](#), which would bring rain to some areas of the LMB. But based on the Tropical Storm Risk (TSR), as displayed in [Figure 3](#), there was no sign of tropical depression, moving to the Mekong region up to 20 September 2021.

Active system as of 20 September 2021 6:23 GMT

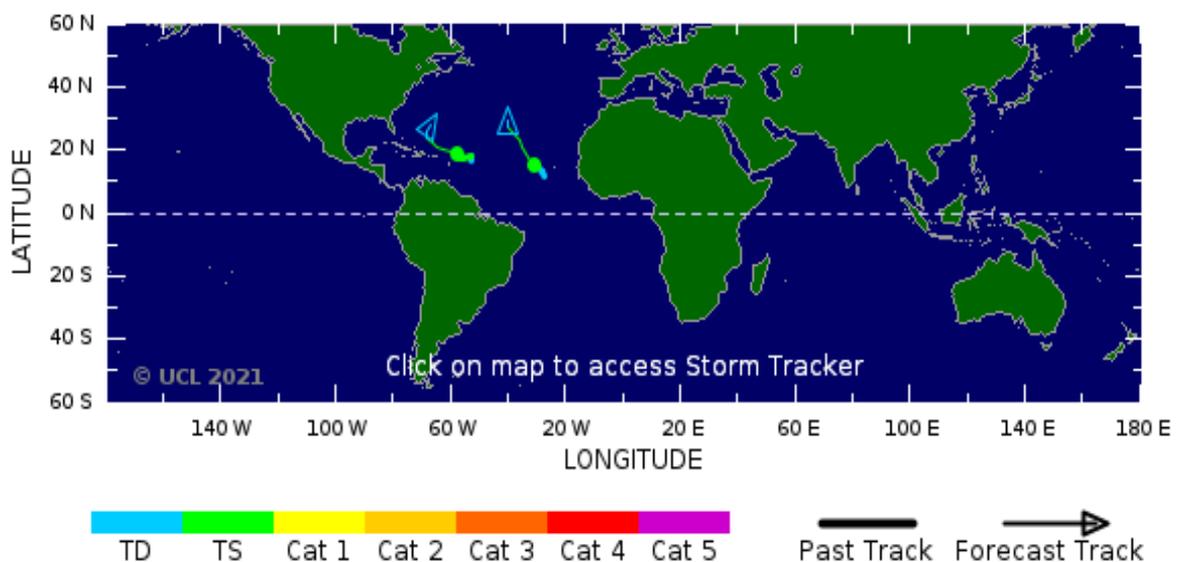


Figure 3. A tropical depression risk observed on 20 September 2021.

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 16.60 mm to 182.00 mm. The weekly total rainfall from 14 to 20 September 2021 in this reporting week was considered high at Prek Kdam in Cambodia. This week rainfall is lower than last week rainfall in the Lower part of the LMB (see [Figure 4](#)).

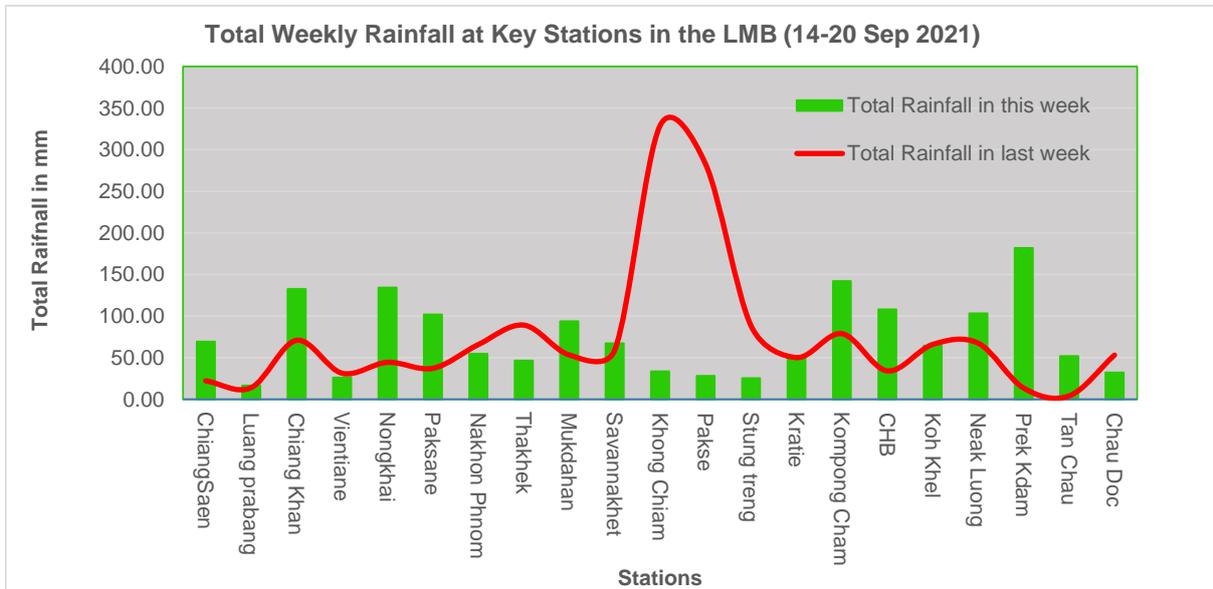


Figure 4. Weekly total rainfall at key stations in the LMB during 14-20 September 2021.

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 14-20 September 2021.

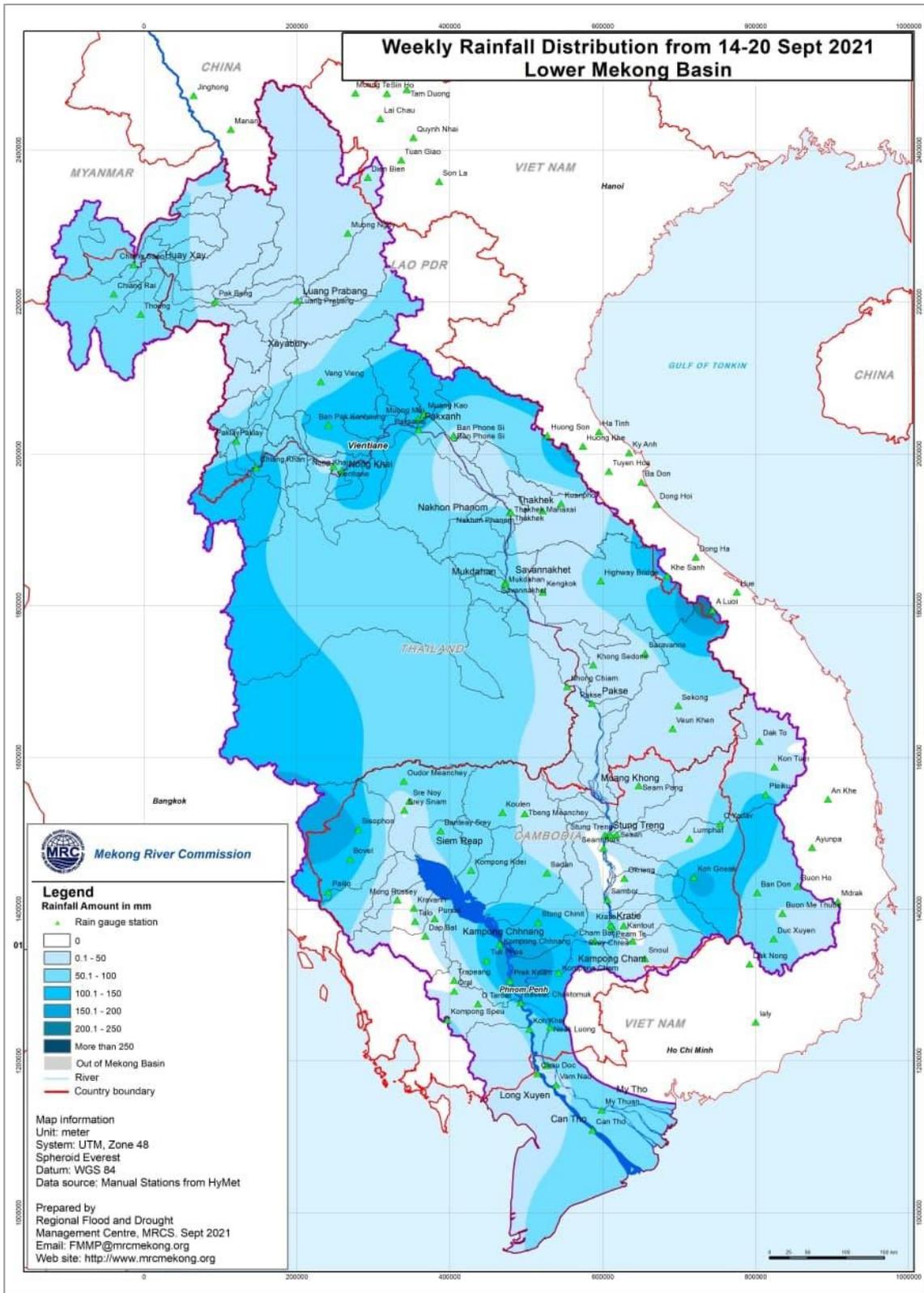


Figure 5. Weekly rainfall distribution over the LMB during 14-20 September 2021.

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](#).

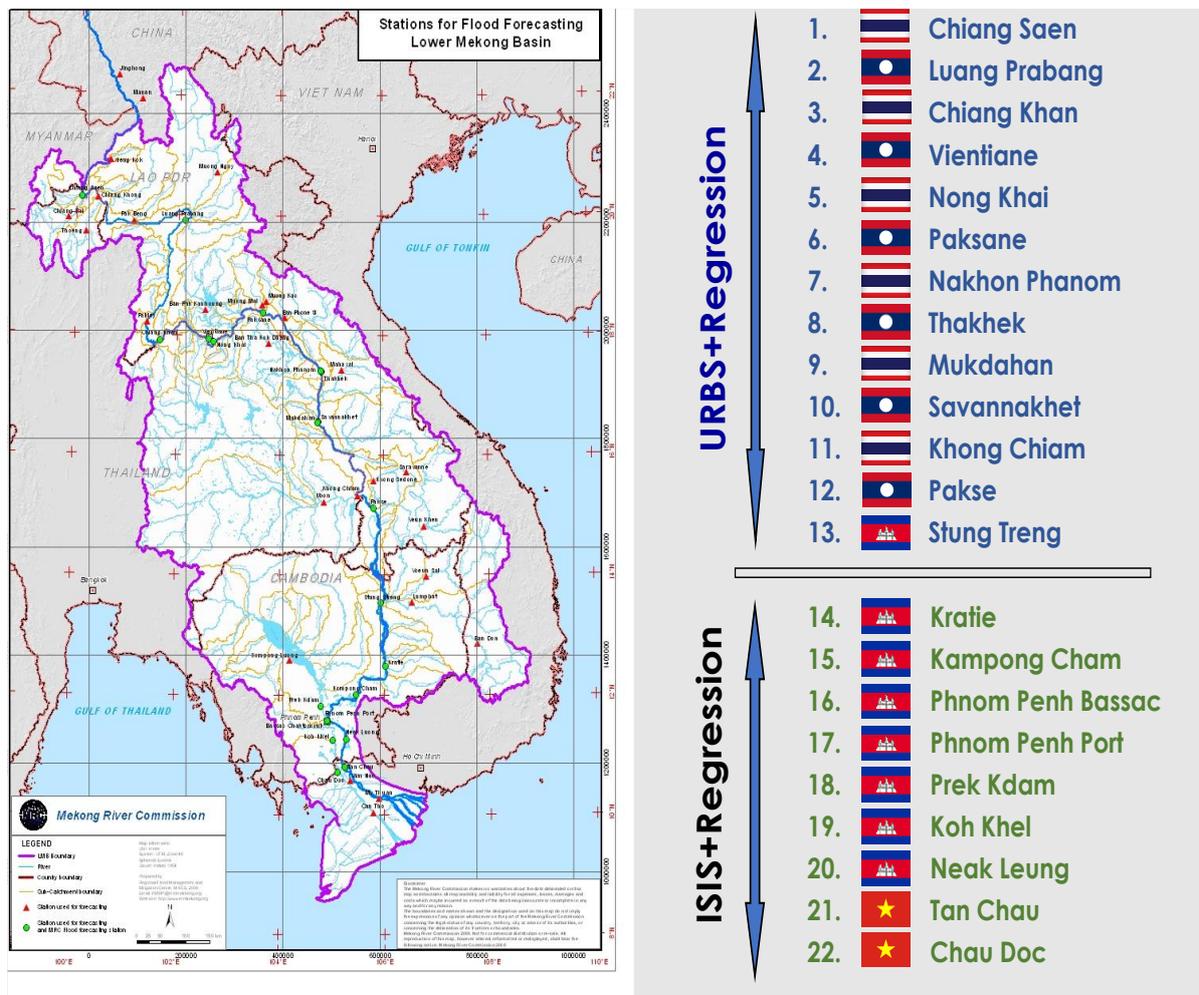


Figure 6. Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC’s observed water level data, the outflows at Jinghong hydrological station showed a significant decrease over the monitoring period from 10 to 20 September 2021. It dropped **about 0.89 m from 535.98 m on 10 Sept to 535.09 on 13 Sept 2021 (recorded on 7:00 am)**. The outflows decreased from 1,318 m³/s on Sept 10 to 727 m³/s on Sept 20, 2021. From 19 to 20 September, water level at this station went down to 0.14 m lower than its historical minimum value.

[Figure 7](#) below presents water level decreases at the Jinghong hydrological station¹, indicating that the trend of decreased water level from 10 to 20 September 2021 and showed about 0.14 m lower than its minimum level.

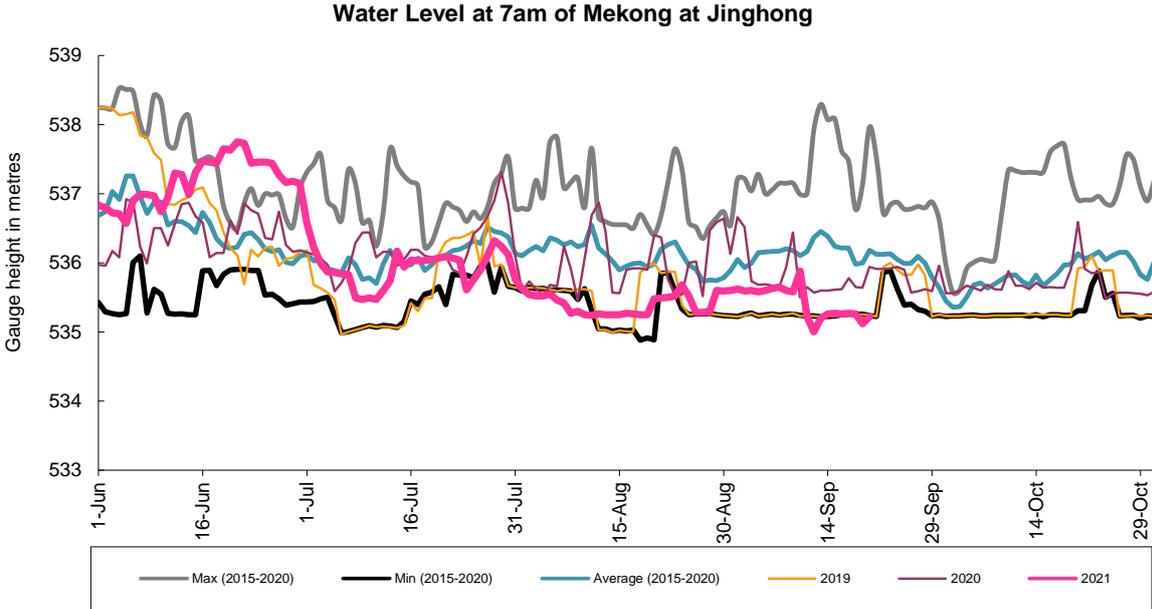


Figure 7. Water level at the Jinghong hydrological station during 1 July-20 September 2021.

Along with the significant low outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand also decreased about 0.48 m from 7 to 20 September 2021. From Chiang Khan in Thailand to Vientiane in Lao PDR, water levels decreased during 14-20 September due to below-average rainfall in the area. However, water levels from Nakhon Phanom in Thailand to Savannakhet in Lao PDR were slightly increasing. Water levels from the stretches of the river from Stung Treng to Kratie and at Kampong Cham in Cambodia were decreasing, following the same trend of the upstream flow (at Pakse) 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.

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>.

Chiang Saen and Luang Prabang

The water level from 14 to 20 September 2021 at Thailand’s Chiang Saen slightly increased from 2.44 m to 2.82 m, showing 0.38 m up and was about 2.33 m lower than its Long-Term Average (LTA). However, the water level at Luang Prabang station in Lao PDR decreased from 9.84 m to 9.44 m during the reporting period. This level shows 1.89 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.**

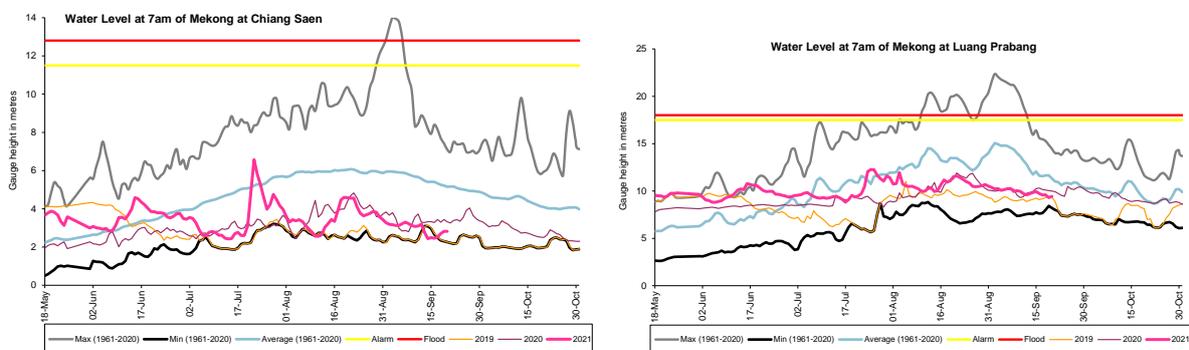


Figure 8. Water levels at Chiang Saen in Thailand and Luang Prabang in Lao PDR.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) fluctuated between 8.80 m and 8.82 m during the reporting week. This fluctuation showed 2.89 m lower than its Long-Term- Average (LTA). The water level downstream at Vientiane in Lao PDR followed the upstream trend. It also fluctuated between 5.45 m and 5.66 m and was about 2.52 m lower than its LTA during 14-20 September. At Nong Khai station in Thailand, the water level also fluctuated during the reporting period. It was up and down varying from 5.13 m to 5.42 m and to 5.66 m, showing 3.30 m lower than its LTA. Due to some rainfall, water level at Paksane in Lao PDR increased about 0.17 m, rising from 6.98 m to 7.15 m. The WL at this station was still about 2.98 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.

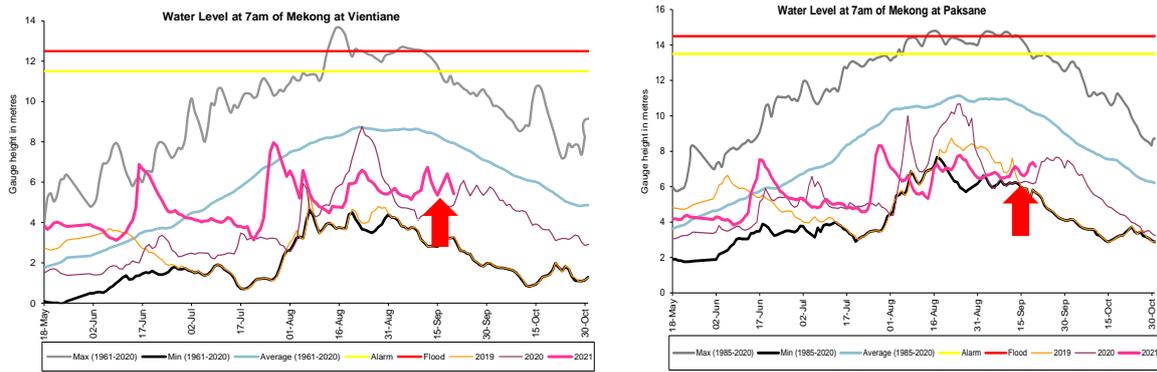


Figure 9. Water levels Veintiane and Paksane in Lao PDR.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Savannakhet in Lao PDR slightly increased about 0.15 m due to some rainfall and inflow from upstream. Further downstream from Khong Chiam in Thailand to Pakse in Lao PDR significantly decreased from 0.63 m to 1.22 m due to no rainfall in the catchment area. **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.

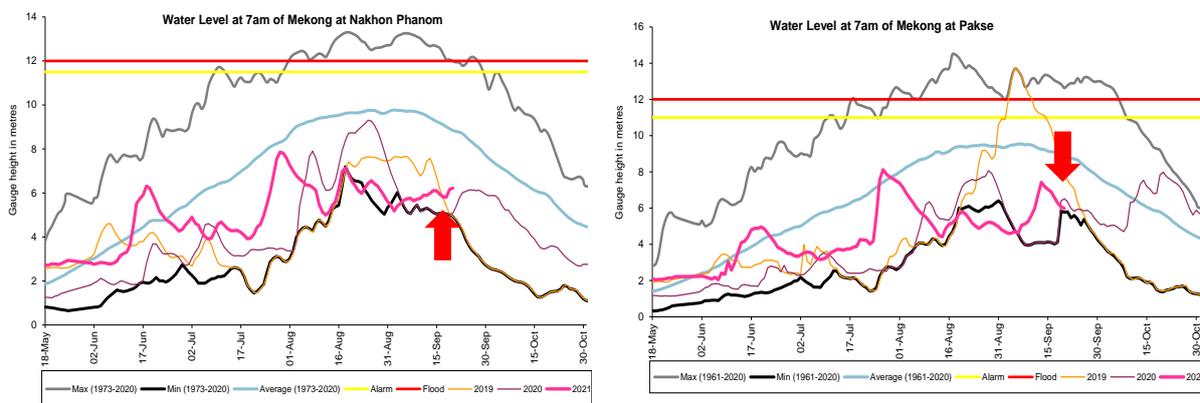


Figure 10. Weekly water levels at Nakhon Phanom in Thailand and Pakse in Lao PDR

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

Followed the same trend 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 down during 14-20 September 2021. This week water level at Stung Treng and Kratie decreased about 1.63 m and 1.64 m, respectively, moving towards their minimum level (as showed in [Figure 11](#)). Also, the water level at Kompong Cham remarkably decreased about 0.59 m and still remained about 3.37 m lower than its LTA. **Water levels at these stations were moving close to their minimum level, which considered very critical.**

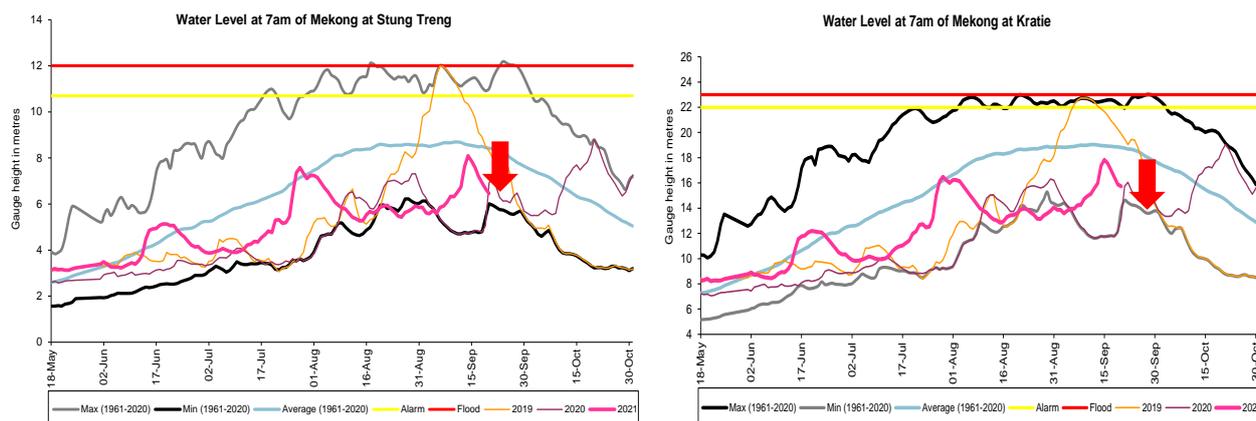


Figure 11. Water levels at Stung Treng and Kratie on the Mekong River.

At Chaktomuk on the Bassac River, due to local rainfall in the inflow catchment, the water level increased by about 0.10 m and stayed 3.09 m lower than its LTA value; while at Koh Khel, water level went up 0.14 m, staying 1.43 m lower than its LTA value. The water level at Prek Kdam on the Tonle Sap Lake increased about 0.26 m and was about 2.95 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 14 to 20 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 1.32 m and 2.07 m; they were in between the range of their LTA and historical minimum level 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 September 20 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.

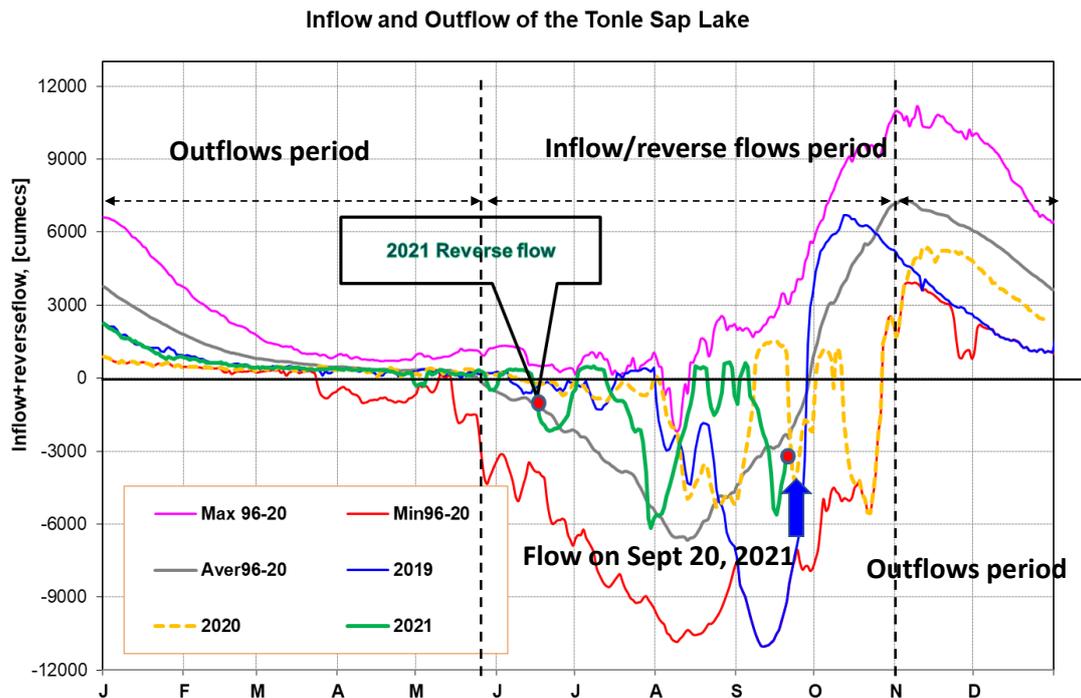


Figure 12. Seasonal change of inflows and outflows of Tonle Sap Lake

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 20 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 20, **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.

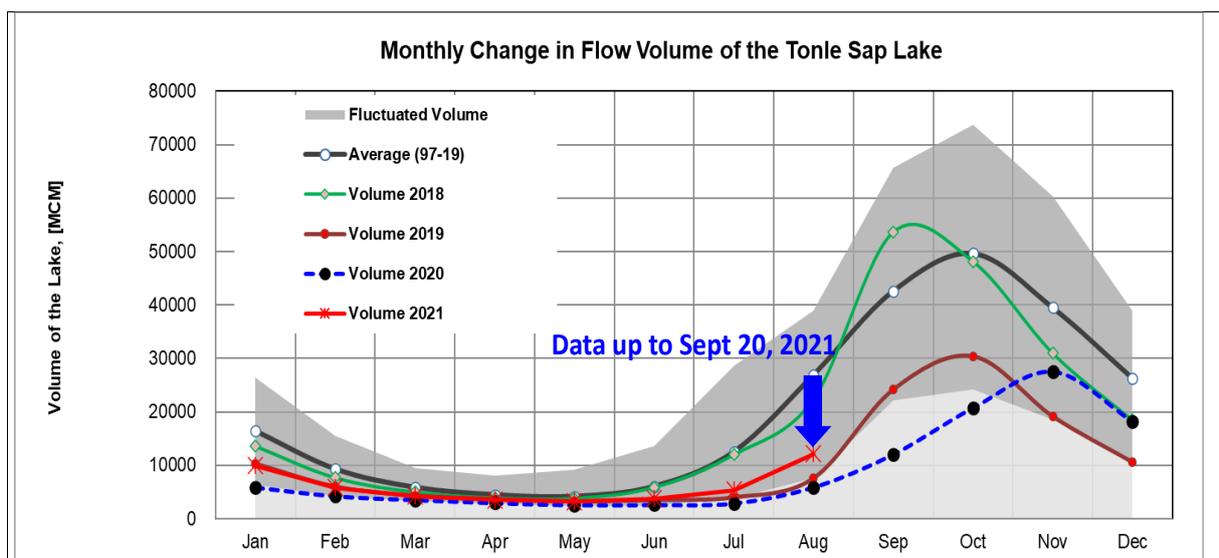


Figure 13. The seasonal change in monthly flow volume of Tonle Sap Lake.

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	12123.51
Sep	42644.05	65632.35	22180.73	53639.54	24194.19	12105.31	
Oct	49698.19	73757.23	24276.79	48193.08	30358.38	20799.13	
Nov	39542.58	60367.33	18576.01	31036.07	19112.65	27546.80	
Dec	26325.13	38888.95	10869.43	18469.21	10577.29	18251.65	
	Critical situation, compared with historical Min values						
	Normal condition, compared with LTA (Long term average)						
	Low volume situation, compared with LTA values						
Unit: Million Cubic Meter (1 MCM= 0.001 Km ³)							

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 14 to 20, the LMB was affected by three weather factors including (i) The monsoon trough lay across the lower northern and central parts during the beginning and the middle of the week. It moved towards an active low-pressure cell which downgraded from the tropical storm “Conson” circulation over central Viet Nam on the first day of the week; (ii) the southwest monsoon prevailed over Gulf of Thailand throughout the week; and (iii) the active low-pressure cell covered the coast of central Viet Nam on the last day of the week. These conditions caused moderate and 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 moderate level, as shown in [Figure 14](#) and [Table 2](#).

Table 2. Detected flash flood in Thailand, Lao PDR, Cambodia, and Viet Nam on September 14.

 Rate-risk and location of the flash flood may occur in the next 1, 3, and 6 hours in Thailand												
Date of FFG products 14/09/2021 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	
Sa Kaeo	Arunyaprathet	Eastern	Low-Risk	Phetchabun	Khao Kho	Northern	Low-Risk	Sa Kaeo	Arunyaprathet	Eastern	Low-Risk	
Sa Kaeo	Wang Num Yen	Eastern	Low-Risk					Sa Kaeo	Arunyaprathet	Eastern	Low-Risk	
Chonburi	Phan Thong	Eastern	Low-Risk					Loei	Phu Luang	Northeastern	Low-Risk	
Phetchabun	Khao Kho	Northern	Low-Risk					Sa Kaeo	Wang Num Yen	Eastern	Low-Risk	
Phetchabun	Lomkao	Northern	Low-Risk					Trad	Muang Trat	Eastern	Low-Risk	
Satun	La Ngu	Southern-West Co	Low-Risk					Samut Prakam	Phra Samut Chedi		Low-Risk	
								Chachoengsao	Bang Pakong	Eastern	Low-Risk	
								Chachoengsao	Bang Pakong	Eastern	Low-Risk	
								Chonburi	Phan Thong	Eastern	Low-Risk	
								Phitsanulok	Nakhon Thai	Northern	Low-Risk	
								Phetchabun	Khao Kho	Northern	Low-Risk	
								Phetchabun	Lomkao	Northern	Low-Risk	
								Satun	La Ngu	Southern-West Co	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 14/09/2021 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
Saravane	Ta oi	PHOR SANH	South	Low-Risk	Saravane	Ta oi	PHOR SANH	South	Low-Risk	Savannakhet	Phine	TAMOUN	Southern	Low-Risk
Savannakhet	Atsaphang	PHONESAVANG	Southern	Low-Risk	Vientiane	Thoulakho	NAM ANG	Northwest	Low-Risk	Savannakhet	Nong	LAGNEIG KHOK	Southern	Low-Risk
Savannakhet	Atsaphang	NAMOUANG	Southern	Low-Risk	Champasak	Pathoomph	NAMPAAK	Southwestern	Low-Risk	Saravane	Ta oi	PHOR SANH	South	Low-Risk
Vientiane	Thoulakho	NAM ANG	Northwest	Low-Risk	Sekong	Kaleum	PRO	Southeast	Low-Risk	Savannakhet	Atsaphang	PHONESAVANG	Southern	Low-Risk
Vientiane Municipality	Sangthong	MAIPAKSANG	Northwest	Low-Risk	Sekong	Kaleum	KA-OUANG	Southeast	Low-Risk	Savannakhet	Atsaphang	DONGKULUM	Southern	Low-Risk
Champasak	Pathoomph	NAMPAAK	Southwestern	Low-Risk	Sekong	Kaleum	AR-PEUANG	Southeast	Low-Risk	Savannakhet	Atsaphang	XIENGLNAM	Southern	Low-Risk
Sekong	Kaleum	PRO	Southeast	Low-Risk	Sekong	Kaleum	PALAEIG	Southeast	Low-Risk	Savannakhet	Atsaphang	NAMOUANG	Southern	Low-Risk
Sekong	Kaleum	KA-OUANG	Southeast	Low-Risk	Sekong	Kaleum	VAK TAI	Southeast	Low-Risk	Xaysomboun	Hom	KORMI	province is mountainous Northeast	Low-Risk
Sekong	Kaleum	AR-PEUANG	Southeast	Low-Risk	Sekong	Kaleum	STTHORI	Southeast	Low-Risk	Vientiane	Thoulakho	NAM ANG	Northwest	Low-Risk
Sekong	Kaleum	PALAEIG	Southeast	Low-Risk	Sekong	Lamarm	KANONG MAI	Southeast	Low-Risk	Vientiane Municipality	Sangthong	MAIPAKSANG	Northwest	Low-Risk
Sekong	Kaleum	VAK TAI	Southeast	Low-Risk	Sekong	Dakcheung	DAKDEN	Southeast	Low-Risk	Khammuane	Bualapha	PA SEW	Center of Laos	Low-Risk
Sekong	Kaleum	TIN	Southeast	Low-Risk	Sekong	Dakcheung	DAKVANG	Southeast	Low-Risk	Savannakhet	Xaybuly	NONGSAPHANG	Southern	Low-Risk
Sekong	Kaleum	STTHORI	Southeast	Low-Risk						Savannakhet	Xaybuly	PHAKKHAGNA	Southern	Low-Risk
Sekong	Lamarm	KANONG MAI	Southeast	Low-Risk						Champasak	Pathoomph	NAMPAAK	Southwestern	Low-Risk
Sekong	Dakcheung	DAKDEN	Southeast	Low-Risk						Champasak	Paksong	THONGYAO	Southwestern	Low-Risk
Sekong	Dakcheung	DAKVANG	Southeast	Low-Risk						Sekong	Kaleum	PRO	Southeast	Low-Risk
										Sekong	Kaleum	KA-OUANG	Southeast	Low-Risk
										Sekong	Kaleum	AR-PEUANG	Southeast	Low-Risk
										Sekong	Kaleum	PALAEIG	Southeast	Low-Risk
										Sekong	Kaleum	VAK TAI	Southeast	Low-Risk
										Sekong	Kaleum	TIN	Southeast	Low-Risk
										Sekong	Kaleum	STTHORI	Southeast	Low-Risk
										Sekong	Lamarm	KANONG MAI	Southeast	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 14/09/2021 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
Sihanouk Ville	Prey Nob	Chumpu Khmau	Southwest	Low-Risk	Sihanouk Ville	Prey Nob	Chumpu Khmau	Southwest	Low-Risk	Banteay Meanchey	Mongkol Borei	Anlong Thngan Lech	Northwest	Low-Risk
Tboung Khmum	Tboung Khmum	Phum Pram Dab	Central Lowland	Low-Risk						Kampong Cham	Cheung Prey	Kngak	Central Lowland	Low-Risk
Tboung Khmum	Tboung Khmum	Thnal Thmei	Central Lowland	Low-Risk						Tboung Khmum	Memot	Kantot	Central Lowland	Low-Risk
Kampong Cham	Kang Meas	Ou Svay Kaout	Central Lowland	Low-Risk						Tboung Khmum	Tboung Khmum	Phum Pramuoy Dabpir	Central Lowland	Low-Risk
										Sihanouk Ville	Prey Nob	Chumpu Khmau	Southwest	Low-Risk
										Tboung Khmum	Tboung Khmum	Phum Pram Dab	Central Lowland	Low-Risk
										Tboung Khmum	Tboung Khmum	Thnal Thmei	Central Lowland	Low-Risk
										Kampong Cham	Kang Meas	Ou Svay Kaout	Central Lowland	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 14/09/2021 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
Quang Tri	Huong Hoa	North Central	Low-Risk	Quang Tri	Huong Hoa	North Central	Low-Risk	Kon Tum	Sa Thay	Central Highlands	Low-Risk
Quang Nam	Hien	South Central Coast	Low-Risk	Quang Nam	Hien	South Central Coast	Low-Risk	Gia Lai	Ia Grai	Central Highlands	Low-Risk
Quang Nam	Nam Giang	South Central Coast	Low-Risk	Quang Nam	Nam Giang	South Central Coast	Low-Risk	Gia Lai	Duc Co	Central Highlands	Low-Risk
Kon Tum	Dak Glei	Central Highlands	Low-Risk	Kon Tum	Dak Glei	Central Highlands	Low-Risk	Quang Binh	Le Thuy	North Central	Low-Risk
Quang Binh	Quang Ninh	North Central	Low-Risk	Quang Binh	Bo Trach	North Central	Low-Risk	Quang Tri	Huong Hoa	North Central	Low-Risk
Quang Binh	Bo Trach	North Central	Low-Risk	Quang Binh	Quang Ninh	North Central	Low-Risk	Quang Binh	Minh Hoa	North Central	Low-Risk
Quang Binh	Le Thuy	North Central	Moderate-Risk	Quang Binh	Le Thuy	North Central	Low-Risk	Thua Thien Hue	A Luoi	North Central	Low-Risk
Quang Tri	Da Krong	North Central	Low-Risk	Quang Nam	Tra My	South Central Coast	Low-Risk	Quang Nam	Nam Giang	South Central Coast	Low-Risk
Kon Tum	Dak To	Central Highlands	Low-Risk	Binh Thuan	Ham Thuan Nam	South Central Coast	Low-Risk	Kon Tum	Dak Glei	Central Highlands	Low-Risk
Quang Nam	Tra My	South Central Coast	Low-Risk	Quang Tri	Da Krong	North Central	Low-Risk	Kon Tum	Ngoc Hoi	Central Highlands	Low-Risk
Binh Thuan	Ham Thuan Nam	South Central Coast	Low-Risk	Kon Tum	Dak To	Central Highlands	Low-Risk	Quang Binh	Quang Ninh	North Central	Low-Risk
Dong Nai	Xuan Loc	Southeast	Low-Risk					Quang Binh	Bo Trach	North Central	Low-Risk
Tien Giang	Cai Lay	Southwest-Mekong	Low-Risk					Quang Nam	Hien	South Central Coast	Low-Risk
								Da Nang	Hoa Vang	South Central Coast	Low-Risk
								Thua Thien Hue	Phong Dien	North Central	Low-Risk
								Thua Thien Hue	A Luoi	North Central	Low-Risk
								Quang Binh	Le Thuy	North Central	Moderate-Risk
								Quang Tri	Da Krong	North Central	Low-Risk
								Quang Nam	Dai Loc	South Central Coast	Low-Risk
								Kon Tum	Dak To	Central Highlands	Low-Risk
								Quang Nam	Phuoc Son	South Central Coast	Low-Risk
								Quang Nam	Tra My	South Central Coast	Low-Risk

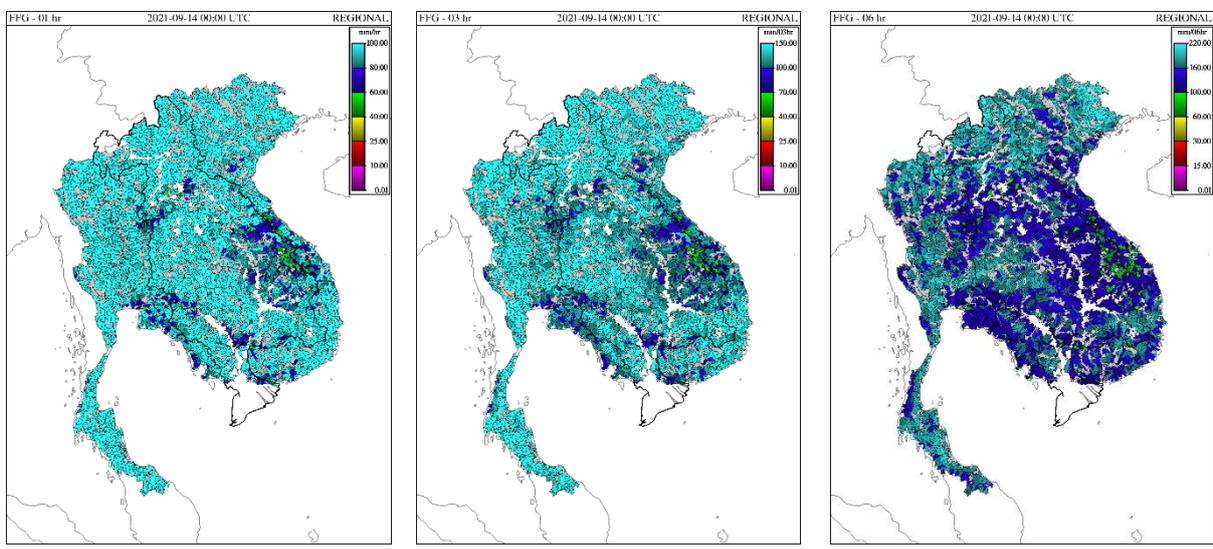


Figure 14. Flash Flood Guidance for the next 1 hour, 3 hours and 6 hours on Sep 14.

5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 11 to 17 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)**

Drought meteorological indicator of SPI from September 11 to 17, as shown in [Figure 15](#), shows that there were some dry hotspots in the north part covering small area of Thailand's Chiang Mai, Chiang Rai, and Phayao and Lao PDR's Phongsaly, Luang Prabang and Hiengkhuang; central part of the LMB was at normal condition while the southern part was relatively wet. In summary the LMB did not face any threat during the monitoring week.

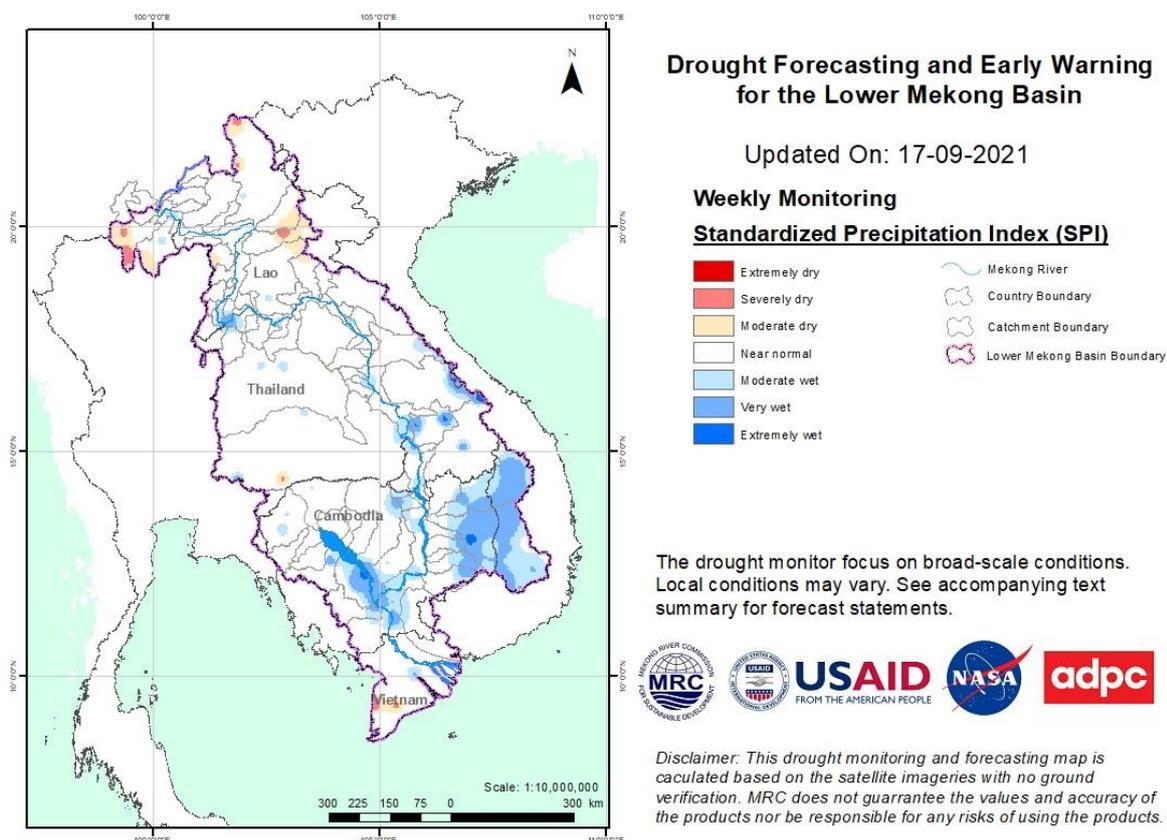


Figure 15. Weekly standardized precipitation index from 11 to 17 September 2021.

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

Like meteorological indicator, the soil water fraction from September 11 to 17, as displayed in [Figure 16](#), shows that the LMB region was normal and wet in general. The only dry spots were found in northern Lao PDR in the upper part of the region including Phongsaly and Xiengkhuang. There was no significant threat posed by agricultural indicator during the monitoring week.

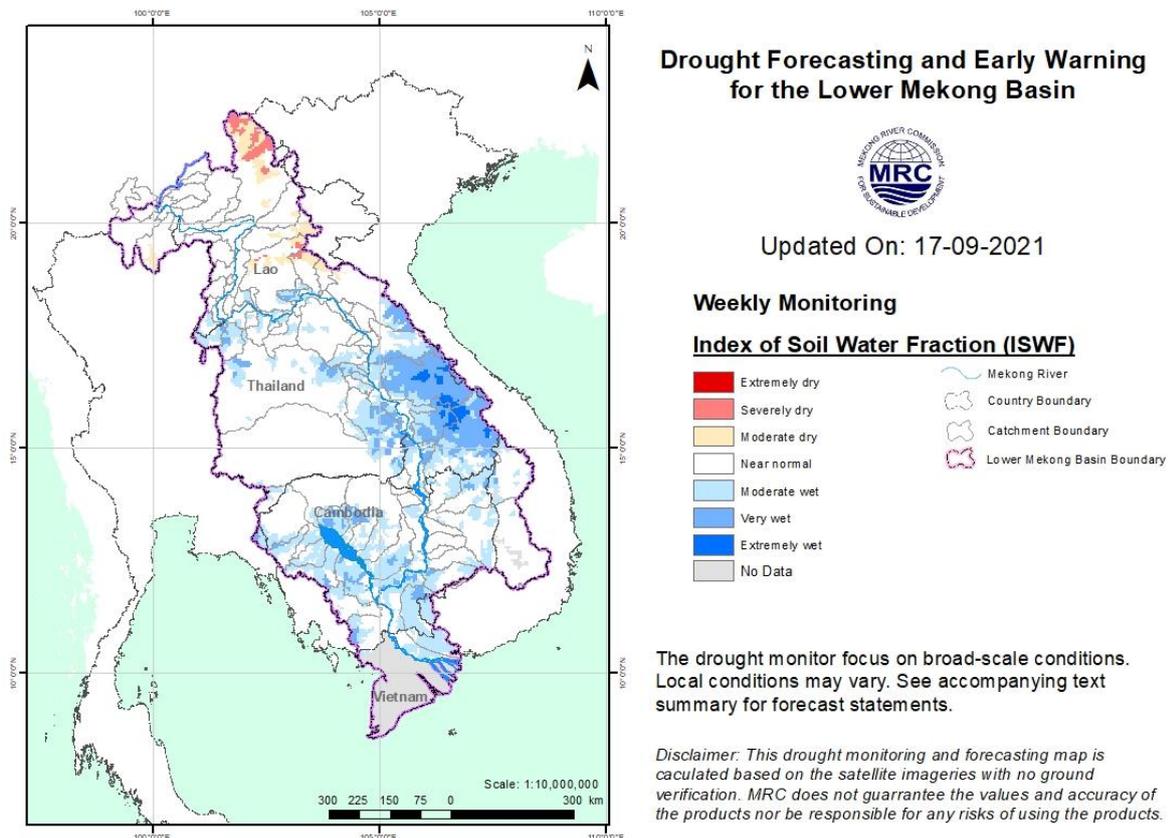


Figure 16. Weekly Soil Moisture Anomaly from 11 to 17 September 2021.

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

The medium pressure put by both meteorological and agricultural indicators has made some areas of the upper part of the LMB become moderately dry, in combination. Those areas cover Chiang Rai and Phayao of Thailand and Phongsaly and Xiengkhuang of Lao PDR, as displayed in [Figure 17](#). The rest of the region was normal. No threat was found during the monitoring period.

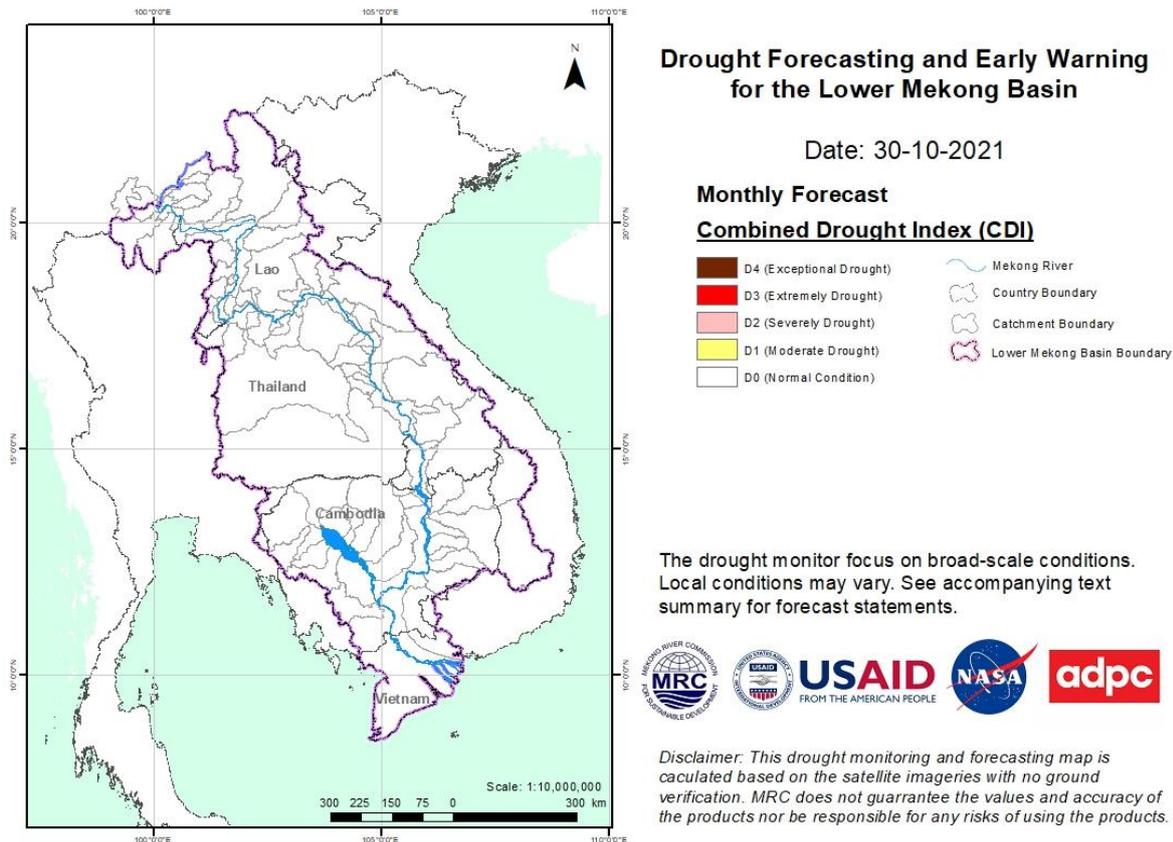


Figure 17. Weekly Combined Drought Index from 11 to 17 September 2021.

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.

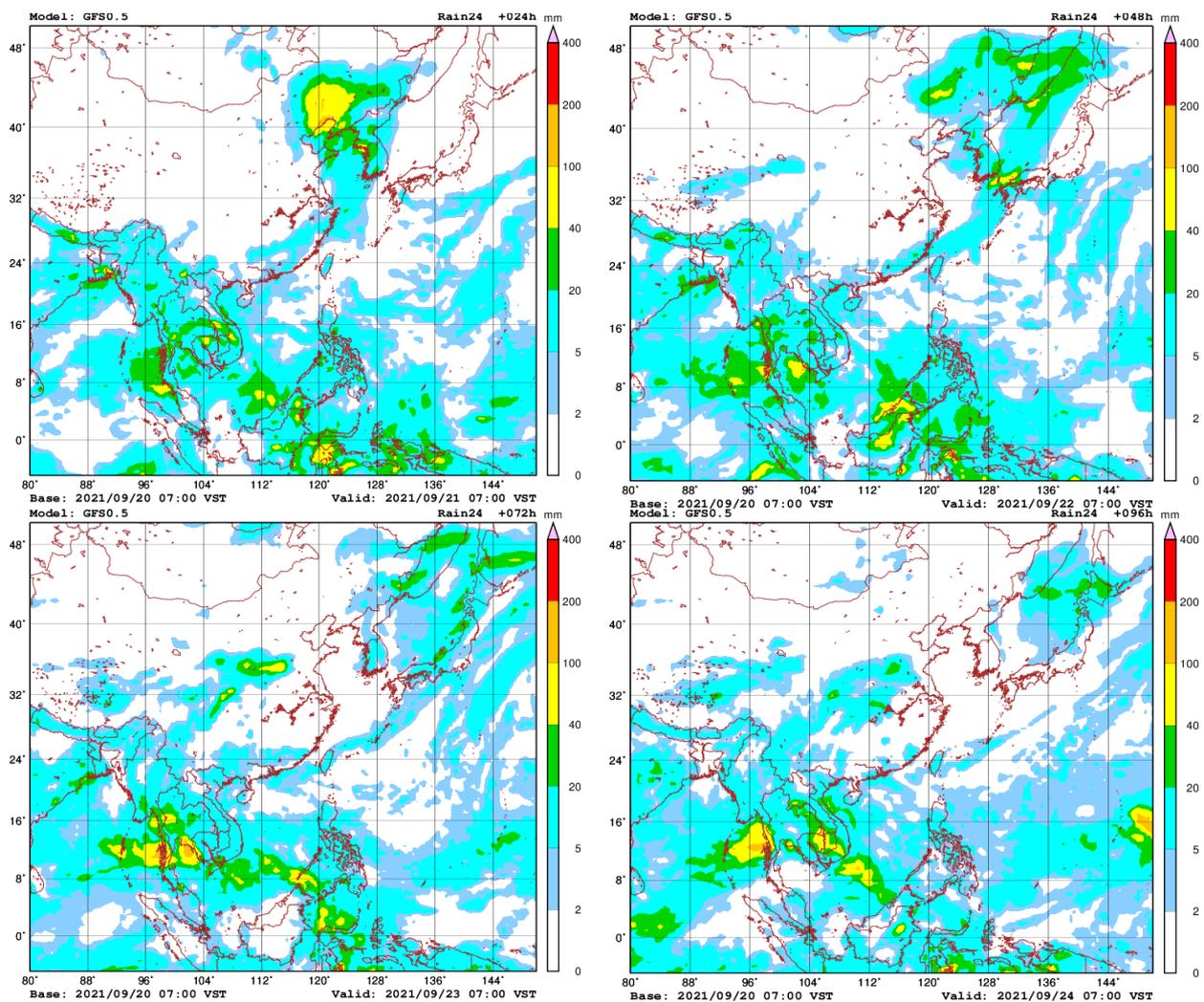
6 Weather and Water Level Forecast and Flash Flood Information

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 21 to 27, in general, small rainfall (5 -20 mm/24h) will likely occur from upper to middle part of the LMB; exceptionally, heavy rainfall (50-100 mm/24h) will likely occur in some areas of the lower part of the LMB (including Cambodia and Viet Nam) on September 24.

[Figure 18](#) shows accumulated rainfall forecast (24 h) of the GFS model from September 21 to 27.



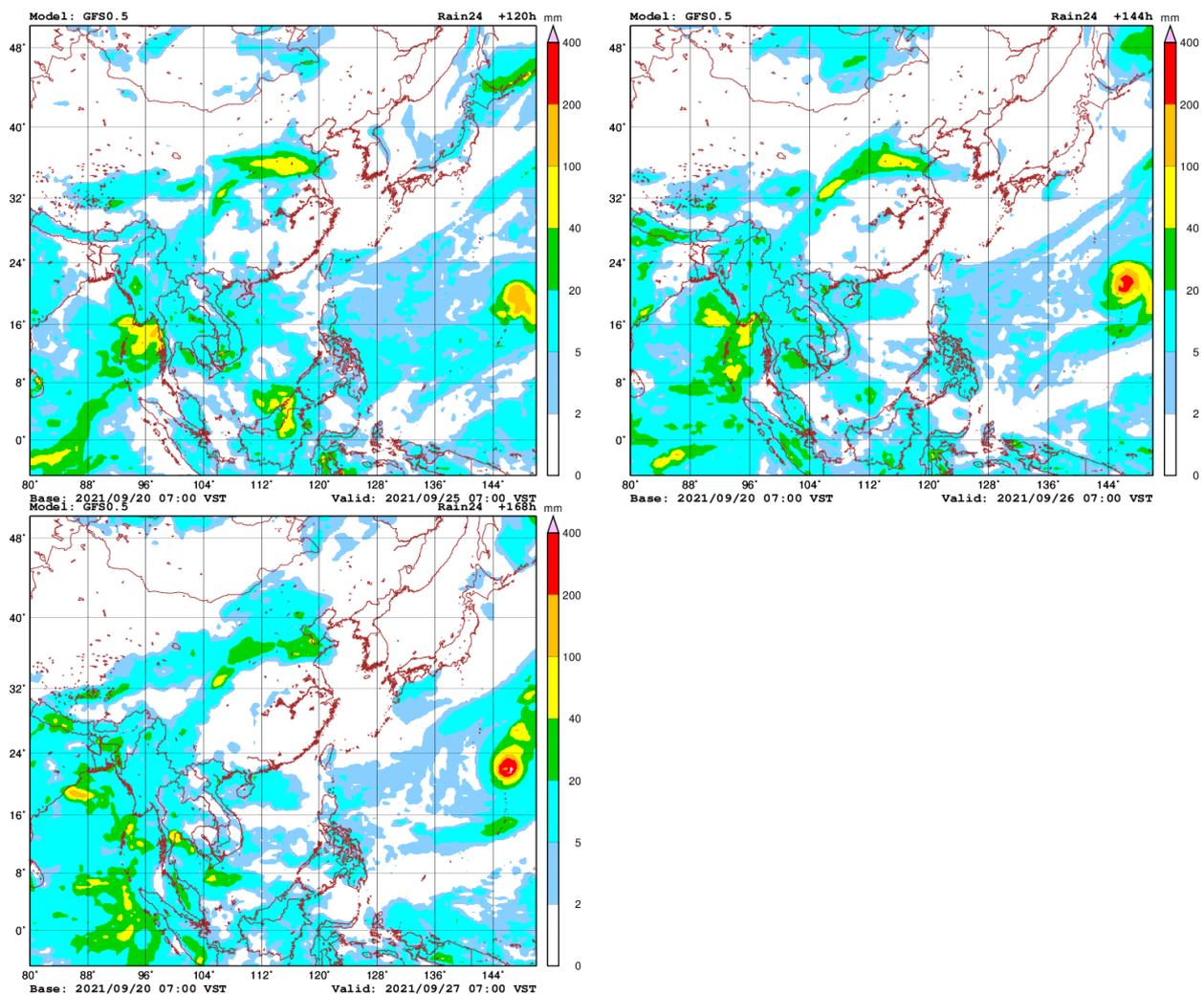


Figure 18. Accumulated rainfall forecast (24 h) based on a GFS model.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on September 20's daily flood forecasting bulletin, the daily forecasted water level at Chiang Saen in Thailand is expected to increase from 2.82 m to 3.05 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 9.44m to 9.80 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 0.30 m, while water level at Vientiane in Lao PDR will also increase about 0.16 m. Furthermore, from Nong Khai in Thailand, the water level will slightly increase about 0.03 m over the next five days and at Paksane in Lao PDR water level will decrease about 0.57 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 Pakse in Lao PDR are forecasted to decrease in between 0.05 m and 0.30 m over the next five days. Water level at these stations will stay lower than their LTA levels. 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 down from 0.05 m to 0.30 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 decrease by about 0.15 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 14 to 20 September 2021, is presented in **Annex 1**.

[Table 2](#) shows the daily flood forecasting Bulletin issued on September 20. 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.

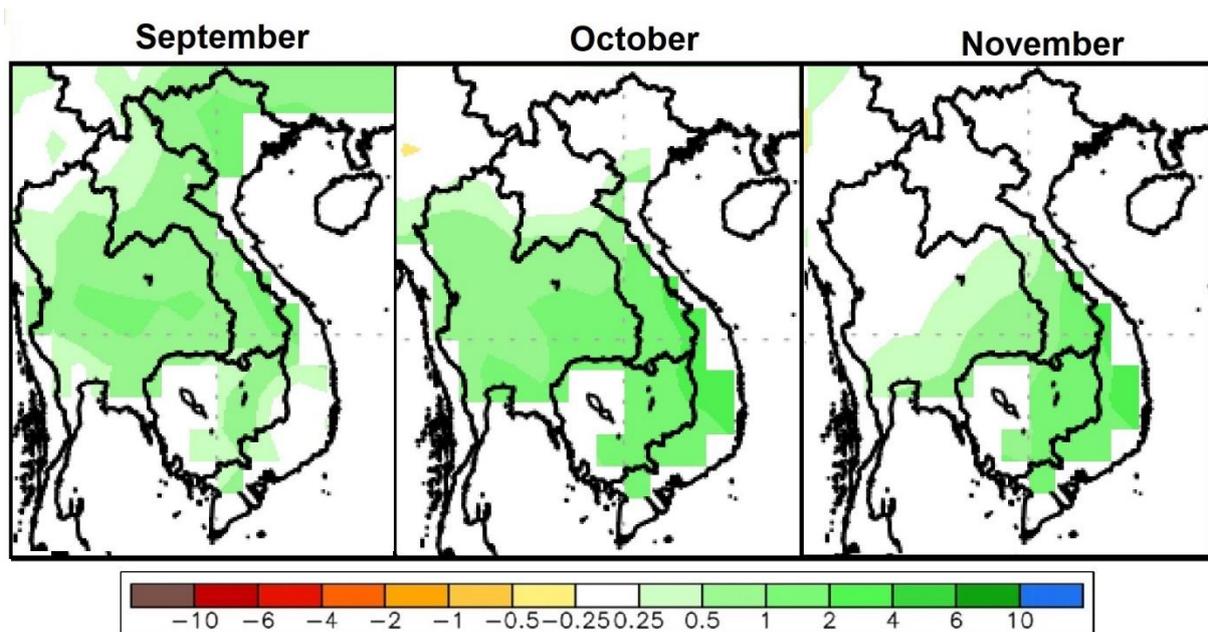


Figure 19. Daily average of monthly rainfall anomaly forecast from August to November 2021.

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.

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 14-20, including the lower part in Cambodia and Viet Nam, varying from 16.60 mm to 182.00 mm, and considered low 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 21-25 September 2021.

7.2 Water level and its forecast

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed a significant decrease over the monitoring period from 10 to 20 September 2021. It dropped **about 0.89 m from 535.98 m on 10 Sept to 535.09 on 13 Sept 2021**. The outflows significantly decreased from 1,318 m³/s on Sept 10 to 727 m³/s on Sept 20, 2021. From 19 to 20 September, water levels at this station significantly dropped to the level below its historical minimum level.

Along with the significant low outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand also decreased about 0.48 m from 7 to 20 September 2021. From Chiang Khan in Thailand to Vientiane in Lao PDR, water levels decreased during 14-20 September due to below-average rainfall in the area. However, water levels from Nakhon Phanom in Thailand to Savannakhet in Lao PDR were slightly increasing. Water levels from the stretches of the river from Stung Treng to Kratie and at Kampong Cham in Cambodia were decreasing, following the same trend of the upstream flow (at Pakse) 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 decrease between 0.05 m and 0.30 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 accumulated 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 from 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

Some areas of the upper part of the LMB were moderately dry during the reporting week due to moderately dry meteorological and agricultural indicators. Those areas cover Chiang Rai and Phayao of Thailand and Phongsal and Xiengkhuang of Lao PDR. The rest of the region was normal. No significant threat was found from 11 to 17 September 2021.

For the upcoming three-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.

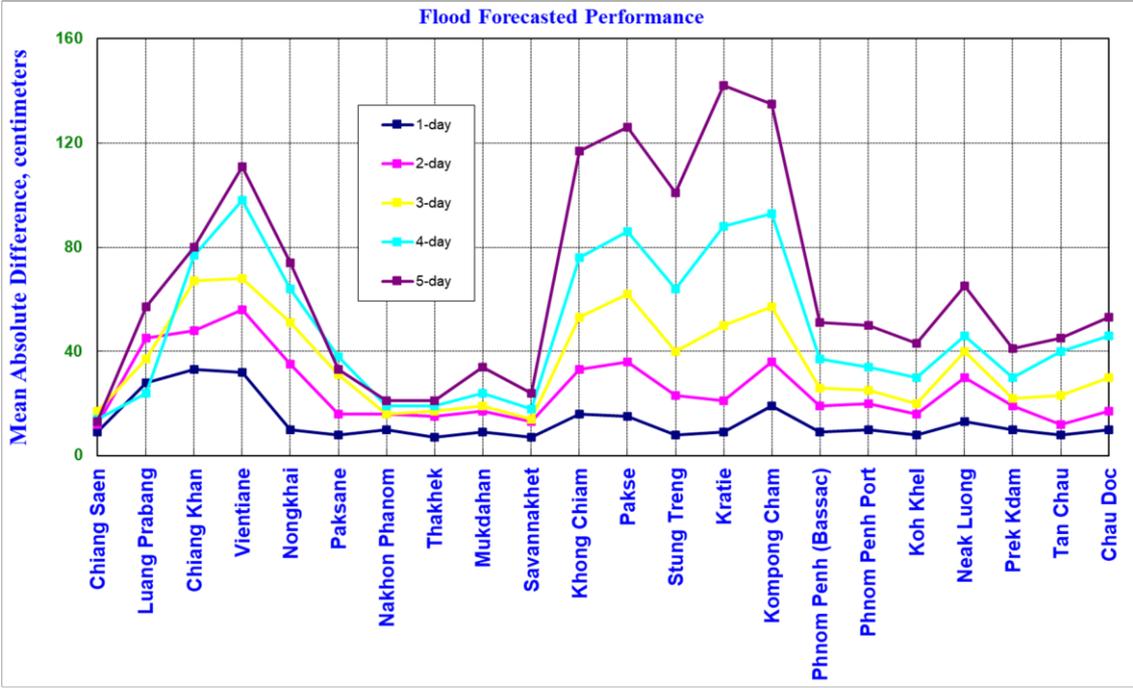
Annex 1: Performance of the weekly flood forecasting

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 14 to 20 September 2021.

The forecasting values from 14 to 20 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 were due to daily tidal effects of the sea in the Mekong Delta.
- Satellite rainfall data were 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 14 to 20 September, 2021.

Table B1: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 14 to 20 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	9	<u>28</u>	<u>33</u>	<u>32</u>	10	8	10	7	9	7	16	15	8	9	19	9	10	8	13	10	8	10
2-day	12	<u>45</u>	<u>48</u>	56	<u>35</u>	16	16	15	17	13	<u>33</u>	<u>36</u>	<u>23</u>	<u>21</u>	<u>36</u>	19	<u>20</u>	16	<u>30</u>	19	12	17
3-day	17	<u>37</u>	67	68	51	<u>31</u>	16	17	19	14	53	62	<u>40</u>	<u>50</u>	57	<u>26</u>	<u>25</u>	<u>20</u>	<u>40</u>	<u>22</u>	<u>23</u>	<u>30</u>
4-day	14	<u>24</u>	77	98	64	<u>38</u>	19	19	<u>24</u>	18	76	86	64	88	93	<u>37</u>	<u>34</u>	<u>30</u>	<u>46</u>	<u>30</u>	<u>40</u>	<u>46</u>
5-day	13	57	80	111	74	<u>33</u>	<u>21</u>	<u>21</u>	<u>34</u>	<u>24</u>	117	126	101	142	135	51	<u>50</u>	<u>43</u>	65	<u>41</u>	<u>45</u>	53

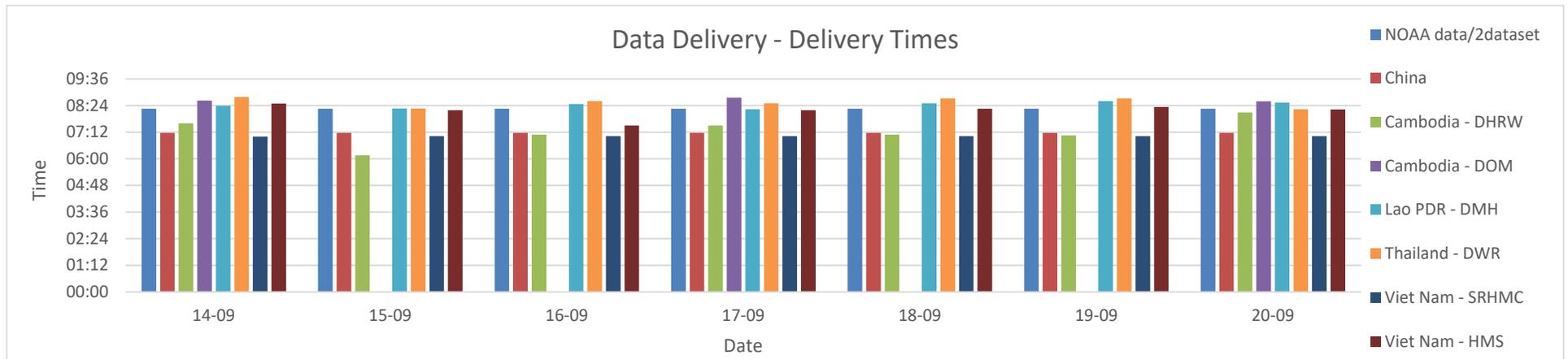
Table B2: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 14 to 20 September, 2021 in %

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	71.4	57.1	57.1	71.4	85.7	71.4	57.1	71.4	57.1	71.4	57.1	<u>42.9</u>	57.1	71.4	57.1	85.7	85.7	85.7	85.7	85.7	85.7	71.4	71.4	69.5
2-day	66.7	16.7	<u>50.0</u>	<u>50.0</u>	66.7	66.7	<u>50.0</u>	66.7	<u>50.0</u>	<u>50.0</u>	66.7	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	66.7	83.3	83.3	66.7	66.7	83.3	66.7	66.7	66.7	60.6
3-day	60.0	60.0	60.0	60.0	60.0	60.0	80.0	60.0	60.0	80.0	60.0	<u>40.0</u>	60.0	<u>40.0</u>	60.0	80.0	80.0	80.0	60.0	80.0	<u>40.0</u>	60.0	60.0	62.7
4-day	<u>50.0</u>	75.0	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	75.0	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>25.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	75.0	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	52.3
5-day	66.7	66.7	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	66.7	<u>33.3</u>	66.7	66.7	66.7	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	66.7	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	43.9

Table B3: Overview of performance indicators for the past 7 days from 14 to 20 September 2021

	FF time sent				Arrival time of input data								Missing data (number-mainstream and trib.st.)							
	FF completed and sent (time)	Stations without forecast	FF2 completed and sent (time)	Weather data available (time)	NOAA data	China	Cambodia - DHRW	Cambodia - DOM	Lao PDR - DMH	Thailand - DWR	Viet Nam - SRHMC	Viet Nam - HMS	NOAA data/2dataset	China/2	Cambodia - DHRW/15	Cambodia - DOM/34	Lao PDR - DMH/32	Thailand - DWR/13	Viet Nam - SRHMC/6	Viet Nam - HMS/39
2021																				
<i>week</i>	10:32	00:00	-	-	08:15	07:10	07:13	08:39	08:25	08:32	07:00	08:09	0	0	0	136	60	14	2	0
<i>month</i>	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 14 to 20 September 2021



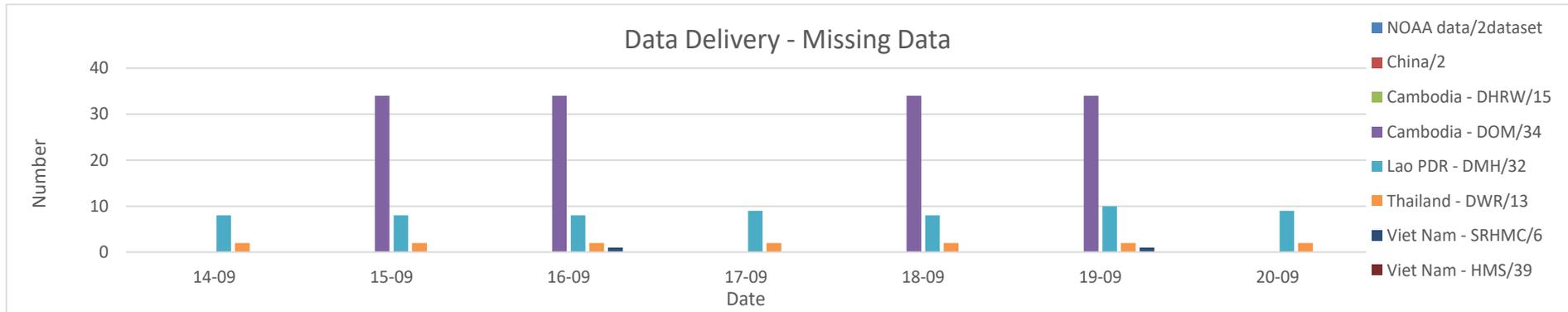
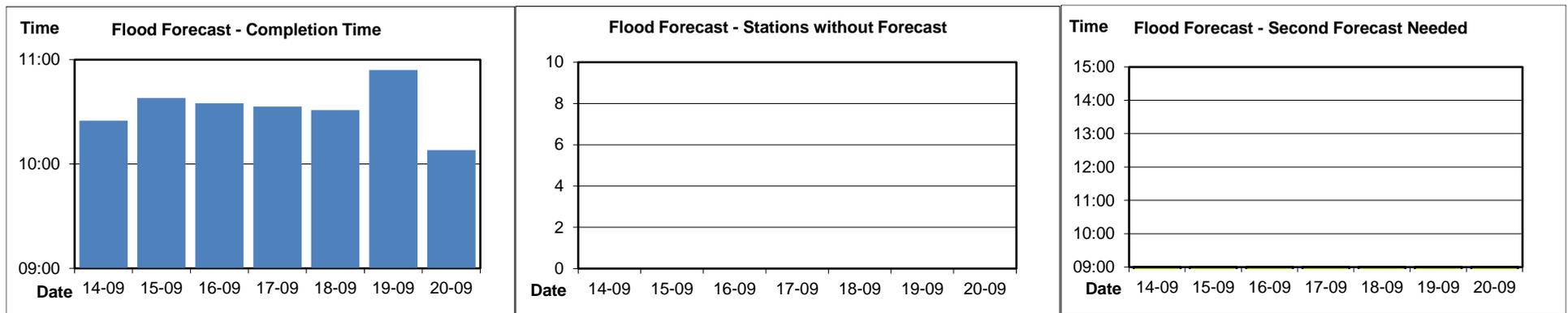


Fig. B5: Missing data for the past 7 days from 14 to 20 September 2021

Fig. B6: Flood forecast completion time, stations without forecasts, and second forecasts need from 14 to 20 September 2021





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