Mekong River Commission

Weekly Wet Season Situation Report in the Lower Mekong River Basin

1–7 June 2021

Prepared by
The Regional Flood and Drought Management Centre
10 June 2021

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Contents

Figures

Table

Key Messages

Key messages for this weekly report are presented below.

Rainfall and its forecast

- Rainfall took place from Nong Khai in Thailand to Pakse in Lao PDR, including the lower part of the Lower Mekong Basin at Chaktomuk in Cambodia and Tan Chau and Chau Doc in Viet Nam, varying from 3.70 mm to 114 mm.
- No significant rainfall is projected in the Mekong region from 8 to 13 June 2021.

Water level and its forecast

- The outflows at Jinghong hydrological station showed a slight increase over the monitoring period from 1 to 7 June 2021, rising from 536.83 metres on June 1 to 536. 99 metres on June 7.
- At Chiang Saen in Thailand, the closest station to the Jinghong hydrological station, the water level decreased by about 0.48 m during the same period.
- The water levels across most monitoring stations from Chiang Khan in Thailand to Pakse in Lao PDR, and from the stretches of the river between Stung Treng and Kratie in Cambodia were lower than their long-term average condition.
- . Due to heavy rain in late October 2020, the water volume of the Lake at this reporting point is higher than that in 2020. However, the volume in 2021 is lower than its long-term average.
- Over the next few days, the water levels across most monitoring stations are expected to increase.

Drought condition and its forecast

- From 29 May to 4 June 2021, most parts of the LMB were at normal condition except some areas in the central part of the LMB where moderate and some severe droughts took place due to rainfall deficit.
- The ensemble prediction model forecasts that in June the entire LMB is likely to receive from average to above-average rainfall; the central part of the LMB and the eastern part of Cambodia are forecasted to be the wettest areas. Moving into July, it is forecasted that Cambodia, the Central Highland of Viet Nam, and southern Lao PDR will be the driest area in the region. In August, the entire LMB region is forecasted to experience some meteorological drought, a situation when there is a prolonged period with less than average rainfall. Lastly, the lower part of the LMB covering eastern Cambodia and Viet Nam is likely to receive below average rainfall in September.

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 **1 to 7 June 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 – Cambodia, Lao PDR, Thailand, and Viet Nam – and on satellite data. All the water level indicated in this report refers to an above zero gauge of each station.

The report covers the following topics that are updated weekly:

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

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

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

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

2 General Weather Patterns

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

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

Figure 1 presents the weather map of 7 June 2021, showing that a low pressure is dominating the upper part of Lao PDR and Viet Nam, including the 3S area (Sesan, Sre Pok and Sekong) in Cambodia and Viet Nam of the LMB.

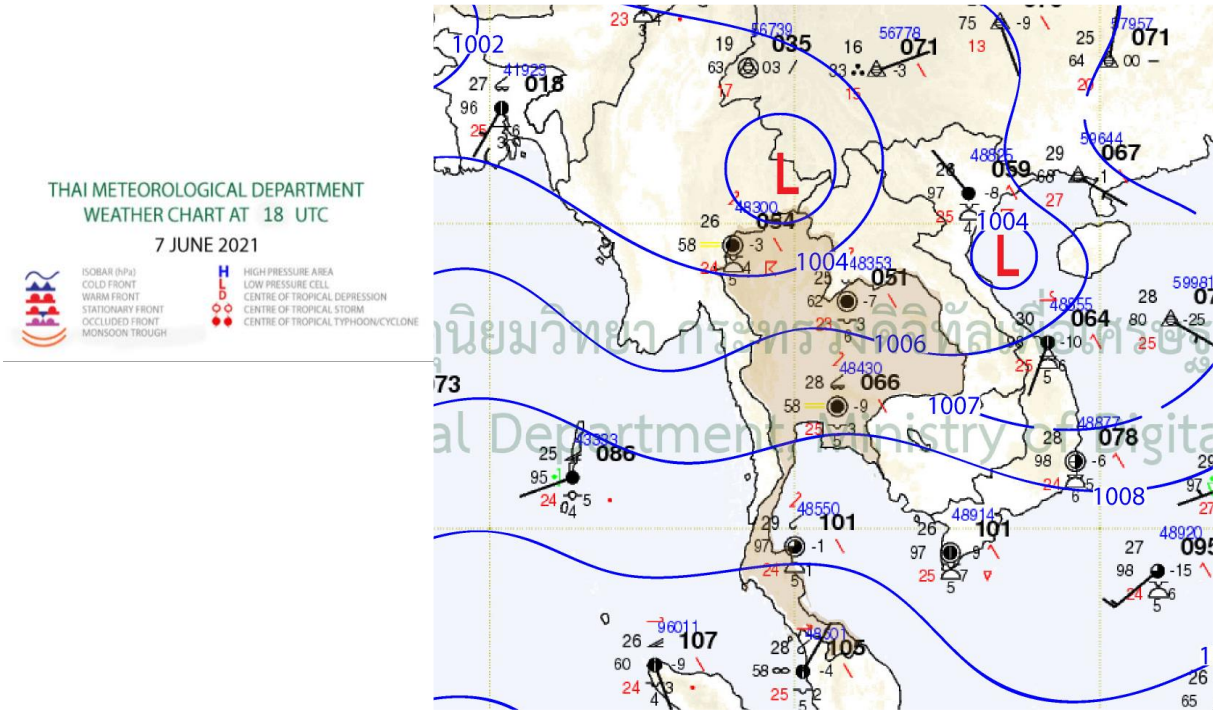


Figure 1. Summary of weather conditions over the LMB.

According to the ASEAN Specialised Meteorological Centre (ASMC), a highest probability of warm and dry conditions is predicted over of the Mekong region covering northern Lao PDR, Thailand, Cambodia, and Viet Nam during 31 May–13 June 2021. Nonetheless, the southwest Monsoon weather may be in transition in the region, causing average rainfall.

Figure 2 shows the outlook of comparative warm conditions from 31 May to 13 June 2021 in Southeast Asia based on results from the NCEP model (National Centres for Environmental Prediction).

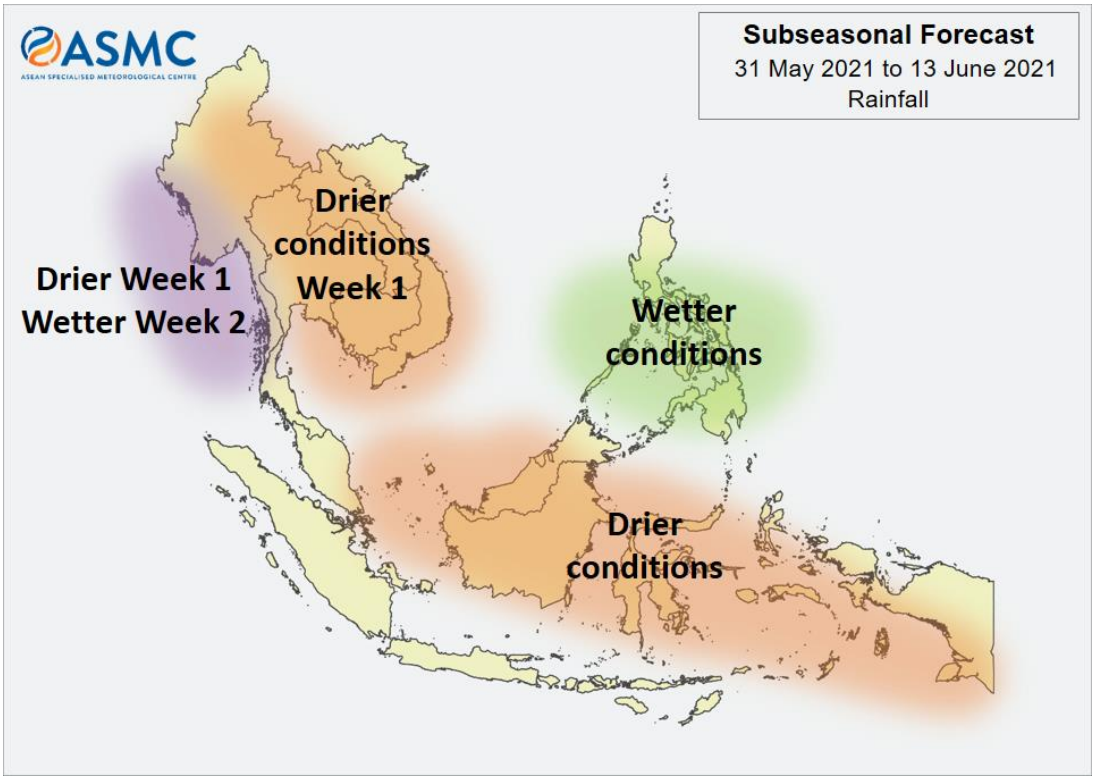


Figure 2. Outlook of wet and dry conditions over the Asian countries by ASMC.

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

There were low-pressure lines taking place in the lower part of the LMB during 7 June 2021, as shown in Figure 1, which would bring rain to some areas of the LMB. But based on a Tropical Strom Risk (TSR), as displayed in Figure 3, there was no sign of tropical depression (TD), tropic storm (TS), or typhoon (TY) in the Mekong region up to 7 June 2021.

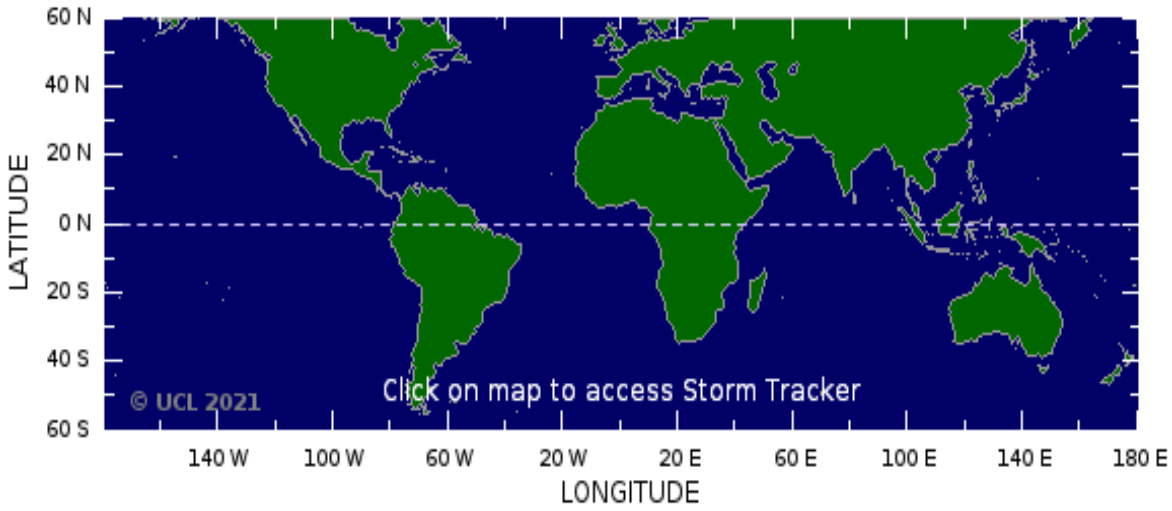


Figure 3. A tropical depression risk observed on 7 June 2021.

2.2 Rainfall patterns over the LMB

This week, rainfall was focused in the areas from Chiang Khan in Thailand to Pakse in Lao PDR including the lower part in Cambodia and Viet Nam, varying from 3.70 millimetres (mm) to 114 mm. The highest concentration was observed from Vientiane to Pakse in Lao PDR. The total rainfall this week is considered high in the middle part (54 mm to 114 mm) of the LMB (see Figure 4).

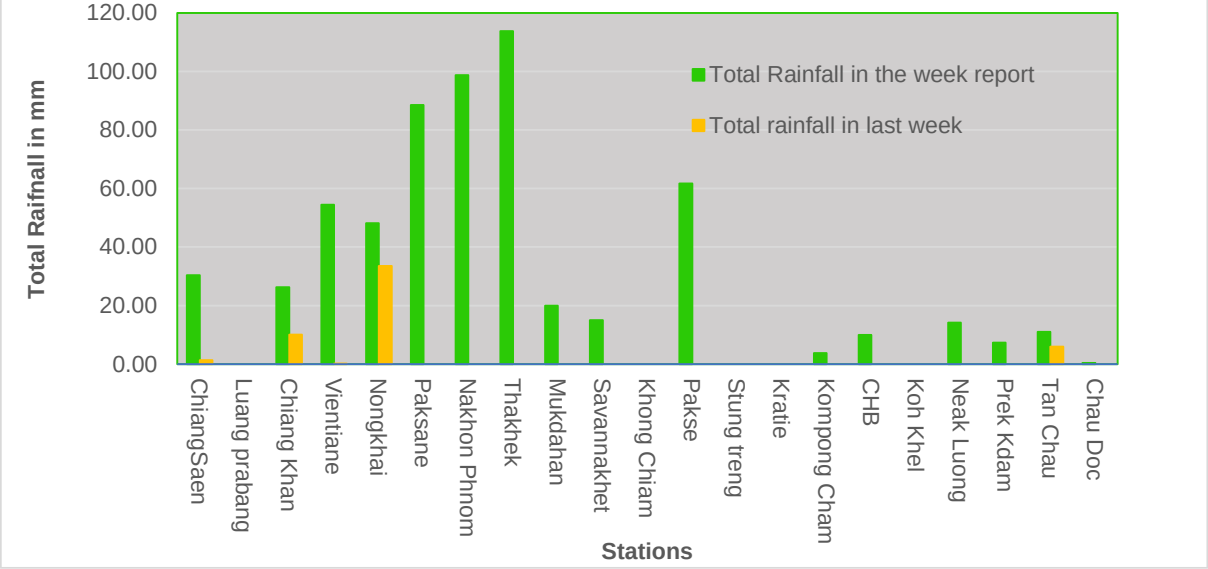


Figure 4. Weekly total rainfall at key stations in the LMB during 1–7 Jun 2021.

To verify area rainfall distribution, Figure 5 shows a map of the weekly accumulated rainfall based on observed data provided by the MRC Member Countries – Cambodia, Lao PDR, Thailand, and Viet Nam – from 1 to 7 May 2021.

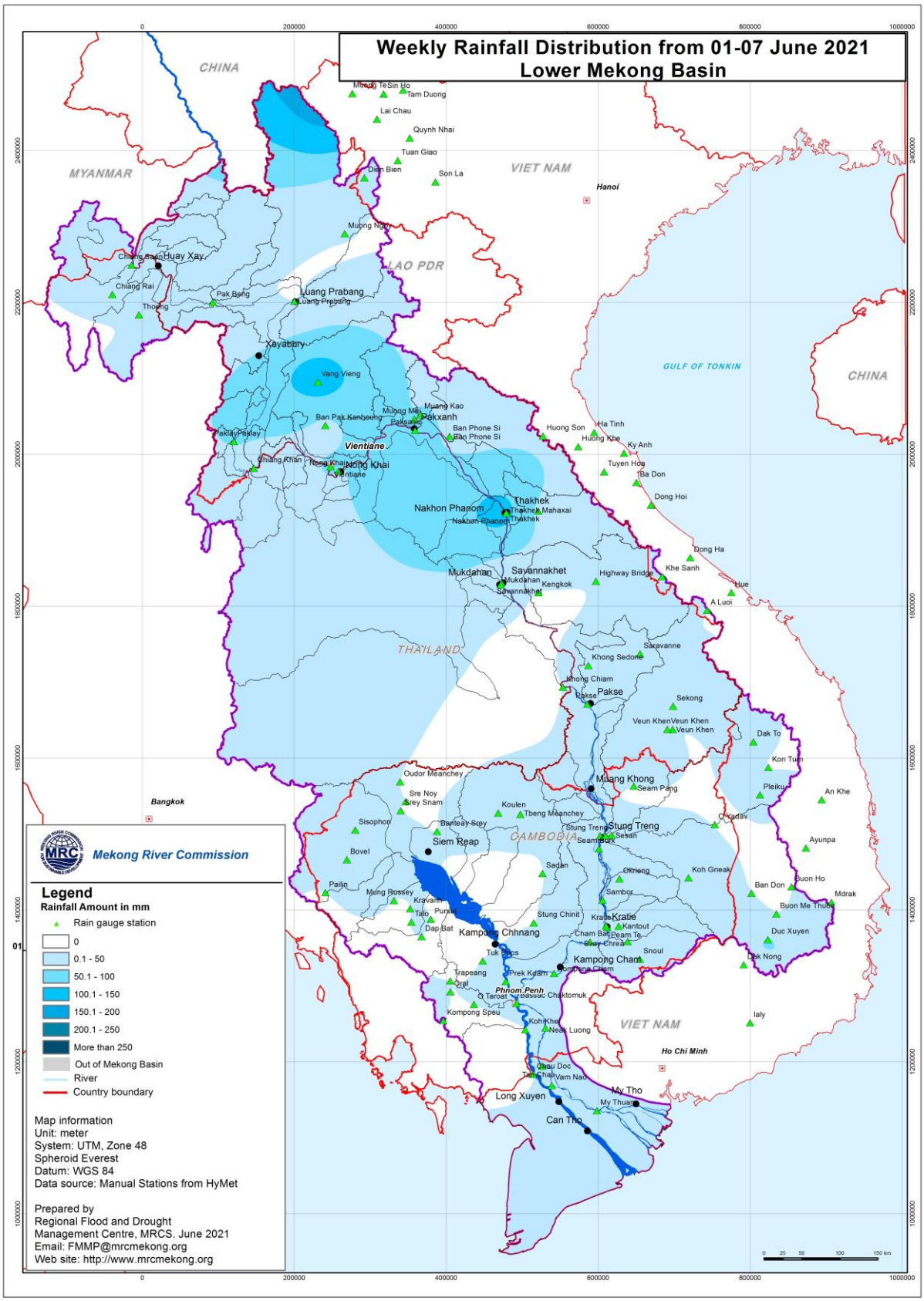


Figure 5. Weekly rainfall distribution over the LMB during 1–7 June 2021.

3 Water Levels in the Lower Mekong River

The hydrological regimes of the Mekong mainstream are illustrated by recorded WLs 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 WLs and rainfall at each key station are summarised in Annex A.

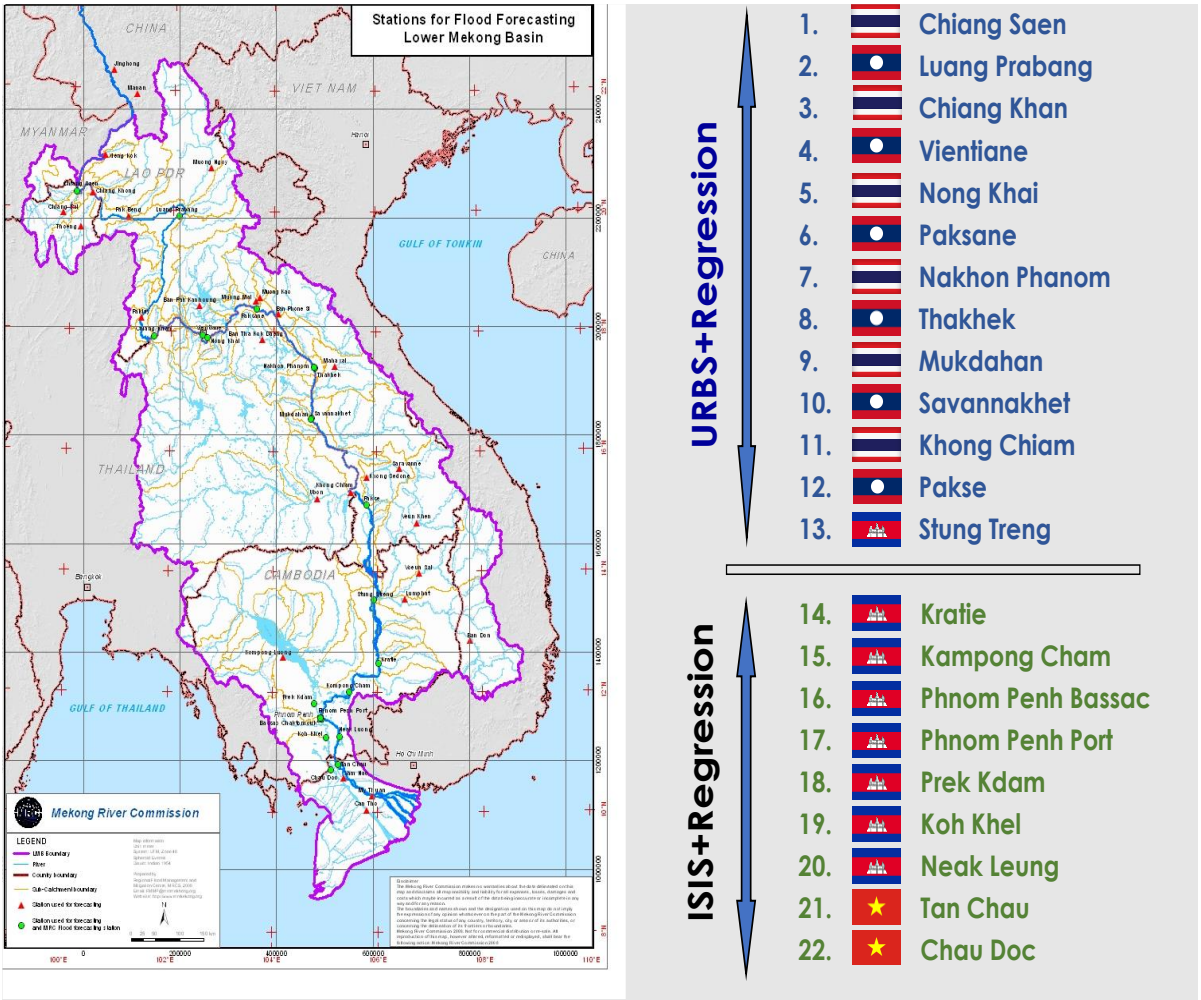


Figure 6. Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed a slight increase over the monitoring period from 1 to 7 June 2021. It rose from 536.83 metres (m) on June 1 to 536. 99 m on June 7.

From mid- to the end of May, the station's outflows experienced rapid fluctuations with a dropping trend. The outflows decreased from 3,285 cubic metres per second (m^3/s) on May 14 to 2,098 m^3/s on May 30. Its daily average water level dropped by 1.33 m (from 538.29 metres on May 14 to 536.96 metres on May 30).

Figure 7 below presents water level fluctuations at the Jinghong hydrological station[1] during 1 May – 7 June 2021.

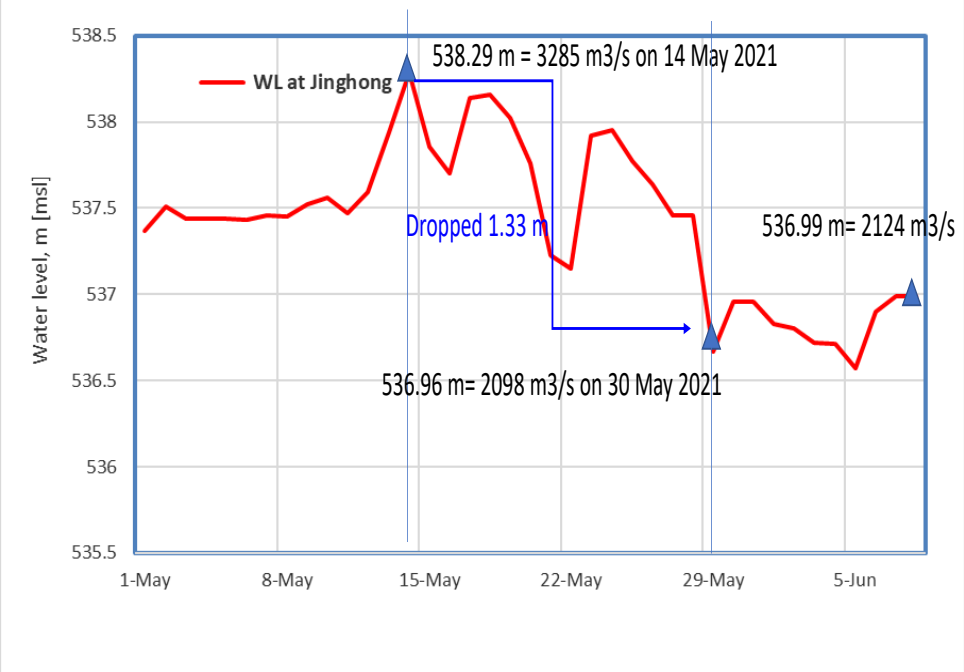


Figure 7. Water level at the Jinghong hydrological station during 1 May – 7 June 2021.

The water level at Chiang Saen in Thailand dropped by about 0.48 m during the same period (1–7 June). In spite of this, the station's recorded water level was still higher than its long-term average (LTA).

Due to the influence of rapid fluctuation of water levels at Jinghong from mid- to the end of May, water levels across most monitoring stations from Nong Khai in Thailand to Pakse in Lao PDR, and from the stretches of the river between Stung Treng, Kratie and Kompong Cham in Cambodia were lower than their LTA during 1–7 June 2021.

Based on a hydrological phenomenon, the contribution of inflow water from the upstream of Lancang-Mekong in China to the Mekong mainstream is about 25% in total during the dry season from November to May. The whole inflow of water into the LMB is influenced not only

[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.

by the Mekong-Lancang upstream but also by downstream dam operations at the Mekong mainstream and its tributaries during the dry season.

Chiang Saen and Luang Prabang

The water level from 1 to 7 June 2021 at Thailand's Chiang Saen decreased from 2.99 m to 2.83 m, representing a drop of 0.16 m over the week. But the level was still about 0.57 m higher than its LTA and was slightly higher than last week's level.

The water level at Luang Prabang station in Lao PDR also saw a moderate decrease, dropping from 9.65 m to 8.90 m during the reporting period. This level shows 1.19 m above its LTA. The trend – of sometimes higher, or closer to its historical maximum value – has been observed since late 2020. The phenomenon was potentially caused by upstream dam operations, downstream Xayaburi dam, and rainfall in the surrounding areas.

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 wet and dry season**.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) decreased from 6.43 m to 5.72 m, or 0.71 m. The level corresponded to its LTA value.

The water level downstream at Vientiane in Lao PDR followed the upstream trend. It decreased from 3.90 m to 3.25 m but was still about 0.51 metres higher than its LTA. At Nong Khai station in Thailand, the water level also decreased. It dropped about 0.67 m, and was 0.62 m lower than its LTA. The water level at Paksane in Lao PDR decreased by about 0.13 m and was about 0.99 m lower than its LTA. The decreased level here was probably influenced by Nam Ngum dam operation located upstream and less rainfall.

The water levels at Chiang Khan and Paksane are shown in Figure 8 below.

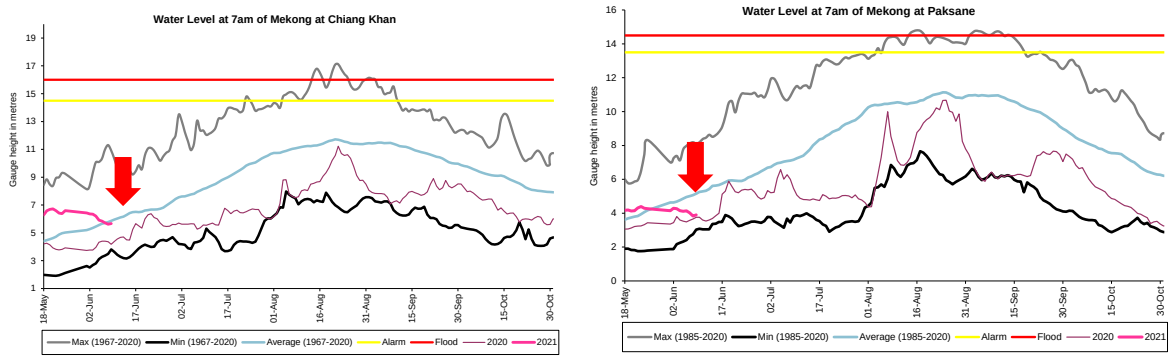


Figure 8. Water levels at Chiang Khan in Thailand and Paksane in Lao PDR.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR decreased by about 0.10 m and were about 0.50 m below their LTAs (see Figure 9).

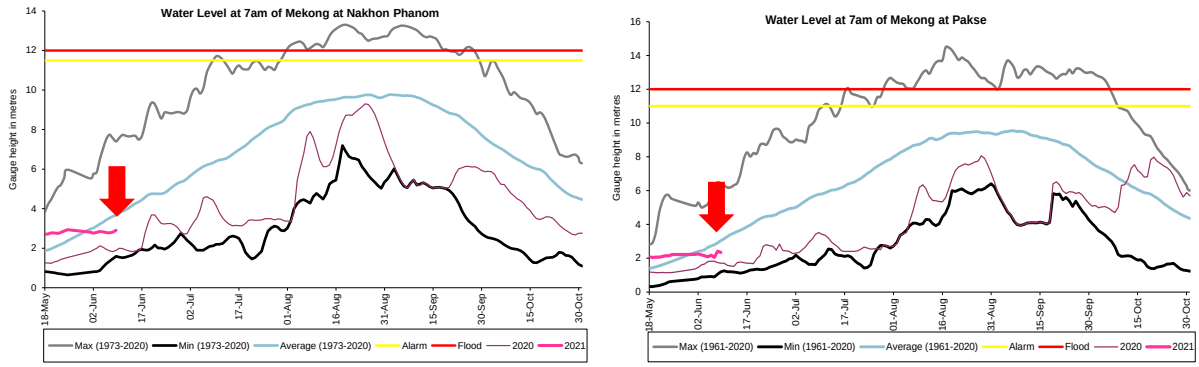


Figure 9. Weekly water levels at Nakhon Phanom in Thailand and Pakse in Lao PDR

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

Through a contribution of flows 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 slightly decreased. This week water levels were about 0.45 m below their LTA at these stations (see Figure 10 for the levels in Stung Treng and Kompong Cham). The water level at Kompong Cham decreased about 0.40 m and stayed 1.22 m below its LTA.

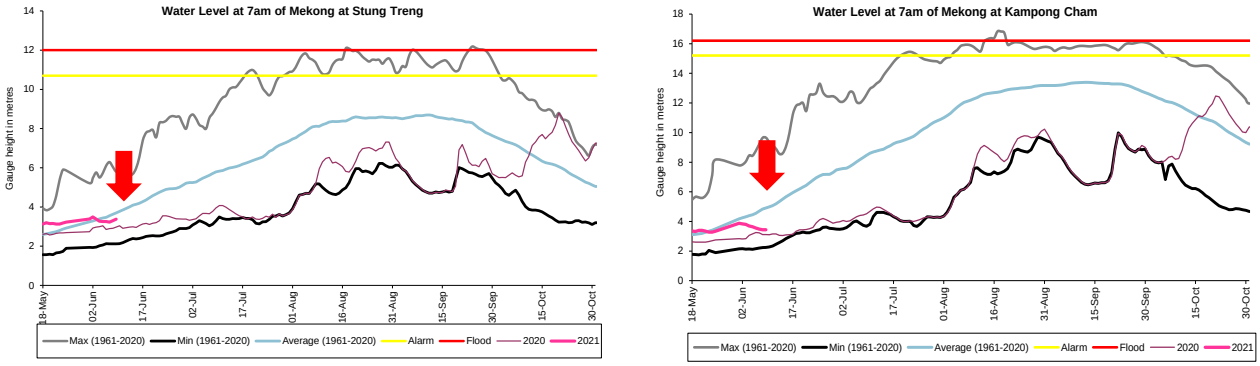


Figure 10. Water levels at Stung Treng and Kompong Cham on the Mekong River.

At Neak Luong on the Mekong River and Koh Khel on the Bassac River, the water levels were influenced by the tidal effect extending from the Mekong Delta, causing their levels to fluctuate by about 0.15 m from June 1 to 7 and remain below to their LTA. At Chaktomuk on the Bassac River, the water level decreased by about 0.50 m and stayed 1 m below its LTA. The water level at Prek Kdam on the Tonle Sap Lake increased about 0.52 m but was still about 1 m below its LTA. The water level at the Tonle Sap Lake (observed at Kompong Luong) was similar to Prek Kdam station's water level. The decreased water level was likely due to a low rainfall contribution from upstream of the Tonle Sap Lake area. The water level at the Tonle Sap Lake (observed at Kompong Luong) followed the same trend of Prek Kdam station's.

Tidal stations at Tan Chau and Chau Doc

Like last week, the water levels from 1 to 7 June 2021 at Viet Nam's Tan Chau and Chau Doc fluctuated due to daily tidal effects from the sea. The fluctuation levels were between -0.22 m and 0.82 m. This fluctuation levels have been out of the historical range between maximum and minimum levels for almost six months 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 11 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 8 June of this reporting period, it is observed that **the main inflow/reverse flow to the Tonle Sap Lake has not started yet**. The outflow condition in 2021 was lower than its average flow but was similar to the 2020 flow condition. Since the water level at Prek Kdam on the Tonle Sap River rapidly decreased and moved lower than its LTA value, it could be inferred that the flows at the Tonle Sap Lake also increased during this reporting period. However, the outflow of the Tonle Sap Lake is expected to slightly increase starting from next week due to some predicted rainfall from inflow catchments.

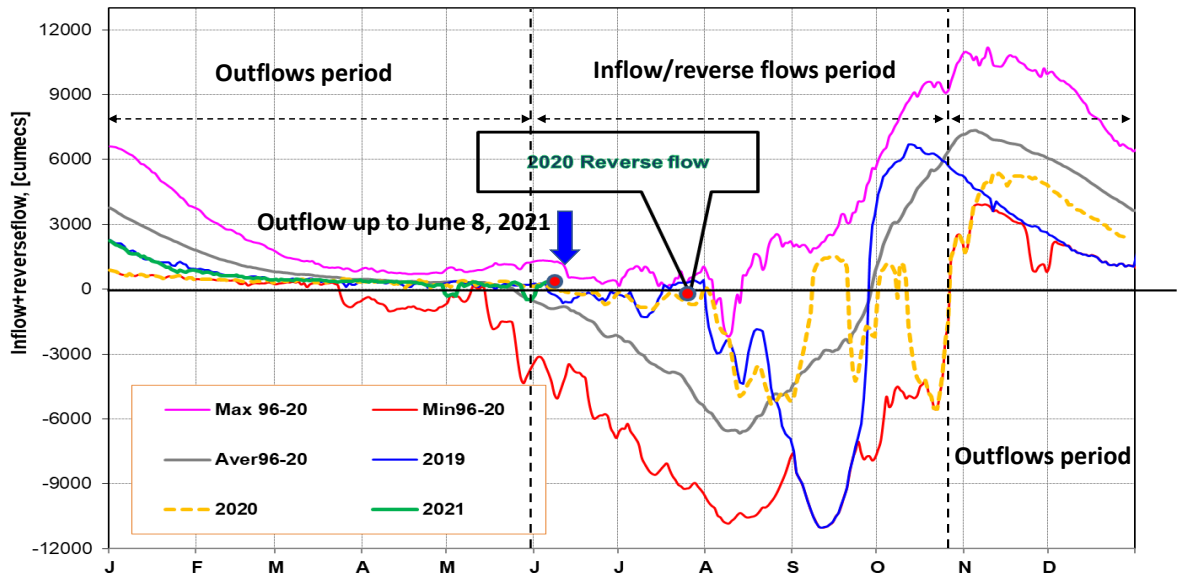


Figure 11. Seasonal change of inflows and outflows of Tonle Sap Lake.

The water volume of the Tonle Sap Lake up to this point has been considered low in comparison with its LTA level. Figure 12 shows seasonal changes in monthly flow volumes up to June 8 for the Lake compared with the volumes in 2018 and 2019, their LTA, and the fluctuation levels (1997–2019). It shows that up to June 8 **the water volumes of the Tonle Sap Lake remained stable and were higher than the level in 2020 and close to that of 2019 during**

the same period. This is displayed in Table 1, which indicates that the Tonle Sap Lake has been affected by water levels from the Mekong River, the tributaries, and rainfall in the surrounding sub-catchments.

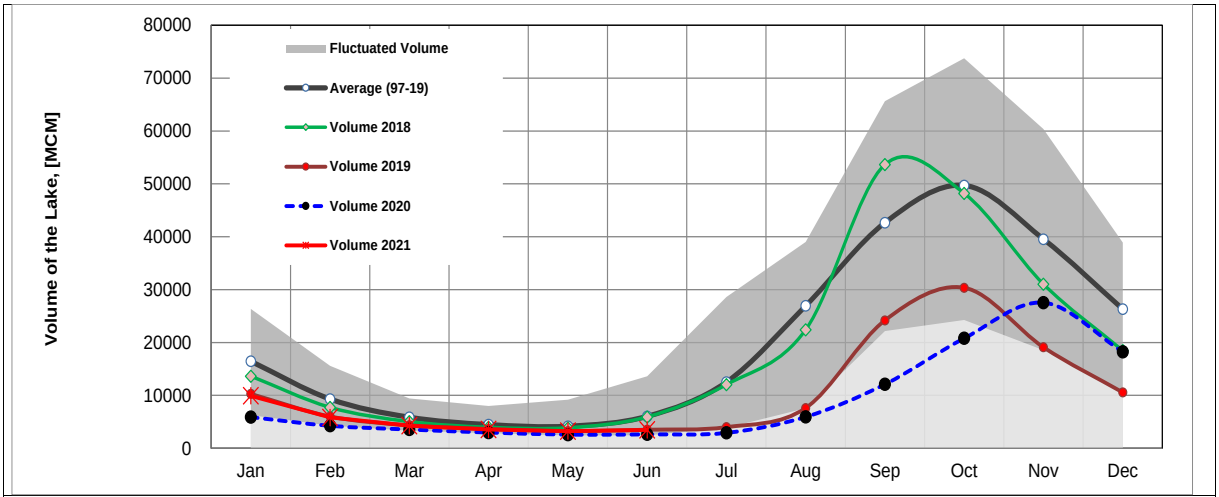


Figure 12. The seasonal change in monthly flow volume of Tonle Sap Lake.

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	3484.93
Jul	12502.58	28599.56	3832.51	12024.96	4001.99	2925.86	
Aug	26934.35	39015.12	7554.93	22399.65	7622.71	5941.07	
Sep	42644.05	65632.35	22180.73	53639.54	24194.19	12105.31	
Oct	49698.19	73757.23	24276.79	48193.08	30358.38	20799.13	
Nov	39542.58	60367.33	18576.01	31036.07	19112.65	27546.80	
Dec	26325.13	38888.95	10869.43	18469.21	10577.29	18251.65	
	Critical situation, 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)							

The decreased outflows from the Mekong River and tributaries of the Tonle Sap Lake from January to May 2021 dry season have resulted in a lower flow in early wet season 2021. This demonstrates the influence of the relationships between the reverse flows, water levels of the Mekong River, inflows from tributaries, and the flow direction in the complex hydraulic environment of the Tonle Sap Lake during the wet and dry seasons. The data show that about half of the annual inflow volume into the Tonle Sap Lake has originated from the Mekong mainstream. Thus, flow alterations in the mainstream could have direct impact on the Tonle Sap Lake water levels and on its hydrology.

4 Flash Flood in the Lower Mekong Basin

From June 1 to 7, the LMB was affected by two weather factors: (i) southwest monsoon which was strengthened during the weekend; and (ii) the low-pressure cell covering upper Viet Nam on the last day of the week. These conditions caused increasing amount and distribution of rainfall in upper and middle parts of the LMB during the second half of the week. However, hot weather persisted in most areas of the LMB.

According to the MRC-Flash Flood Guidance System (MRC- FFGS) and analysis, flash flood events were detected during the reporting period in some areas in the northwest of Viet Nam with the impacts ranging from low to high level as shown in Figure 13 and Table 2.

Table 2. Detected flash flood in Viet Nam on June 7

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 07/06/2021 00:00 UTC time

01-Hour Flash Flood Risk and Location				3-Hour Flash Flood Risk and Location in Vietnam				6-Hour Flash Flood Risk and Location in Vietnam			
Provinces	Districts	Region	Level Risks	Provinces	Districts	Region	Level Risks	Provinces	Districts	Region	Level Risks
Lai Chau	Sin Ho	Northwest	Moderate-Risk	Lai Chau	Sin Ho	Northwest	Low-Risk	Lai Chau	Sin Ho	Northwest	Moderate-Risk
Lai Chau	Muong Lay	Northwest	Moderate-Risk	Lai Chau	Muong Lay	Northwest	Low-Risk	Lai Chau	Muong Lay	Northwest	Moderate-Risk
Lai Chau	Muong Te	Northwest	High-Risk	Lai Chau	Muong Te	Northwest	Moderate-Risk	Lai Chau	Muong Te	Northwest	Moderate-Risk
Lai Chau	TX. Lai Chau	Northwest	Moderate-Risk	Lai Chau	TX. Lai Chau	Northwest	Low-Risk	Lai Chau	TX. Lai Chau	Northwest	Moderate-Risk

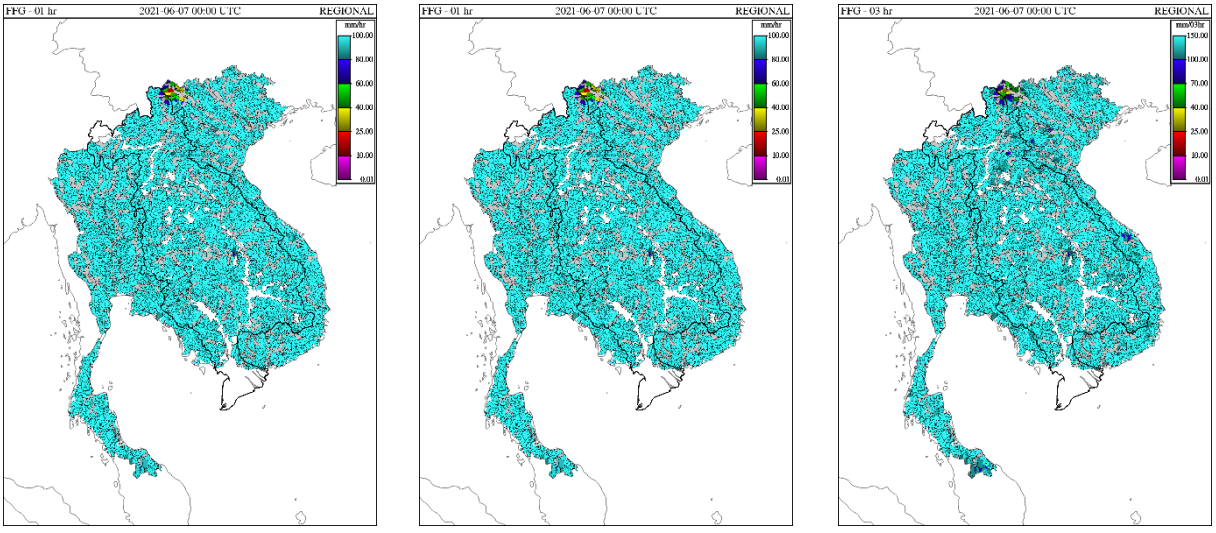


Figure 13. Flash Flood Guidance for the next 1 hour, 3 hours and 6 hours on June 7

5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 29 May to 04 June 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 drought conditions from 29 May to 4 June 2021, as shown in Figure 14, were normal in most parts of the LMB but dry in some areas of the middle part of the region covering mainly Thailand. The situation was very much like that of last week (May 22 to 28). Those dry areas cover parts of Thailand's Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nakhon Phanom, Mukdahan, Kalasin, Amnat Charoen, Yasothon, Roi Et, Maha Sarakham, Khon Kaen, Chaiyaphum, Nakhon Ratchasima, Burirum, Surin, and Si Saket. They were classified as moderate and severe meteorological droughts.

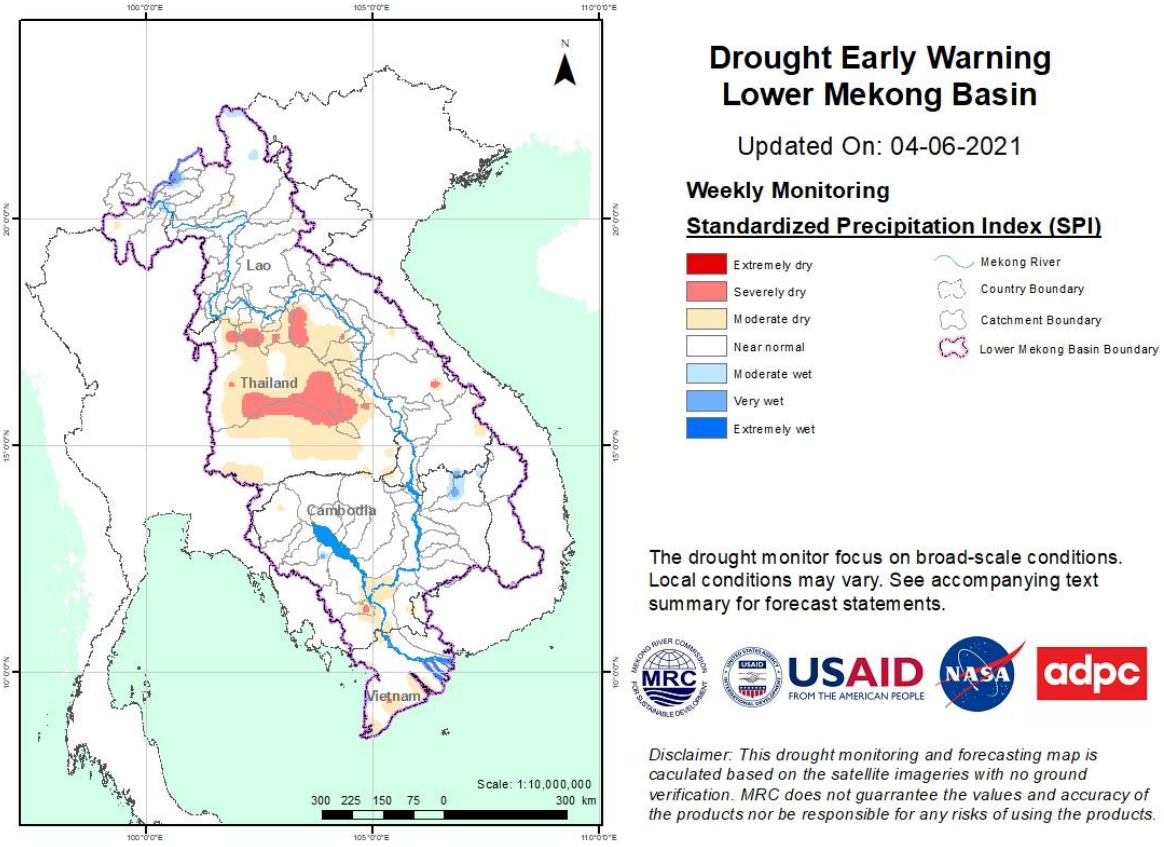


Figure 14. Weekly standardized precipitation index from 29 May to 04 June 2021.

- **Weekly Soil Moisture Anomaly (SMA)**

Unlike last week, soil moisture conditions from 29 May to 4 June 2021, as shown in Figure 15 shows that the upper part of the LMB was wet and normal while most areas in the central and lower parts of the region were moderately and some severely dry. Those dry conditions cover most areas of central part of the LMB spreading over Thailand and Lao PDR, and the lower part of the LMB over Cambodia and the Central Highlands of Viet Nam. Nevertheless, the situation was not considered significant as they were mainly at moderate level with small extent scattering all over the area.

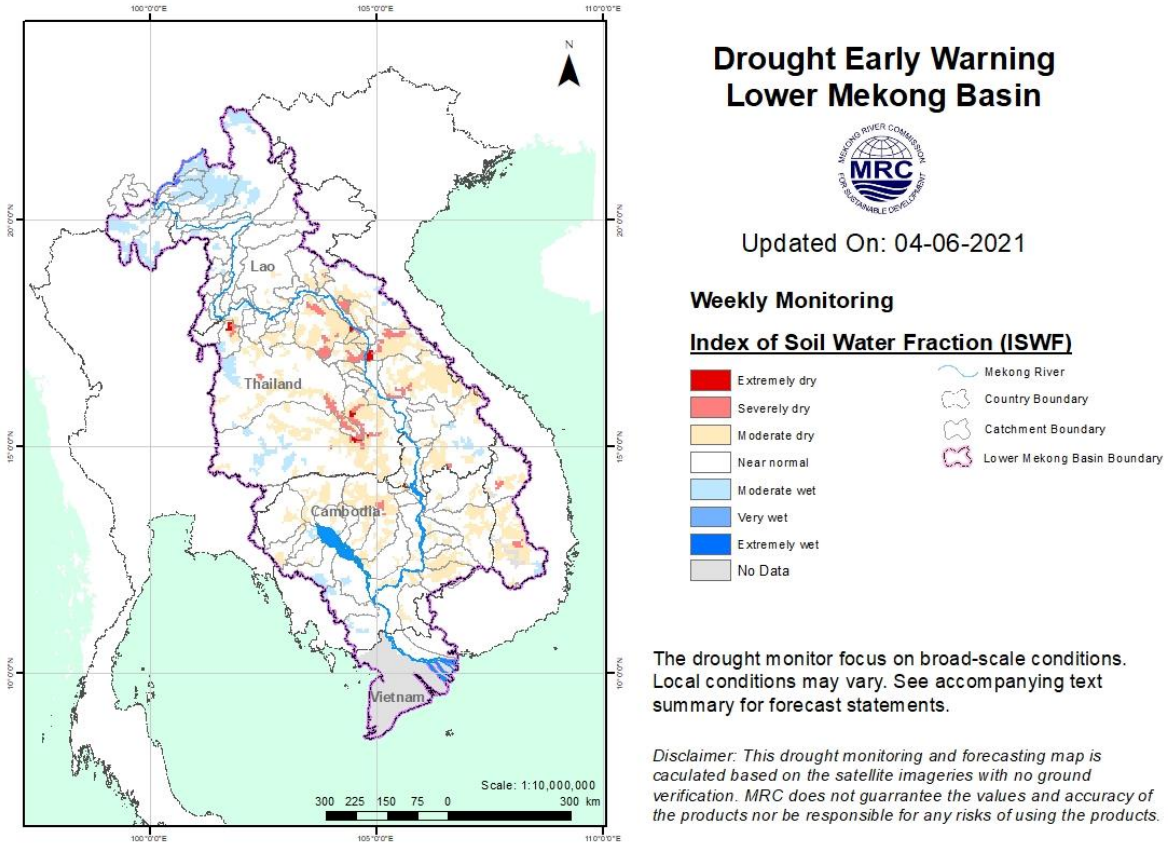


Figure 15. Weekly Soil Moisture Anomaly from 29 May to 04 June 2021.

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

The overall drought conditions through the combined drought index from 29 May to 4 June 2021, as displayed in Figure 16, indicates normal conditions in most parts of the LMB except some areas in the central part of the LMB where moderate and some severe droughts took place. Those areas cover parts of Thailand's Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nakhon Phanom, Kalasin, Amnat Charoen, Yasothon, Roi Et, Maha Sarakham, and Si Saket. Rainfall deficit was observed to be the main cause of such phenomenon in those drought areas.

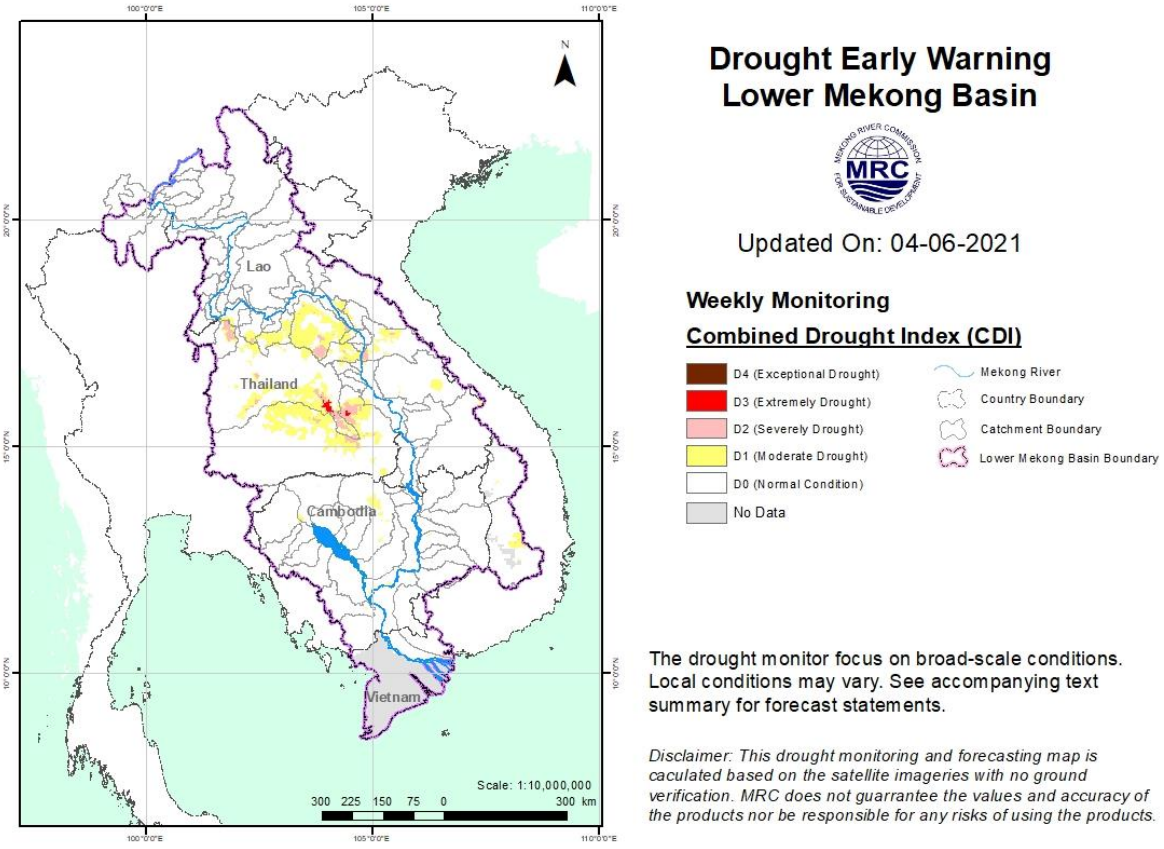


Figure 16. Weekly Combined Drought Index from 29 May to 4 June 2021.

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.

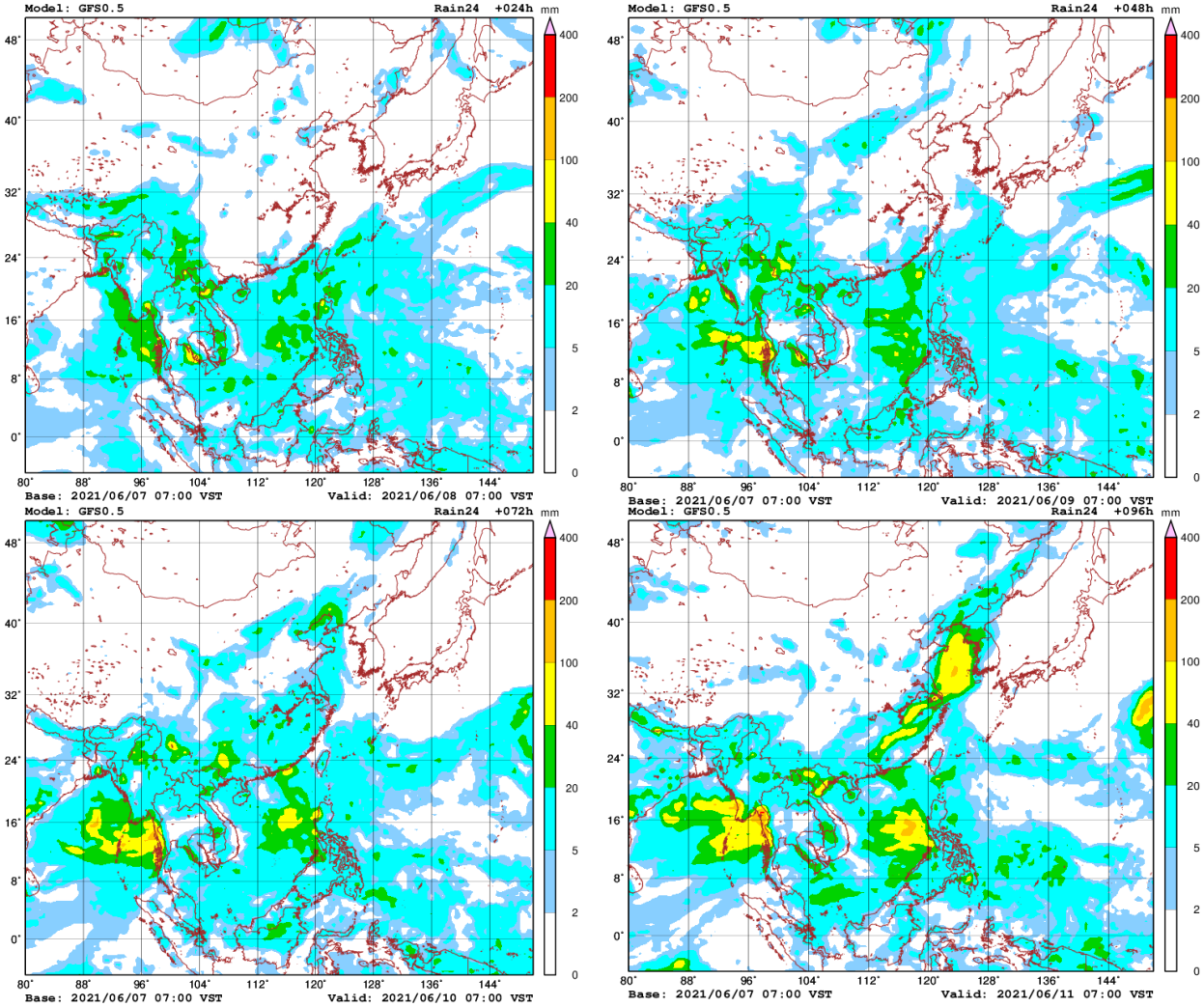
6 Weather and Water Level Forecast and Flash Flood Information

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 will continue prevailing over the LMB.

From June 8 to 13, small rainfall (5–10 mm/24 h) and moderate rainfall (20 - 40 mm/24 h) will likely occur in some parts of the LMB. However, on 14 June heavy rainfall (50 -100 mm/24h) will likely occur in some areas of the middle part of the LMB.

Figure 17 shows accumulated rainfall forecast (24 h) of the GFS model from 8 to 14 June 2021.



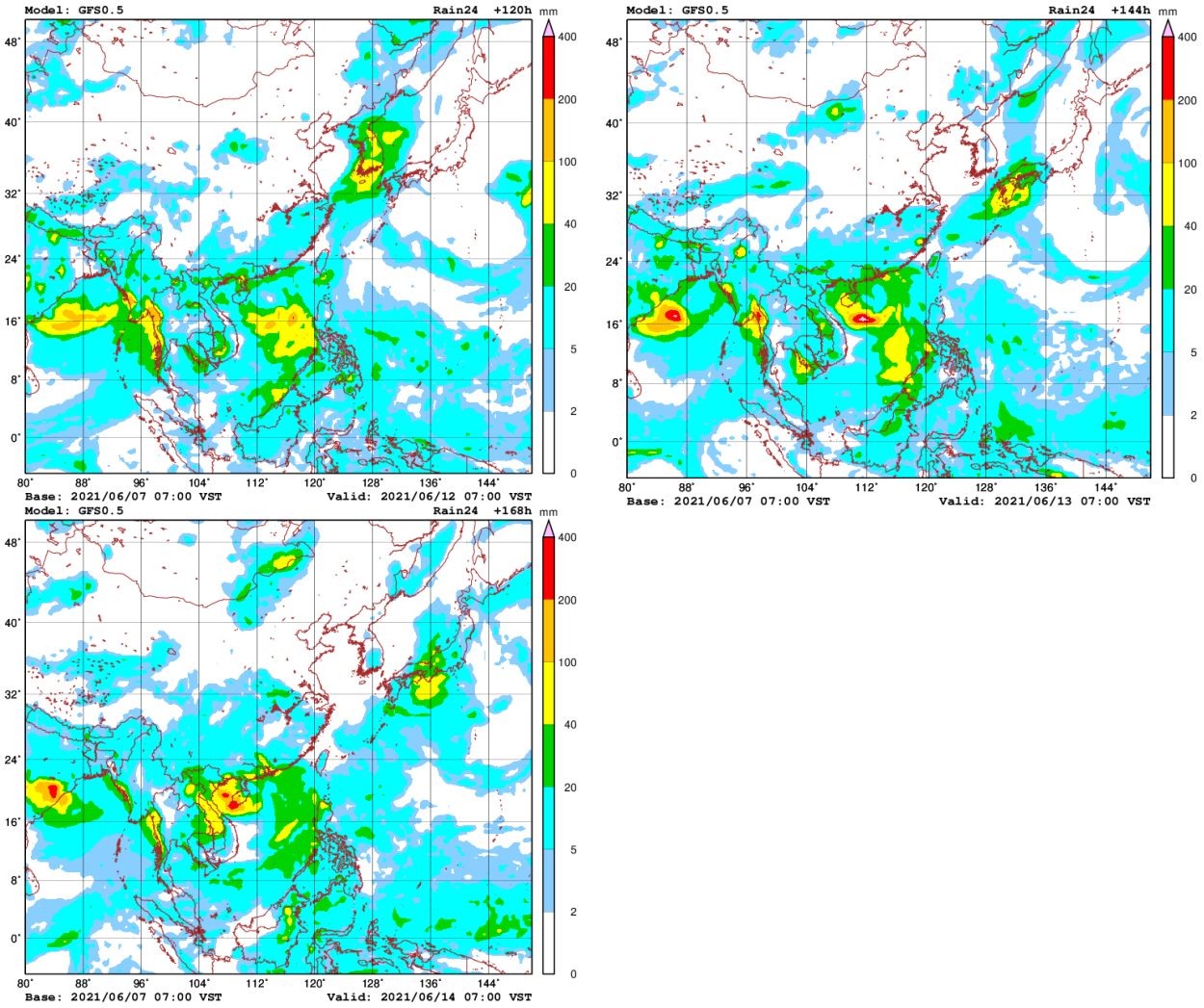


Figure 17. Accumulated rainfall forecast (24 h) based on a GFS model.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on June's daily flood forecasting bulletin, the daily forecasted water level at Chiang Saen in Thailand is expected to increase from 2.83 m to 3 m in the next five days. The trend will keep the water level at this station above its LTA.

For Luang Prabang in Lao PDR, the water level will increase from 8.90 m to 9.14 m during next five days. The current water level is slightly close to its maximum value. Precipitation is forecasted for the areas 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 by about 0.19 m, and about 0.02 m at Vientiane in Lao PDR. From Nong Khai in Thailand to Paksane in Lao PDR, the water levels will slightly increase by about 0.06 m over the next five days. Rainfall is forecasted for the areas between Chiang Khan and Paksane next week.

The water levels are expected to remain higher than their LTA at Chiang Khan, Vientiane and Nong Khai, except at Paksane where the level will likely remain lower than its LTA.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Savannakhet in Lao PDR may decrease by about 0.15 m in the next seven days. But from Khong Chiam in Thailand to Pakse in Lao PDR, the stations will likely see an increase by about 0.16 m. The water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR will stay lower than their LTA while some rainfall is forecasted for these areas next week.

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

From Stung Treng to Kampong Cham along the Mekong River in Cambodia, the water levels will decrease by about 0.17 m in the next seven days. Precipitation is forecasted for the area between Stung Treng and Kratie 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 seven days.

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

Tidal stations at Tan Chau and Chau Doc

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

The performance of the weekly flood forecast, with an accuracy and data input evaluation from 1–7 June 2021, is presented in Annex 1

Table 2 shows the daily flood forecasting Bulletin issued on June 7. Results of the weekly river monitoring bulletin are also available at http://ffw.mrcmekong.org/bulletin_wet.php.

6.3 Flash Flood Information

With some potential rainfall forecasted for next week, flash flood events are likely to happen from the middle to the lower parts of the LMB. Moreover, local heavy rain in a short period of time is also possible with unexpected short flash floods. The information on flash flood guidance for the next one, three, and six hours is updated twice daily at: http://ffw.mrcmekong.org/ffg.php.

Detailed information on Flash Flood Warning Information as well as on its explanation is available for download here.

6.4 Drought forecast

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

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

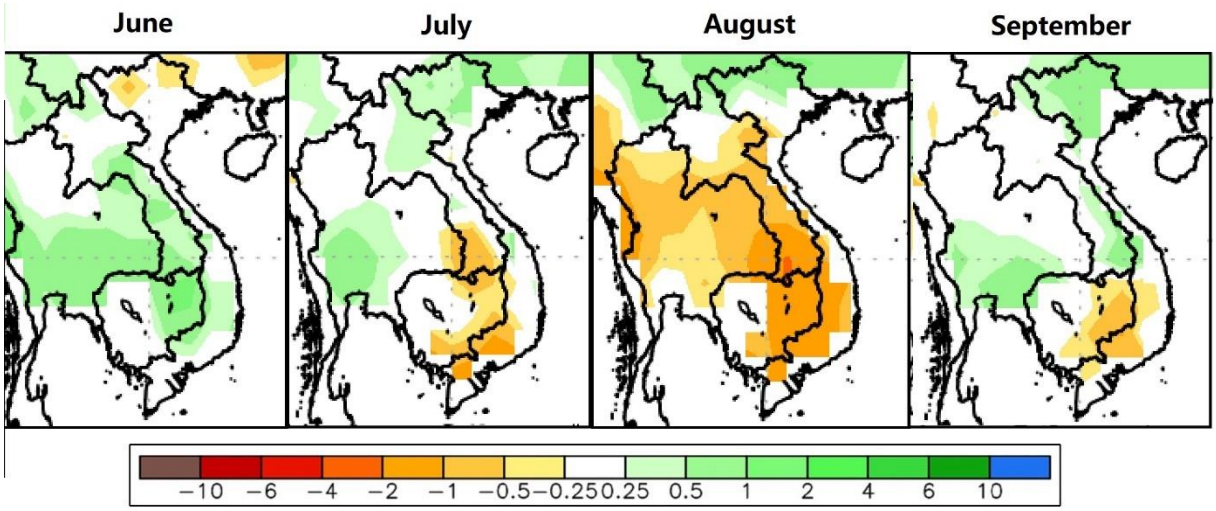


Figure 18. Daily average of monthly rainfall anomaly forecast from April to July 2021.

The ensemble prediction model forecasts that in June the entire LMB is likely to receive from average to above-average rainfall; the central part of the LMB and the eastern part of Cambodia are forecasted to be the wettest areas. Moving into July, it is forecasted that Cambodia, the Central Highlands of Viet Nam, and southern Lao PDR will be the driest areas in the region. In August, the entire LMB region is most likely to experience some meteorological drought, a situation when there is a prolonged period with less than average rainfall. Lastly, the lower part of the LMB covering eastern Cambodia and Viet Nam is anticipated to receive below average rainfall in September.

It seems that the 2021 dry season is relatively wetter than that of 2020 and that the monsoon rain may come earlier in the 2021 wet season than it did in 2019 and 2020.

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: 08 June - 12 June 2021

Date: 07 June 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					
		06-Jun				06-Jun	07-Jun	08-Jun	09-Jun	10-Jun	11-Jun	12-Jun	07	08	09	10	11	12
Jinghong		0.0				536.90	536.99							×	×	×	×	×
Chiang Saen		0.0	357.110	12.80	11.50	2.97	2.83	3.00	3.05	3.11			↓	↑			★	★
Luang Prabang		0.0	267.195	18.00	17.50	8.80	8.90	8.96	8.82	9.00	9.07	9.14			↓	↑		
Chiang Khan		0.5	194.118	16.00	14.50	5.84	5.72	5.80	5.85	5.75			↓				★	★
Vientiane		2.5	158.040	12.50	11.50	3.38	3.25	3.11	3.18	3.23	3.15	3.26	↓	↓				↑
Nongkhai		2.4	153.648	12.20	11.40	3.03	2.83	2.65	2.72	2.78			↓	↓			★	★
Paksane		0.0	142.125	14.50	13.50	4.14	4.02	3.89	3.80	3.85	3.90	3.85	↓	↓				
Nakhon Phanom		14.1	130.961	12.00	11.50	2.79	2.78	2.73	2.67	2.63							★	★
Thakhek		13.3	129.629	14.00	13.00	4.03	4.03	3.98	3.91	3.86	3.90	3.94						
Mukdahan		4.3	124.219	12.50	12.00	2.98	2.97	2.96	2.94	2.91							★	★
Savannakhet		3.6	125.410	13.00	12.00	1.42	1.40	1.40	1.39	1.38	1.37	1.39						
Khong Chiam		0.0	89.030	14.50	13.50	3.30	3.41	3.37	3.32	3.26			↑				★	★
Pakse		0.0	86.490	12.00	11.00	2.18	2.04	2.01	1.97	1.93	1.90	1.86	↓					
Stung Treng		nr	36.790	12.00	10.70	3.26	3.23	3.15	3.13	3.10	3.08	3.06		↓				
Kratie		nr	-0.101	23.00	22.00	8.52	8.48	8.44	8.35	8.32	8.30	8.27	↓	↓	↓	↓		↓
Kompong Cham		3.7	-0.930	16.20	15.20	3.56	3.48	3.42	3.38	3.28	3.24	3.21	↓	↓	↓	↓	↓	↓
Phnom Penh (Bassac)		10.0	-1.020	12.00	10.50	1.85	1.83	1.80	1.78	1.74	1.72	1.71		↓		↓		
Phnom Penh Port		-	0.070	11.00	9.50	0.87	0.86	0.84	0.82	0.78	0.75	0.73				↓	↓	
Koh Khel (Bassac)		nr	-1.000	8.40	7.90	1.86	1.87	1.89	1.95	2.01	2.12	2.15			↑	↑	↑	↑
Neak Luong		14.2	-0.330	8.00	7.50	1.40	1.34	1.31	1.33	1.40	1.48	1.52	↓	↓		↑	↑	↑
Prek Kdam		7.3	0.080	10.00	9.50	1.04	0.95	0.91	0.88	0.85	0.82	0.80	↓	↓	↓	↓	↓	
Tan Chau		11.0	0.000	4.50	3.50	0.49	0.78	0.89	1.02	0.97	0.83	0.70	↑	↑	↑	↓	↓	↓
Chau Doc		0.4	0.000	4.00	3.00	0.60	0.87	1.00	1.14	1.06	0.91	0.76	↑	↑	↑	↓	↓	↓

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	×
as suggested by Thailand, forecasted values are not displayed pending further improvement of the system	★

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

River Flood Forecaster

KHEM Sothea

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

7 Summary and Possible Implications

7.1 Rainfall and its forecast

During this reporting week, rainfall took place from Nong Khai in Thailand to Pakse in Lao PDR, including the lower part of the LMB at Chaktomuk in Cambodia and Tan Chau and Chau Doc in Viet Nam, varying from 3.70 mm to 114.00 mm.

Based on the forecasted satellite data, rainfall is forecasted for some areas of the LMB, with value ranging from 50 mm to 180 mm for the next seven days. The forecasting model using GFS data, on the other hand, shows that no significant rainfall (>70 mm) is likely to take place in the Mekong region from 8 to 13 June 2021.

7.2 Water level and its forecast

According to MRC's observed water level data, the outflows at Jinghong hydrological station increased slightly over the monitoring period, moving from 536.83 m on June 1 to 536. 99 m on June 7.

From mid- to the end of May, the station's outflows experienced rapid fluctuations with a dropping trend. The outflows decreased from 3,285 m^3/s on May 14 to 2,098 m^3/s on May 30. Its daily average water level dropped by 1.33 m.

The water level at Chiang Saen in Thailand dropped by about 0.48 m during the same period. In spite of this, the station's recorded water level was still higher than its LTA.

Due to the rapid fluctuation of water levels at Jinghong from mid to the end of May, the water levels across most monitoring stations from Nong Khai in Thailand to Pakse in Lao PDR, and from the stretches of the river between Stung Treng, Kratie and Kompong Cham in Cambodia were lower than their LTA from 1 to 7 June 2021.

Over the next few days, the water levels from Chiang Khan to Vientiane are expected to increase by about 0.10 m, and by about 0.35 m from Nakhon Phanom to Pakse. Nonetheless, this situation will continue to put most stations' water levels closer to their LTA.

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

From Stung Treng to Kampong Cham, the water levels will increase but remain lower than their LTA. The water levels – at Neak Luong on the Mekong River, from Prek Kdam to Phnom Penh Port on the Tonle Sap, and from Chaktomuk to Koh Khel on the Bassac – are forecasted to remain close to 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 beginning of March 2021, water levels across most monitoring stations in the LMB increased above their LTA (from upper to lower stretches within the LMB), but started to contract in late May. Like many parts of the world, the Mekong region was affected by the prolonged El Nino event, the phenomenon that usually causes extreme heat and insufficient rainfall. This climate change impact has been observed since 2019 and 2020. For a more complete preliminary analysis of the hydrological conditions in the LMB over January–July 2020, see this Situation Report, and for July–December 2020, 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 moderate and heavy amounts of rainfall for the coming week as mentioned earlier in section 6.1, major flash floods are likely to happen in some areas from the middle to the lower parts of the LMB during next week.

7.4 Drought condition and its forecast

From 29 May to 4 June 2021, most parts of the LMB were at normal condition except some areas in the central part of the LMB where moderate and some severe droughts took place. Those areas cover some parts of Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nakhon Phanom, Kalasin, Amnat Charoen, Yasothon, Roi Et, Maha Sarakham, and Si Saket of Thailand. It was observed that rainfall deficit was the main cause of such phenomenon in those drought areas.

The ensemble prediction model forecasts that in June the entire LMB is likely to receive from average to above-average rainfall; the central part of the LMB and the eastern part of Cambodia are forecasted to be the wettest areas. Moving into July, it is forecasted that Cambodia, the Central Highland of Viet Nam, and southern Lao PDR will be the driest area in the region. In August, the entire LMB region is forecasted to experience some meteorological drought, a situation when there is a prolonged period with less than average rainfall. Lastly, the lower part of the LMB covering eastern Cambodia and Viet Nam is likely to receive below average rainfall in September.

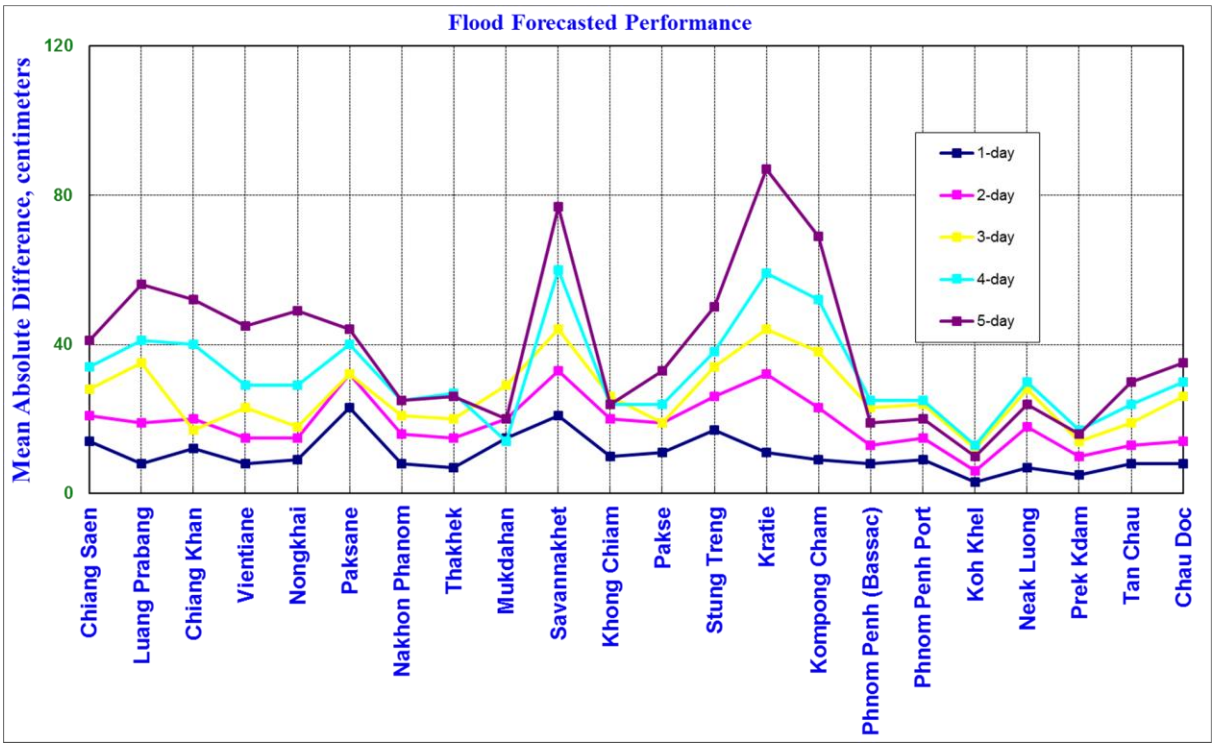
Annex 1: Performance of the weekly flood forecasting

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 1 to 7 June 2021.

The forecasting values from 8 to 13 June 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 Savannakhet to Kratie due to the effect of heavy rain in this area during the report period.



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

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

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

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

Performance based on data from the Member Countries

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

The evaluation of performance indicators, missing data and completion time for flood forecasting are presented in Table B3 and Figures B4, B5 and B6, respectively from 1–7 June 2021.

Table B1: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 1 to 7 June 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	4	9	16	5	8	7	5	5	4	4	23	23	12	13	12	6	6	10	6	7	4	3
2-day	7	14	22	21	18	16	13	11	15	9	45	48	44	32	28	13	11	17	16	13	14	13
3-day	15	22	26	28	25	21	24	23	29	13	68	65	82	93	59	22	20	24	28	25	21	21
4-day	16	28	24	32	28	34	39	38	48	18	100	92	130	166	122	43	41	40	44	37	24	28
5-day	16	23	26	32	28	29	47	46	65	24	145	138	187	249	205	76	70	53	75	62	36	46

Table B2: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 1 to 7 June 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	42.9	28.6	71.4	71.4	85.7	100.0	57.1	71.4	100.0	85.7	100.0	85.7	85.7	85.7	85.7	57.1	57.1	85.7	71.4	85.7	42.9	28.6	***72.1***
2-day	50.0	33.3	83.3	100.0	83.3	83.3	100.0	83.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	50.0	50.0	66.7	66.7	83.3	33.3	33.3	***77.3***
3-day	40.0	40.0	60.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	60.0	60.0	80.0	100.0	100.0	40.0	40.0	***82.7***
4-day	0.0	50.0	0.0	100.0	75.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	75.0	100.0	100.0	50.0	50.0	***81.8***
5-day	33.3	66.7	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	66.7	100.0	100.0	66.7	100.0	***87.9***

Table B3: Overview of performance indicators for the past 7 days from 1 to 7 June 2021

	FF time sent				Arrival time of input data							
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
week	*10:32*	*#DIV/0!*	-	-	*08:15*	*07:10*	*08:06*	*08:00*	*09:00*	*08:22*	*07:33*	*08:26*
month	*10:32*	*#DIV/0!*	-	-	*08:15*	*07:10*	*08:06*	*08:00*	*09:00*	*08:22*	*07:33*	*08:28*

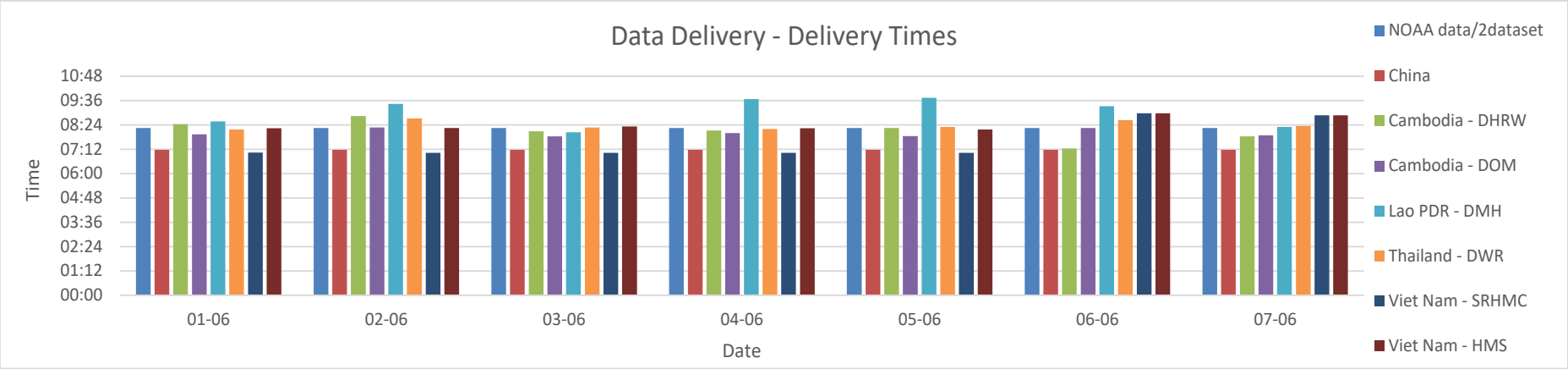


Fig. B4: Data delivery times for the past 7 days from 1 to 7 June 2021

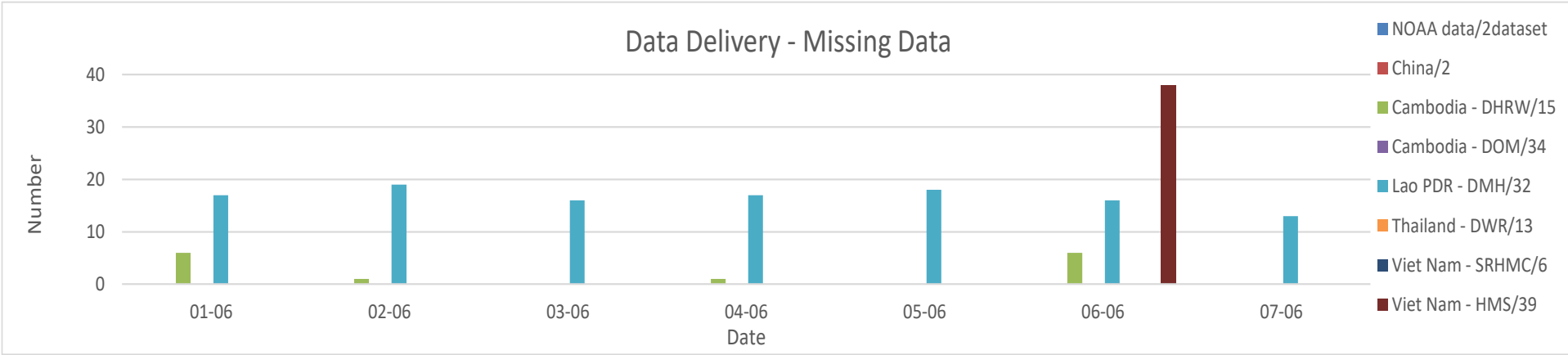


Fig. B5: Missing data for the past 7 days from 1 to 7 June 2021

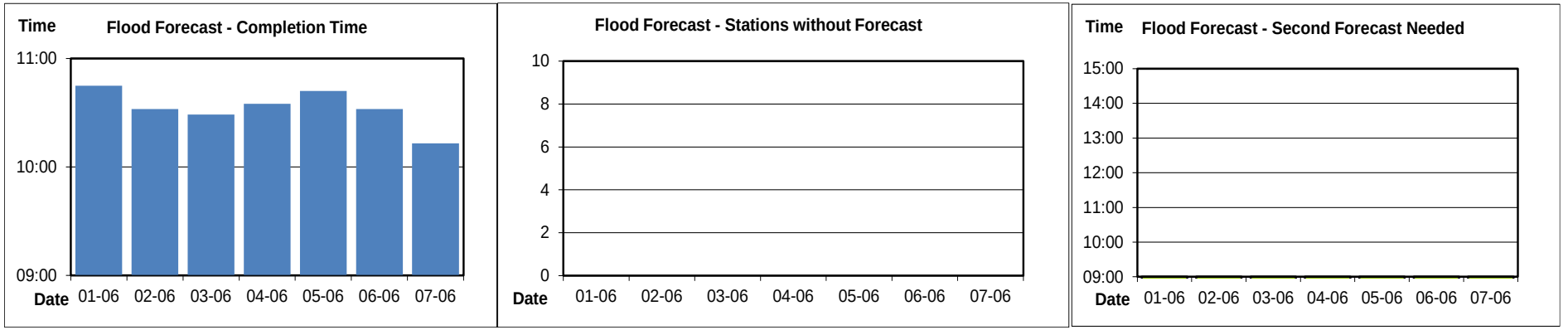


Fig. B6: Flood forecast completion time, stations without forecasts, and second forecasts need from 1 to 7 June 2021

Mekong River Commission Secretariat

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