Mekong River Commission

Weekly Wet Season Situation Report in the Lower Mekong River Basin

26 July-01 August 2022

Prepared by
The Regional Flood and Drought Management Centre
02 August 2022

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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 Tan Chau and Chau Doc in Viet Nam, including the middle and lower parts in Lao PDR and Cambodia, varying from 3.40 millimetres (mm) to 137.80 mm.

- There will be above-average rainfalls for the next 5 days over the Mekong region from 02 to 06 August 2022 because there will be a low pressure dominating the Mekong region.

Water level and its forecast

- According to MRC's observed water level at Jinghong, it showed a significantly increased water level of about 0.99 m from 536.25 m to 537.24 m between 26 July and 01 August 2022, staying about 1.21 m higher than its Long-Term-Average (LTA: 2015-2021) value. The outflow at Jinghong station increased from 1,490.00 m3/s to 2,300.00 m3/s from 26 July to 01 August 2022.

- Along with the increasing outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand also increased about 0.56 m from 26 July to 01 August 2022, staying about 1.61 m lower than its LTA level**,** which is **considered critical**.

- However, water level at Chiang Khan in Thailand from 26 July to 01 August 2022 decreased about 0.91 m and stayed about 2.64 m lower than its LTA value, while water level at Vientiane decreased about 1.45 m and stayed about 2.27 m lower than its LTA level, which **considered critical**. Water levels at Nong Khai decreased 1.60 m and at Paksane decreased about 1.54 m, staying about 3.17 m and 3.77 m lower than their LTA value, respectively, **considered critical**.

- Water levels from Nakhon Phanom in Thailand and Pakse in Lao PDR decreased between 0.48 m and 1.10 m. The current WLs at these stations are staying about 1.00 m and 3.50 m lower than their LTA level, **considering critical**. From the stretches of the river at Stung Treng water level decreased 0.19 m and stayed about 1.77 m lower than its LTA, while at Kratie water level decreased 0.76 m, staying 2.87 m lower than its LTA level, which **considered normal**.

- Water levels from Kompong Cham down to Chaktomuk, Koh Khel and Phnom Penh Port to Prek Kdam in Cambodia decreased about 0.20 m, staying between 1.00 m and 2.80 m lower than their LTA level, **considering critical.**

- The current water levels for most of the stations are lower than their LTA value. WLs at the 2 tidal stations at Tan Chau and Chau Doc were above their LTA value due to tidal effect during this monitoring period.

- Over the next five days, the water levels across most monitoring stations are expected to go up but still staying lower than their long-term average value.

Drought condition and its forecast

- During July 24-30, the LMB was hit by **moderate and severe droughts** mainly in **Khammuane and Savannakhet of Lao PDR and Nong Khai, Sakon Nakhon, and Nakhon Phanom of Thailand**. However, it was just a short-term drought which does not have serious effect yet on agriculture.

- In **July**, droughts are likely to take place in the **northern part, 3S area, and Mekong Delta of Viet Nam** with **moderate, severe, and extreme conditions**; in **August** droughts are intensifying over the **3S area of Cambodia, Lao PDR, and Viet Nam** with **severe and extreme conditions;** while in **September** droughts are moving westwards from the locations in August with smaller extent and severity.

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 **26 July-01 August 2022**. 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 (July, August and September) and the weather maps issued by the Thai Meteorological Department (TMD) were used to verify weather conditions in the LMB.

At the end of July 2022, below-average rainfall has dropped over the LMB with decreasing water levels in both mainstream and tributaries. The data from the TMD predict that heavy rainfall will happen again in the 3rd week of July because of the coming back low-pressure trough moving downward in the LMB. However, at the 4th week, rainfall was considered lower than in the 3rd week. From July to September, the low-pressure trough is going to prevail over the Mekong region bringing rainfalls during the rainy season period in 2022.

Figure 1 presents the weather map of 01 August 2022, showing low-pressure dominating the upper part of the Mekong region, which might bring some rains for the next few days. The average rainfall is also predicted over the upper and lower parts of LMB, including northern Thailand, Lao PDR and Viet Nam and the 3S area (Sesan, Sre Pok, and Sekong) of Cambodia and Viet Nam.

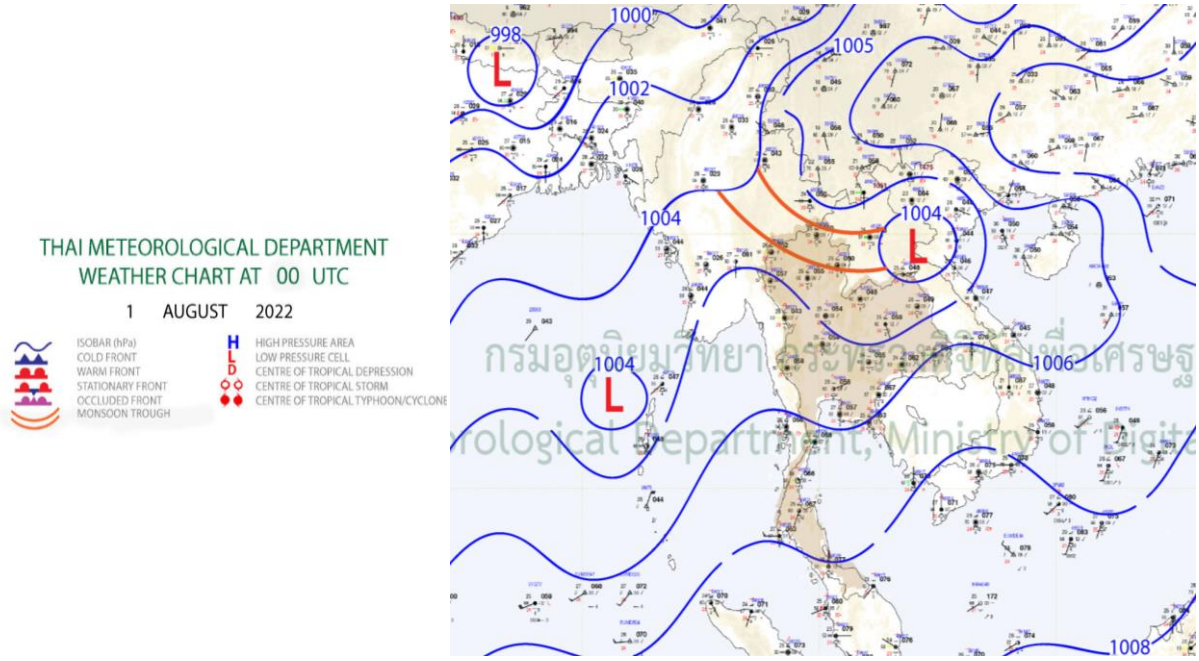


Figure 1. Summary of weather conditions over the LMB.

According to the ASEAN Specialised Meteorological Centre (ASMC), the highest probability of warm and dry conditions is predicted over the lower part of the Mekong region from 25 July to 7 August 2022. Therefore, the Mekong region is likely dominated by warm and dry conditions, which may bring less rainfall and warm temperatures in general to the upper and lower parts of the LMB. **Figure 2** shows the outlook of weather condition from 25 July to 7 August 2022 in Southeast Asia based on results from the NCEP model (National Centres for Environmental Prediction).

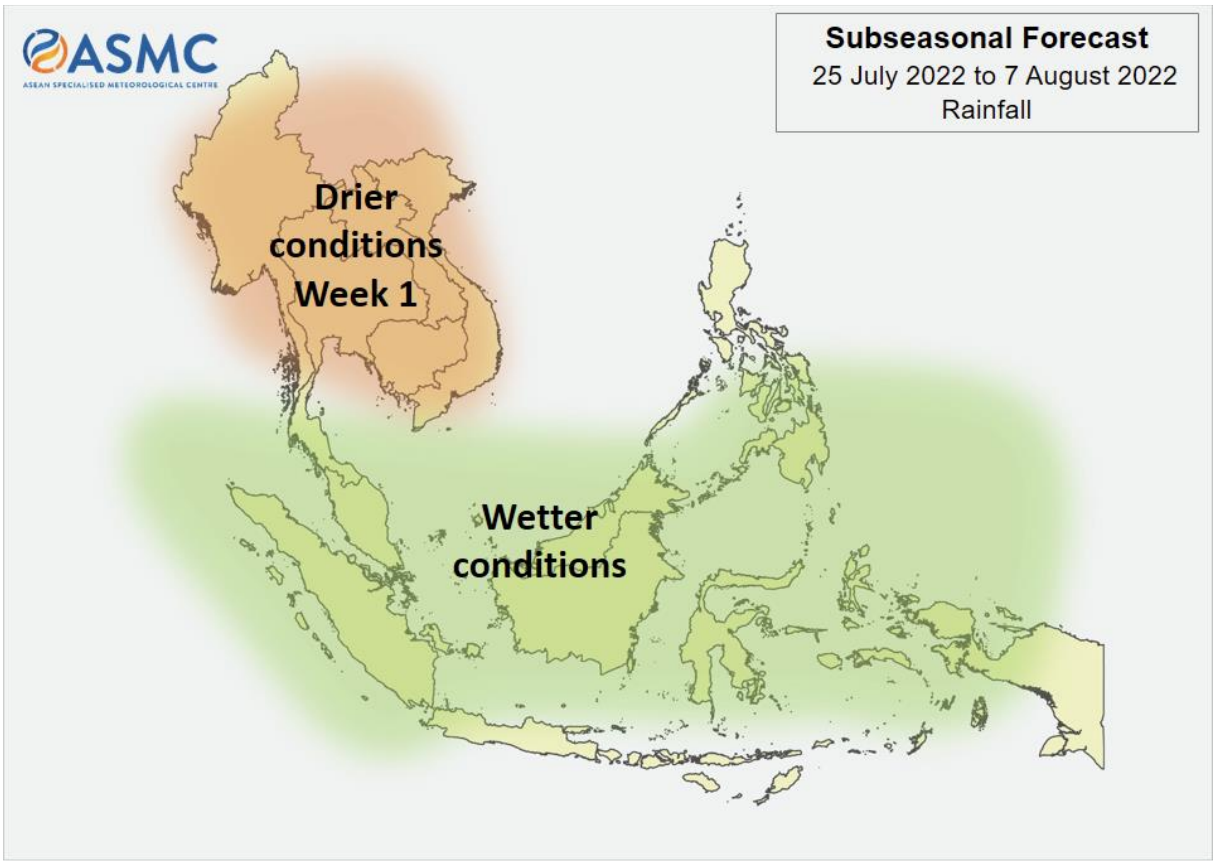


Figure 2. Outlook of wet and dry conditions over the Asian countries by ASMC.

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

There is no sign of Tropical Storm moving from the Sea to the LMB between 26 July and 01 August 2022, a low-pressure line is still presenting as shown in Figure 1. No storms movement detected on August 1 in the LMB, as displayed in Figure 3.

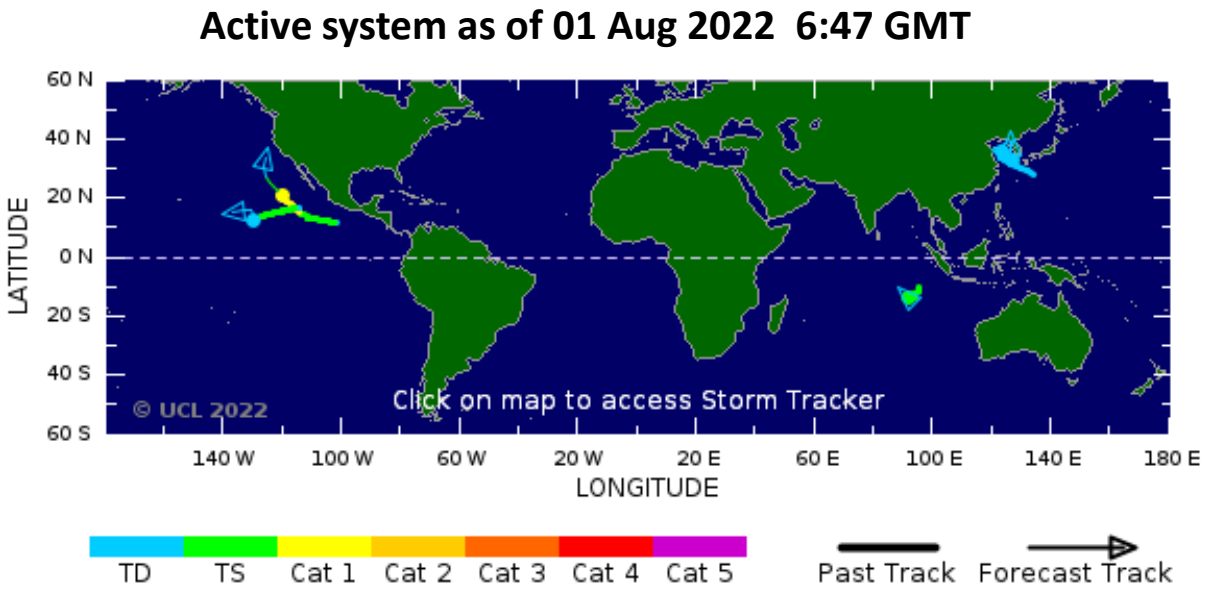


Figure 3. A tropical depression risk observed on 01 Augst 2022.

2.2 Rainfall patterns over the LMB

This week from 26 July to 01 August 2022, rainfall was observed from the upper to lower part starting from Chiang Saen in Thailand to Tan Chau and Chau Doc in Viet Nam of the Lower Mekong Basin, varied from 3.40 mm to 137.80 mm. The highest rainfall of this week report concentrated in Paksane area of Lao PDR, which reached up to 137.80 mm. The total rainfall of this week report in the Mekong region, compared with last week and its long-term-average (LTA) is showed in Figure 4. The total rainfall of this week was lower, compared with last week rainfall and its LTA.

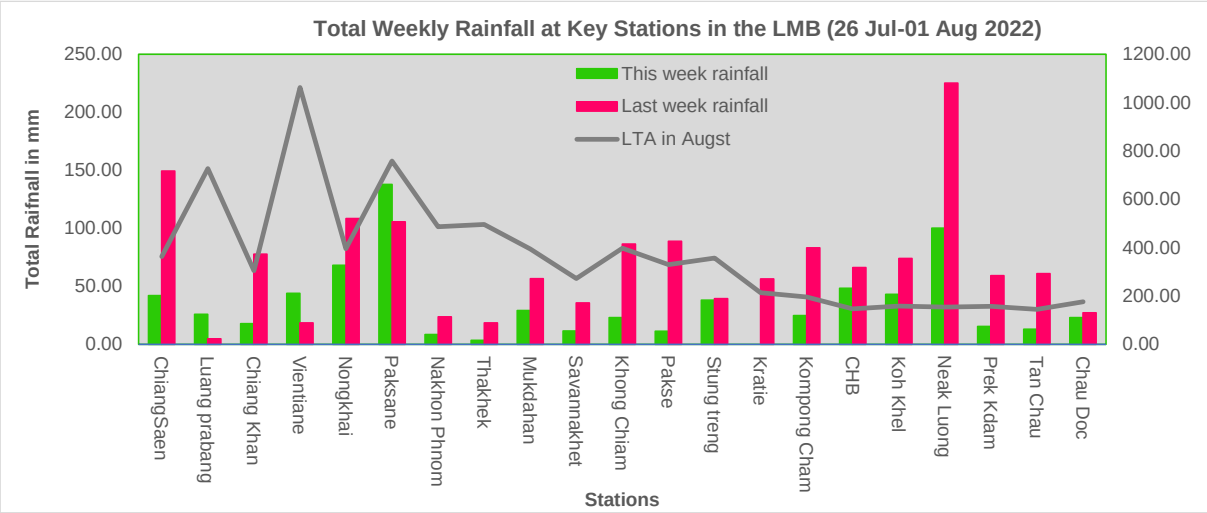


Figure 4. Weekly total rainfall at key stations in the LMB during 26 July-01 August 2022.

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 26 July to 01 August 2022.

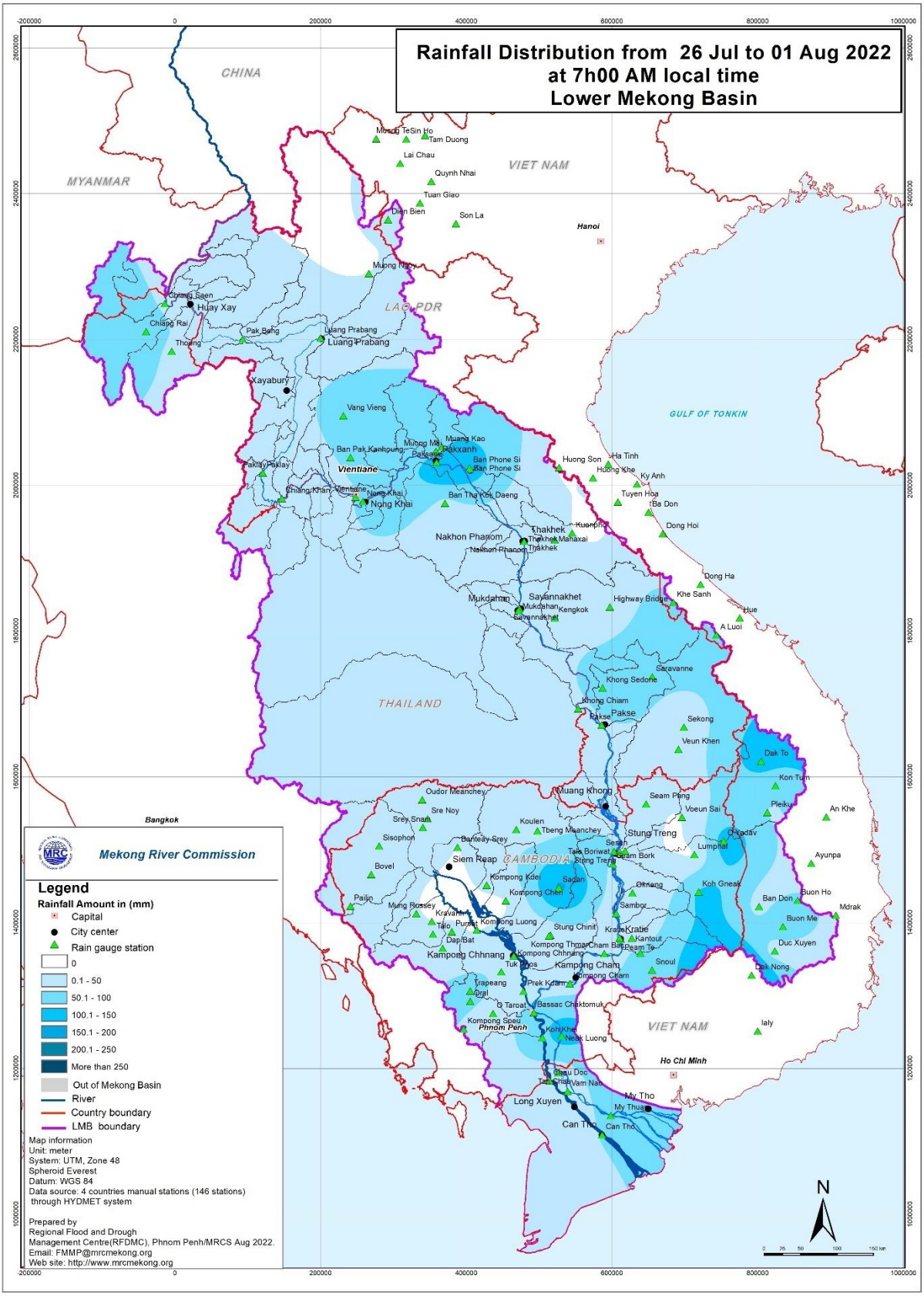


Figure 5. Weekly rainfall distribution over the LMB during 26 July-01 August 2022.

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.

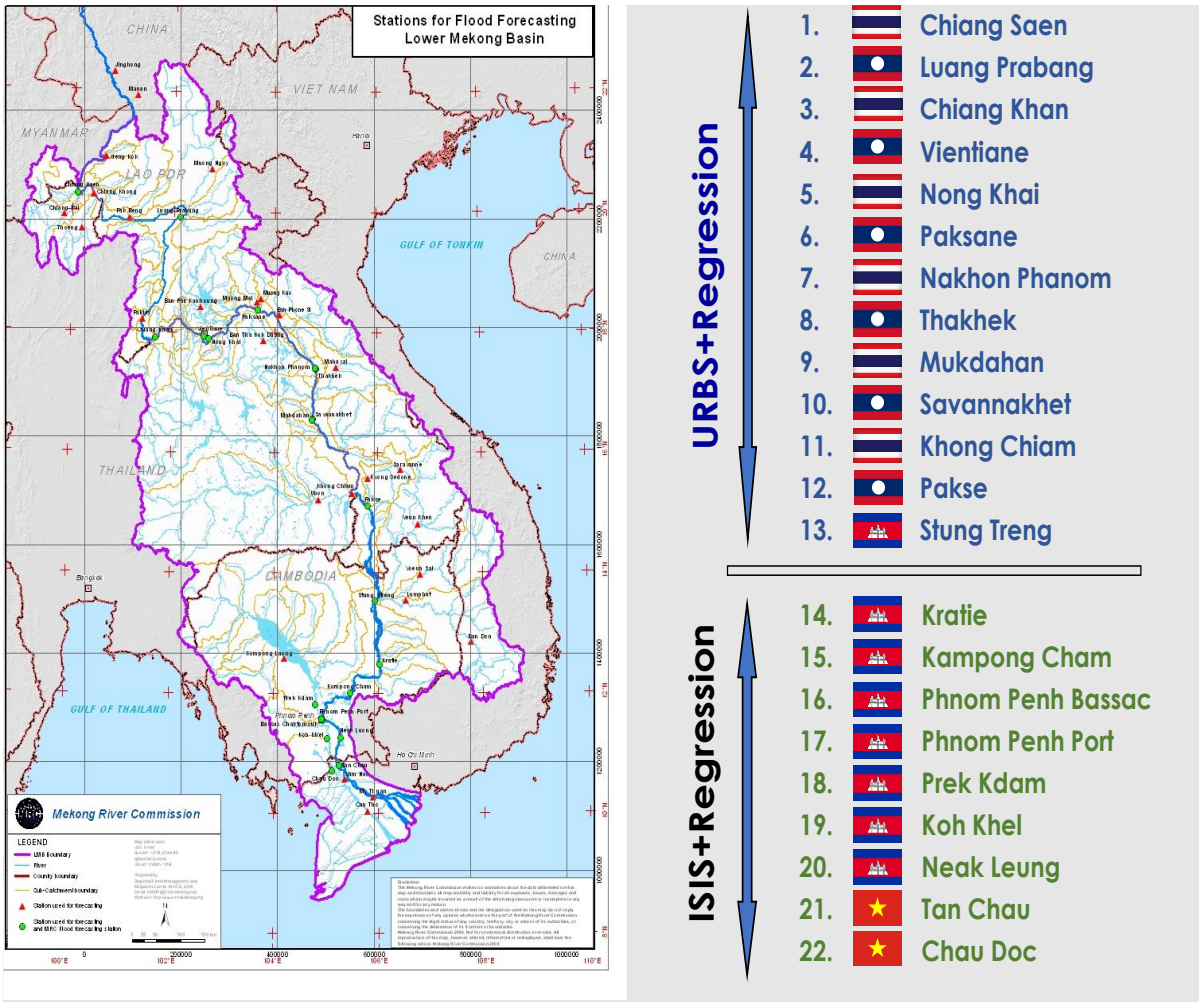


Figure 6. Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC's observed water level at Jinghong, it showed a significantly increased water level of about 0.99 m from **536.25 m to 537.24 m between 26 July and 01 August 2022 (recorded on 7:00 am)**. The current level is staying about 1.21 m higher than its Long-Term-Average (LTA: 2015-2021) value. The outflow at Jinghong station increased from 1,490.00 m^3/s to 2,300.00 m^3/s from 26 July to 01 August 2022. Figure 7 below presents water level that increased at the Jinghong hydrological station[1], indicating the trend of fluctuating water level up to 01 August 2022

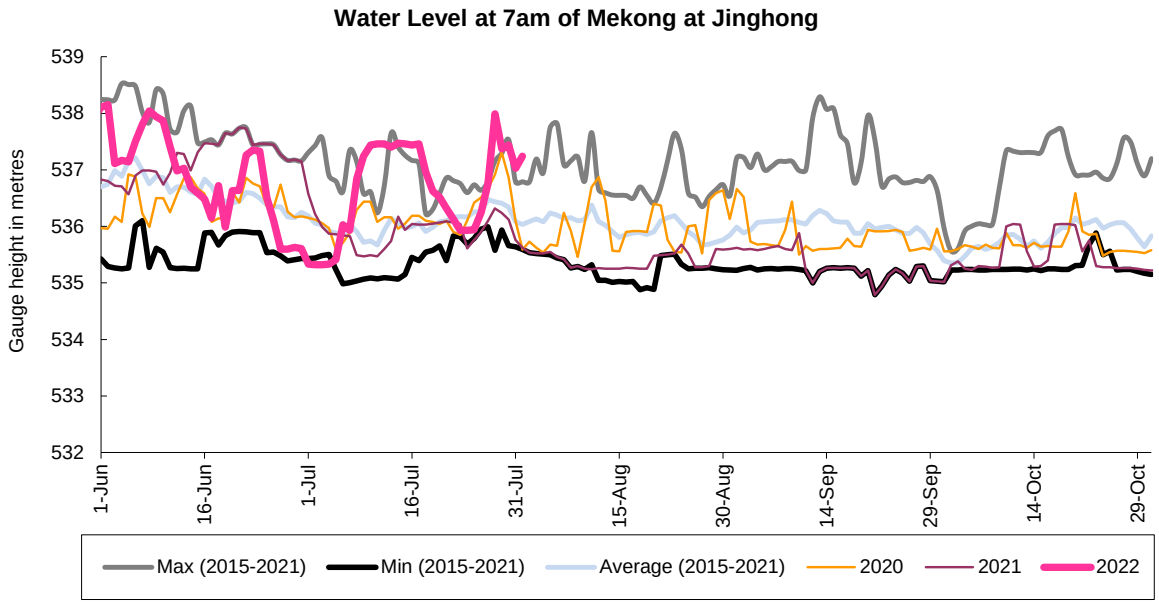


Figure 7. Water level at the Jinghong hydrological station up to 01 August 2022.

Along with the increasing outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand also increased about 0.56 m from 26 July to 01 August 2022, staying about 1.61 m lower than its LTA level**, which is considered critical**.

Water level at Chiang Khan in Thailand from 26 July to 01 August 2022, on the other hand, decreased about 0.91 m and stayed about 2.64 m lower than its LTA value, while water level at Vientiane decreased about 1.45 m and still stayed about 2.27 m lower than its LTA level, which **considered critical**. Water levels at Nong Khai decreased 1.60 m and at Paksane decreased about 1.54 m, staying about 3.17 m higher and 3.77 m lower than their LTA value, respectively **which is still considered critical**.

Water levels from Nakhon Phanom in Thailand and Pakse in Lao PDR decreased between 0.50 m and 1.00 m. The current WLs at these stations are staying about 1.50 m to 3.00 m lower than their LTA level, considering **critical**. From the stretches of the river at Stung Treng decreased 0.19 m and stayed about 1.77 m lower than its LTA, while at Kratie water level decreased 0.76 m, staying 2.87 m lower than its LTA level, **which considered critical.**

Water levels from Kompong Cham down to Chaktomuk, Koh Khel and Phnom Penh Port to Prek Kdam in Cambodia decreased between 0.10 m and 0.65 m, staying between 0.30 m and 0.80 m lower than their LTA level, **considering critical**.

[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.

Except water levels at Luang Prabang, Chiang Khan, Vientiane and Nong Khai, the rest of water levels at key stations were lower than their LTA value. The tidal stations at Tan Chau and Chau Doc have WL lower than their LTA value due to tidal effect during this monitoring period.

Based on hydrological phenomenon, the contribution of inflow water from the upstream of Lancang-Mekong in China to the Mekong mainstream is from 16% to 18% in total during the wet season from June to October. The whole inflow of water into the LMB is influenced by rainfall at the Mekong mainstream and its tributaries during the wet season.

Chiang Saen and Luang Prabang

The water level from 26 July to 01 August 2022 at Thailand's Chiang Saen station increased from 3.46 m to 4.02 m, showing 1.61 m lower than its Long-Term-Average (LTA) value, which considered critical. The water level at Luang Prabang station in Lao PDR decreased about 0.84 m from 10.70 m to 9.86 m during the reporting period. This level shows 1.67 m lower than its LTA. The trend – sometimes higher or lower to its historical maximum and LTA values – has been observed since early 2022. 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**.

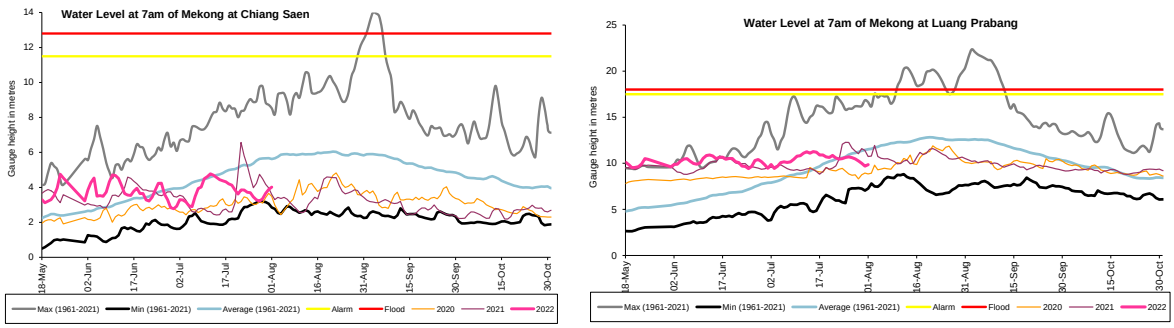


Figure 8. Water levels at Chiang Saen in Thailand and Luang Prabang in Lao PDR.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) decreased from 8.98 m to 8.07 m during the reporting week. It showed 2.64 m lower than its LTA value. The water level downstream at Vientiane in Lao PDR followed the upstream trend. It also decreased from 6.65 m to 5.20 m and was about 2.26 m lower than its LTA during 26 July-01 August 2022. At Nong Khai station in Thailand, the water level was also down during the reporting period. It decreased about 1.60 m from 6.78 m to 5.18 m and showed 3.17 m lower than its LTA. At Paksane in Lao PDR, water level decreased about 1.54 m from 7.93 m to 6.39 m. The water level at this station was about 3.77 m lower than its LTA value. The recently decreased water levels were obviously due to the less rainfall in the sub-catchment area, along

with the inflows and water released from upstream. The water levels at Vientiane and Paksane are shown in Figure 9 below.

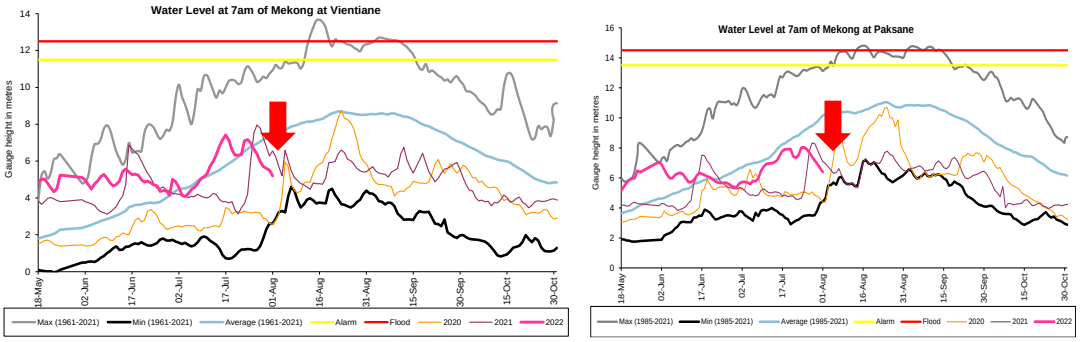


Figure 9. Water levels Veintiane and Paksane in Lao PDR.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR were decreasing between 0.50 m and 1.10 m due to less contribution of rainfalls and inflow from upstream. **Water levels at these stations are staying about 3.50 m lower than their LTA level, which considered critical**. Figure 10 shows the water levels at Nakhon Phanom and Pakse stations.

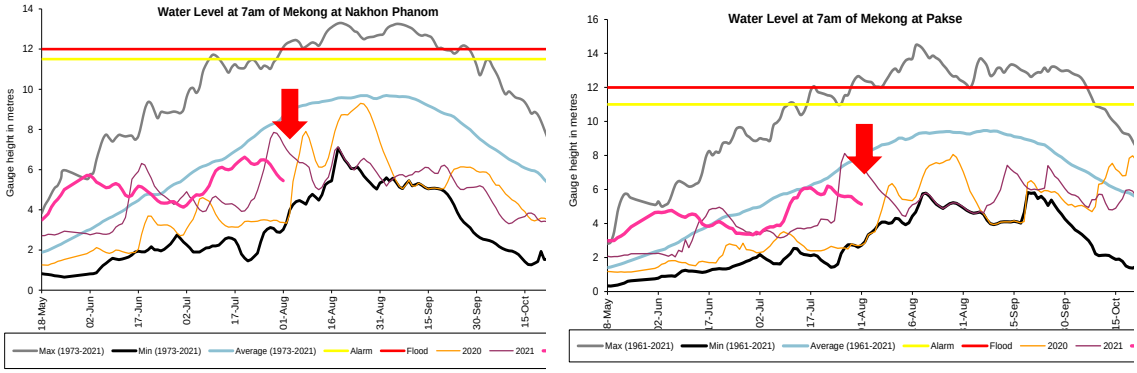


Figure 10. Weekly water levels at Nakhon Phanom in Thailand and Pakse in Lao PDR

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

Following 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 were decreasing during 26 July and 01 August 2022. The water levels at Stung Treng decreased about 0.19 m, while at Kratie it decreased about 0.76 m, staying about 1.77 m and 2.87 m lower than their LTA respectively (as showed in Figure 11). The water level at Kompong Cham station decreased about 0.62 m and was still about 2.85 m lower than its LTA. **The water levels at other stations were lower than their LTA, which considered critical**.

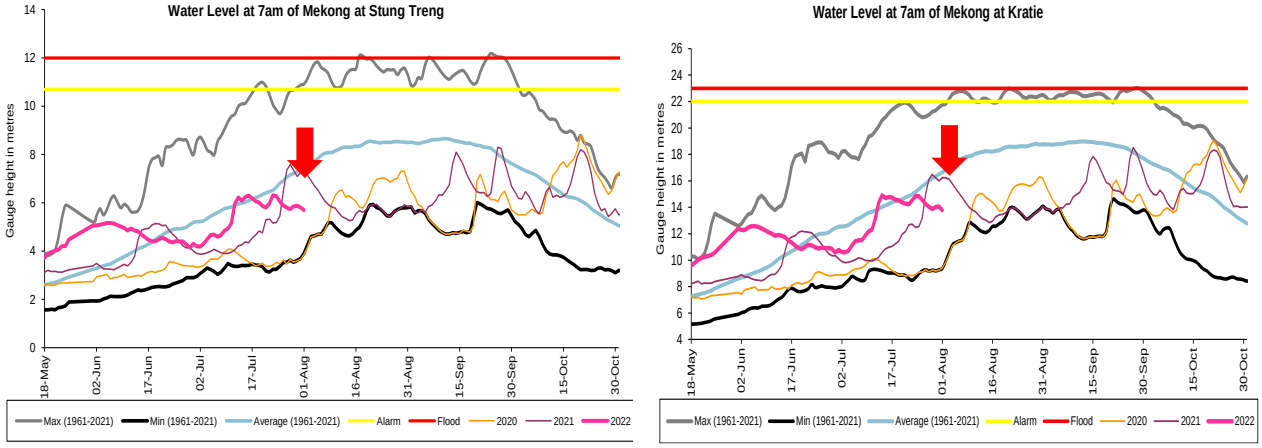


Figure 11. Water levels at Stung Treng and Kratie on the Mekong River.

At Chaktomuk on the Bassac River, due to low accumulated rainfall and less contributed flows from upstream catchment, the water level was down by about 0.19 m and stayed 1.79 m lower than its LTA value; while at Koh Khel, water level decreased about 0.13 m, staying 1.06 m lower than its LTA value. The water level at Prek Kdam on the Tonle Sap Lake decreased about 0.13 m and was about 1.46 m lower than its LTA value. The water level at the Tonle Sap Lake (observed at Kampong Luong) was similar to Prek Kdam station's water level. The recently decreased water level was due to low rainfall and less inflow contributed from upstream of the Tonle Sap Lake area during the reporting period. The water level at the Tonle Sap Lake (observed at Kampong Luong) followed the same trend of Prek Kdam station's water level. From next week, **water levels at most of those stations will stay lower than their LTA level, which are considered critical**.

Tidal stations at Tan Chau and Chau Doc

Like last week, the water levels from 26 July to 01 August 2022 at Viet Nam's Tan Chau and Chau Doc were fluctuating due to daily tidal effects from the sea. The fluctuation levels were between 0.76 m and 1.75 m; they were in between the range of their LTA and historical minimum level and **considered critical**. The current water levels at Tan Chau and Chau Doc are lower than their LTA level up to 01 August 2022.

The Tonle Sap Flow

At the end of the dry season, when water levels along the Mekong River rise and the inflows of the Mekong River return into the Tonle Sap Lake. This phenomenon normally takes place from end of May to July. Based on flow observation at Prek Kdam, the inflow of the Tonle Sap Lake took place since 29 May 2022.

Figure 12 shows the seasonal changes of the inflow/reverse flow and the inflow of the TSL at Prek Kdam in comparison with the flows of 2019 and 2020, and their LTA level (1997-2020). Up to 01 August of this reporting period, **it was observed that the main inflow into Tonle Sap Lake slightly decreased due to rainfall and inflows from upstream**. This decreased inflow into the Tonle Sap Lake was most likely caused by inflows and rainfall from the catchment area. Up to present, the inflow into the Tonle Sap Lake condition in 2022 is higher than 2019, 2020,

2021 but stays close to its LTA (1997-2021) inflow conditions. For next week, some rainfall is forecasted for the Tonle Sap area; thus, the outflow from the Tonle Sap Lake is likely continuing to slightly go up from the current level.

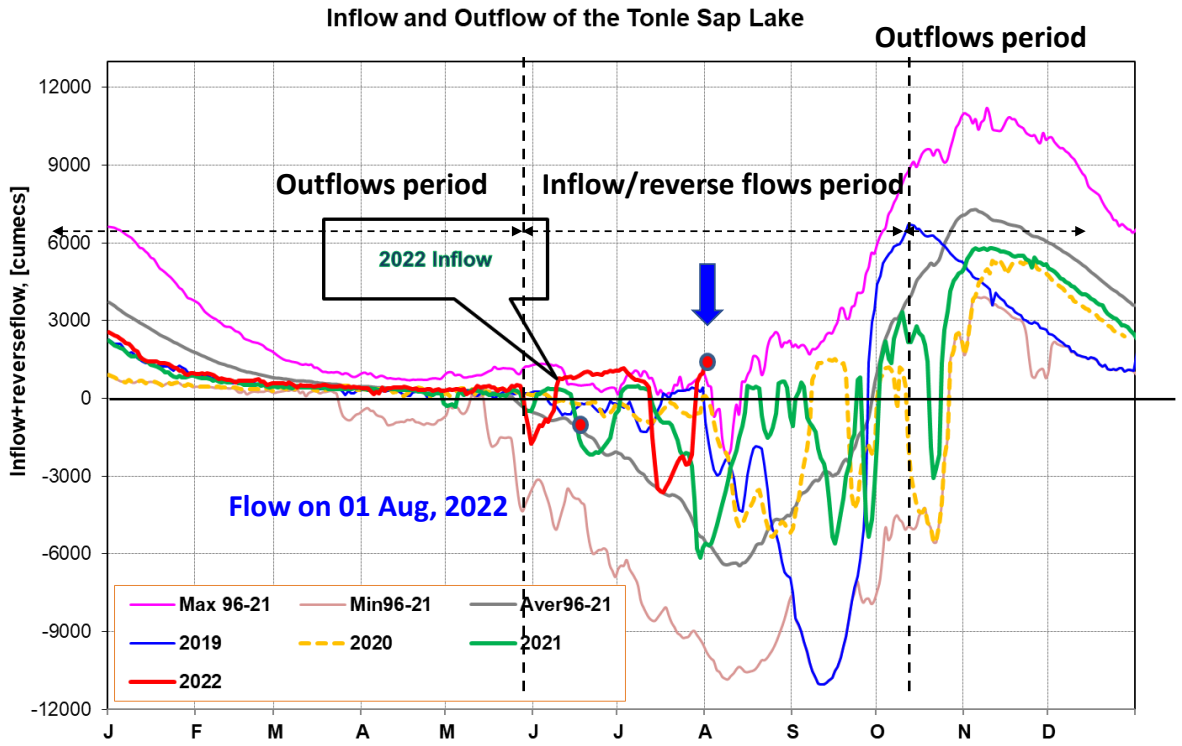


Figure 12. Seasonal change of inflows and outflows of Tonle Sap Lake

Figure 13 shows seasonal changes in monthly flow volumes up to 01 August 2022 for the Lake compared with the volumes in 2019, 2020, 2021 and their LTA, and the fluctuation levels (1997–2021). It shows that up to August 1, **the water volume of the Tonle Sap Lake was even higher than 2019, 2020, 2021 but lower than its LTA (about 86%), 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 tributaries and rainfall in the surrounding sub-catchments and ***considered normal***.

This demonstrates the influence of the relationships of the reverse and out 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.

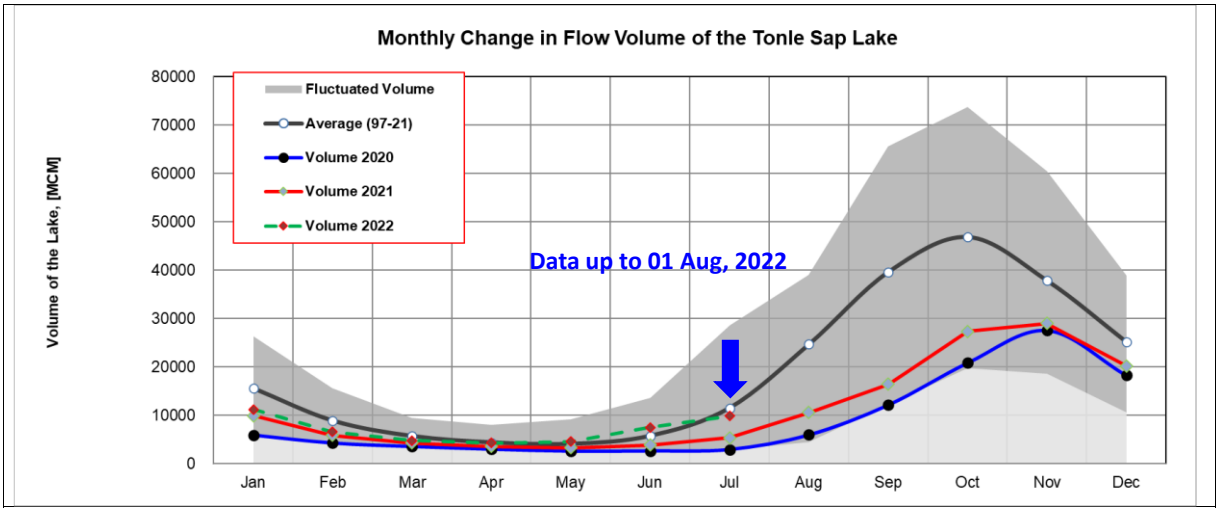


Figure 13. The seasonal change in monthly flow volume of Tonle Sap Lake.

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

Month	LTA (97-21) [MCM]	Max Volume [MCM]	Min Volume [MCM]	Volume 2018 [MCM]	Volume 2019 [MCM]	Volume 2020 [MCM]	Volume 2021 [MCM]	Volume 2022 [MCM]	Volume in 2022 [%], compared with its LTA
Jan	15523.23	26357.53	5906.80	13633.41	10285.31	5906.80	9923.80	11214.32	72.24
Feb	8837.89	15596.22	4198.60	7729.72	6019.30	4264.19	5832.97	6558.79	74.21
Mar	5654.18	9438.24	3347.07	5037.06	4354.62	3553.99	4264.88	4736.52	83.77
Apr	4346.65	8009.14	2866.91	3956.47	3667.47	2992.61	3556.68	4288.31	98.66
May	4030.23	9176.93	2417.81	3864.00	3266.43	2594.92	3240.78	4556.83	113.07
Jun	5708.30	13635.01	2468.70	5919.18	3517.06	2641.88	3798.29	7489.04	131.20
Jul	11493.25	28599.56	2925.86	12024.96	4001.99	2925.86	5346.73	9853.84	85.74
Aug	24666.69	39015.12	4433.46	22399.65	7622.71	5941.07	10547.80		
Sep	39634.03	65632.35	12105.31	53639.54	24194.19	12105.31	16382.34		
Oct	46873.44	73757.23	19705.50	48193.08	30358.38	20799.13	27318.21		
Nov	37823.16	60367.33	18534.61	31036.07	19112.65	27546.80	28982.93		
Dec	25126.11	38888.95	10563.49	18469.21	10577.29	18251.65	20170.76		
	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)						LTA: Long-Term-Average			

4 Flash Flood in the Lower Mekong Basin

From 26 July to 01 August 2022, the LMB was affected by three weather factors including (i) southerly and south-easterly winds prevailed over the lower north-eastern, lower central, and eastern parts during early week then it was prevailing over LMB during mid-week, (ii) the low pressure cell covered the upper part of Viet Nam during late week and the monsoon trough laid across Myanmar and upper Lao PDR towards the mentioned low pressure cell on the last day of the week, and (iii) The southwest monsoon that prevailed over the Gulf of Thailand which strengthened during the first half of the week. These conditions caused showery in every afternoon in some areas in the LMB.

According to the MRC-Flash Flood Guidance System (MRC-FFGS) and analysis, flash flood events were detected during the reporting period in several areas in Cambodia and Viet Nam with low risk levels as shown in Figure 14 and Table 2.

Table 2. Detected flash flood in Viet Nam on August 01

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

Date of FFG products 1/8/2022 6:00 UTC time

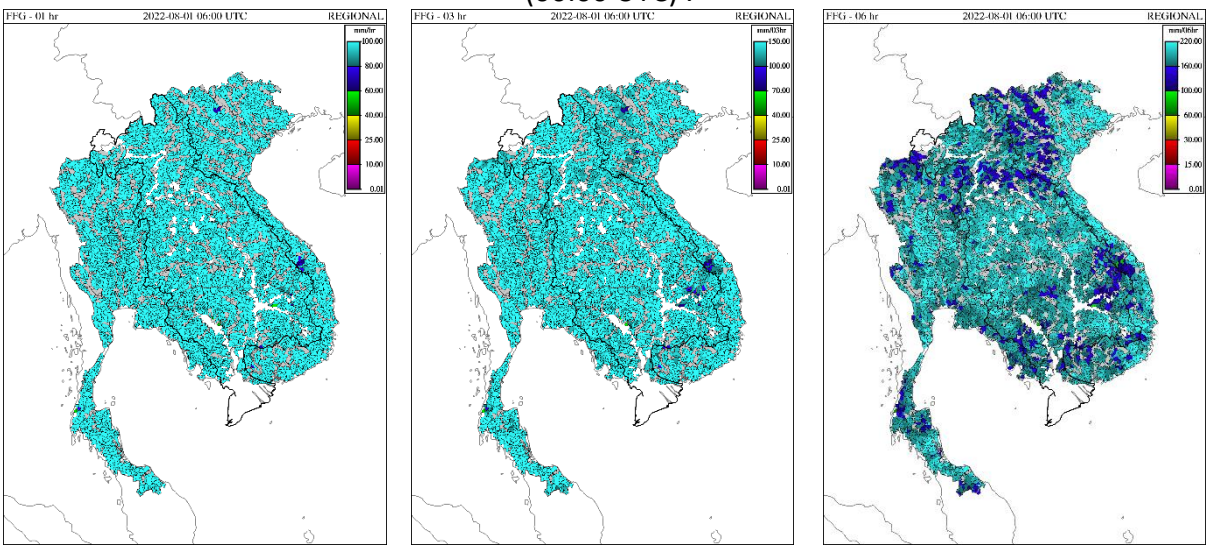
01-Hour Flash Flood Risk and Location					03-Hour Flash Flood Risk and Location					06-Hour Flash Flood Risk and Location				
Provinces	Districts	Villages	Region	Level Risk	Provinces	Districts	Villages	Region	Level Risk	Provinces	Districts	Villages	Region	Level Risk
Ratana Kiri	Koun Mom	Ko Hokseb	Northeast	Low-Risk	NO ANY DETECTION OF FLASH FLOOD WITHIN NEXT 03-HOUR					Ratana Kiri	Koun Mom	Ko Hokseb	Northeast	Low-Risk

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

Date of FFG products 1/8/2022 6:00 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
NO ANY DETECTION OF FLASH FLOOD WITHIN NEXT 01-HOUR				NO ANY DETECTION OF FLASH FLOOD WITHIN NEXT 03-HOUR				Kon Tum	Dak Glei	Central Highlands	Low-Risk
								Quang Nam	Tra My	South Central Coast	Low-Risk
								Yen Bai	Tram Tau	Northwest	Low-Risk

Figure 14. Flash Flood Guidance for the next 1 hour, 3 hours and 6 hours on August 01 (06:00 UTC) .



5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 17 to 23 July 2022

Drought monitoring data in 2022 are available from Sunday to Saturday 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)**

Unlike last week (July 17-23), the meteorological drought indicator of SPI from July 17 to 23, as displayed in Figure 15, shows a relatively dry condition with **moderate and severe droughts** in the north of the LMB covering mainly **Phongsaly, Bokeo, Oudomxay, Luang Prabang, Xieng Khuang, Xaysomboun, Borikhamxay, and Khammuane of Lao PDR, Lai Chau of Viet Nam, and Nong Khai and Nakhon Phanom of Thailand**. The middle and southern parts of the region were normal. No significant meteorological drought threat was found during the reporting week.

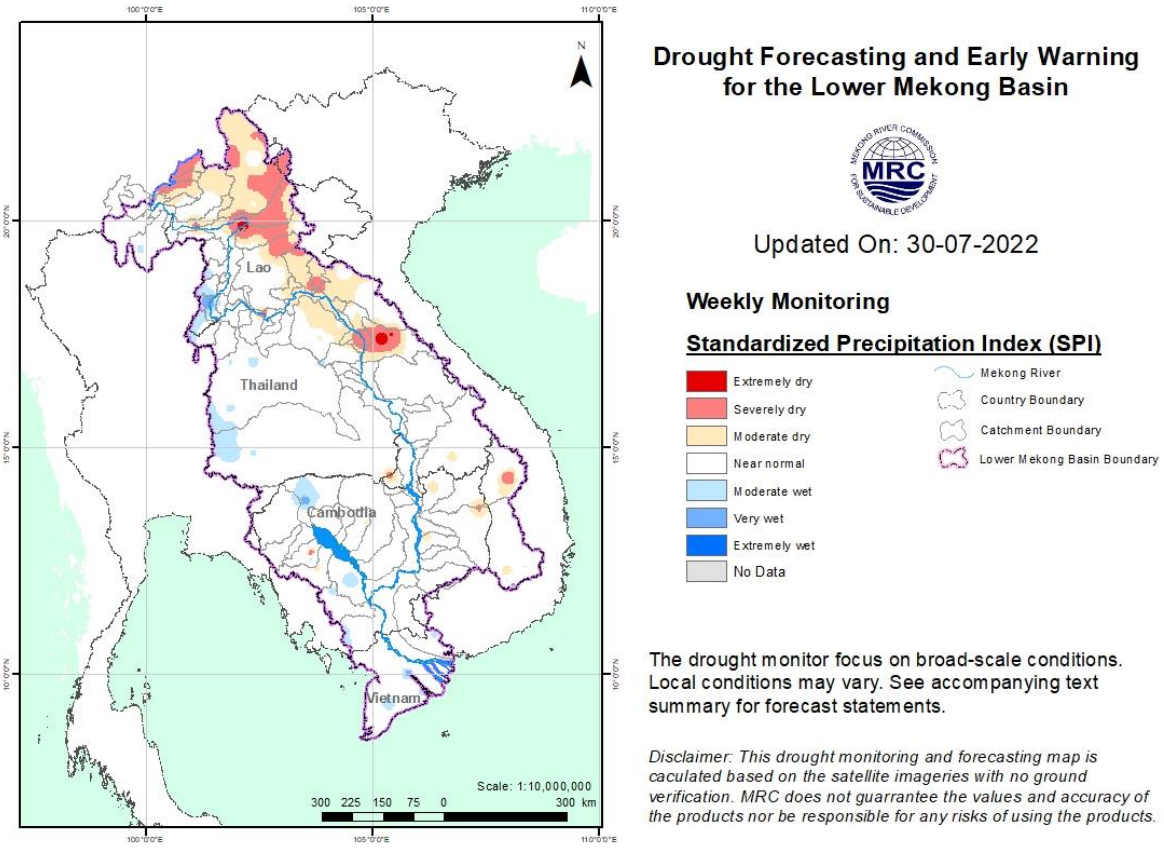


Figure 15. Weekly standardized precipitation index from 24 to 30 July 2022.

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

Like SPI, the soil water fraction from July 24 to 30, as displayed in Figure 16, shows **moderate and severe agricultural droughts covering Khammuane and Savannakhet of Lao PDR and Nong Khai, Sakon Nakhon, and Nakhon Phanom of Thailand**. However, it was a short-term drought which does not have serious effect on agriculture.

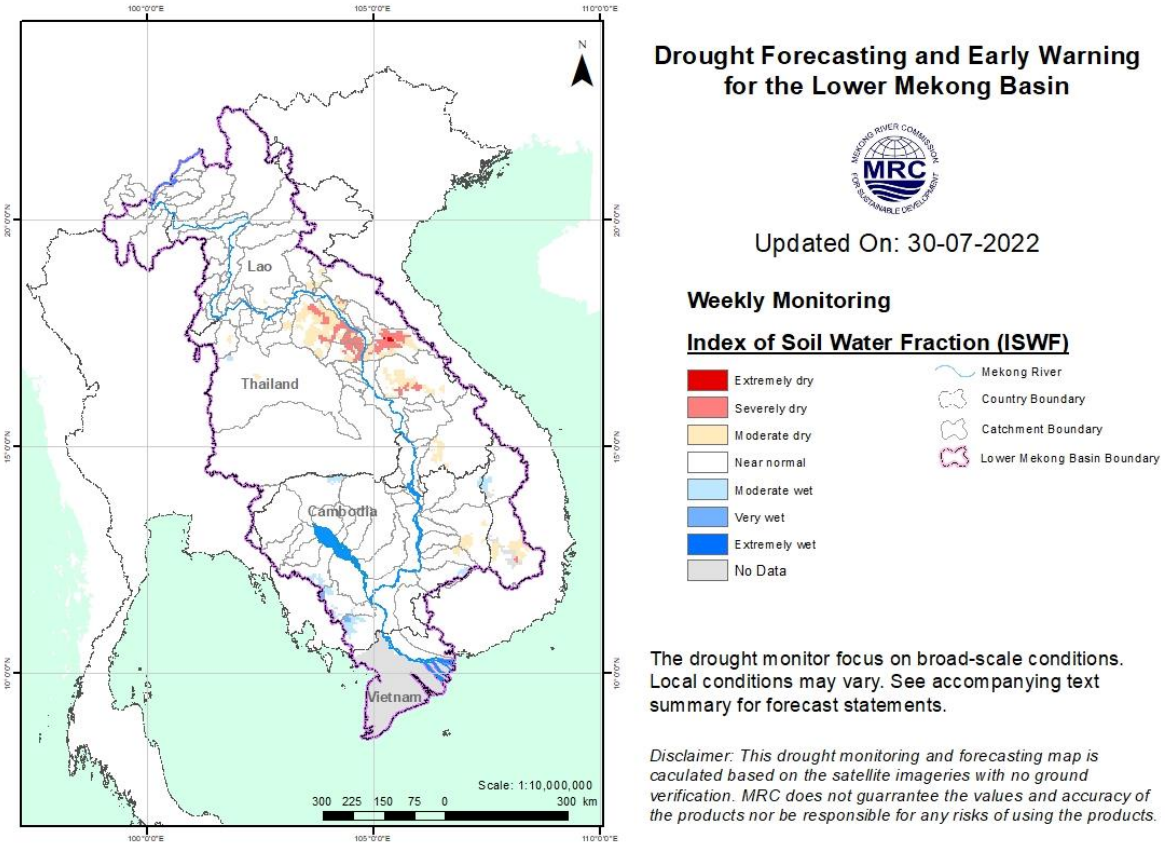


Figure 16. Index of Soil Water Fraction from 24 to 30 July 2022.

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

The combined drought indicator from the meteorological and agricultural indices, as displayed in Figure 17, shows that moderate and severe droughts hit **Khammuane and Savannakhet of Lao PDR and Nong Khai, Sakon Nakhon, and Nakhon Phanom of Thailand** during the monitoring week from July 24 to 30.

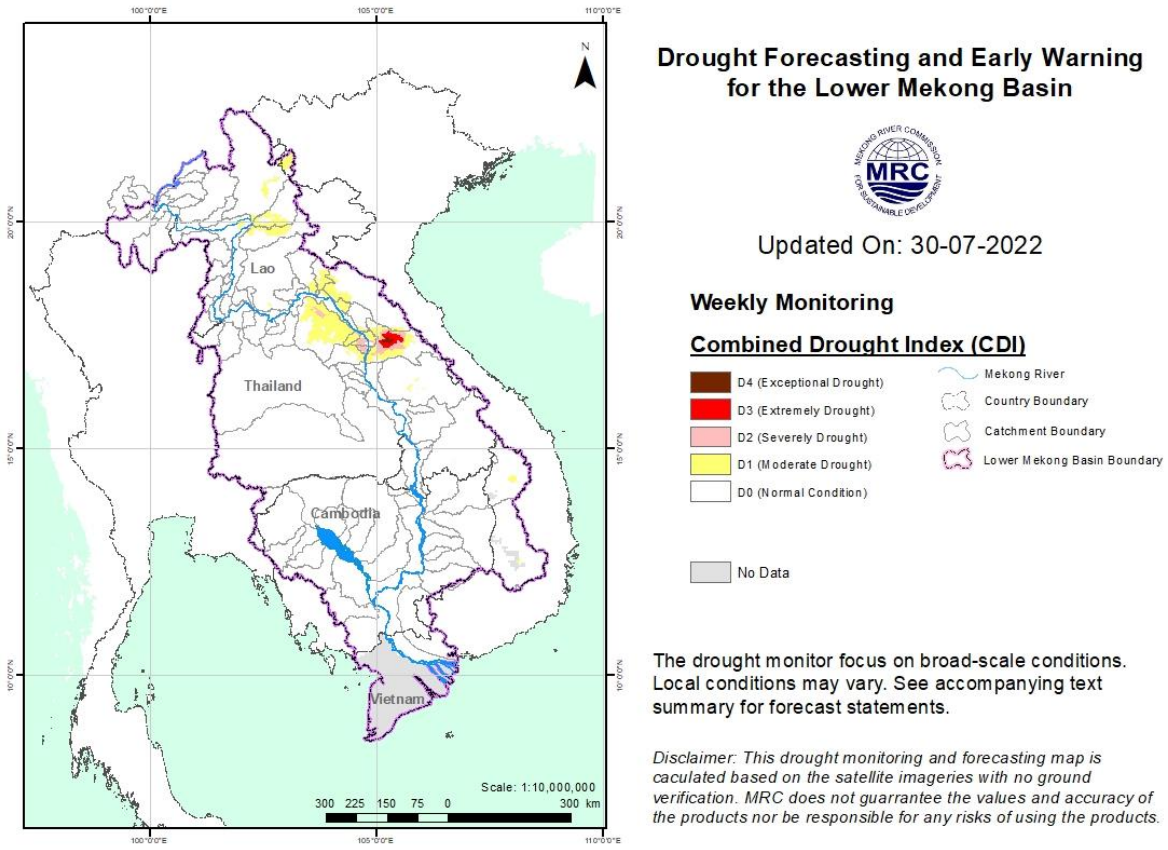


Figure 17. Weekly Combined Drought Index from 24 to 30 July 2022.

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.

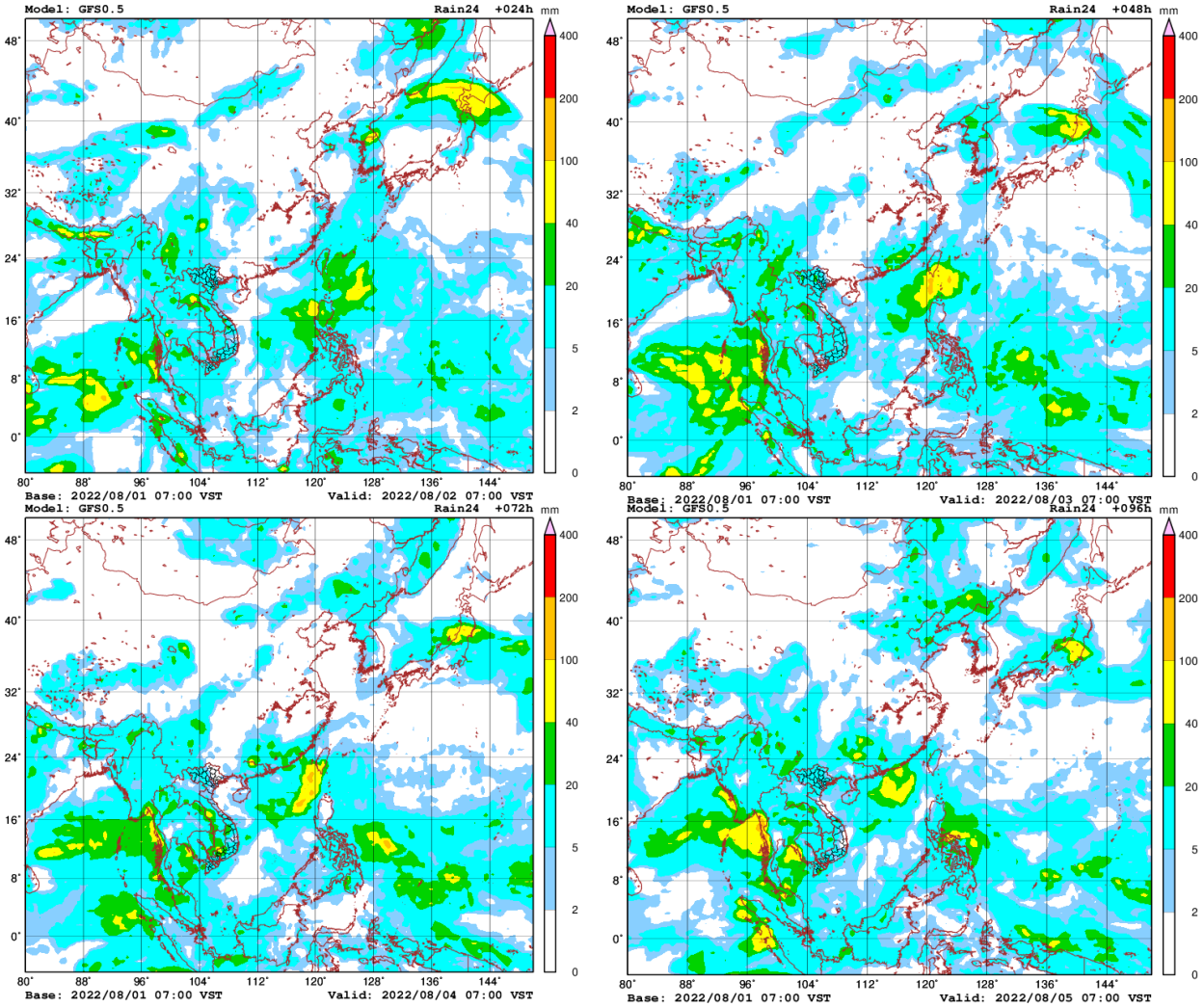
6 Weather and Water Level Forecast and Flash Flood Information

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.

In general, during August 2-8, small (5 -20 mm/24h) and moderate (20-50 mm/24h) amounts of rainfall will likely occur over the LMB. Especially, during August 7-8, heavy (50-100 mm/24h) rainfall will likely occur in some areas in the upper part of the LMB.

Figure 18 shows accumulated rainfall forecast (24 h) of the GFS model from 2-8 August.



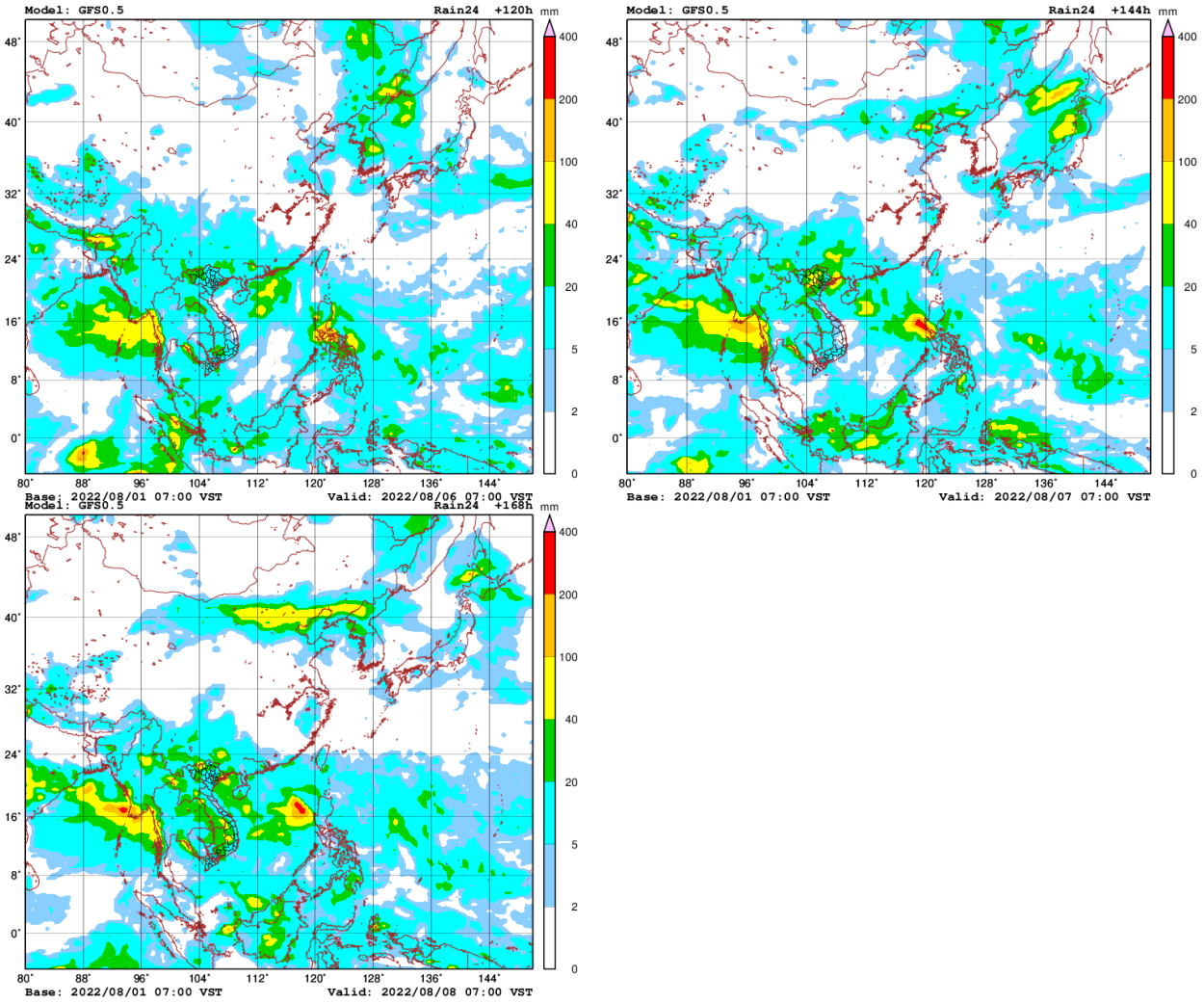


Figure 18. Accumulated rainfall forecast (24 h) based on a GFS model.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on August 01's daily flood forecasting bulletin, the daily forecasted water level at Chiang Saen in Thailand indicates an increase of WL from 4.02 m to 4.30 m over 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 9.86 m to 10.27 m during the next five days. The current water level is higher 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 go up approximately 0.43 m, while water level at Vientiane in Lao PDR will increase about 0.30 m. Furthermore, from Nong Khai in Thailand, the water level will increase about 0.25 m over the next five days; at Paksane in Lao PDR water level will increase about 0.30 m due to high forecasted rainfall and dam operation 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 and Thakhek in Lao PDR are forecasted to go up by about 0.25 m, while from Mukdahan in Thailand to Pakse in Lao PDR will go down by about 0.35 m over the next five days. Water level at these stations will stay lower than their LTA level. Rainfall is forecasted for the area next week.

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

From Stung Treng to Kompong Cham along the Mekong River in Cambodia, the water levels will go down between 0.20 m and 0.40 m over the next five days. Precipitation is forecasted for the area between Stung Treng and Kompong Cham during next week.

The water levels of the Tonle Sap Lake at Prek Kdam and Phnom Penh Port as well as at Phnom Penh's Chaktomuk on the Bassac River will increase about 0.10 m over the next five days.

Water levels at most of the stations will go down and will be staying lower than their LTA value, particularly in the middle part of the region from the Chiang Khan to Paksane and from Nakhon Phanom to Pakse as well as the lower part at Stung Treng, Kratie and Kompong Cham stations. 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 LTA 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 26 July to 01 August 2022, is presented in **Annex 1**.

Table 2 shows the daily flood forecasting Bulletin issued on 01 August 2022. 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 levels are not expected to take place in the LMB. However local heavy rain in a short period of time, especially during August 7-8, 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 its explanation is available for download here.

6.4 Drought forecast

There are several climate-prediction models with different scenarios in the upcoming months until November 2022. The MRC's DFEWS adopts an ensemble model called the North America Multi-Model Ensemble (NMME), which averages all scenarios, and downscales the forecasts to the regional level. The Viable Infiltration Capability (VIC) is then used to generate soil moisture and runoff for the whole basin.

Figure 19 below shows the Combine Drought Indicator (CDI) forecast for July, August, and September 2022. CDI is a combination of meteorological and agricultural indicators.

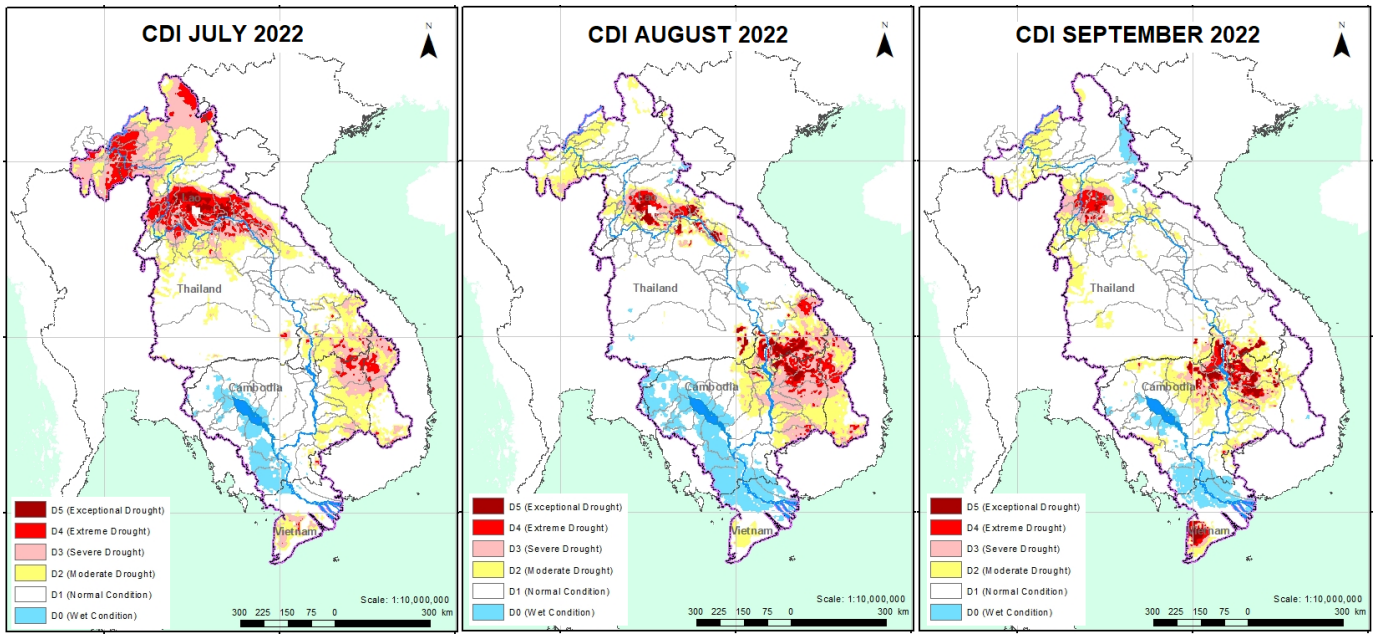


Figure 19. Monthly forecast of CDI for July, August, and September in 2022.

- **JULY:**

Droughts are likely to take place in the northern part, 3S area, and Mekong Delta of Viet Nam with moderate, severe, and extreme conditions. They cover mainly **Chiang Mai, Chiang Rai, Bokeo, Luangnamtha, Phongsaly, Oudomxay, Luangprabang, Xayaburi, Vientiane, Xaysomboun, Loei, Bong Bua Lamphu, Udon Thani, Sakon Nakhon, Nong Khai, Borikhamxay, and Khammuane in the north and Saravane, Sekong, Champasack, Attapeu, Kon Tum, Gia Lai, Ratana Kiri, Stung Treng, Mondul Kiri, Mondul Kiri, Kratie, Dak Lak, Lam Dong, Kien Giang, Can Tho, Soc Trang, Bac Lieu, and Ca Mau in the souther part**. Below-average rainfall is the main cause of drought phenomena.

- **AUGUST:**

Droughts are intensifying over the 3S area of Cambodia, Lao PDR, and Viet Nam with **severe and extreme conditions**; **Sekong, Attapeu, Campasack, Ubon Ratchathani, Preah Vihea, Stung Treng, Ratana Kiri, Kon Tum, Gia Lai, Dak Lak, Mondul Kiri, and Kratie are covered**. While the conditions in the northern part are predicted to get better from July situation; however, there will be some small moderate and severe droughts over the bordering area

between Lao and Thailand covering mainly **Vientiane, Xaysomboun, Nong Khai, Borikhamxay, and Khammuane**; however, only small part of Borikhamxay, and Khammuane are taken.

- **SEPTEMBER:**

Drought conditions forecasted for August are moving westwards during September with smaller extent and severity to cover **Vientiane, Xayaburi, and Borikhamxay. At the 3S area it moves to Champasack, Attapeu, Ratana Kiri, Stung Treng, Preah Vihear, Kampong Thom, and Mondul Kiri**. Additionally, **Ca Mau, Bac Lieu and Kien Giang in the Delta are also forecasted with severe and extreme droughts**. Both precipitation and soil moisture are the main cause of such droughts.

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: 02 August - 06 August 2022

Date: 01 August 2022

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					
		31-Jul				31-Jul	01-Aug	02-Aug	03-Aug	04-Aug	05-Aug	06-Aug	01	02	03	04	05	06
Jinghong		0.0				537.03	537.24						↑	×	×	×	×	×
Chiang Saen		13.0	357.110	12.80	11.50	3.88	4.02	3.90	4.03	4.10	4.20	4.30	↑	↑	↑	↑	↑	↑
Luang Prabang		0.0	267.195	18.00	17.50	9.70	9.86	9.98	10.12	10.00	10.15	10.27	↑	↑	↑	↑	↑	↑
Chiang Khan		1.5	194.118	16.00	14.50	8.00	8.07	8.25	8.33	8.45	8.36	8.50			↑	↑	↑	↑
Vientiane		43.9	158.040	12.50	11.50	5.50	5.20	5.15	5.30	5.40	5.52	5.48	↓	↓		↑	↑	↑
Nongkhai		44.8	153.648	12.20	11.40	5.31	5.18	5.18	5.28	5.35	5.45	5.41	↓			↑	↑	↑
Paksane		35.1	142.125	14.50	13.50	6.65	6.39	6.30	6.36	6.50	6.58	6.69	↓		↑	↑	↑	↑
Nakhon Phanom		2.5	130.961	12.00	11.50	5.57	5.45	5.35	5.30	5.37	5.53	5.66	↓	↓	↑	↑	↑	↑
Thakhek		1.0	129.629	14.00	13.00	6.68	6.52	6.37	6.32	6.40	6.58	6.74	↓	↓	↑	↑	↑	↑
Mukdahan		14.5	124.219	12.50	12.00	5.36	5.25	5.05	4.88	4.83	4.93	5.13	↓		↑	↑	↑	↑
Savannakhet		10.5	125.410	13.00	12.00	3.70	3.69	3.60	3.53	3.55	3.63	3.80		↑	↑	↑	↑	↑
Khong Chiam		2.3	89.030	14.50	13.50	6.71	6.55	6.43	6.23	6.05	6.00	6.13	↓			↑	↑	↑
Pakse		11.4	86.490	12.00	11.00	5.24	5.14	5.05	4.91	4.80	4.77	4.86	↓		↑	↑	↑	↑
Stung Treng		37.0	36.790	12.00	10.70	5.75	5.70	5.65	5.60	5.50	5.43	5.42				↑	↑	↑
Kratie		nr	-0.101	23.00	22.00	14.01	13.78	13.65	13.60	13.55	13.46	13.40	↓	↓		↑	↑	↑
Kompong Cham		8.6	-0.930	16.20	15.20	8.24	8.14	8.00	7.90	7.85	7.80	7.73	↓	↓	↓		↑	↑
Phnom Penh (Bassac)		6.8	-1.020	12.00	10.50	5.06	5.08	5.03	5.00	4.99	4.97	4.95					↑	↑
Phnom Penh Port		-	0.070	11.00	9.50	3.90	3.89	3.87	3.85	3.85	3.87	3.90		↓			↑	↑
Koh Khel (Bassac)		25.7	-1.000	8.40	7.90	4.76	4.79	4.77	4.75	4.76	4.78	4.81	↑					↑
Neak Luong		51.0	-0.330	8.00	7.50	3.55	3.56	3.58	3.52	3.48	3.48	3.46			↓	↓		
Prek Kdam		8.2	0.080	10.00	9.50	4.18	4.21	4.23	4.22	4.23	4.25	4.30	↑				↑	↑
Tan Chau		0.0	0.000	4.50	3.50	1.05	1.00	0.95	0.92	0.89	0.88	0.89	↓	↓	↓			
Chau Doc		15.0	0.000	4.00	3.00	0.79	0.76	0.72	0.69	0.67	0.66	0.67	↓	↓				

REMARKS:

-: not available.

nr: no rain.

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

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

River Flood Forecaster

KHEM Sothea

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

7 Summary and Possible Implications

7.1 Rainfall and its forecast

Rain was observed from Chiang Saen in Thailand to Tan Chau and Chau Doc in Viet Nam during July 26-August 01, including the lower part in Lao PDR and Cambodia, varying from 3.40 mm to 138.80 mm due to low pressure dominating the LMB. However, this week rainfall was considered low in the middle and lower parts of the LMB compared with last week rainfall.

Based on the forecasted satellite data, rainfall is forecasted for some areas of the LMB with the value range from 70 mm to 250 mm for the next seven days. The forecasting model using GFS data, moreover, shows that no significant rainfall (<100 mm) is likely to take place in the Mekong region from 02 to 07 August 2022.

7.2 Water level and its forecast

According to MRC's observed water level at Jinghong, it showed a significantly increased water level of about 0.99 m from 536.25 m to 537.24 m between 26 July and 01 August 2022. The current level is staying about 1.21 m higher than its Long-Term-Average (LTA: 2015-2021) value. The outflow at Jinghong station increased from 1,490.00 m^3/s to 2,300.00 m^3/s from 26 July to 01 August 2022.

Along with the increased outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand increased about 0.56 m from 26 July to 01 August 2022. However, from Chiang Khan in Thailand to Vientiane in Lao PDR, water levels decreased between 0.91 m and 1.45 m during Jul 26-Aug 01 due to influence of rainfall and dam operation. Water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR were also decreasing about 1.10 m. Water levels from the stretches of the river from Stung Treng to Kratie and at Kompong Cham in Cambodia were decreasing about 0.25 m, due to less contributed rainfall from the upstream part (at Pakse and 3S area in Viet Nam).

Over the next five days, the water levels from Chiang Saen down to Stung Treng and to the lower part at key stations in Cambodia are expected to go up between 0.10 m and 0.45 m.

The flow volume of the Tonle Sap Lake is lower than its LTA up to August 1. From next week, the flow is expected to increase due to average-rainfall forecasted in the inflow catchments of the Tonle Sap Lake.

From Stung Treng to Kratie, the water levels will continue staying lower than their LTA value. 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 continue staying 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 second week of June 2022, water levels across most monitoring stations in the LMB have significantly dropped to the level lower than their LTA (from middle to lower stretches within the LMB). The preliminary analysis of the hydrological conditions in the LMB over July–December 2020 and November 2020 to May 2021 was done as Situation Report, which can be used as reference for the trend of water level and flows of the Mekong River Basin.

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 during August 7-8 is possible with unexpected short flash floods.

7.4 Drought condition and its forecast

During July 24-30, the LMB was hit by **moderate and severe droughts** mainly in **Khammuane and Savannakhet of Lao PDR and Nong Khai, Sakon Nakhon, and Nakhon Phanom of Thailand**. However, it was just a short-term drought which does not have serious effect yet on agriculture.

In **July**, droughts are likely to take place in the **northern part, 3S area, and Mekong Delta of Viet Nam** with **moderate, severe, and extreme conditions**; in **August** droughts are intensifying over the **3S area of Cambodia, Lao PDR, and Viet Nam** with **severe and extreme conditions,** while in **September** droughts are moving westwards from the locations in August with smaller extent and severity.

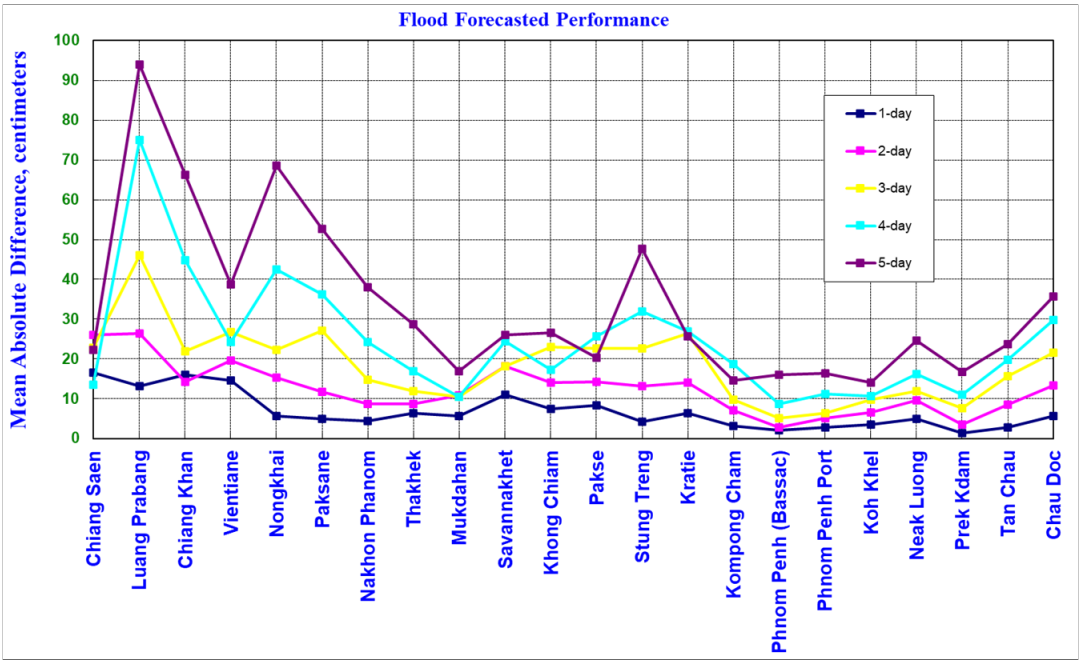
Annex 1: Performance of the weekly flood forecasting

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 26 July to 01 August 2022.

The forecasting values from 26 July to 01 August 2022 show that the overall accuracy is fair for a one-day to five-day forecast in lead time at stations in the lower parts of the Mekong River from Chiang Khan in Thailand to Paksane in Lao PDR due to some effect of 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.
- Luang Prabang to Chiang Khan and Stung Treng to Kratie have been effluent by hydropower operations upstream, tributaries inflows.
- 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).

- Khong Chaim, Pakse, Stung Treng and Kratie stations have been affected by heavy rainfall from Viet Nam and some hydropower operations on Sekong, Sesan and Sre Pok (water retention and release). Rainfall always accumulates at this spot, which could be causing rapidly high-water levels.
- 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 26 July to 01 August 2022.

Table B1: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 26 July to 01 August 2022 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	17	13	16	15	6	5	4	6	6	11	7	8	4	6	3	2	3	3	5	1	3	6
2-day	26	26	14	20	15	12	9	9	11	18	14	14	13	14	7	3	5	7	10	4	9	13
3-day	23	46	22	27	22	27	15	12	10	18	23	23	23	26	10	5	6	10	12	8	16	22
4-day	14	75	45	24	43	36	24	17	11	25	17	26	32	27	19	9	11	11	16	11	20	30
5-day	22	94	66	39	69	53	38	29	17	26	27	20	48	26	15	16	16	14	25	17	24	36

Table B2: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 26 July to 01 August 2022 in %

Lead-time Forecasted	Chiang Saen	Luang Prabang	Chiang Khan	Vientiane	Nongkhai	Paksane	Nakhon Phanom	Thakhek	Mukdahan	Savannakhet	Khong Chiam	Pakse	Stung Treng	Kratie	Kompong Cham	Phnom Penh (Bassac)	Phnom Penh Port	Koh Khel	Neak Luong	Prek Kdam	Tan Chau	Chau Doc	*Average*
1-day	57.1	85.7	57.1	42.9	71.4	71.4	57.1	71.4	57.1	71.4	42.9	57.1	85.7	57.1	57.1	57.1	42.9	71.4	57.1	57.1	57.1	42.9	***60.4***
2-day	50.0	50.0	50.0	50.0	66.7	50.0	33.3	50.0	50.0	66.7	66.7	50.0	66.7	50.0	50.0	50.0	50.0	50.0	66.7	66.7	50.0	50.0	***53.8***
3-day	40.0	60.0	20.0	60.0	80.0	60.0	40.0	60.0	60.0	60.0	60.0	60.0	60.0	40.0	40.0	40.0	60.0	60.0	60.0	60.0	40.0	40.0	***52.7***
4-day	75.0	50.0	50.0	50.0	75.0	75.0	75.0	75.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	75.0	75.0	75.0	50.0	50.0	50.0	25.0	***58.0***
5-day	66.7	33.3	33.3	33.3	66.7	33.3	66.7	66.7	66.7	66.7	33.3	66.7	33.3	33.3	33.3	33.3	66.7	66.7	33.3	33.3	66.7	66.7	***50.0***

Table B3: Overview of performance indicators for the past 7 days from 26 July to 01 August 2022

	FF time sent				Arrival time of input data								Missing data (number-mainstream and trib.st.)							
2022	FF completed and sent (time)	Stations without forecast	FF2 completed and sent (time)	Weather data available (time)	NOAA data	China	Cambodia - DHRW	Cambodia - DOM	Lao PDR - DMH	Thailand - DWR	Viet Nam - SRHMC	Viet Nam - HMS	NOAA data/2dataset	China/2	Cambodia - DHRW/15	Cambodia - DOM/34	Lao PDR - DMH/32	Thailand - DWR/13	Viet Nam - SRHMC/6	Viet Nam - HMS/39
week	*10:16*	*#DIV/0!*	-	-	*08:15*	*07:10*	*06:55*	*07:39*	*08:33*	*08:36*	*07:58*	*08:06*	*0*	*0*	*6*	*0*	*15*	*1*	*0*	*0*
month	*10:27*	*#DIV/0!*	-	-	*08:15*	*07:10*	*07:16*	*08:01*	*08:33*	*08:25*	*07:16*	*08:07*	*0*	*0*	*0*	*34*	*62*	*0*	*0*	*2*

Fig. B4: Data delivery times for the past 7 days from 26 July to 01 August 2022

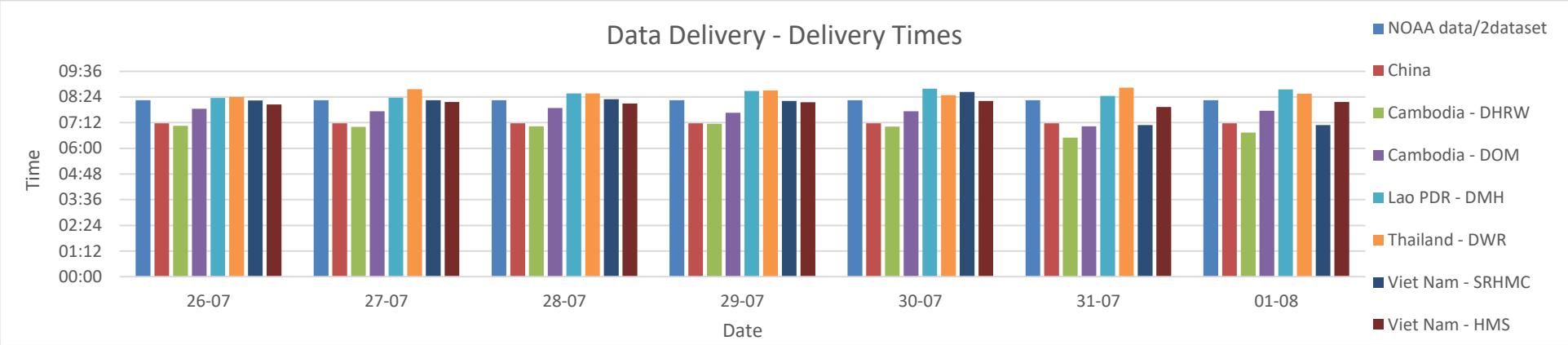


Fig. B5: Missing data for the past 7 days from 26 July to 01 August 2022

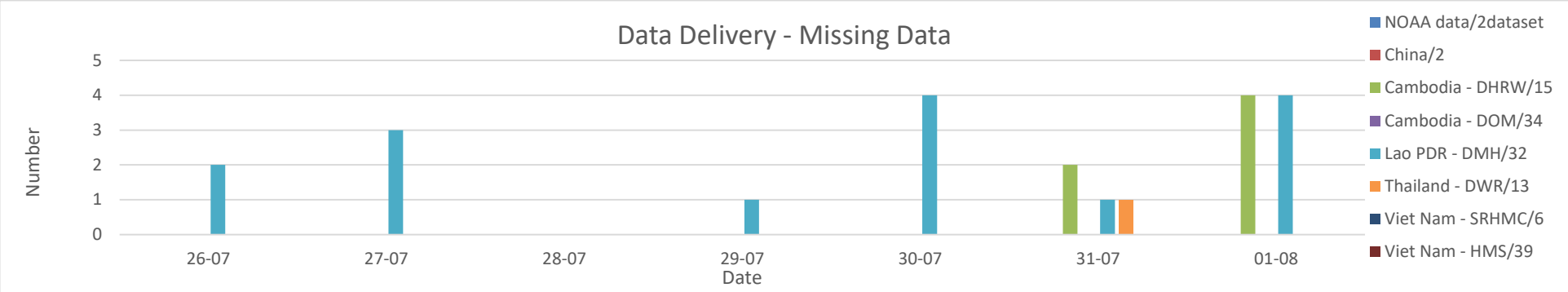
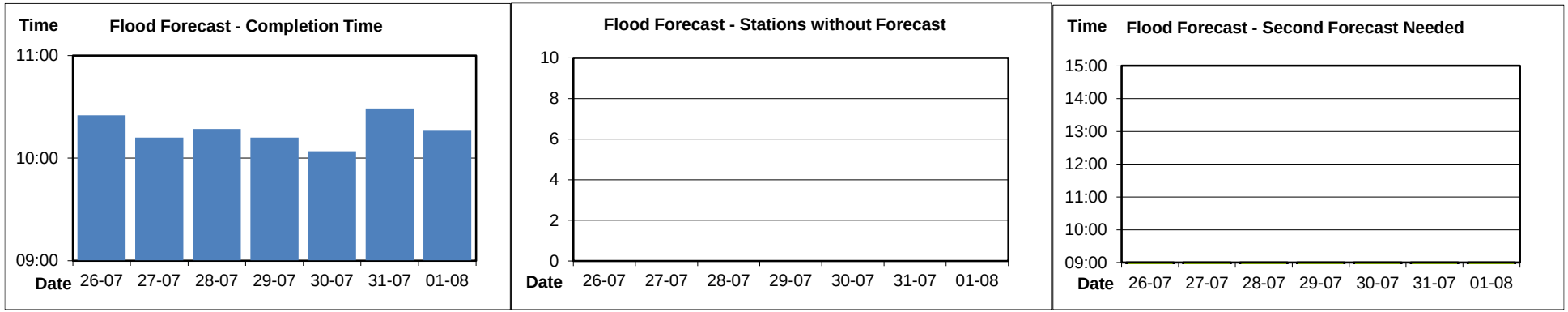


Fig. B6: Flood forecast completion time, stations without forecasts, and second forecasts need from 26 July to 01 August 2022



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