Mekong River Commission

Weekly Wet Season Situation Report in the Lower Mekong River Basin

22-28 August 2023

Prepared by
The Regional Flood and Drought Management Centre
29 August 2023

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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 upper, middle and lower parts of the LMB covering Lao PDR and Cambodia, varying from 6.00 millimetres (mm) to 272.10 mm.

- There will be moderate and heavy rainfall for the next 5 days over the Mekong region from 29 August to 03 September 2023 although there is no any movement of tropical storm moving towards the Mekong region.

Water level and its forecast

- According to MRC's observed water level at Jinghong, it showed decreasing water levels from **536.39 m** and **535.20 m** during 22-28 August 2023. The current level is staying about 0.48 lower than its LTA value. The outflow at Jinghong station varied between 814.00 m^3/s and 1,660.00 m^3/s during 22-28 August 2023.

- Even with the decreased outflow from Jinghong upstream and rainfall at catchment inflow, water levels of monitoring stations at Chiang Saen in Thailand still increased about 0.18 m from 22 to 28 August 2023, staying about 3.34 m lower than its LTA level. Water level at Xieng Kok upstream of Chiang Saen decreased about 1.25 m.

- Water level at Chiang Khan in Thailand from 22 to 28 August 2023 increased about 0.27 m and stayed about 2.83 m lower than its LTA value, while water level at Vientiane increased about 0.11 m staying about 1.97 m lower than its LTA level. Water levels at Nong Khai increased 0.16 m and stayed about 3.84 m lower than its LTA, while at Paksane it was stable at 7.05 m, staying about 3.68 m lower than its LTA value. Water levels at these stations are considered low.

- Water levels from Nakhon Phanom to Pakse decreased from 0.39 m to 0.81 m, due to the contribution of below-average rainfalls and less inflows from upstream. The current WLs at these stations are staying lower than their LTA value, considering low.

- From the stretches of the river from Stung Treng, Kratie to Kompong Cham, water level decreased and stayed between 1.85 m and 3.10 m lower than their LTA values, which were considered low.

- The water volume of the Tonle Sap Lake was lower than its LTA (about 78%) during the same period from 22 to 28 August 2023, which is considered low.

- Water levels from downstream at Chaktomuk and Phnom Penh Port, Koh Khel on the Bassac river to Prek Kdam in Cambodia decreased, staying lower than their LTA level.

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

- Over the next five days, the water levels at the upper, middle and lower parts from Chiang Saen to Khong Chiam are expected to go up due to moderate rainfall and dam operation upstream, while at downstream from Stung Treng down to the Mekong floodplain area they are going to drop.

Drought condition and its forecast

- During **Aug 21-27**, some moderate and severe droughts were detected in all four countries mainly from the middle to the southern parts of the LMB. They were taking place in some areas of **Otdar Meanchey, Siem Reap, Preah Vihear, Stung Treng, Ratana Kiri, Mondul Kiri, Kratie, Kampong Thom, Kampong Cham, Pursat, Battambang, Takeo, Kandal, Svay Rieng, Prey Veng, Luangnamtha, Xayaburi, Luang Prabang, Saravane, Sekong, Champasack, Attapeu, Chiang Rai, Chiang Mai, Phayao, Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Chaiyaphum, Khon Kaen, Maha Sarakham, Kalasin, Roi Et, Nakhon Ratchasima, Burirum, Surin, Yasothon, Si Saket, Amnat Charoen, Ubon Ratchathani, Kon Tum, Gia Lai, Dak Lak, Long An, Tien Giang, Dong Thap, and An Giang.**

- The three-month forecast shows that **August** is expected to be moderately dry in the upper north, severely and extremely dry in the west covering mainly Thailand, and extremely dry in the south-east covering southern Laos and 3S areas. In **September**, Xayaburi, Vientiane and Luang Prabang of northern Laos are likely to be hit by moderate drought, while central Laos in the eastern LMB is likely to be facing some moderate and severely droughts. In **October**, moderate and severe droughts are forecasted for the north-west, west, and south-west areas of the LMB covering some areas of northern Laos, Thailand, and north-western Cambodia. Most parts of Laos and Vietnam are likely not at any risk.

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 **22** to **29 August 2023**. 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 (August, September and October) and the weather maps issued by the Thai Meteorological Department (TMD) were used to verify weather conditions in the LMB.

Since the beginning of August 2023, moderate to heavy rainfall has dropped over the LMB with increasing trend of water levels in both mainstream and tributaries. The data from the TMD predict that between August and September 2023, moderate high-pressure system from China will extend to upper Thailand and the East-Sea of Viet Nam. Moderate to heavy rains, strong wind and increasing temperature are likely to take place in the upper part of LMB. Temperature will increase in the northeast and then move to other places of the region in August. The monsoon trough lies across the LMB throughout the period with rainfall and isolated heavy rains in the upper and middle parts from Chaing Saen to Pakse.

Figure 1 presents the weather map during 21-24 August 2023, indicating that a low-pressure cell was active in the East-Sea of Viet Nam, having rainfall impact on the LMB area. Generally, the Mekong region was influenced by the southwest monsoon and the ITCZ band located in northern part of the region with active low-pressure cell located over northern Viet Nam. Under this weather condition, moderate to heavy rainfall occurred over most parts LMB, especially over central part of Lao PDR, eastern part of Thailand in LMB, the 3S area, northeastern Cambodia, and central to northern Viet Nam.

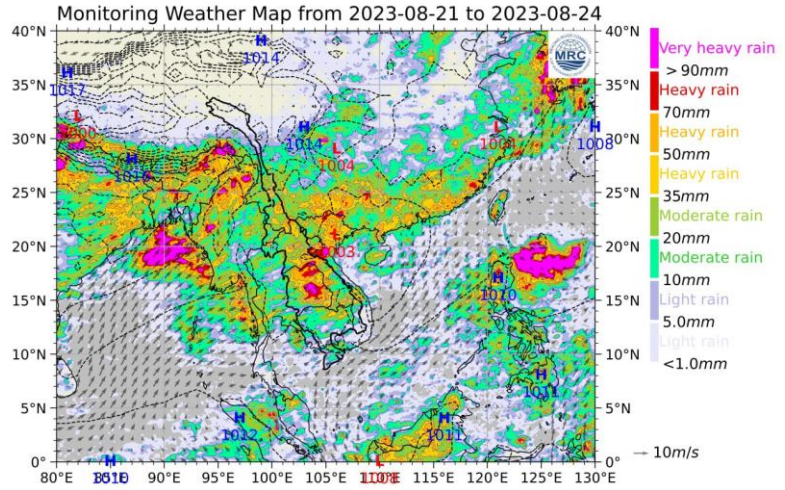

Figure 1. Summary of weather conditions over the LMB.

According to the ASEAN Specialised Meteorological Centre (ASMC), the highest probability of wet condition is predicted over the lower part of the Mekong region from 21 August to 3 September 2023. 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 21 August to 3 September 2023 in Southeast Asia based on results from the NCEP model (National Centres for Environmental Prediction).

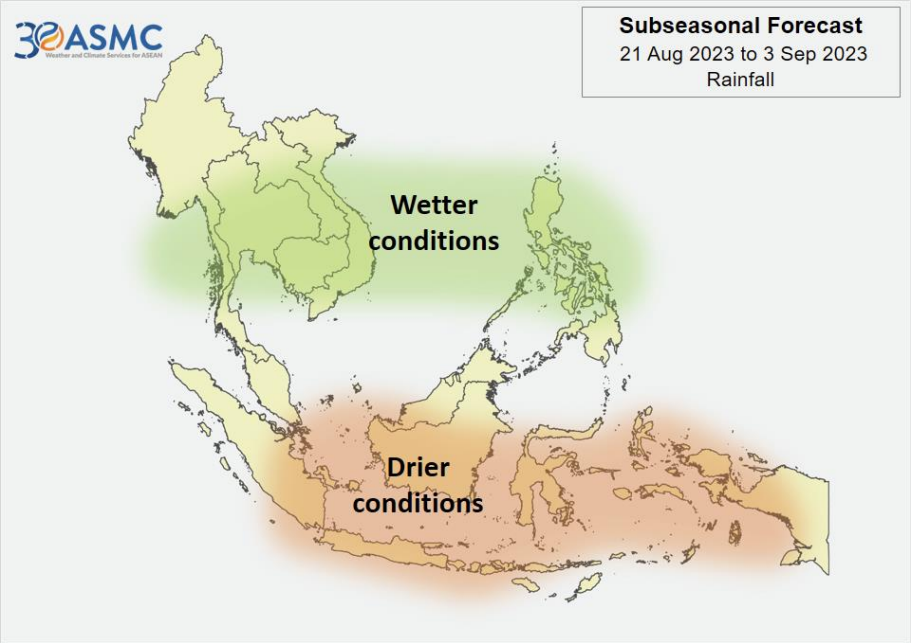

Figure 2. Outlook of wet and dry conditions over the Asian countries by ASMC.

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

There was no movement of any storm from the sea to the LMB during 22-28 Aug 2023. No low-pressure line was observed over the Mekong region as shown in Figure 1. The active system for the LMB on August 28 is displayed in Figure 3.

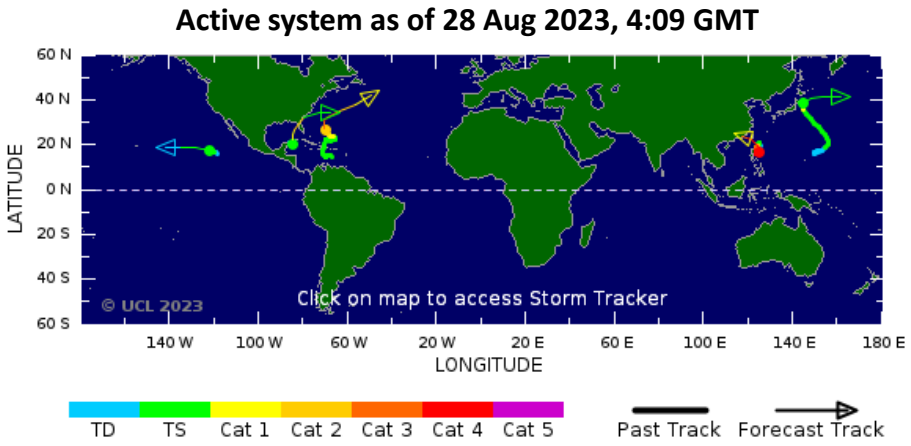

Figure 3. A tropical depression risk observed on 28 August 2023.

2.2 Rainfall patterns over the LMB

This week from 22 to 28 August 2023, rainfall was observed at the key stations along the mainstream from Chiang Saen in Thailand to the lower part stations in Cambodia and Tan Chau and Chau Doc in Viet Nam of the Lower Mekong Basin, varied from 6.00 mm to 272.10 mm. The highest rainfall of this week report was recorded at Paksane in Lao PDR reaching 272.10 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 considered high in the upper and middle parts of the LMB, compared with its last week rainfall in most of the stations.

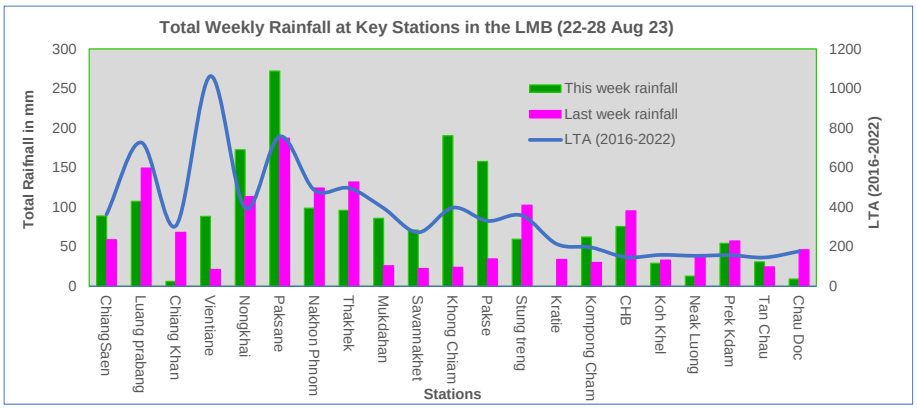

Figure 4. Weekly total rainfall at key stations in the LMB during 22-28 August 2023.

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 22 to 28 August 2023.

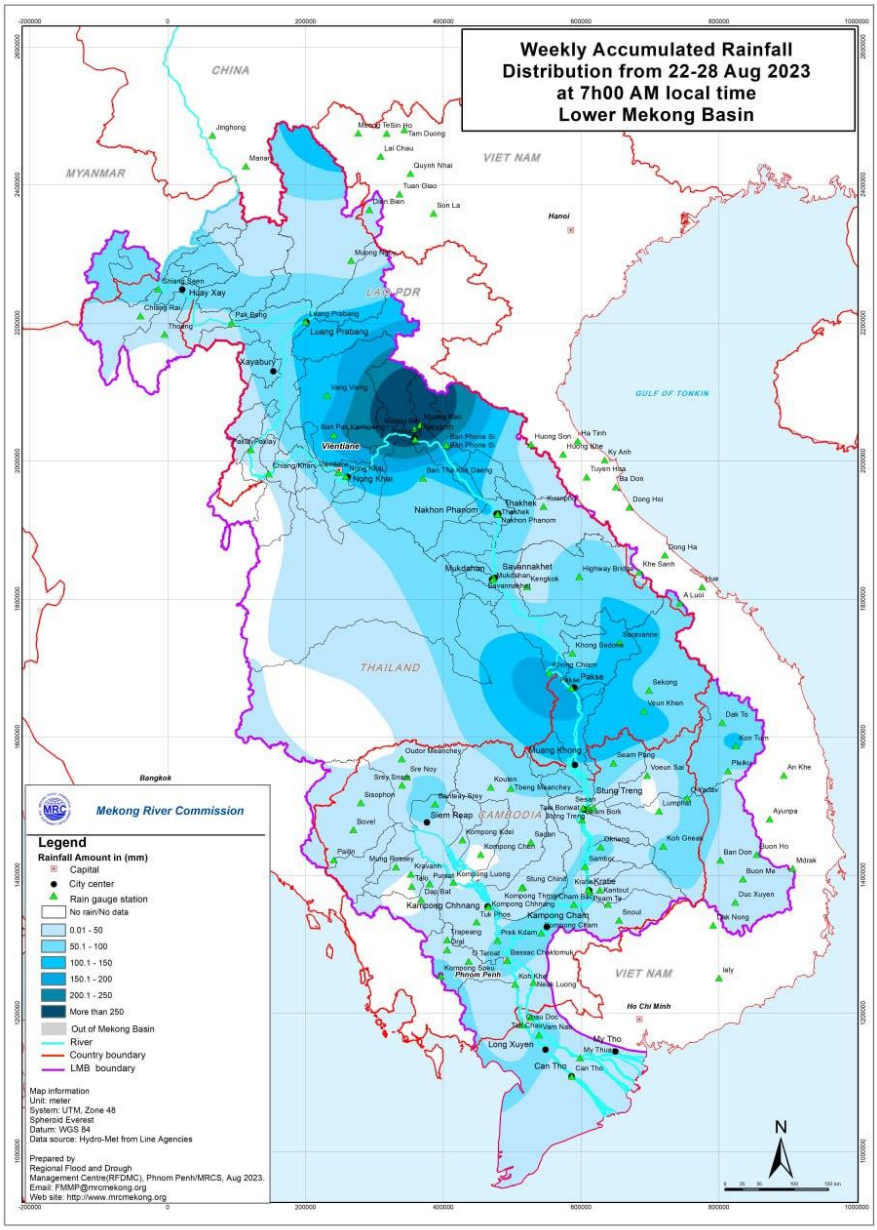

Figure 5. Weekly rainfall distribution over the LMB during 22-28 August 2023.

3 Water Levels in the Lower Mekong Basin

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.

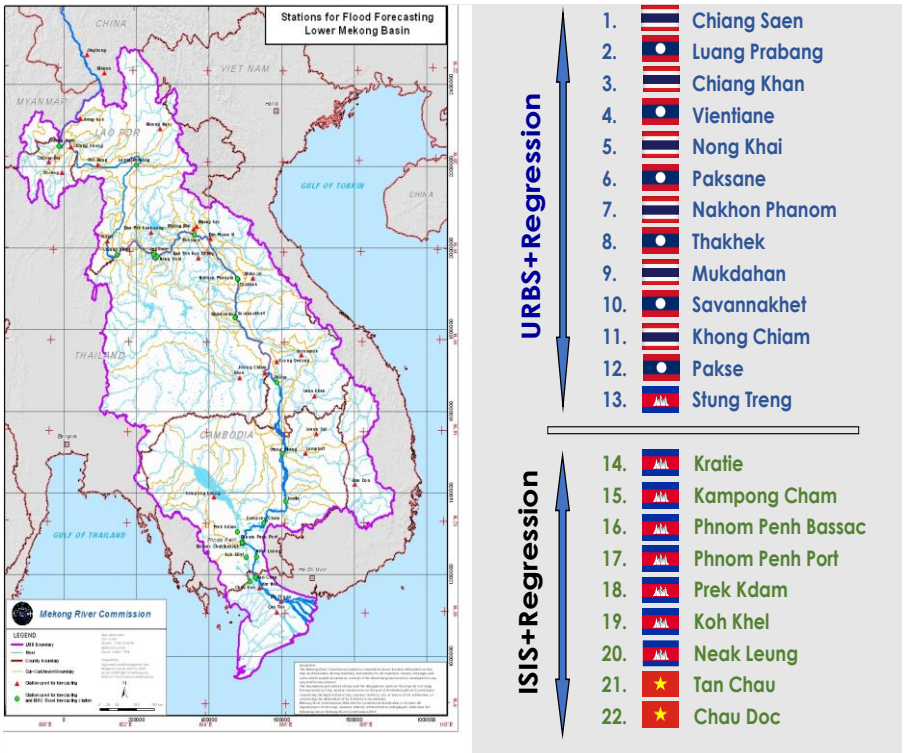

Figure 6. Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC's observed water level at Jinghong, it showed decreased levels between **535.21 m** and **536.39 m** during 22-28 August 2023 (recorded on 7:00 am). The current level is staying about 0.48 m lower than its LTA value (max: 2015-2022). The outflow at Jinghong station decreased between 814.00 m^3/s and 1,560.00 m^3/s from 22 to 28 August 2023. Figure 7 below presents water level that decreased level at the Jinghong hydrological station[1], indicating the trend of fluctuating water level up to 28 August 2023.

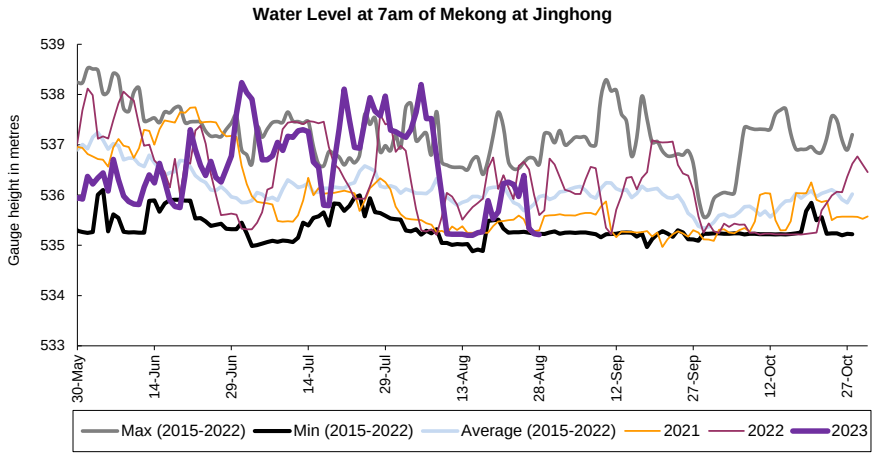

Figure 7. Water level at the Jinghong hydrological station up to 28 August 2023.

With the decreased outflow from Jinghong upstream, water levels of monitoring stations at Xieng Kok in Lao PDR, upper of Chiang Saen, showed a decreased water level about 1.25 m; while at Chiang Saen in Thailand it showed an increase of about 0.18 m from 22 to 28 August 2023, staying about 3.34 m lower than its LTA level, considered low.

Water level at Chiang Khan in Thailand from 22 to 28 August 2023, moreover, increased about 0.27 m and stayed about 2.83 m lower than its LTA value; while water level at Vientiane station increased about 0.11 m and stayed about 1.97 m lower than its LTA level, which was **considered low water level**. Water levels at Nong Khai increased 0.16 m, staying 3.84 m lower than its LTA value. And at Paksane it was considered stable level at 7.05 m, staying about 3.68 m lower than their LTA value, **which was considered low**.

Water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR decreased between 0.39 m and 0.81 m. The current WLs at these stations are staying lower over 1.50 m lower than their LTA level, **considered low**. From the stretches of the river at Stung Treng, WL decreased 0.35 m and stayed about 1.85 m lower than its LTA, while at Kratie water level was down about 0.70 m, staying 3.10 m lower than its LTA level, **considered low.**

Water level at Kompong Cham was down about 0.60 m and stayed 3.34 m lower than its LTA value. Water levels at Chaktomuk, Koh Khel, Phnom Penh Port and Prek Kdam in Cambodia

[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.

dropped between 0.28 m and 0.44 m, and WLs at these stations were lower than their LTA level, **considered low**.

Water levels at the 22 stations along the Mekong River were staying lower than their LTA values, during this week report. The tidal stations at Tan Chua and Chau Doc had WLs 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 22 to 28 August 2023 at Thailand's Chiang Saen station increased from 3.08 m to 3.26 m, showing 3.34 m lower than its Long-Term-Average (LTA) value, which considered low. The water level at Luang Prabang station in Lao PDR was down about 0.06 m from 10.86 m to 10.80 m during the reporting period. This level shows 1.38 m lower than its LTA. The trend – sometimes higher or lower to its historical maximum and LTA values – has been observed since early of 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**.

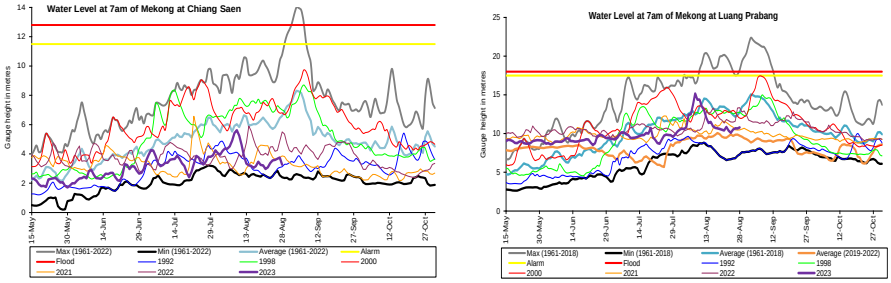

Figure 8. Water levels at Chiang Saen in Thailand and Luang Prabang in Lao PDR.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) increased about 0.27 m staying about 2.83 m lower than its LTA value. At Vientiane in Lao PDR, it also increased about 0.11 m and showed about 1.97 m lower than its LTA during the reporting week of 22-28 August 2023. At Nong Khai station in Thailand, the water level was down about 0.16 m from 5.28 m to 5.44 m, staying about 3.84 m lower than its LTA value, during the reporting period. At Paksane in Lao PDR, water level was stable at 2.05 m on the same period of the

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report. The water level at this station was about 3.68 m lower than its LTA value. The recently increased water levels from Chiang Khan to Paksane were obviously due to rainfalls contributed from the sub-catchment area along with the inflows and reservoir operation in the upstream part. The water levels at Vientiane and Paksane are shown in Figure 9 below.

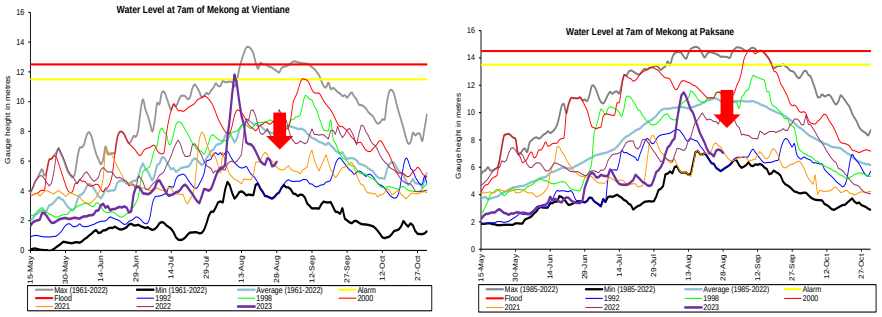


Figure 9. Water levels Veintiane and Paksane in Lao PDR.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR decreased between 0.39 m and 0.81 m. Consequently, water levels at these stations are about over 1.00 m lower than their LTA value, which considered low levels. Figure 10 shows the water levels at Nakhon Phanom and Pakse stations.

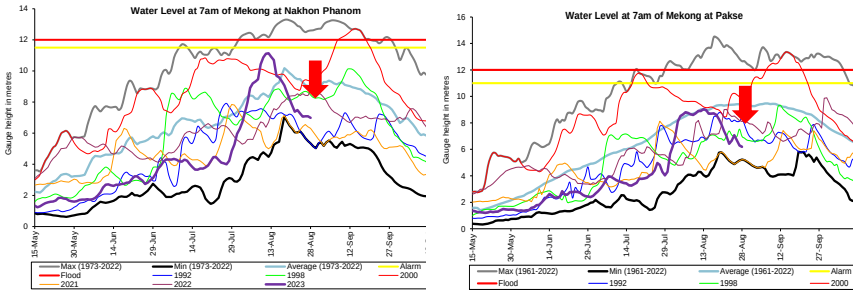


Figure 10. Weekly water levels at Nakhon Phanom in Thailand and Pakse in Lao PDR

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 continued decreasing during 22-28 August 2023. The water levels at Stung Treng decreased about 0.35 m and stayed about 1.85 m lower than its LTA, while at Kratie it decreased about 0.70 m, staying about 3.10 m lower than its LTA (as showed in Figure 11). The water level at

Kompong Cham station decreased about 0.60 m and was about 3.34 m lower than its LTA. The water levels at these stations were influenced by rainfall in their catchment areas, including Sekong, Se San and Srepok river basins.

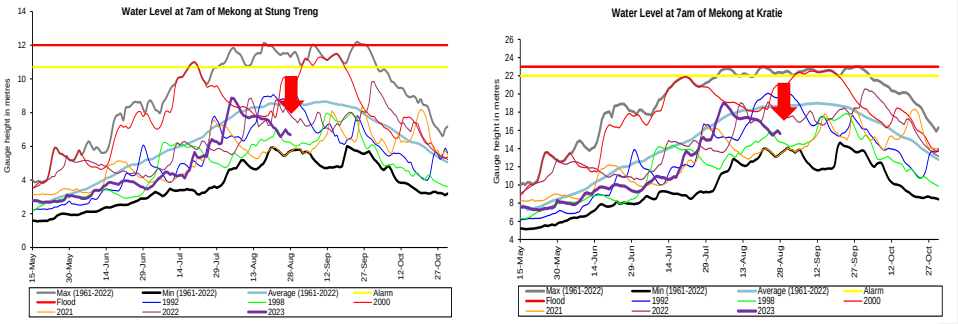


Figure 11. Water levels at Stung Treng and Kratie on the Mekong River.

At Chaktomuk on the Bassac River, due to less rainfall and contributed flows from upstream catchment, the water level decreased by about 0.33 m and stayed 2.61 m lower than its LTA value; while at Koh Khel, water level decreased about 0.31 m, staying 1.16 m lower than its LTA value. The water level at Prek Kdam on the Tonle Sap Lake decreased about 0.28 m and was about 2.39 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 at Prek Kdam was due to less rainfall and 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 the stations will rise and is considered normal**.

Tidal stations at Tan Chau and Chau Doc

Like last week, the water levels from 22 to 28 August 2023 at Viet Nam's Tan Chau and Chau Doc were fluctuating due to daily tidal effects from the sea. The fluctuation levels were between 1.37 m and 1.94 m; they were below the range of their LTA level and were **considered normal**.

The Tonle Sap Flow

At the end of the dry season, when water levels along the Mekong River rise then the inflows of the Mekong River return to the Tonle Sap Lake. This phenomenon normally takes place from end of May to July. Based on flow observation at Prek Kdam, the reversed flow from the Mekong River into the Tonle Sap began between 06 and 10 July 2023.

The flows of the Tonle Sap Lake were calculated based on a formula of rating-curves by different water levels at Kompong Luong and Phnom Penh Port for slop and Prek Kdam as cross-section of the Lake. The formula of flows at the Tonle Sap Lake is as follows:

Flows = (WL at Prek Kdam)^1.2*SQRT (WL difference between PP port and Kampong Luong)

Where, WL is water level in m (msl).

Figure 12 shows the seasonal changes of the outflow and the inflow/reversed flow of the TSL at Prek Kdam in comparison with the flows of 2020, 2011, 2022 and their LTA level (1997-2022). Up to August 28 of this reporting period, **it was observed that the main outflow from the Tonle Sap Lake decreased due to less 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 from the Tonle Sap Lake condition in 2023 is higher than 2020, 2021 but lower than 2022 and its LTA (1997-2022) inflow conditions. For next week, moderate rainfall is forecasted for the Tonle Sap area; and the inflow into the Tonle Sap Lake is likely expected to go up from the current level.

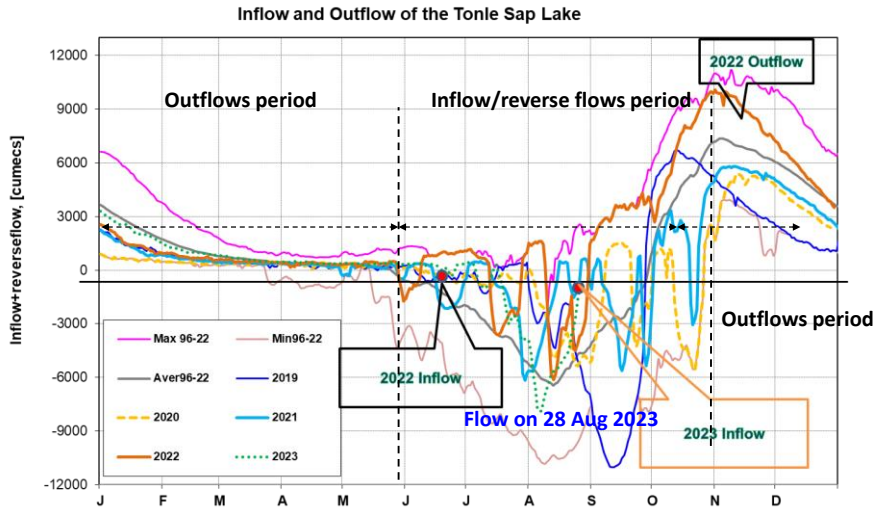


Figure 12. Seasonal change of inflows and outflows of Tonle Sap Lake

Figure 13 shows seasonal changes in monthly flow volumes up to 28 August 2023 for the Lake compared with the volumes in 2020, 2021, 2022 and their LTA, and the fluctuation levels (1997–2022). It shows that up to August 28, **the water volume of the Tonle Sap Lake was higher than 2020, 2021 but lower than 2022 and its LTA (about 78%), 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 situation**.

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.

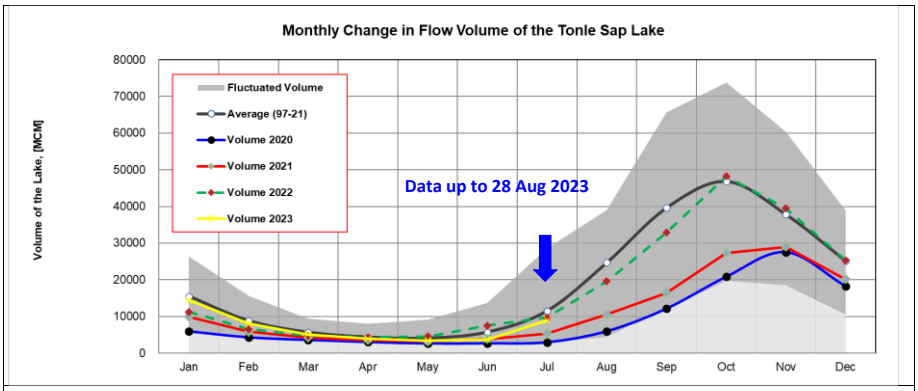


Figure 13. The seasonal change in monthly flow volume of Tonle Sap Lake.

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

Month	LTA (97-22) [MCM]	Max Volume [MCM]	Min Volume [MCM]	Volume 2019 [MCM]	Volume 2020 [MCM]	Volume 2021 [MCM]	Volume 2022 [MCM]	Volume 2023 [MCM]	Volume in 2023 [%], compared with its LTA
Jan	15523.23	26357.53	5906.80	10285.31	5906.80	9923.80	11214.32	14422.11	92.91
Feb	8837.89	15596.22	4198.60	6019.30	4264.19	5832.97	6558.79	8069.29	91.30
Mar	5654.18	9438.24	3347.07	4354.62	3553.99	4264.88	4736.52	5080.64	89.86
Apr	4346.65	8009.14	2866.91	3667.47	2992.61	3556.68	4288.31	3884.16	89.36
May	4030.23	9176.93	2417.81	3266.43	2594.92	3240.78	4556.83	3438.66	85.32
Jun	5708.30	13635.01	2468.70	3517.06	2641.88	3798.29	7489.04	3689.97	64.64
Jul	11493.25	28599.56	2925.86	4001.99	2925.86	5346.73	9703.79	8940.31	77.79
Aug	24666.69	39015.12	4433.46	7622.71	5941.07	10547.80	19554.70		
Sep	39634.03	65632.35	12105.31	24194.19	12105.31	16382.34	32860.34		
Oct	46873.44	73757.23	19705.50	30358.38	20799.13	27318.21	48199.12		
Nov	37823.16	60367.33	18534.61	19112.65	27546.80	28982.93	39452.53		
Dec	25126.11	38888.95	10563.49	10577.29	18251.65	20170.76	25346.65		
	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)					LTA: Long-Term-Average				

4 Flash Flood in the Lower Mekong Basin

During the weekly monitoring period from August 22 to 28, the LMB received from moderate to heavy rain and isolated thundershowers in some areas.

According to the MRC-Flash Flood Guidance System (MRC-FFGS) and analysis, low to hight risk of flash flood events were detected during the reporting period in some area of Lao PDR and Viet Nam as shown in Figure 14 and Table 2.

Table 2. Detected low-risk flash flood in the LMB during August 22-28.

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 23-08-2023 0:00 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
Cao Bang	Bao Lac	Northeast	Low-Risk	Cao Bang	Bao Lac	Northeast	Low-Risk	Lao Cai	Bat Xat	Northeast	Low-Risk
Ha Giang	Quan Ba	Northeast	Low-Risk					Ha Giang	Vi Xuyen	Northeast	Low-Risk
								Cao Bang	Bao Lac	Northeast	Low-Risk
								Ha Giang	Yen Minh	Northeast	Low-Risk
								Ha Giang	Quan Ba	Northeast	Low-Risk
								Ha Giang	Bac Me	Northeast	Low-Risk
								Lao Cai	Bao Yen	Northeast	Low-Risk
								Nghe An	Tuong Duong	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 24-08-2023 0:00 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
Cao Bang	Hoa An	Northeast	Low-Risk	Cao Bang	Hoa An	Northeast	Moderate-Risk	Cao Bang	Hoa An	Northeast	Moderate-Risk
Cao Bang	Ha Quang	Northeast	Low-Risk	Ha Giang	Vi Xuyen	Northeast	Low-Risk	Cao Bang	Ha Quang	Northeast	Low-Risk
Ha Giang	Vi Xuyen	Northeast	Low-Risk	Ha Giang	Quan Ba	Northeast	Low-Risk	Cao Bang	Nguyen Binh	Northeast	Low-Risk
Ha Giang	Yen Minh	Northeast	Low-Risk	Ha Giang	Bac Me	Northeast	Low-Risk	Lao Cai	Bat Xat	Northeast	Low-Risk
Ha Giang	Quan Ba	Northeast	Low-Risk	Ha Giang	Bac Quang	Northeast	Low-Risk	Son La	Phu yen	Northeast	Low-Risk
Ha Giang	Bac Me	Northeast	Moderate-Risk	Nghe An	Que Phong	Northeast	Low-Risk	Tuyen Quang	Chiem Hoa	Northeast	Low-Risk
Ha Giang	Bac Quang	Northeast	Low-Risk	Thanh Hoa	Muong Lat	Northeast	Low-Risk	Tuyen Quang	Chiem Hoa	Northeast	Low-Risk
Nghe An	Que Phong	Northeast	Low-Risk	Nghe An	Tuong Duong	Northeast	Low-Risk	Ha Giang	Vi Xuyen	Northeast	Low-Risk
Thanh Hoa	Muong Lat	Northeast	Low-Risk	Nghe An	Con Cuong	Northeast	Low-Risk	Ha Giang	Bac Me	Northeast	Low-Risk
Nghe An	Tuong Duong	Northeast	Low-Risk	Nghe An	Quy Chau	Northeast	Low-Risk	Ha Giang	Yen Minh	Northeast	Low-Risk
Nghe An	Con Cuong	Northeast	Low-Risk					Ha Giang	Quan Ba	Northeast	Low-Risk
Nghe An	Quy Chau	Northeast	Low-Risk					Ha Giang	Bac Me	Northeast	Moderate-Risk
Nghe An	Que Phong	Northeast	Low-Risk					Ha Giang	Bac Quang	Northeast	Low-Risk
								Lao Cai	Bao Yen	Northeast	Low-Risk
								Tuyen Quang	Ham Yen	Northeast	Low-Risk
								Nghe An	Tuong Duong	Northeast	Low-Risk
								Nghe An	Que Phong	Northeast	Low-Risk
								Nghe An	Quy Chau	Northeast	Low-Risk
								Thanh Hoa	Muong Lat	Northeast	Low-Risk
								Nghe An	Que Phong	Northeast	Low-Risk
								Nghe An	Con Cuong	Northeast	Low-Risk
								Nghe An	Quy Chau	Northeast	Low-Risk

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

Date of FFG products 24-08-2023 0:00 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
Xiengkhuang	Khoune	LATHONG	Northwest	Low-Risk	Xiengkhuang	Khoune	LATHONG	Northwest	Low-Risk	Xiengkhuang	Khoune	LATHONG	Northwest	Low-Risk
Bolikhamxay	Thaphabat		Northwest	Low-Risk	Huaphanh	Xamtay		Northwest	Low-Risk	Xaysomboun	Thathom		Northwest	Low-Risk
Huaphanh	Xamtay		Northwest	Low-Risk	Xiengkhuang	Nonghed		Northwest	Low-Risk	Bolikhamxay	Thaphabat		Northwest	Low-Risk
Xiengkhuang	Nonghed		Northwest	Low-Risk	Huaphanh	Xamtay	NAMATH	Northwest	Low-Risk	Bolikhamxay	Thaphabat		Northwest	Low-Risk
Huaphanh	Xamtay	NAMATH	Northwest	Low-Risk	Xiengkhuang	Nonghed		Northwest	Low-Risk	Xaysomboun	Xaysombou		Northwest	Low-Risk
Huaphanh	Xamtay	MEUAKUANE	Northwest	Low-Risk	Xiengkhuang	Nonghed		Northwest	Low-Risk	Xaysomboun	Xaysombo	PHOUHU	Northwest	Low-Risk
Xiengkhuang	Nonghed		Northwest	Low-Risk						Khammuane	Hinboon	NA TANG	Northwest	Low-Risk
Xiengkhuang	Nonghed		Northwest	Moderate-Risk						Champasak	Paksong		Northwest	Low-Risk
										Huaphanh	Xamtay		Northwest	Low-Risk
										Xiengkhuang	Nonghed		Northwest	Low-Risk
										Huaphanh	Xamtay	NAMATH	Northwest	Low-Risk
										Huaphanh	Xamtay	NAXANG	Northwest	Low-Risk
										Huaphanh	Xamtay	MEUAKU	Northwest	Low-Risk
										Huaphanh	Xamtay	PAKHOM	Northwest	Low-Risk
										Xiengkhuang	Nonghed		Northwest	Low-Risk
										Xiengkhuang	Nonghed		Northwest	Moderate-Risk
										Xiengkhuang	Nonghed		Northwest	Low-Risk

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

Date of FFG products 28-08-2023 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
Huaphanh	Xiengkhor		Northwest	Moderate-Risk	Huaphanh	Xiengkhor		Northwest	Low-Risk	Vientiane	Feuang		Northwest	Low-Risk
Huaphanh	Viengthon		Northwest	High-Risk	Huaphanh	Viengthon		Northwest	Low-Risk	Huaphanh	Viengthon		Northwest	Low-Risk
Huaphanh	Xiengkhor		Northwest	Low-Risk	Huaphanh	Viengthon		Northwest	Moderate-Risk	Luangprabang	Pak xeng		Northwest	Low-Risk
Huaphanh	Viengthon	PHAMORN	Northwest	Low-Risk	Huaphanh	Viengthon		Northwest	Low-Risk	Huaphanh	Xiengkhor		Northwest	Moderate-Risk
Huaphanh	Viengthon		Northwest	Moderate-Risk						Luangprabang	Viengkham		Northwest	Low-Risk
Huaphanh	Viengthon	VATKHUANG	Northwest	Low-Risk						Huaphanh	Viengthon		Northwest	Moderate-Risk
										Huaphanh	Xiengkhor		Northwest	Low-Risk
										Huaphanh	Viengthon	PHAMOR	Northwest	Low-Risk
										Huaphanh	Viengthon	VATKHUA	Northwest	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 28-08-2023 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
Cao Bang	Quang Hoa	Northeast	Low-Risk	Cao Bang	Hoa An	Northeast	Moderate-Risk	Cao Bang	Quang Hoa	Northeast	Low-Risk
Cao Bang	Hoa An	Northeast	High-Risk	Bac Kan	Ngan Son	Northeast	Low-Risk	Cao Bang	Hoa An	Northeast	Moderate-Risk
Cao Bang	Ha Quang	Northeast	Low-Risk	Cao Bang	Tra Linh	Northeast	Low-Risk	Cao Bang	Ha Quang	Northeast	Low-Risk
Cao Bang	Nguyen Binh	Northeast	Moderate-Risk	Yen Bai	Tram Tau	Northeast	Low-Risk	Cao Bang	Nguyen Binh	Northeast	Moderate-Risk
Cao Bang	Thach An	Northeast	Low-Risk	Lao Cai	Bat Xat	Northeast	Low-Risk	Cao Bang	Thach An	Northeast	Low-Risk
Bac Kan	Ngan Son	Northeast	Low-Risk	Hoa Binh	Da Bac	Northeast	Low-Risk	Bac Kan	Ngan Son	Northeast	Low-Risk
Lang Son	Binh Gia	Northeast	Low-Risk	Lao Cai	Bat Xat	Northeast	Low-Risk	Lang Son	Binh Gia	Northeast	Low-Risk
Lang Son	Trang Dinh	Northeast	Low-Risk	Son La	TX. Son La	Northeast	Low-Risk	Lang Son	Trang Dinh	Northeast	Low-Risk
Bac Kan	Na Ri	Northeast	Low-Risk	Son La	Mai Son	Northeast	Low-Risk	Bac Kan	Na Ri	Northeast	Low-Risk
Bac Kan	Bach Thong	Northeast	Low-Risk	Son La	Bac Yen	Northeast	Low-Risk	Bac Kan	Bach Thong	Northeast	Low-Risk
Cao Bang	Tra Linh	Northeast	Low-Risk	Son La	Phu yen	Northeast	Low-Risk	Cao Bang	Tra Linh	Northeast	Low-Risk
Yen Bai	Tram Tau	Northeast	Low-Risk	Ha Giang	Xin Man	Northeast	Low-Risk	Lao Cai	Bat Xat	Northeast	Low-Risk
Lao Cai	Bat Xat	Northeast	Low-Risk	Ha Giang	Hoang Su Phi	Northeast	Low-Risk	Lao Cai	TX. Cam Duong	Northeast	Low-Risk
Lao Cai	Van Ban	Northeast	Low-Risk	Lao Cai	Bao Yen	Northeast	Low-Risk	Lao Cai	Van Ban	Northeast	Low-Risk
Hoa Binh	Da Bac	Northeast	Low-Risk	Tuyen Quang	Chiem Hoa	Northeast	Low-Risk	Yen Bai	Mu Cang Chai	Northeast	Low-Risk
Lao Cai	Bat Xat	Northeast	Low-Risk	Tuyen Quang	Na Hang	Northeast	Low-Risk	Yen Bai	Mu Cang Chai	Northeast	Low-Risk
Son La	Thuan Chau	Northeast	Low-Risk	Bac Kan	Ba Be	Northeast	Low-Risk	Hoa Binh	Da Bac	Northeast	Low-Risk
Son La	TX. Son La	Northeast	Low-Risk	Bac Kan	Bach Thong	Northeast	Low-Risk	Lao Cai	Sa Pa	Northeast	Low-Risk
Son La	Mai Son	Northeast	Low-Risk	Ha Giang	Bac Quang	Northeast	Low-Risk	Lao Cai	Than Uyen	Northeast	Low-Risk
Son La	TX. Son La	Northeast	Low-Risk	Ha Giang	Hoang Su Phi	Northeast	Low-Risk	Son La	Muong La	Northeast	Low-Risk
Son La	Yen Chau	Northeast	Low-Risk	Ha Giang	Vi Xuyen	Northeast	Low-Risk	Son La	Thuan Chau	Northeast	Low-Risk
Son La	Mai Son	Northeast	Moderate-Risk	Ha Giang	Bac Me	Northeast	Low-Risk	Son La	Muong La	Northeast	Low-Risk
Son La	Bac Yen	Northeast	Low-Risk	Ha Giang	Bac Quang	Northeast	Low-Risk	Yen Bai	Tram Tau	Northeast	Low-Risk
Son La	Phu yen	Northeast	Low-Risk	Yen Bai	Luc Yen	Northeast	Low-Risk	Son La	Mai Son	Northeast	Low-Risk
Ha Giang	Xin Man	Northeast	Low-Risk	Tuyen Quang	Ham Yen	Northeast	Low-Risk	Son La	TX. Son La	Northeast	Low-Risk
Tuyen Quang	Chiem Hoa	Northeast	Moderate-Risk	Bac Kan	TX. Bac Kan	Northeast	Moderate-Risk	Son La	Mai Son	Northeast	Low-Risk
Bac Kan	Ba Be	Northeast	Low-Risk	Son La	Song Ma	Northeast	Moderate-Risk	Son La	Yen Chau	Northeast	Low-Risk
Tuyen Quang	Na Hang	Northeast	Low-Risk					Son La	Mai Son	Northeast	Moderate-Risk

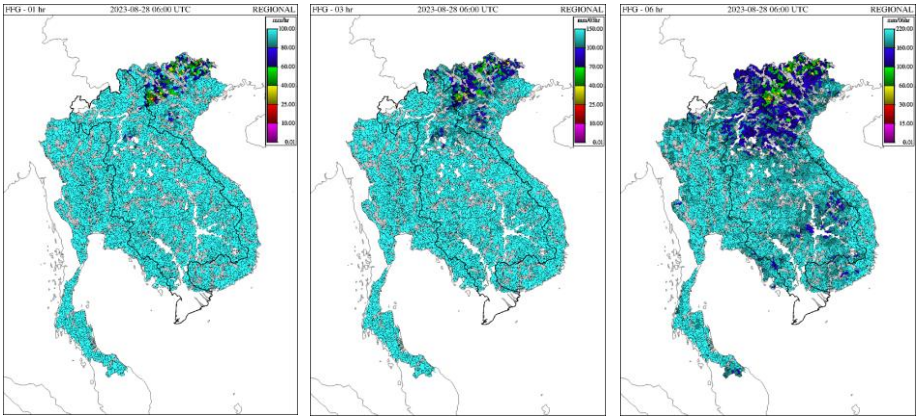


Figure 14. Flash Flood Guidance for the next 1-hr, 3-hr and 6-hr on August 28

5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 21 to 27 August 2023

Drought monitoring data in 2023 are available from Monday to Sunday every week; thus, the reporting period is normally delayed by two 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)**

The meteorological drought indicator of SPI from Aug 21 to 27, as displayed in Figure 15, shows that the LMB was severely dry from the middle to the lower parts of the region. The conditions were more severe than the previous weeks. The impacted areas are listed in the table below.

Number	Country	Province	Mderate	Severe	Extreme
1	Cambodia	Banteay Meanchey	x	x	x
2	Cambodia	Siem Reap	x	x	
3	Cambodia	Preah Vihear	x	x	
4	Cambodia	Stung treng	x	x	
5	Cambodia	Ratana Kiri	x	x	x
6	Cambodia	Battambang	x		
7	Cambodia	Pursat	x	x	
8	Cambodia	Koh Kong	x		
9	Cambodia	Kampong Thom	x	x	
10	Cambodia	Kampong Cham	x	x	
11	Cambodia	Kratie	x		
12	Cambodia	Kandal	x	x	
13	Cambodia	Takeo	x	x	
14	Cambodia	Kampot	x		
15	Cambodia	Prey Veng	x		
16	Cambodia	Svai Rieng	x		
17	Cambodia	Otdar Meanchey	x	x	x
18	Cambodia	Mondul Kiri	x	x	
19	Laos	Luang Prabang	x	x	
20	Laos	Bokeo	x		
21	Laos	Xayaburi	x	x	
22	Laos	Vientiane	x	x	
23	Laos	Luangnamtha	x		
24	Laos	Svannakhet	x		
25	Laos	Borikhamxay	x	x	
26	Laos	Saravane	x	x	
27	Laos	Khammuane	x	x	
28	Laos	Sekong	x	x	
29	Laos	Champasack	x	x	
30	Laos	Attapeu	x	x	
31	Thailand	Chiang Mai	x		
32	Thailand	Chiang Rai	x	x	
33	Thailand	Payao	x	x	x
34	Thailand	Loei	x	x	
35	Thailand	Nong Bua Lamphu	x		
36	Thailand	Khon Kaen	x	x	
37	Thailand	Udon Thani	x	x	
38	Thailand	Chaiyaphum	x	x	
39	Thailand	Nakhon Ratchasima	x	x	
40	Thailand	Maha Sarakham	x		
41	Thailand	Roi Et	x		
42	Thailand	Sa Kaeo	x	x	
43	Thailand	Yasothon	x		
44	Thailand	Si Saket	x		
45	Thailand	Ubon Ratchathani	x	x	
46	Thailand	Amnat Charoen	x	x	
47	Thailand	Kalasin	x	x	
48	Viet Nam	Kon Tum	x	x	x
49	Viet Nam	Gia Lai	x	x	x
50	Viet Nam	Dak Lak	x	x	x
51	Viet Nam	Tay Ning	x		
52	Viet Nam	Long An	x	x	
53	Viet Nam	An Giang	x	x	
54	Viet Nam	Tien Giang	x	x	
55	Viet Nam	Ben Tre	x	x	
56	Viet Nam	Dong Thap	x		
57	Viet Nam	Tra Vinh	x		
58	Viet Nam	Can Tho	x		
59	Viet Nam	Soc Trang	x	x	
60	Viet Nam	Bac Lieu		x	
61	Viet Nam	Kien Giang	x	x	
62	Viet Nam	Ca Mau	x	x	
		Moderate		Extreme	
		Severe		No drought	

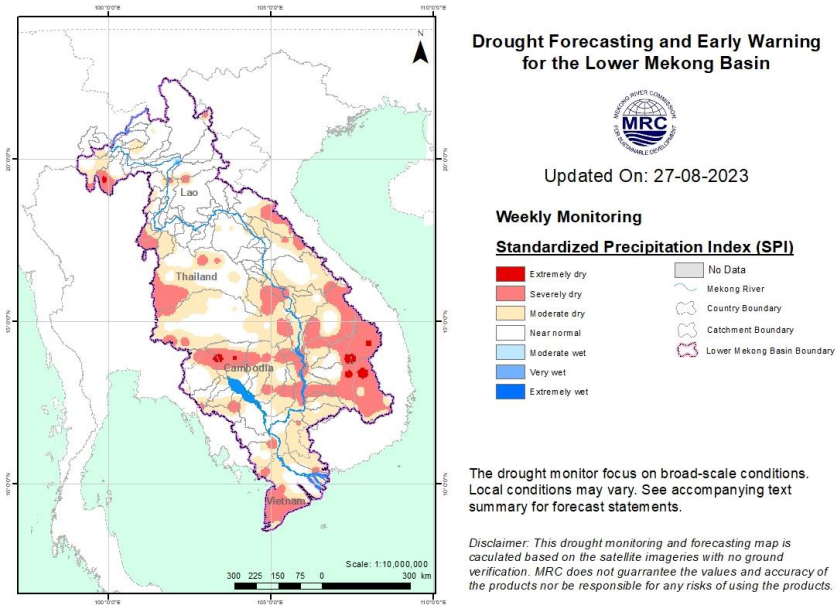


Figure 15. Weekly standardized precipitation index from 21 to 27 August 2023.

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

For the agricultural indicator, the nowcast this week from Aug 21 to 27 indicates that the LMB was facing some moderate and severe agricultural droughts in the central and southern parts of the region covering Thailand, Laos, Cambodia and Vietnam. Figure 16 displays weekly ISWF for the LMB.

Number	Country	Province	Mderate	Severe	Extreme
1	Cambodia	Otdar Meanchey	x		
2	Cambodia	Siem Reap	x	x	
3	Cambodia	Preah Vihear	x	x	
4	Cambodia	Battambang	x		
5	Cambodia	Ratana Kiri	x		
6	Cambodia	Stung Treng	x		
7	Cambodia	Pursat	x		
8	Cambodia	Kratie	x	x	
9	Cambodia	Kampong Thom	x	x	
10	Cambodia	Kampong Cham	x	x	
11	Cambodia	Mondul Kiri	x		
12	Cambodia	Prey Veng	x		
13	Cambodia	Svai Rieng	x		
14	Cambodia	Pailin	x		
15	Laos	Luang Prabang	x		
16	Laos	Borikhamxay	x	x	
17	Laos	Savannakhet	x	x	
18	Laos	Saravane	x		
19	Laos	Sekong	x		

20	Laos	Champasack	x	x
21	Laos	Attapeu	x	x
22	Thailand	Loei	x	x
23	Thailand	Roi Et	x	
24	Thailand	Burirum	x	
25	Thailand	Surin	x	
26	Thailand	Si Saket	x	
27	Thailand	Phayao	x	
28	Thailand	Nakhon Ratchasima	x	
29	Thailand	Ubon Ratchathani	x	x
30	Thailand	Udon Thani	x	x
31	Viet Nam	Kon Tum	x	
32	Viet Nam	Gia Lai	x	x
33	Viet Nam	Dak Lak	x	x
34	Viet Nam	Lam Dong	x	x
35	Viet Nam	Tay Ning	x	x
36	Viet Nam	Long An	x	
37	Viet Nam	Dong Thap	x	
38	Viet Nam	Tien Giang	x	
		Moderate		Extreme
		Severe		No drought

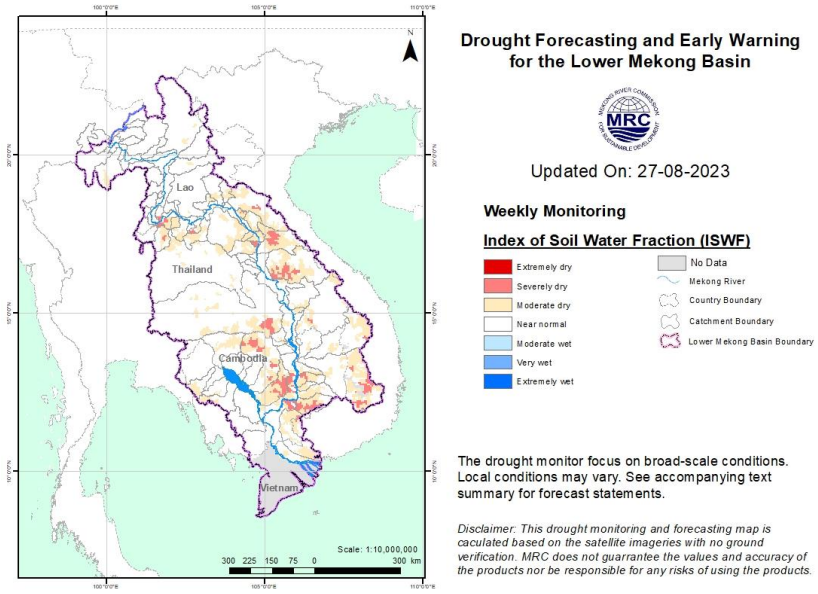


Figure 16. Index of Soil Water Fraction from 21 to 27 August 2023.

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

The combined drought indicator from the meteorological and agricultural indices August 21 to 27, as displayed in Figure 17, shows that some moderate and severe droughts were detected in the middle and southern parts of the LMB. The conditions were more severe than the previous weeks.

Number	Country	Province	Mderate	Severe	Extreme	Exceptional
1	Cambodia	Otdar Meanchey	x	x		
2	Cambodia	Siem Reap	x	x		
3	Cambodia	Preah Vihear	x	x		
4	Cambodia	Stung Treng	x			
5	Cambodia	Ratana Kiri	x	x		
6	Cambodia	Mondul Kiri	x			
7	Cambodia	Kratie	x	x		
8	Cambodia	Kampong Thom	x	x		
9	Cambodia	Kampong Cham	x	x		
10	Cambodia	Pursat	x			
11	Cambodia	Battambang	x			
12	Cambodia	Takeo	x			
13	Cambodia	Kandal	x			
14	Cambodia	Svay Rieng	x			
15	Cambodia	Prey Veng	x			
16	Laos	Khammuane	x	x		
17	Laos	Borikhamxay		x		
18	Laos	Xayaburi	x			
19	Laos	Luang Prabang	x			
20	Laos	Saravane	x			
21	Laos	Sekong	x	x		
22	Laos	Champasack	x	x		
23	Laos	Attapeu	x	x		
24	Thailand	Chiang Rai	x			
25	Thailand	Phayao	x	x		
26	Thailand	Loei	x	x		
27	Thailand	Nong Bua Lamphu	x			
28	Thailand	Udon Thani	x			
29	Thailand	Sakon Nakhon	x			
30	Thailand	Chaiyaphum	x			
31	Thailand	Khon Kaen	x			
32	Thailand	Nakhon Phanom	x			
33	Thailand	Kalasin	x			
34	Thailand	Sa Kaeo	x			
35	Thailand	Nakhon Ratchasima	x			
36	Thailand	Buriram	x			
37	Thailand	Surin	x			
38	Thailand	Si Saket	x			
39	Thailand	Amnat Charoen	x			
40	Thailand	Ubon Ratchathani	x	x		
41	Viet Nam	Kon Tum	x	x		
42	Viet Nam	Gia Lai	x	x	x	
43	Viet Nam	Dak Lak	x	x	x	
44	Viet Nam	Long An	x			
45	Viet Nam	Tien Giang	x	x		
46	Viet Nam	Lam Dong	x			
47	Viet Nam	Dong Thap	x			
48	Viet Nam	Kien Giang	x			
		Moderate		Severe		
		Severe		Exceptional		

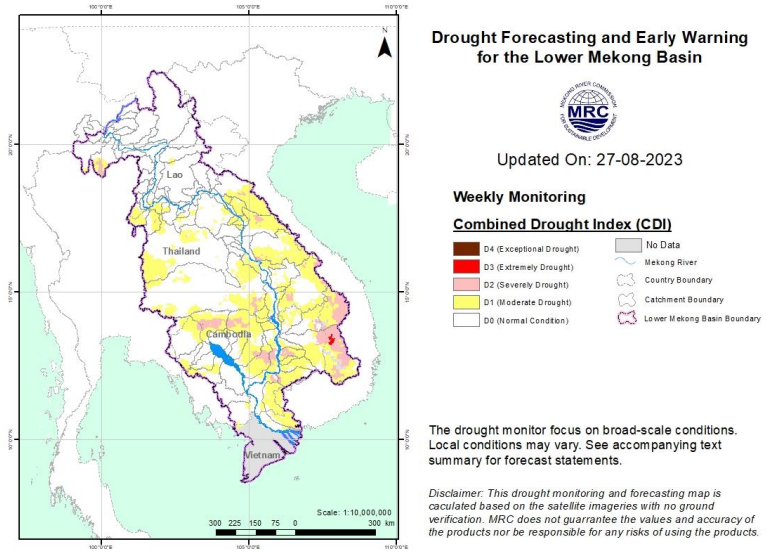


Figure 17. Weekly Combined Drought Index from 21 to 27 August 2023.

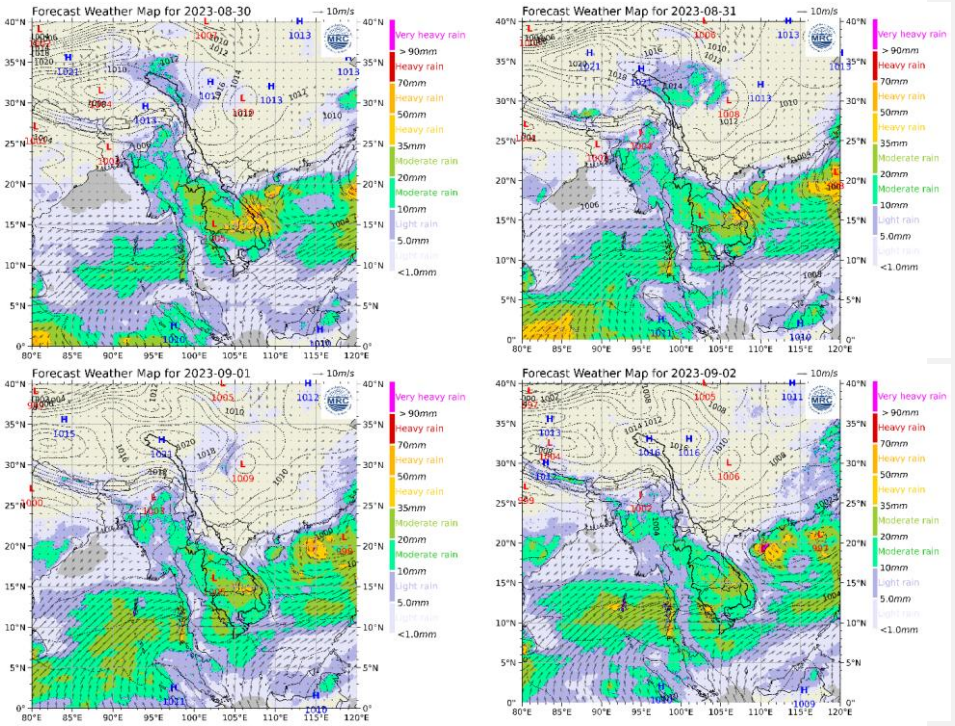
More information on Drought Forecasting and Early Warning (DFEW) as well as the explanation is available here: http://droughtforecast.mrcmekong.org/templates/view/our-product. DFEW provides not only weekly monitoring and forecasting information but also a three-month forecast of drought indicators with 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

During August 30 - September 05, based on result from the CHIRPS-GEFS, which merges observations from the Climate Hazards Group Infrared Precipitation with Stations (CHIRPS) data set with the Global Ensemble Forecast System (GEFS), small to heavy rain (5-75 mm/24h) is forecasted for the LMB area.

Figure 18 shows accumulated rainfall forecast (24h) of the forecasting model using CHIRPS-GEFS data from August 30 to September 05.



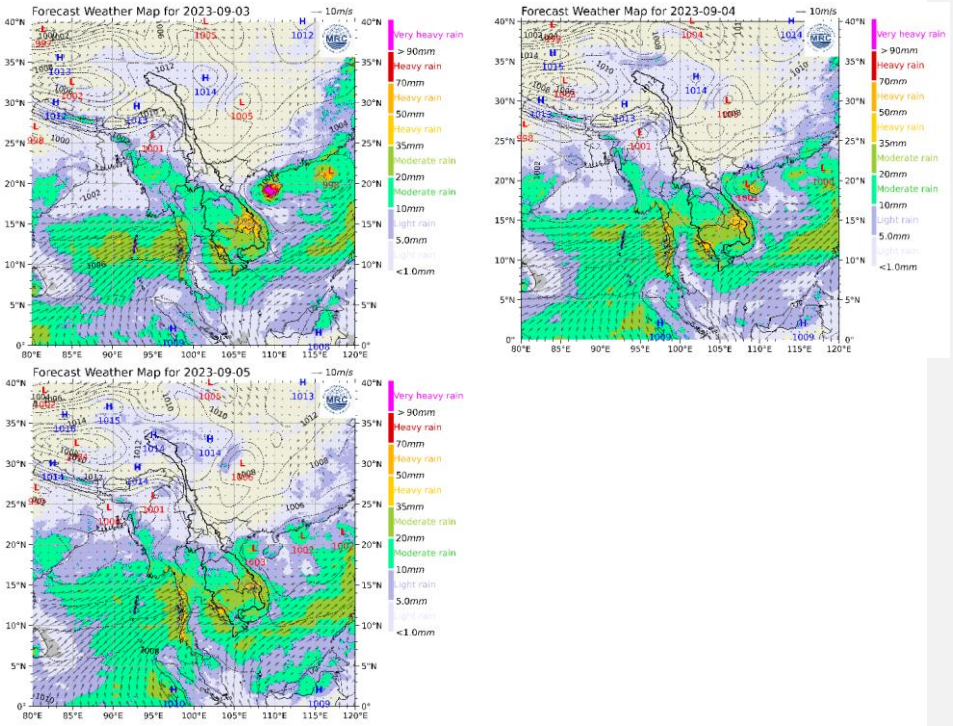


Figure 18. Accumulated rainfall forecast (24 h) based on the forecasting model using CHIRPS-GEFS data.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on August 28's daily flood forecasting bulletin, the daily forecasted water level at Chiang Saen in Thailand shows an increase of water level from 3.26 m to 3.50 m over the next five days. The trend will keep the water level at this station lower than its LTA.

For Luang Prabang in Lao PDR, the water level will decrease about 0.25 m during the next five days. The current water level is lower than its LTA. Precipitation is forecasted for the area between Chiang Saen and Luang Prabang next week.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand is forecasted to go down approximately 0.16 m, while water level at Vientiane in Lao PDR will decrease about 0.17 m. Furthermore, in Nong Khai of Thailand the water level will decrease about 0.13 m over the next five days; at Paksane in Lao PDR water level will increase about 0.32 m due to moderate rainfalls and dam operation in the upper catchments. Rainfall is forecasted for the area of Paksane next week. The water levels at these stations will stay higher than their LTA value.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand and Thakhek in Lao PDR are forecasted to go up between 0.17 m and 0.21, while from Mukdahan in Thailand to Pake in Lao PDR will go down between 0.02 m and 0.20 m due to below-average rainfall predicted and less inflows from upstream into these areas. Consequently, water level at these stations is still staying lower than their LTA level. Moderate rainfall is forecasted for the area next week.

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

WL at Stung Treng and Kratie in Cambodia will go down between 0.13 m and 0.46 m, while at Kompong Cham along the Mekong River the water level will go down about 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 go down between 0.05 m and 0.15 m over the next five days.

Water levels at most of the stations will go down during next week. WLs at most stations will be still staying lower than their LTA value. From Chiang Khan to Vientiane / Nong Khai and from Mukdahan to Pakse, and from Stung Treng to Kompong Cham and downstream at Phnom Penh the water level will drop and WLs at most stations will be staying lower than their LTA value. 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 staying lower than their LTA level, following daily tidal effects from the sea. Rainfall is forecasted for the Mekong Delta area next week.

The performance of the weekly flood forecast, with an accuracy and data input evaluation from 22 to 28 August 2023, is presented in **Annex 1**.

Table 2 shows the daily flood forecasting Bulletin issued on 28 August 2023. 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 to heavy rain for next week, flash floods might be detected in some areas in the LMB. And local heavy rain in a short period of time is possible with unpredictable short flash floods.

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 August 2023. 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 Variable 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 August, September, and October 2023. CDI is a combination of meteorological and agricultural indicators.

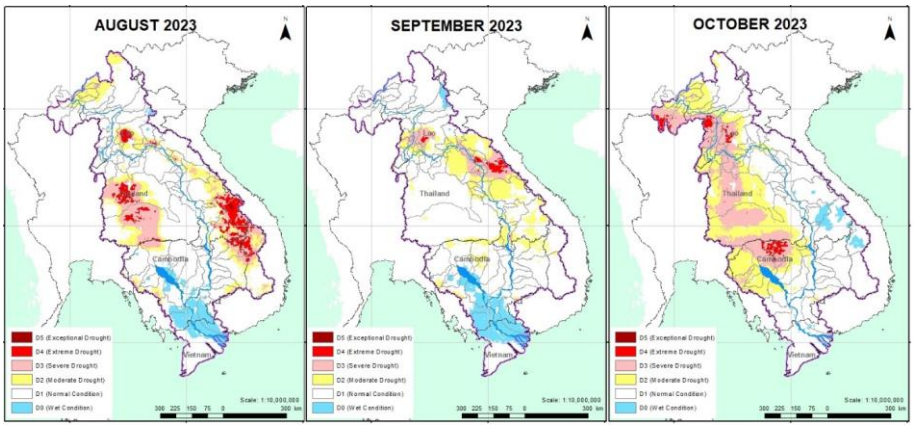


Figure 19. Monthly forecast of CDI for August, September, and October 2023.

Figure 19 above shows that **August** is expected to be moderately dry in the upper north, severely and extremely dry in the west covering mainly Thailand, and extremely dry in the south-east covering southern Laos and 3S areas. In **September**, Xayaburi, Vientiane and Luang Prabang of northern Laos are likely to be hit by moderate drought, while central Laos in the eastern LMB is likely to be facing some moderate and severely droughts. In **October**, moderate and severe droughts are forecasted for the north-west, west, and south-west areas of the LMB covering some areas of northern Laos, Thailand, and north-western Cambodia. Most parts of Laos and Vietnam are likely not at any risk.

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: 29 Aug - 02 September 2023

Date: 28 August 2023

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					
		27-Aug				27-Aug	28-Aug	29-Aug	30-Aug	31-Aug	01-Sep	02-Sep	28	29	30	31	01	02
Jinghong		0.0				535.23	535.21							×	×	×	×	×
Chiang Saen		1.5	357.110	12.80	11.50	3.75	3.26	3.22	3.20	3.24	3.34	3.50	↓					↑
Luang Prabang		0.0	267.195	18.00	17.50	10.66	10.80	10.44	10.40	10.38	10.43	10.55	↑	↓				↑
Chiang Khan		0.0	194.118	16.00	14.50	8.40	8.31	8.40	8.15	8.12	8.10	8.15			↓			
Vientiane		0.0	158.040	12.50	11.50	5.71	5.95	5.90	6.04	5.83	5.80	5.78	↑		↑	↓		
Nongkhai		0.0	153.648	12.20	11.40	5.00	5.44	5.41	5.53	5.35	5.33	5.31	↑		↑	↓		
Paksane		0.0	142.125	14.50	13.50	7.22	7.05	7.35	7.40	7.50	7.38	7.37	↓	↑			↓	
Nakhon Phanom		1.3	130.961	12.00	11.50	7.09	6.99	6.83	7.11	7.18	7.30	7.20		↓	↑		↑	
Thakhek		0.7	129.629	14.00	13.00	8.10	7.95	7.73	8.02	8.10	8.23	8.12	↓	↓	↑		↑	↓
Mukdahan		4.5	124.219	12.50	12.00	6.76	6.70	6.55	6.35	6.50	6.55	6.63		↓	↓	↑		
Savannakhet		0.0	125.410	13.00	12.00	5.10	5.07	5.00	4.90	4.97	5.00	5.05						
Khong Chiam		0.0	89.030	14.50	13.50	7.91	7.78	7.63	7.44	7.22	7.40	7.47	↓	↓	↓	↓	↑	
Pakse		5.4	86.490	12.00	11.00	6.30	6.19	6.10	6.00	5.87	5.95	6.00	↓	↓	↓	↓	↑	
Stung Treng		7.0	36.790	12.00	10.70	6.76	6.69	6.63	6.60	6.56	6.51	6.56	↓	↓				
Kratie		nr	-0.101	23.00	22.00	15.95	15.64	15.50	15.39	15.32	15.25	15.18	↓	↓	↓	↓	↓	↓
Kompong Cham		13.5	-0.930	16.20	15.20	9.78	9.70	9.54	9.42	9.36	9.33	9.30	↓	↓	↓	↓	↓	↓
Phnom Penh (Bassac)		22.5	-1.020	12.00	10.50	5.95	5.97	5.92	5.87	5.85	5.84	5.83		↓	↓			
Phnom Penh Port		-	0.070	11.00	9.50	4.81	4.83	4.78	4.74	4.72	4.70	4.70		↓	↓			
Koh Khel (Bassac)		29.2	-1.000	8.40	7.90	5.46	5.49	5.46	5.44	5.43	5.43	5.44	↑	↓				
Neak Luong		9.5	-0.330	8.00	7.50	4.20	4.20	4.18	4.12	4.08	4.06	4.05			↓	↓		
Prek Kdam		22.4	0.080	10.00	9.50	5.02	5.04	5.03	5.00	4.98	4.97	4.95			↓			
Tan Chau		18.8	0.000	4.50	3.50	1.73	1.94	2.05	2.12	2.15	2.10	2.00	↑	↑	↑	↑	↓	↓
Chau Doc		nr	0.000	4.00	3.00	1.69	1.92	2.06	2.15	2.20	2.20	2.07	↑	↑	↑	↑		↓

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 August 22-28, including the lower part in Lao PDR and Cambodia, varying from 6.00 mm to 272.10 mm due to the low pressure covered the LMB during the report period. This week rainfall was considered high in 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 50.00 mm to 150.00 mm for the next seven days. The forecasting model using CHIRPS-GEFS data, moreover, shows significant rainfall (>150 mm) is likely to take place in the Mekong region from 29 August to 04 September 2023.

7.2 Water level and its forecast

According to MRC's observed water level at Jinghong, it showed decreased water levels from 536.39 m to 535.21 m during 22-28 August 2023**.** The current level is staying about 0.48 m lower than its LTA value. The outflow at Jinghong station varied between 814.00m^3/s and 1,660.00 m^3/s between 22 and 28 August 2023.

Even with the decreased outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen still increased about 0.27 m from 22 to 28 August 2023. Moreover, at Chiang Khan the water level increased about 0.17 m, while at Valentine and Nong Khai it increased between 0.10 m and 0.16 m due to the influence of dam operation upstream and less rainfall. Water levels from Nakhon Phanom to Pakse decreasing between 0.39 m and 0.81 m. The current WLs at these stations are staying lower than their LTA level, **considered low**. From the stretches of the river at Stung Treng, water levels decreased 0.35 m and stayed about 1.85 m lower than its LTA, while at Kratie water level was down about 0.70 m, staying 3.10 m lower than its LTA level, due to the contributed less rainfall from upstream part including Pakse and reservoir operation of the 3S area in Viet Nam.

The flow volume of the Tonle Sap Lake is lower than its LTA (about 78%) up to August 28. 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 and Kompong Cham on the Mekong River, the water levels are expected to decrease between 0.10 m and 0.46 m and will still remaining lower than their LTA value for the next 5 days. The water levels – at Prek Kdam to Phnom Penh Port on the Tonle Sap, and Chaktomuk to Koh Khel on the Bassac – are forecasted to decrease and still stay lower than their LTA value.

The situation in Tan Chau on the Mekong River and Chau Doc on the Bassac River is expected to remain unchanged.

Since the third week of September 2022, water levels across most monitoring stations in the LMB have increased due to the above-average rainfall but still staying lower than their LTA

value (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, flash floods are likely to be detected in some areas of the LMB during next week.

7.4 Drought condition and its forecast

During Aug 21-27, some moderate and severe droughts were detected in all four countries mainly from the middle to the southern parts of the LMB. They were taking place in some areas of Otdar Meanchey, Siem Reap, Preah Vihear, Stung Treng, Ratana Kiri, Mondul Kiri, Kratie, Kampong Thom, Kampong Cham, Pursat, Battambang, Takeo, Kandal, Svay Rieng, Prey Veng, Luangnamtha, Xayaburi, Luang Prabang, Saravane, Sekong, Champasack, Attapeu, Chiang Rai, Chiang Mai, Phayao, Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Chaiyaphum, Khon Kaen, Maha Sarakham, Kalasin, Roi Et, Nakhon Ratchasima, Burirum, Surin, Yasothon, Si Saket, Amnat Charoen, Ubon Ratchathani, Kon Tum, Gia Lai, Dak Lak, Long An, Tien Giang, Dong Thap, and An Giang.

The three-month forecast shows that **August** is expected to be moderately dry in the upper north, severely and extremely dry in the west covering mainly Thailand, and extremely dry in the south-east covering southern Laos and 3S areas. In **September**, Xayaburi, Vientiane and Luang Prabang of northern Laos are likely to be hit by moderate drought, while central Laos in the eastern LMB is likely to be facing some moderate and severely droughts. In **October**, moderate and severe droughts are forecasted for the north-west, west, and south-west areas of the LMB covering some areas of northern Laos, Thailand, and north-western Cambodia. Most parts of Laos and Vietnam are likely not at any risk.

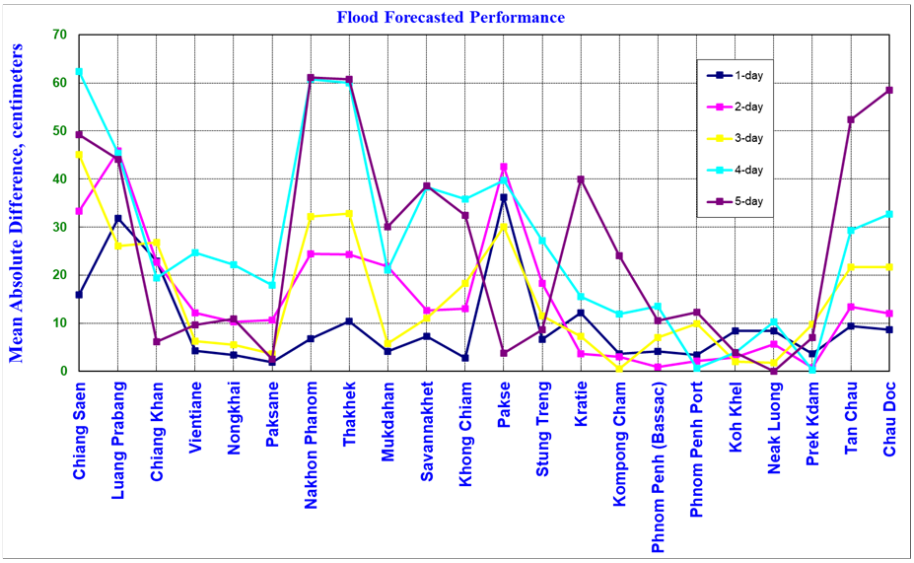
Annex 1: Performance of the weekly flood forecasting

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 22 to 28 August 2023.

The forecasting values from 22 to 28 August 2023 show that the overall accuracy is fair for a four-day to five-day forecast in lead time (less than 160 cm) for most of the stations from the upper to the middle parts of the Mekong River with combine information of rainfall and reservoirs' 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.
- Chiang Saen station is influencing by hydropower upstream operation from China.
- Luang Prabang to Chiang Khan and Paksane to Stung Treng to Kratie have been influenced 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).
- 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 22 to 28 August 2023.

Table B1: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 22 to 28 August 2023 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	16	32	23	4	3	2	7	10	4	7	3	36	7	12	4	4	3	8	8	4	9	9
2-day	33	46	23	12	10	11	24	24	22	13	13	43	18	4	3	1	2	3	6	1	13	12
3-day	45	26	27	6	6	4	32	33	6	11	18	30	12	7	1	7	10	2	2	10	22	22
4-day	62	45	19	25	22	18	61	60	21	38	36	40	27	16	12	14	1	4	10	0	29	33
5-day	49	44	6	10	11	3	61	61	30	39	33	4	9	40	24	11	12	4	0	7	52	58

Table B2: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 22 to 28 August 2023 in %

Lead-time Forecasted	Chiang Saen	Luang Prabang	Chiang Khan	Vientiane	Nongkhai	Paksane	Nakhon Phanom	Thakhek	Mukdahan	Savannakhet	Khong Chiam	Pakse	Stung Treng	Kratie	Kompong Cham	Phnom Penh (Bassac)	Phnom Penh Port	Koh Khel	Neak Luong	Prek Kdam	Tan Chau	Chau Doc	*Average*
1-day	71.4	42.9	71.4	14.3	0.0	14.3	28.6	28.6	28.6	42.9	14.3	57.1	28.6	100.0	57.1	71.4	71.4	100.0	85.7	71.4	100.0	85.7	***53.9***
2-day	83.3	66.7	66.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	33.3	50.0	16.7	0.0	0.0	33.3	33.3	50.0	0.0	50.0	50.0	***30.3***
3-day	60.0	60.0	40.0	0.0	0.0	20.0	20.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	40.0	80.0	0.0	0.0	80.0	40.0	40.0	***22.7***
4-day	75.0	50.0	50.0	25.0	25.0	50.0	25.0	25.0	50.0	25.0	0.0	50.0	50.0	50.0	0.0	50.0	0.0	25.0	50.0	25.0	25.0	25.0	***34.1***
5-day	66.7	33.3	0.0	33.3	0.0	0.0	33.3	33.3	33.3	0.0	33.3	0.0	66.7	100.0	100.0	100.0	100.0	33.3	0.0	66.7	33.3	33.3	***40.9***

Table B3: Overview of performance indicators for the past 7 days from 22 to 28 August 2023

	FF time sent				Arrival time of input data								Missing data (number-mainstream and trib.st.)							
2023	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/25	Thailand - DWR/13	Viet Nam - SRHMC/6	Viet Nam - HMS/39
week	*10:39*	*#DIV/0!*	*-*	*-*	*08:15*	*07:10*	*07:07*	*09:55*	*08:42*	*08:37*	*07:05*	*08:19*	*0*	*0*	*102*	*5*	*5*	*4*	*0*	*0*
month	*10:40*	*#DIV/0!*	*-*	*-*	*08:15*	*07:10*	*07:26*	*09:58*	*08:43*	*08:31*	*07:12*	*08:19*	*0*	*0*	*238*	*36*	*34*	*0*	*0*	*61*

Fig. B4: Data delivery times for the past 7 days from 22 to 28 August 2023

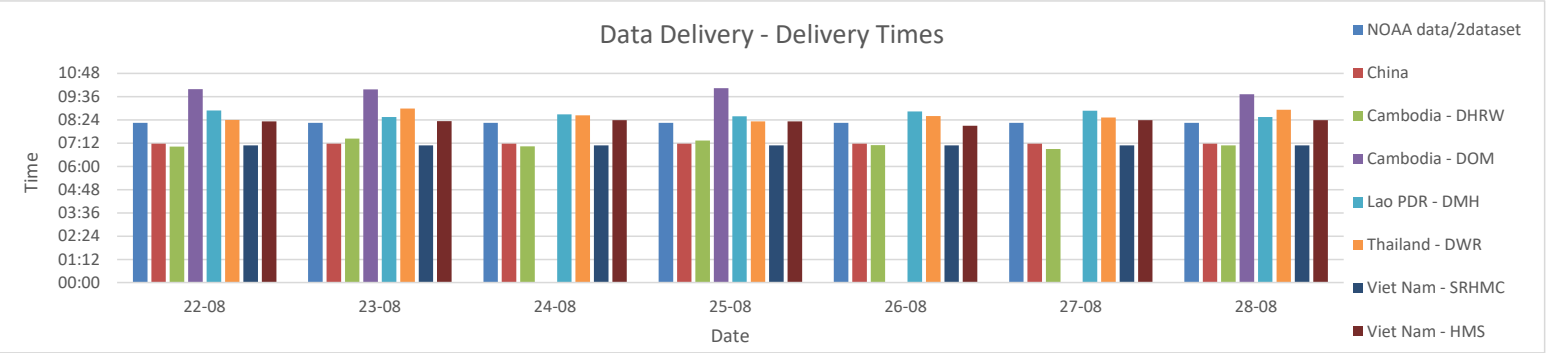


Fig. B5: Missing data for the past 7 days from 22 to 28 August 2023

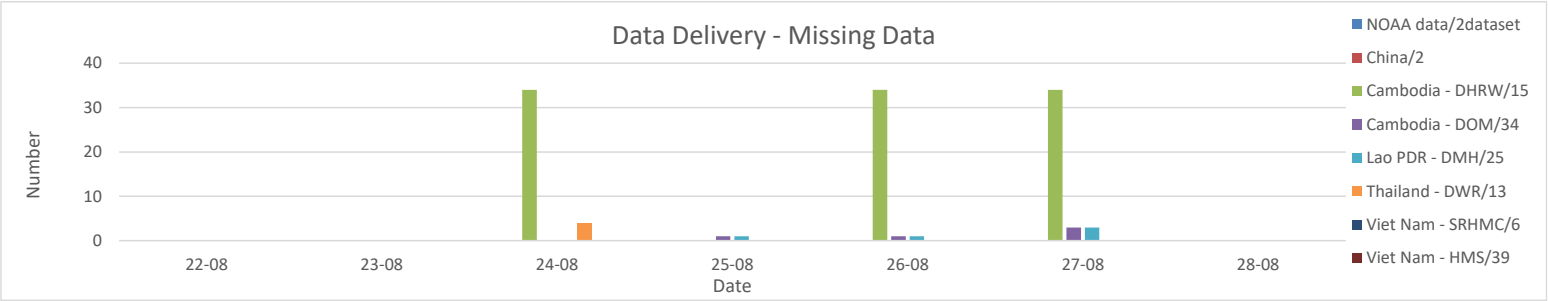
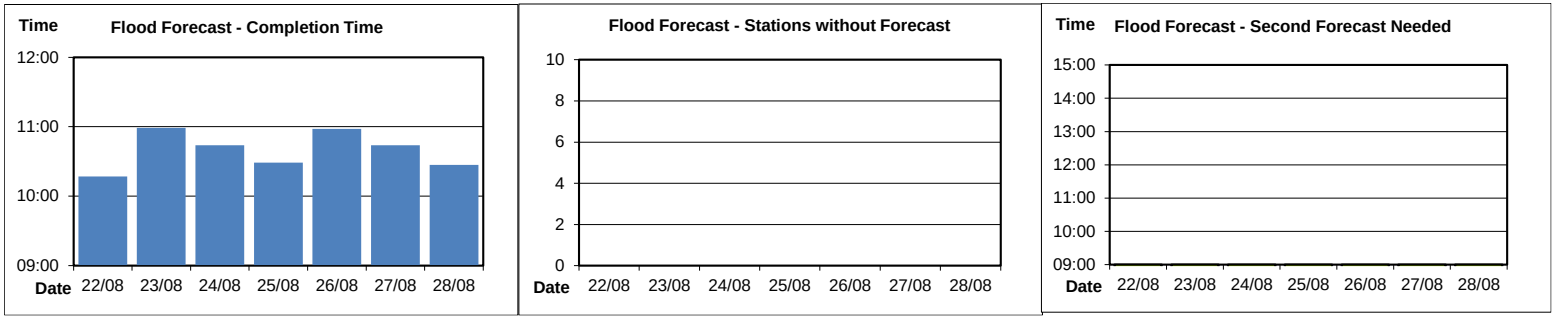


Fig. B6: Flood forecast completion time, stations without forecasts, and second forecasts need from 22 to 28 August 2023



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