Mekong River Commission

Weekly Dry Season Situation Report in the Lower Mekong River Basin

16–22 November 2021

Prepared by
The Regional Flood and Drought Management Centre
23 November 2021

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Key Messages

Key messages for this weekly report are presented below.

Rainfall and its forecast

- Rainfall focused in the areas from Kratie in Cambodia to Tan Chau and Chau Doc in Viet Nam, including the 3S area in Cambodia and Viet Nam, varying from 3.70 millimetres (mm) to 94.00 mm.
- There will be average rainfalls for the next 7 days over the Mekong region from 23 to 29 November 2021 because there is still a low-pressure dominating the Mekong region.

Water level and its forecast

- According to MRC's observed water level data, the outflows at Jinghong hydrological station showed water level changes over the monitoring period from 16 to 22 November 2021. Water levels at this station decreased about 0.58 metres (m) from 535.81 m on 16 Nov to 535.23 m on 22 Nov 2021 (recorded on 7:00 am) and stayed about 0.36 m lower than its two-year-average (2020-2021) value. The outflow was down from 1197.00 m3/s on 16 Nov to 807.00 m^3/s on 22 Nov 2021.
- Amid the decreased outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand increased about 0.18 m from 16 to 22 Nov 2021. Also, from Chiang Khan in Thailand to Paksane in Lao PDR, water levels increased about 0.30 m from Nov 16 to 22 due to some rainfall in the area and influence of dam operation. Water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR, moreover, were slightly increasing. Water levels from the stretches of the river from Stung Treng to Kratie and at Kompong Cham in Cambodia, on the other hand, were decreasing, due to less contributed rainfall from the upstream part (at Pakse and 3S area in Viet Nam).
- The water volume of the Tonle Sap Lake in 2021 was lower than its LTA but higher than the levels in 2019 and 2020 during the same period from 16 to 22 November 2021, and still considered critical.
- Over the next seven days, the water levels across most monitoring stations are expected to go down and remain lower than their long-term average value in most stations.

Drought condition and its forecast

- Drought condition of the LMB from November 13-19 was normal all over the LMB except moderate drought in Borikhamxay due to severely dry soil moisture. The region showed no drought threat except some moderate and severe dry soil moistures in the upper and eastern parts of the LMB.

- For the upcoming thee-month forecast, the LMB is likely to receive from average to above average rainfall from November 2021 to January 2022. There will be some more rain dropping over the southern part of the LMB during November and December 2021 making the condition cooler than normal year, while normal condition is likely taking place in the upper and middle parts of the region during the last two months of the year.

1 Introduction

This Weekly Dry Season Situation Report presents a preliminary analysis of the weekly hydrological situation in the Lower Mekong River Basin (LMB) for **16-22 November 2021**. The trend and outlook for water levels are also presented.

This analysis is based on the daily hydro-meteorological data provided by the Mekong River Commission (MRC) Member Countries – Cambodia, Lao PDR, Thailand, and Viet Nam – and on satellite data. Water level indicated in this report refers to an above zero gauge of each station.

The report covers the following topics that are updated weekly:

- General weather patterns, including rainfall patterns over the LMB
- Water levels in the LMB, including in the Tonle Sap
- 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 (November, December and January) and the weather maps issued by the Thai Meteorological Department (TMD) were used to verify weather conditions in the LMB.

At the end of October 2021, rainfall was much reduced in the LMB, with gradually decreasing water levels in both mainstream and tributaries. The data from the TMD predict that low pressure of air-mass will bring cool weather condition in the upper part of Thailand, Lao PDR and Viet Nam. As a result, the temperature in the upper part of Thailand will drop sharply as commonly chilly weather, specifically at the upper portion of the northern and north-eastern parts together with very cold weather in mountainous areas (within the Mekong region).

Figure 1 presents the weather map of 22 November 2021, showing a line of low pressure of the Monsoon Trough crossing the upper Mekong region which can still bring some rainfall over the next few days.

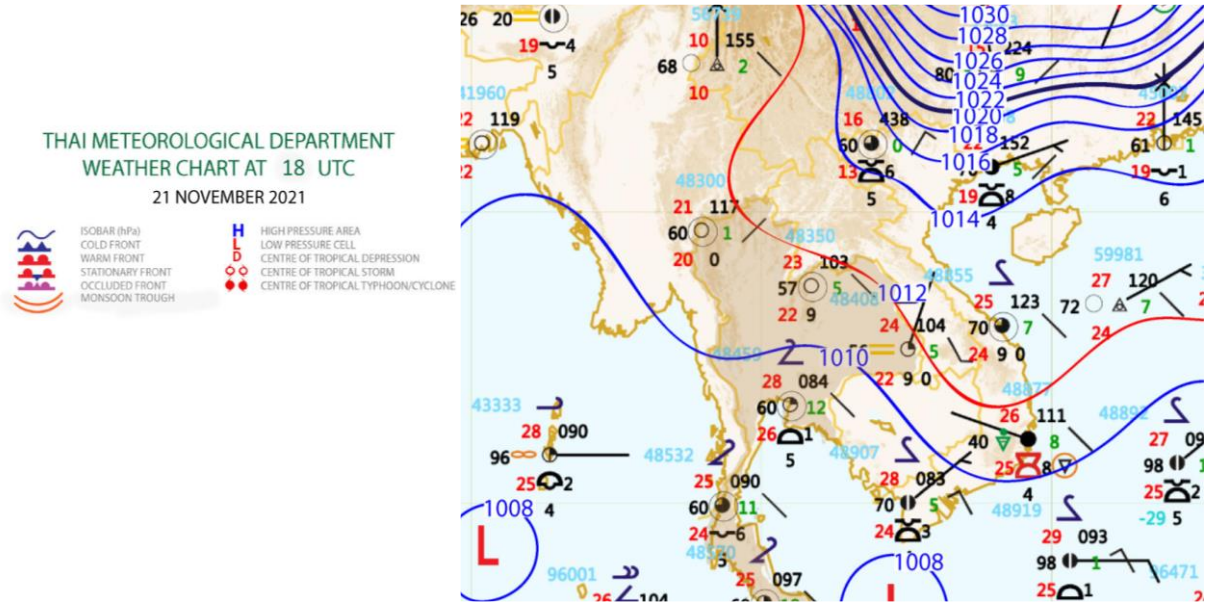


Figure 1: Summary of weather conditions over the LMB.

According to the ASEAN Specialised Meteorological Centre (ASMC), a highest probability of wetter and warm conditions are predicted over of the lower part of the Mekong region covering Lao PDR and Thailand from 15 to 28 November 2021, during the 2st and 3rd weeks of November. Moreover, LMB is likely dominated by wetter condition, which may receive cool temperature in general in the Lower part to the LMB. **Figure 2** shows the outlook of weather condition from 15 to 28 November 2021 in Southeast Asia based on results from the NCEP model (National Centres for Environmental Prediction).

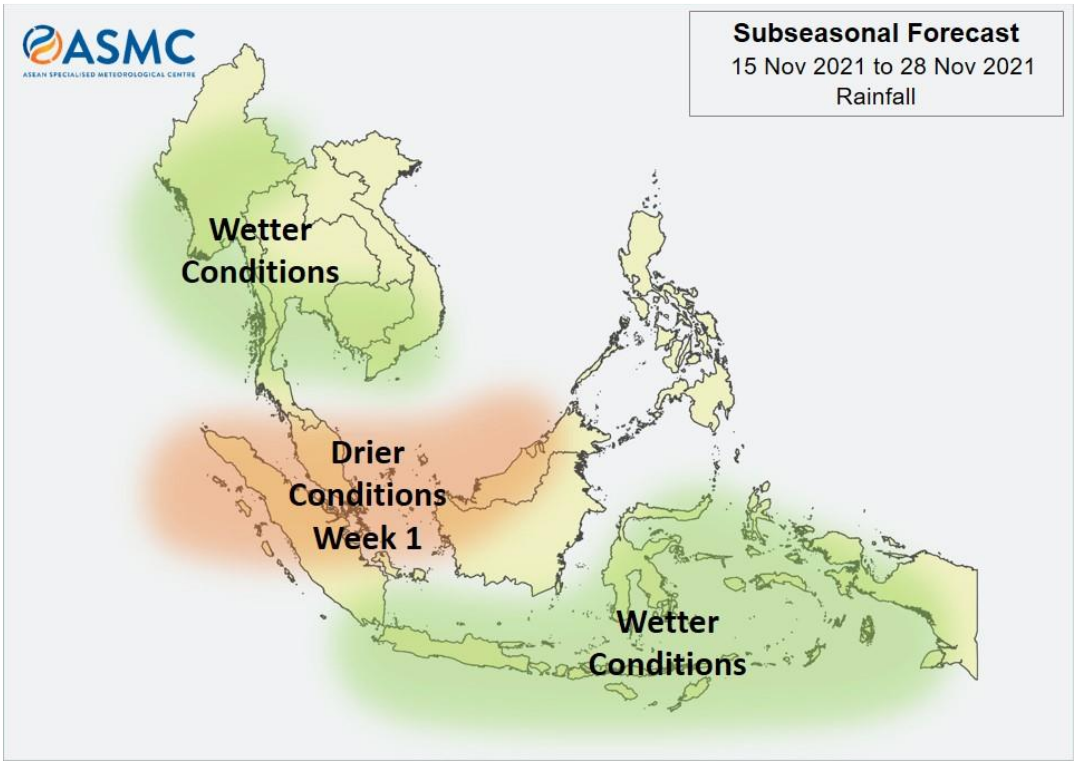


Figure 2: Outlook of wet and dry conditions over the Asian countries by ASMC.

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

There was a low pressure hitting the LMB during 16-22 November 2021. This had caused some rainfall in the middle and the upper part of the LMB, as well as in the Mekong Delta in Viet Nam and the 3S area (Sesan, Sre Pok, and Sekong) of Cambodia and Viet Nam. No storms movement was detected on 22 November in the LMB, as displayed in Figure 3.

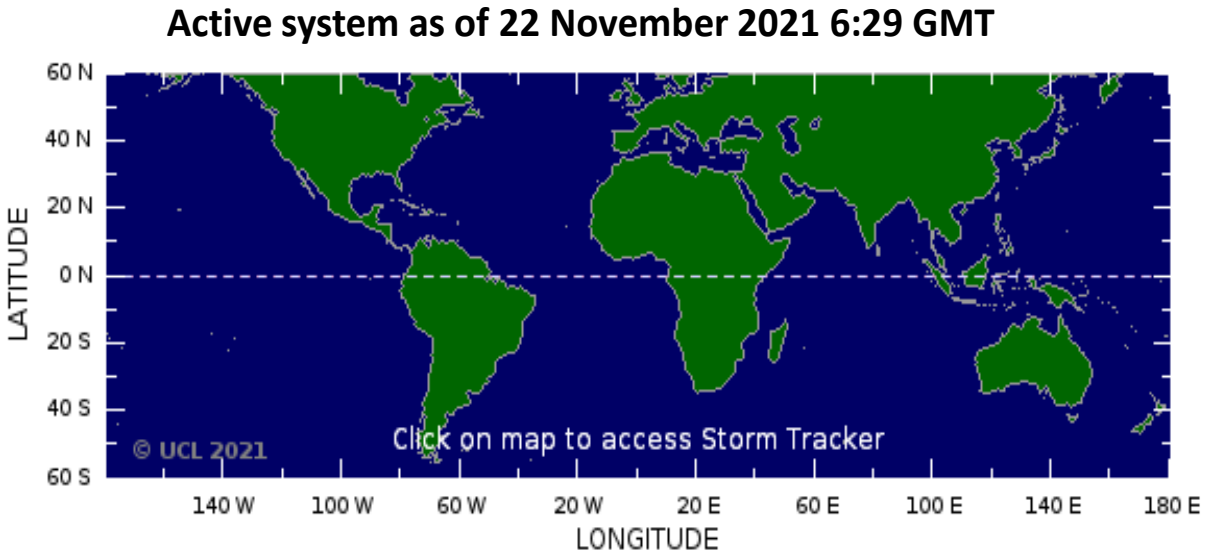


Figure 3: No tropical storm risk observed on 22 November.

Rainfall patterns over the LMB

This week, rain concentrated in the lower part from Kraite in Cambodia to Viet Nam's Tan Chau and Chau Doc. The amount of rainfall over the Mekong region was considered high at the lower part, varying from 3.70 mm to 94.00 mm. No rain was observed at the upper and middle parts of the Mekong basin. Compared with last week's amount, the rainfall this week was considered lower. It was lower than last week rainfall in the LMB (see Figure 4).

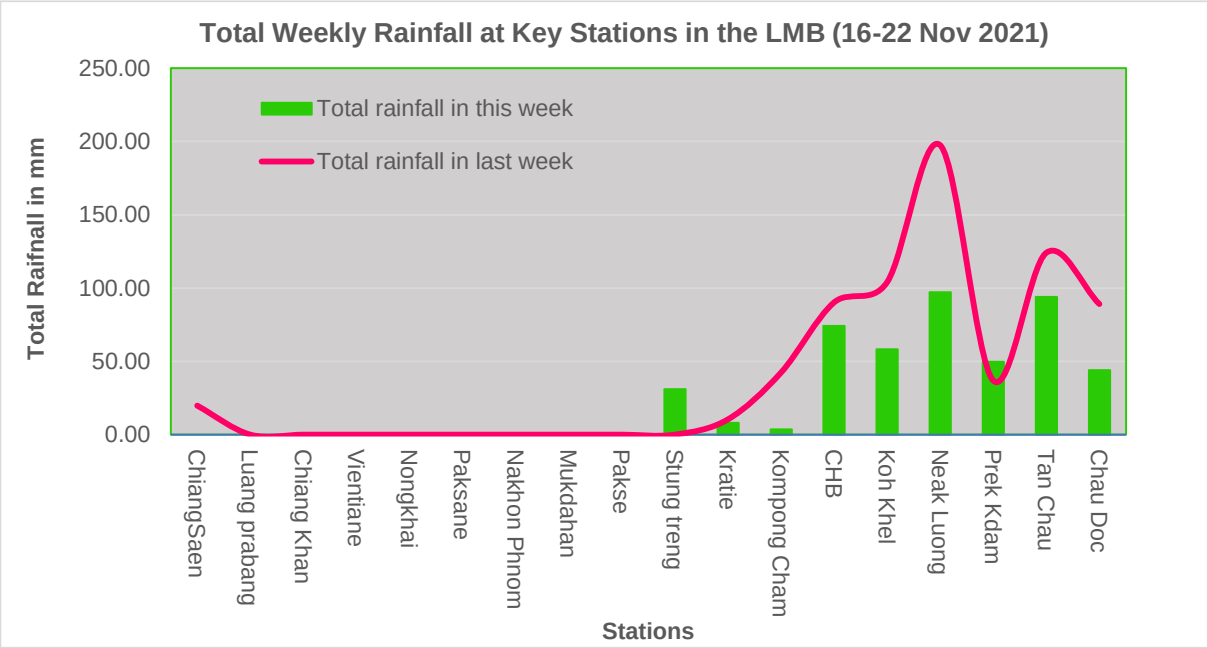


Figure 4: Weekly total rainfall at key stations in the LMB.

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 16 to 22 November 2021.

The very small amount of rainfall this week is considered an indication of the end of the rainy season in the LMB.

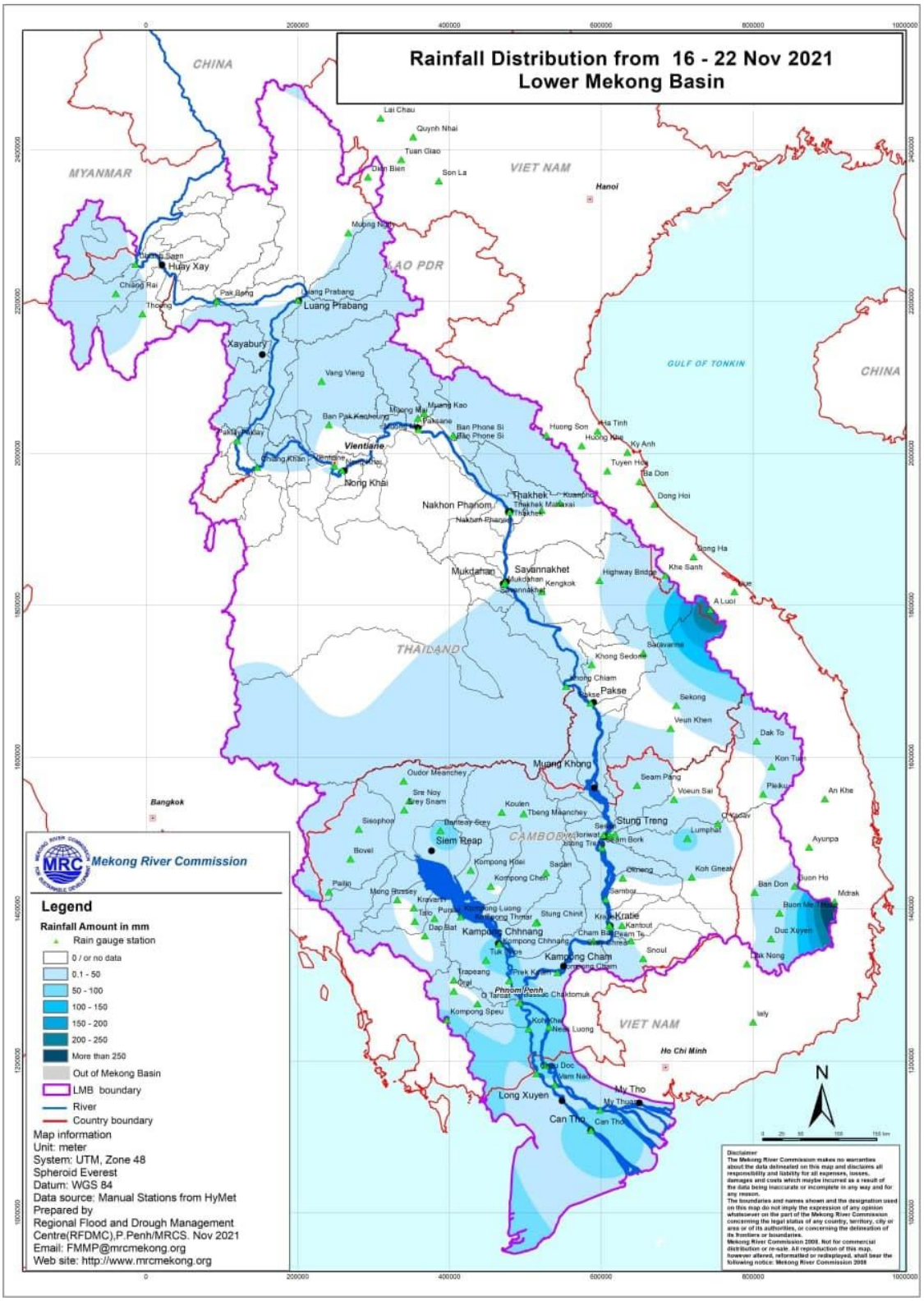


Figure 5: Weekly rainfall distribution over the LMB.

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 to capture mainstream flows entering from the Upper Mekong Basin (UMB); at Vientiane to present flows generated by climate conditions in the upper part of the LMB; at Pakse to investigate flows influenced by inflows from the larger Mekong tributaries; at Kratie in Cambodia to capture overall flows of the Mekong Basin; and at Viet Nam's Tan Chau and Chau Doc to monitor flows to the Delta.

The key stations along the LMB and their respective model application for River Flood Forecasting during the wet season from June to October and River Monitoring during the dry season from November to May are presented in Figure 6. The hydrograph for each key station is available from the MRC's River Flood Forecasting: http://ffw.mrcmekong.org/overview.php. The weekly water levels and rainfall at each key station are summarised in **Annex A**.

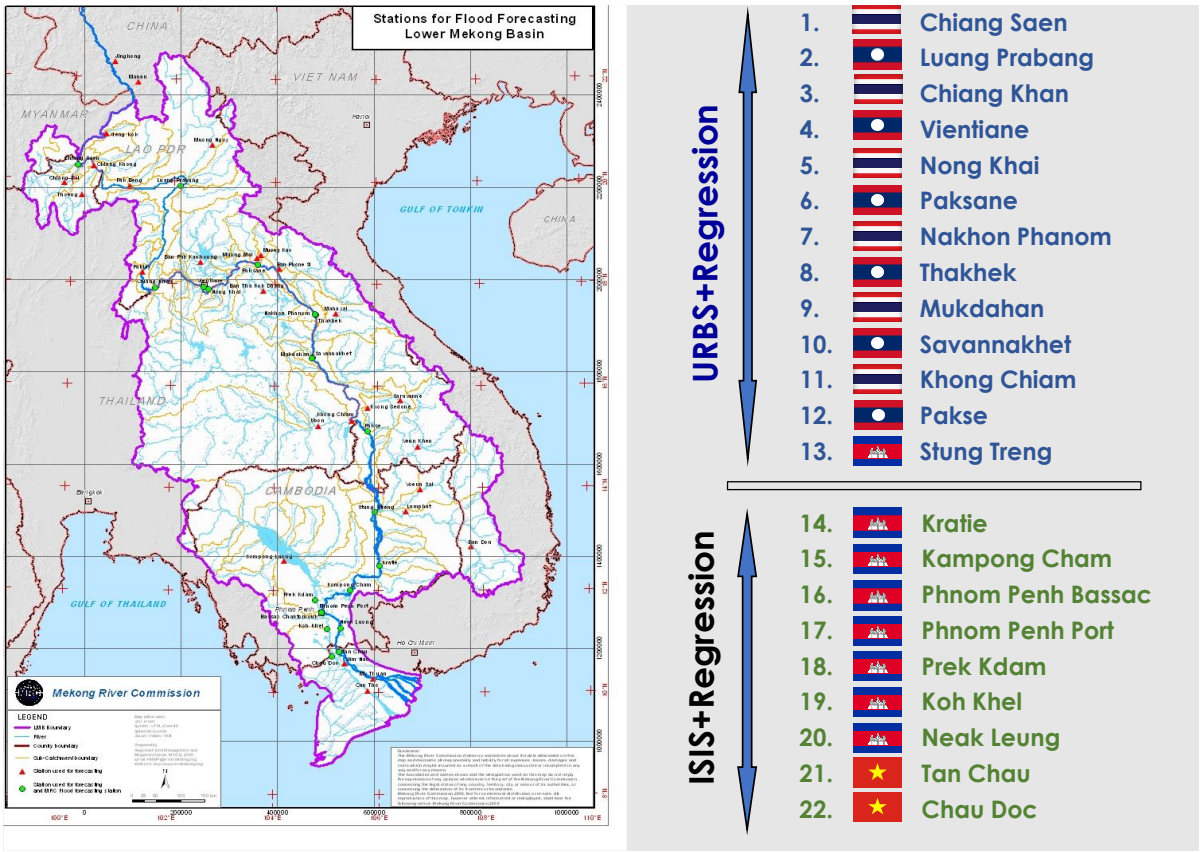


Figure 6: Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed water level changes over the monitoring period from 16 to 22 November 2021. Water levels at this station decreased about 0.58 m from 535.81 m on 16 Nov to 535.23 on 22 Nov 2021 (recorded on 7:00 am) and stayed about 0.36 m lower than its two-year-average (2020-2021) value. The outflow was down from 1197.00 m^3/s on 16 Nov to 807.00 m^3/s on 22 Nov 2021.

Figure 7 below presents water level that decreased at the Jinghong hydrological station[1], indicating the trend of fluctuating water level up to 22 November 2021.

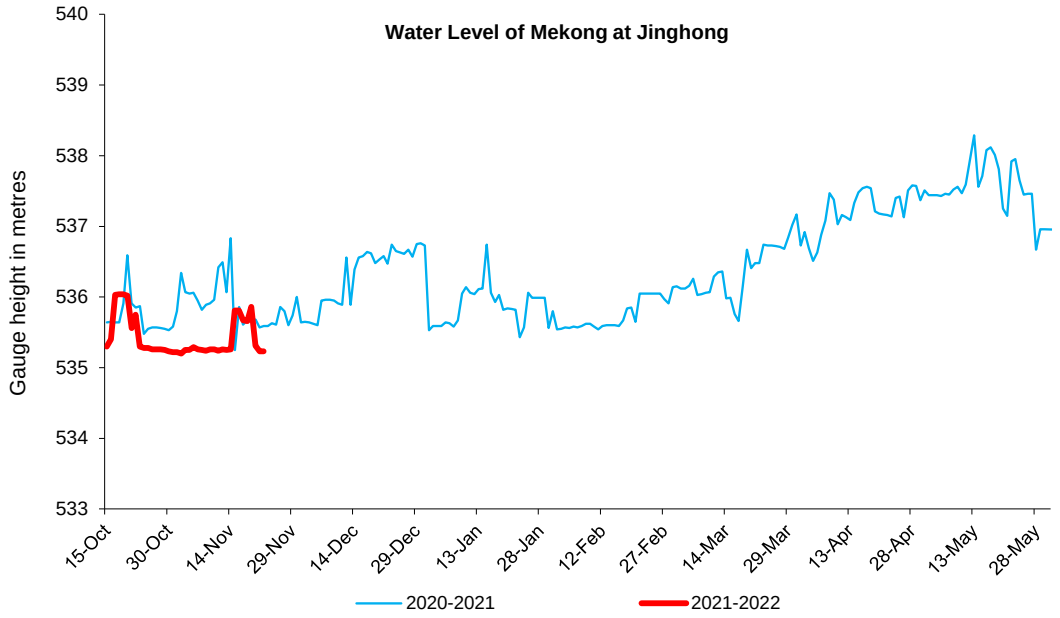


Figure 7. Water level at the Jinghong hydrological station during 15 Oct to 22 Nov 2021.

Amid the decreased outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen in Thailand increased about 0.18 m from 16 to 22 Nov 2021. Also, from Chiang Khan in Thailand to Paksane in Lao PDR, water levels increased about 0.30 m from Nov 16 to 22 due to some rainfall in the area and influence of dam operation. Water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR, moreover, were slightly increasing. Water levels from the stretches of the river from Stung Treng to Kratie and at Kompong Cham in Cambodia, on the other hand, were decreasing, due to less contributed rainfall from the upstream part (at Pakse and 3S area in Viet Nam).

Based on hydrological phenomenon, the contribution of inflow water from the upstream of Lancang-Mekong in China to the Mekong mainstream is about 16% in total during the wet season from June to October and about 25% in total during the dry season from November to May. The whole inflow of water into the LMB is influenced by rainfall at the Mekong mainstream and its tributaries during the wet season.

[1] Near-real time data of hydro-meteorological monitoring at the Jinghong hydrological station is available at https://portal.mrcmekong.org/monitoring/river-monitoring-telemetry.

Chiang Saen and Luang Prabang

Water level during November 16-22 at Thailand's Chiang Saen slightly increased from 2.27 m to 2.45 m. When compared to last week, this week's water level is relatively higher.
Water level at the Luang Prabang station in Lao PDR remarkably increased from 8.90 m to 9.32 m, during the reporting period. Compared to last week, the figure shows an increase by about 0.42 m. The water level at this station was 1.75 m higher than its long-term average (LTA). 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 dry season**.

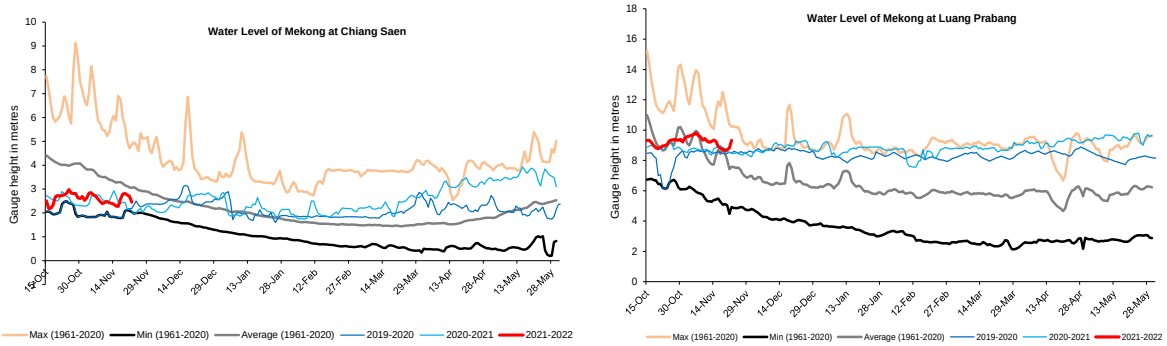


Figure 8. Water levels at Chiang Saen in Thailand and Luang Prabang in Lao PDR.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) significantly decreased from 6.03 m to 5.76 m during the reporting week. It showed 0.90 m lower than its Long-Term- Average (LTA). Furthermore, water level downstream at Vientiane in Lao PDR showed reduction from 3.28 m to 3.14 m and was about 0.45 m lower than its LTA during 16-22 November 2021. At Nong Khai station in Thailand, the water level was also down during the reporting period. It decreased from 2.78 m to 2.63 m, and still showing 1.46 m lower than its LTA. At Paksane in Lao PDR, water levels decreased about 0.36 m, down from 3.51 m to 3.15 m. The WL at this station was still about 1.69 m lower than its LTA. The recently decreased water levels were obviously due to the low rainfall in the sub-catchment area, amid the inflows and water storing from upstream. The water levels at Vientiane and Paksane are shown in Figure 9 below.

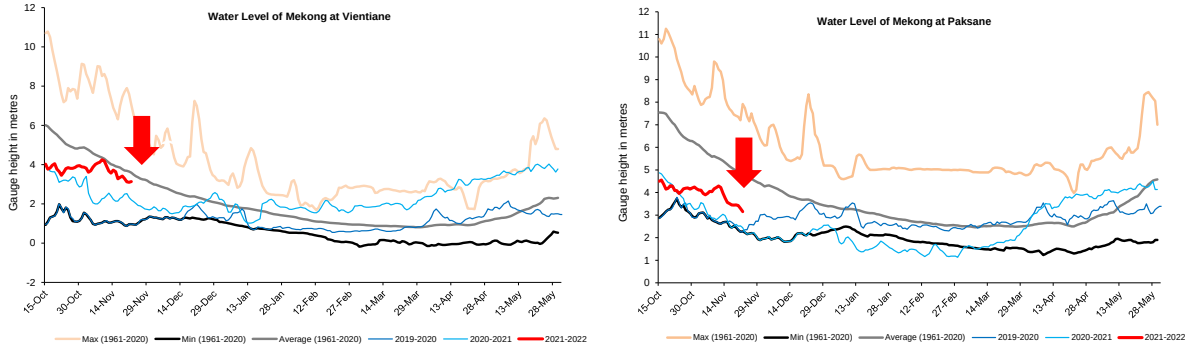


Figure 9. Water levels Veintiane and Paksane in Lao PDR.

Nakhon Phanom to Pakse

Similarly, water levels from Nakhon Phanom to Mukdahan in Thailand slightly decreased by about 0.20 metres, during the reporting period. **Water levels at these stations were staying below their LTA level, except at Pakse where water level was slightly higher than its LTA**. Figure 10 shows the water levels at Nakhon Phanom and Pakse stations.

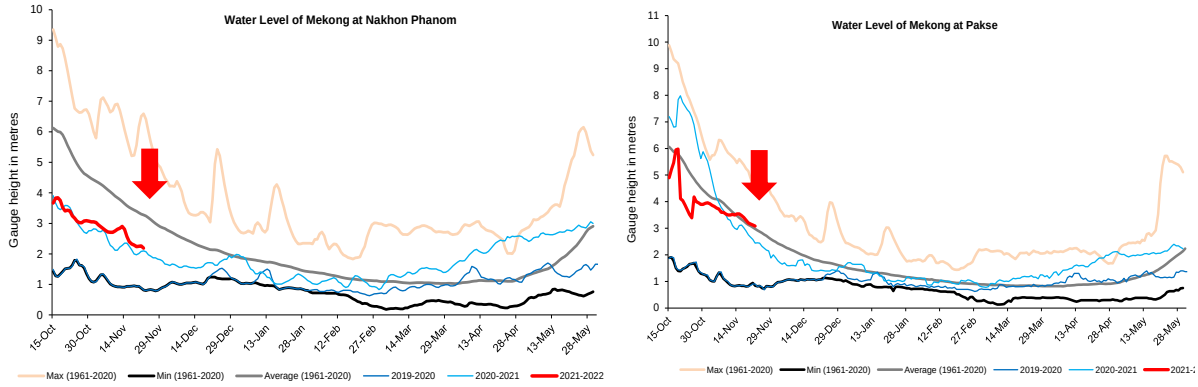


Figure 10: Water levels at Nakhon Phanom and Pakse of Thailand and Lao PDR.

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

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 remarkably down, during 16-22 November 2021. This week water level at Stung Treng and Kratie decreased about 0.22 m and 0.38 m, respectively. Water levels at Stung Treng and Kratie still remained about 0.33 m and 0.28 m higher than their LTA valuse, while water level at Kompong Cham was about 0.80 m, below their LTA (as showed in Figure 11).
Generally, the **Water levels at these stations were lower than their LTA, which considered normal at Stung Treng and Kratie**.

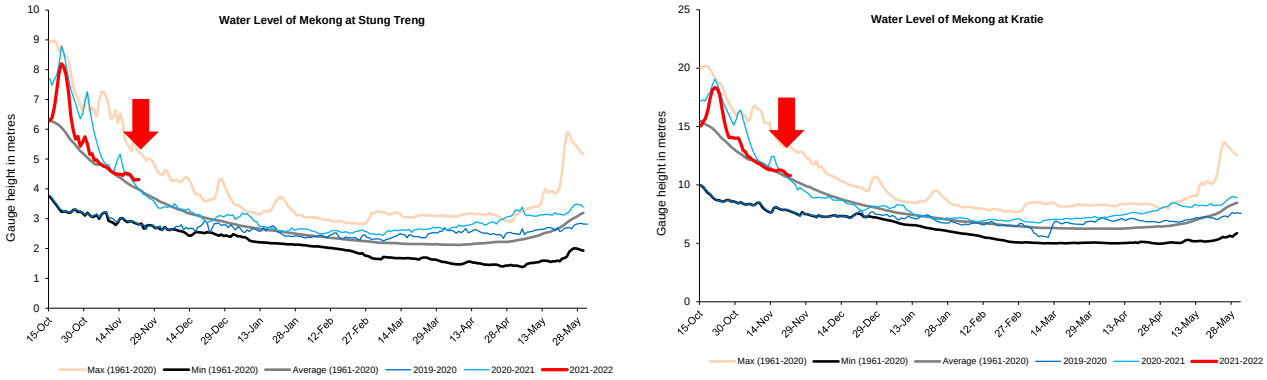


Figure 11: Water levels at Stung Treng and Kratie on the Mekong River.

At Chaktomuk on the Bassac River, due to less rainfall and contributed flows from upstream catchment, the water level was down by about 0.21 m and stayed 1.20 m lower than its LTA value; while at Koh Khel, water level decreased about 0.11 m, staying 0.45 m lower than its LTA value. The water level at Prek Kdam on the Tonle Sap Lake decreased about 0.16 m and was about 0.77 m lower than its LTA value. The water level at the Tonle Sap Lake (observed at Kompong Luong) was similar to Prek Kdam station's water level. The recently decreased water level was because of less rain and low inflow contributed from upstream of the Tonle Sap Lake area during the reporting period. The water level at the Tonle Sap Lake (observed at Kompong Luong) followed the same trend of Prek Kdam station's water level. **Water levels at these stations were staying below their LTA level, which still considered critical**.

Tidal stations at Tan Chau and Chau Doc

Like last week, the water levels from 16 to 22 Novemberr 2021 at Viet Nam's Tan Chau and Chau Doc were fluctuating due to daily tidal effects from the sea. The fluctuation levels were between 1.87 m and 2.23 m; they were in between the range of their LTA and historical minimum levels and **considered normal**.

The Tonle Sap Flow

At the end of the wet season, when water levels along the Mekong River subside, outflows of the Tonle Sap Lake (TSL) return into the Mekong River and then to the Delta. This phenomenon normally takes place from end of September to October. Based on flow observation at Prek Kdam, the outflow of the Tonle Sap Lake was taken place since 10 October 2021.
Figure 12 shows the seasonal changes of the inflow/reverse flow and the outflow of the TSL at Prek Kdam in comparison with the flows of 2019 and 2020, and their LTA level (1997-2020). Up to November 22 of this reporting period, **it was observed that the main outflow to Tonle Sap Lake slihglty increased due to some rainfall and inflows from upstream**. This increased outflow of Tonle Sap Lake was most likely caused by inflows and rainfall from the catchment area. Up to this date, the outflow from the Tonle Sap Lake condition in 2021 is higher than 2019 and 2020 outflow conditions. For next week, small rainfall is forecasted for the Tonle Sap area; thus, the outflow into the Tonle Sap Lake is likely to slightly decreas from the current level.

Figure 13 shows seasonal changes in monthly flow volumes up to November 22 for the Lake compared with the volumes in 2019, 2020 and their LTA, and the fluctuation levels (1997–2020). It shows that up to November 22, **the water volume of the Tonle Sap Lake is lower than its LTA but higher than 2019 and 2020 during the same period**. The figure is displayed in Table 1, which indicates that the Tonle Sap Lake has been affected by water levels from the Mekong River, the tributaries, and rainfall in the surrounding sub-catchments and ***considered critical***.

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

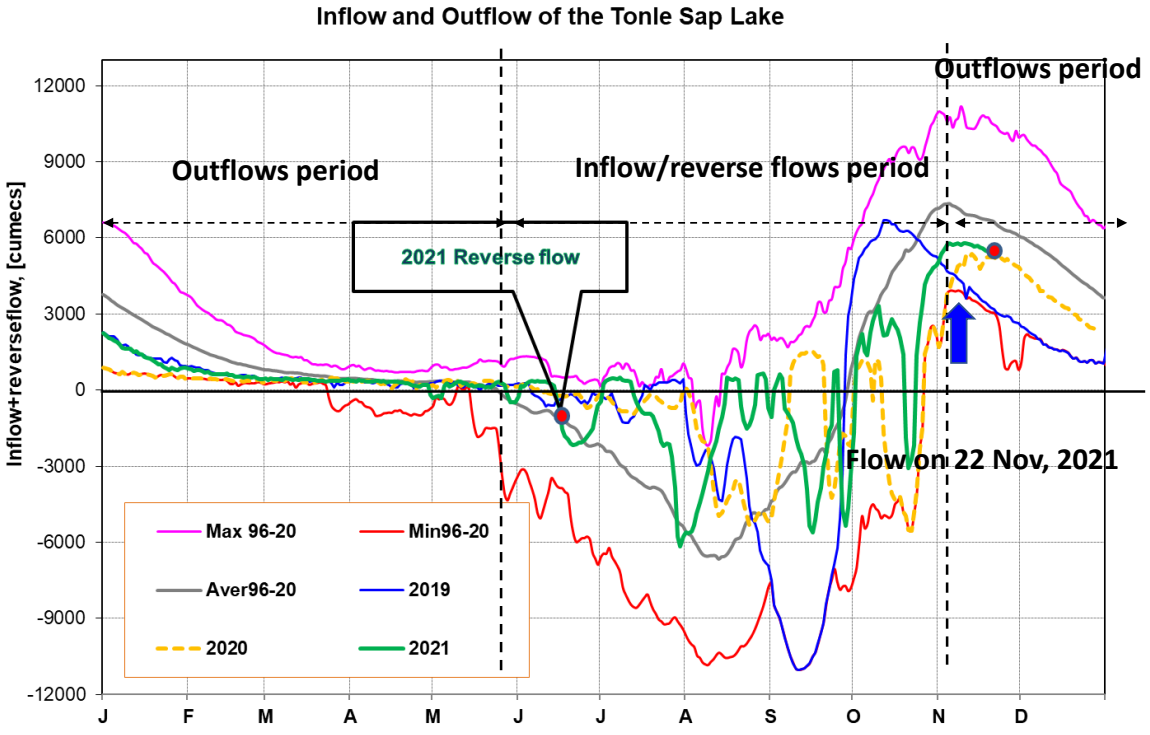


Figure 12: Seasonal change of inflows and outflows of Tonle Sap Lake.

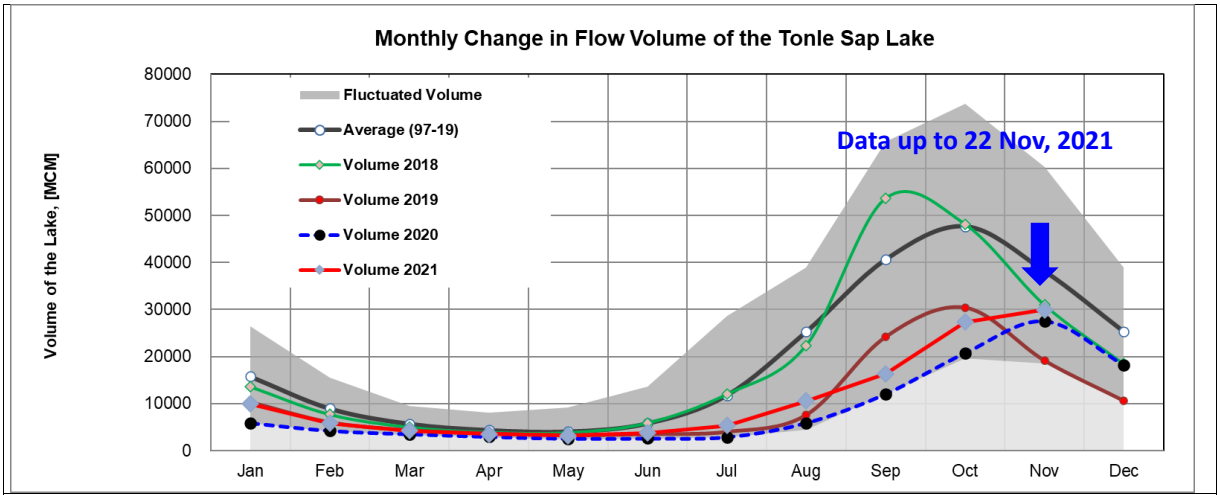


Figure 13. The seasonal change in monthly flow volume of Tonle Sap Lake.

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

Month	Average Volume (97-19) [MCM]	Max Volume [MCM]	Min Volume [MCM]	Volume 2018 [MCM]	Volume 2019 [MCM]	Volume 2020 [MCM]	Volume 2021 [MCM]
Jan	15756.54	26357.53	5906.80	13633.41	10285.31	5906.80	9923.80
Feb	8964.81	15596.22	4198.60	7729.72	6019.30	4264.19	5832.97
Mar	5711.41	9438.24	3347.07	5037.06	4354.62	3553.99	4264.88
Apr	4379.57	8009.14	2866.91	3956.47	3667.47	2992.61	3556.68
May	4063.12	9176.93	2417.81	3864.00	3266.43	2594.92	3240.78
Jun	5787.88	13635.01	2468.70	5919.18	3517.06	2641.88	3798.29
Jul	11749.36	28599.56	2925.86	12024.96	4001.99	2925.86	5346.73
Aug	25254.98	39015.12	4433.46	22399.65	7622.71	5941.07	10547.80
Sep	40602.85	65632.35	12105.31	53639.54	24194.19	12105.31	16382.34
Oct	47688.24	73757.23	19705.50	48193.08	30358.38	20799.13	27318.21
Nov	38191.50	60367.33	18534.61	31036.07	19112.65	27546.80	29969.40
Dec	25332.58	38888.95	10563.49	18469.21	10577.29	18251.65	
	Critical situation, comapred with historical Min values						
	Normal condition, compared with LTA (Long term average)						
	Low volume situation, comapred with LTA values						
Unit: Million Cubic Meter (1 MCM= 0.001 Km^3)							

4 Flash Flood in the Lower Mekong Basin

During November 15-22, the LMB was affected by four main weather factors. These include (i) the high-pressure from China extended its ridge to cover the upper part throughout the week; (ii) the easterly wind prevailed over the lower northeastern, eastern and central parts during the middle of the week and the weekend. These conditions caused cool weather nearly the whole areas in the northern and northeastern parts; (iii) the weak northeast monsoon prevailed over the Gulf of Thailand almost the entire week; and (iv) the low pressure cell covered the middle and lower southern part during the middle of the week causing abundant rainfall in the southern part throughout the week with heavy and very heavy rainfall in some areas (including Lao PDR, Cambodia and eastern part of Thailand) of the region.

According to the MRC-Flash Flood Guidance System (MRC-FFGS) and analysis, flash flood events were detected during the reporting period in several areas of Thailand, Cambodia and Viet Nam ranging from low risk level to high level. Specially, the high-risk level was detected in some areas in south-central coast and central highland of Viet Nam as shown in Figure 14 and Table 2. In Lao PDR, the MRC-FFGS did not detect any flash flood events.

Table 2. Detected flash flood in Thailand, Cambodia and Viet Nam on November 18.

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

Date of FFG products 18/11/2020 00:00 UTC time

01-Hour Flash Flood Risk and Location				03-Hour Flash Flood Risk and Location				06-Hour Flash Flood Risk and Location			
Provinces	Districts	Region	Level Risk	Provinces	Districts	Region	Level Risk	Provinces	Districts	Region	Level Risk
Nakhon Si Thammarat	Phi Pun	Southern-East Coast	Low-Risk	Chumphon	Muang Chumphon	Southern-East Coast	Low-Risk	Chumphon	Muang Chumphon	Southern-East Coast	Low-Risk
Nakhon Si Thammarat	Phromkhili	Southern-East Coast	High-Risk	Chumphon	Phato	Southern-East Coast	Moderate-Risk	Songkhla	Nathawi	Southern-East Coast	Low-Risk
Nakhon Si Thammarat	Lan Saka	Southern-East Coast	Moderate-Risk	Surat Thani	Chaiya	Southern-East Coast	Low-Risk	Songkhla	King Amphoe Na Mom	Southern-East Coast	Low-Risk
Nakhon Si Thammarat	Thung Song	Southern-East Coast	Low-Risk	Surat Thani	Thachang	Southern-East Coast	Low-Risk	Trang	Palian	Southern-West Coast	Low-Risk
Nakhon Si Thammarat	Chawang	Southern-East Coast	Moderate-Risk	Phangnga	Khura Buri	Southern-West Coast	Low-Risk	Pattani	Khok Pho	Southern-East Coast	Low-Risk
Krabi	Khao Phanom	Southern-West Coast	High-Risk	Surat Thani	Khilirat Nikhom	Southern-East Coast	Low-Risk	Yala	Betong	Southern-East Coast	Low-Risk
Nakhon Si Thammarat	King Amphoe Tham Phanra	Southern-East Coast	Low-Risk	Surat Thani	Phanom	Southern-East Coast	Low-Risk	Satun	La Ngu	Southern-West Coast	Low-Risk
Chumphon	Phato	Southern-East Coast	Moderate-Risk	Surat Thani	Phunphin	Southern-East Coast	Low-Risk	Songkhla	Sadao	Southern-East Coast	Moderate-Risk
Surat Thani	King Amphoe Wipawadi	Southern-East Coast	Low-Risk	Krabi	Khao Phanom	Southern-West Coast	Moderate-Risk	Satun	Muang Satun	Southern-West Coast	Low-Risk
Surat Thani	Khilirat Nikhom	Southern-East Coast	Moderate-Risk	Nakhon Si Thammarat	Phi Pun	Southern-East Coast	Moderate-Risk	Narathiwat	Sukhirin	Southern	Low-Risk
Surat Thani	Phanom	Southern-East Coast	Low-Risk	Nakhon Si Thammarat	Tha Sala	Southern-East Coast	Low-Risk	Narathiwat	Su Ngai Kolok	Southern	Low-Risk
Surat Thani	Ban Takhun	Southern-East Coast	Low-Risk	Nakhon Si Thammarat	Muang Nakhon Si Thammarat	Southern-East Coast	Low-Risk	Narathiwat	Waeng	Southern	Low-Risk
Phangnga	Khura Buri	Southern-West Coast	Low-Risk	Nakhon Si Thammarat	Chian Yai	Southern-East Coast	Low-Risk	Surat Thani	Thachang	Southern-East Coast	Moderate-Risk
Surat Thani	Ban Takhun	Southern-East Coast	Low-Risk	Krabi	King Amphoe Nua Khong	Southern-West Coast	Low-Risk	Phangnga	Khura Buri	Southern-West Coast	Moderate-Risk
Phangnga	Khura Buri	Southern-West Coast	Moderate-Risk	Trang	Sikao	Southern-West Coast	Low-Risk	Surat Thani	King Amphoe Wipawadi	Southern-East Coast	Low-Risk
Surat Thani	King Amphoe Wipawadi	Southern-East Coast	Low-Risk	Nakhon Si Thammarat	King Amphoe Phaphom	Southern-East Coast	Low-Risk	Surat Thani	Khilirat Nikhom	Southern-East Coast	Moderate-Risk
Surat Thani	Khiansa	Southern-East Coast	Low-Risk	Phatthalung	Tamot	Southern-East Coast	Low-Risk	Surat Thani	Phanom	Southern-East Coast	Low-Risk
Surat Thani	Thachang	Southern-East Coast	Low-Risk	Phatthalung	Pabon	Southern-East Coast	Low-Risk	Surat Thani	Ban Takhun	Southern-East Coast	Low-Risk
Surat Thani	Chaiya	Southern-East Coast	Low-Risk	Songkhla	Nathawi	Southern-East Coast	Low-Risk	Nakhon Si Thammarat	Phromkhili	Southern-East Coast	Moderate-Risk
Surat Thani	Thachang	Southern-East Coast	Low-Risk	Satun	La Ngu	Southern-West Coast	Low-Risk	Nakhon Si Thammarat	Lan Saka	Southern-East Coast	Moderate-Risk
Nakhon Si Thammarat	Phi Pun	Southern-East Coast	Moderate-Risk	Songkhla	Sadao	Southern-East Coast	Low-Risk	Nakhon Si Thammarat	Thung Song	Southern-East Coast	Low-Risk
Nakhon Si Thammarat	Tha Sala	Southern-East Coast	Low-Risk	Narathiwat	Waeng	Southern	Low-Risk	Nakhon Si Thammarat	Chawang	Southern-East Coast	Moderate-Risk
Nakhon Si Thammarat	Muang Nakhon Si Thammarat	Southern-East Coast	Moderate-Risk	Nakhon Si Thammarat	Phromkhili	Southern-East Coast	Moderate-Risk	Nakhon Si Thammarat	Sichon	Southern-East Coast	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 18/11/2020 00:00 UTC time

01-Hour Flash Flood Risk and Location				3-Hour Flash Flood Risk and Location in Vietnam				6-Hour Flash Flood Risk and Location in Vietnam			
Provinces	Districts	Region	Level Risks	Provinces	Districts	Region	Level Risks	Provinces	Districts	Region	Level Risks
Quang Nam	Tra My	South Central Coast	Low-Risk	Quang Nam	Tra My	South Central Coast	Low-Risk	Kon Tum	Dak To	Central Highlands	Low-Risk
Quang Ngai	Tra Bong	South Central Coast	Low-Risk	Quang Ngai	Tra Bong	South Central Coast	Low-Risk	Quang Nam	Tra My	South Central Coast	Low-Risk
Binh Dinh	Hoai An	South Central Coast	Low-Risk	Binh Dinh	Hoai An	South Central Coast	Low-Risk	Kon Tum	Dak Glei	Central Highlands	Low-Risk
Binh Dinh	Phu Cat	South Central Coast	Low-Risk	Binh Dinh	Phu Cat	South Central Coast	Low-Risk	Quang Ngai	Tra Bong	South Central Coast	Low-Risk
Phu Yen	Son Hoa	South Central Coast	Low-Risk	Phu Yen	Tuy Hoa	South Central Coast	Moderate-Risk	Khanh Hoa	Van Ninh	South Central Coast	Moderate-Risk
Phu Yen	Tuy Hoa	South Central Coast	High-Risk	Khanh Hoa	Van Ninh	South Central Coast	Moderate-Risk	Khanh Hoa	Ninh Hoa	South Central Coast	Moderate-Risk
Khanh Hoa	Van Ninh	South Central Coast	Low-Risk	Khanh Hoa	Ninh Hoa	South Central Coast	Moderate-Risk	Quang Ngai	Tra Bong	South Central Coast	Low-Risk
Khanh Hoa	Van Ninh	South Central Coast	High-Risk	Khanh Hoa	Khanh Vinh	South Central Coast	Low-Risk	Quang Ngai	Ba To	South Central Coast	Low-Risk
Khanh Hoa	Ninh Hoa	South Central Coast	High-Risk	Khanh Hoa	Khanh Son	South Central Coast	Low-Risk	Quang Ngai	Minh Long	South Central Coast	Low-Risk
Khanh Hoa	Khanh Vinh	South Central Coast	Low-Risk	Lam Dong	Lac Duong	Central Highlands	Low-Risk	Binh Dinh	Hoai An	South Central Coast	Low-Risk
Khanh Hoa	Khanh Son	South Central Coast	Low-Risk					Binh Dinh	Phu Cat	South Central Coast	Low-Risk
Lam Dong	Lac Duong	Central Highlands	Low-Risk					Gia Lai	Krong Pa	Central Highlands	Low-Risk
								Phu Yen	Son Hoa	South Central Coast	Low-Risk
								Phu Yen	TX. Tuy Hoa	South Central Coast	Low-Risk
								Phu Yen	Son Hoa	South Central Coast	Low-Risk
								Gia Lai	Kong Chro	Central Highlands	Low-Risk
								Gia Lai	Kbang	Central Highlands	Low-Risk
								Phu Yen	Dong Xuan	South Central Coast	Low-Risk
								Dak Lak	M'Drak	Central Highlands	Low-Risk
								Phu Yen	Tuy Hoa	South Central Coast	Moderate-Risk
								Khanh Hoa	Khanh Vinh	South Central Coast	Low-Risk
								Khanh Hoa	TP. Nha Trang	South Central Coast	Low-Risk

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

Date of FFG products 18/11/2020 00:00 UTC time

01-Hour Flash Flood Risk and Location				
Provinces	Districts	Villages	Region	Level Risk
Phnom Penh	Ruessei Kaev	Tuek Thla	South-central	Low-Risk

03-Hour Flash Flood Risk and Location				
Provinces	Districts	Villages	Region	Level Risk
NO ANY DETECTION OF FLASH FLOOD WITHIN NEXT 03-HOUR				

06-Hour Flash Flood Risk and Location				
Provinces	Districts	Villages	Region	Level Risk
Tboung Khmum	Memot	Chamkar Thmei	Central Lowland	Low-Risk
Phnom Penh	Ruessei Kaev	Tuek Thla	South-central	Low-Risk
Sihanouk Ville	Prey Nob	Chumpu Khmau	Southwest	Low-Risk
Svay Rieng	Romeas Haek	Chhuk	Southeast	Low-Risk
Tboung Khmum	Tboung Khmum	Thnal Thmei	Central Lowland	Low-Risk
Prey Veng	Prey Veaeng	Poun	Southeast	Low-Risk

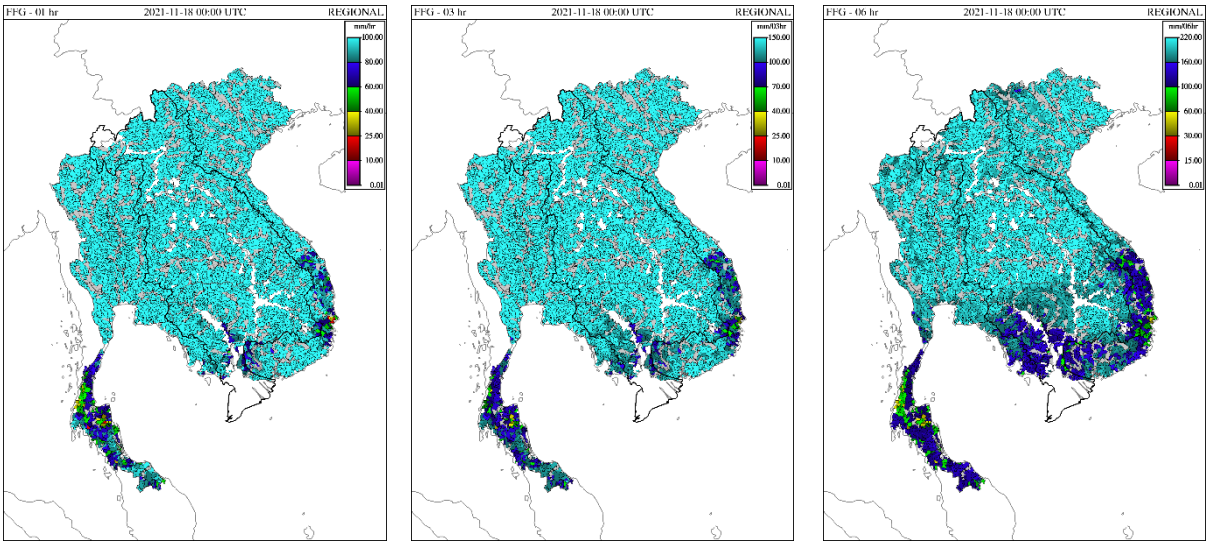


Figure 14. Flash Flood Guidance for the next 1 hour, 3 hours and 6 hours on Nov 18

5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 13 to 19 November 2021

Drought monitoring data for 2021 are available from Saturday to Friday every week; thus, the reporting period is normally delayed by three days compared to Flood and Flash Flood reports. We adopt the Index of Soil Water Fraction (ISWF) data obtained from FFGS to represent soil moisture of agricultural indicator for both dry and wet seasons.

- **Weekly Standardised Precipitation Index (SPI1)**

Drought condition of the LMB from November 13 to 19, as shown in Figure 11, was normal in most parts. Meteorological indicator of SPI shows that the LMB received average rainfall in most parts of the region except the southern part of Cambodia and the Mekong Delta of Viet Nam that received above average rainfall during the monitoring week.

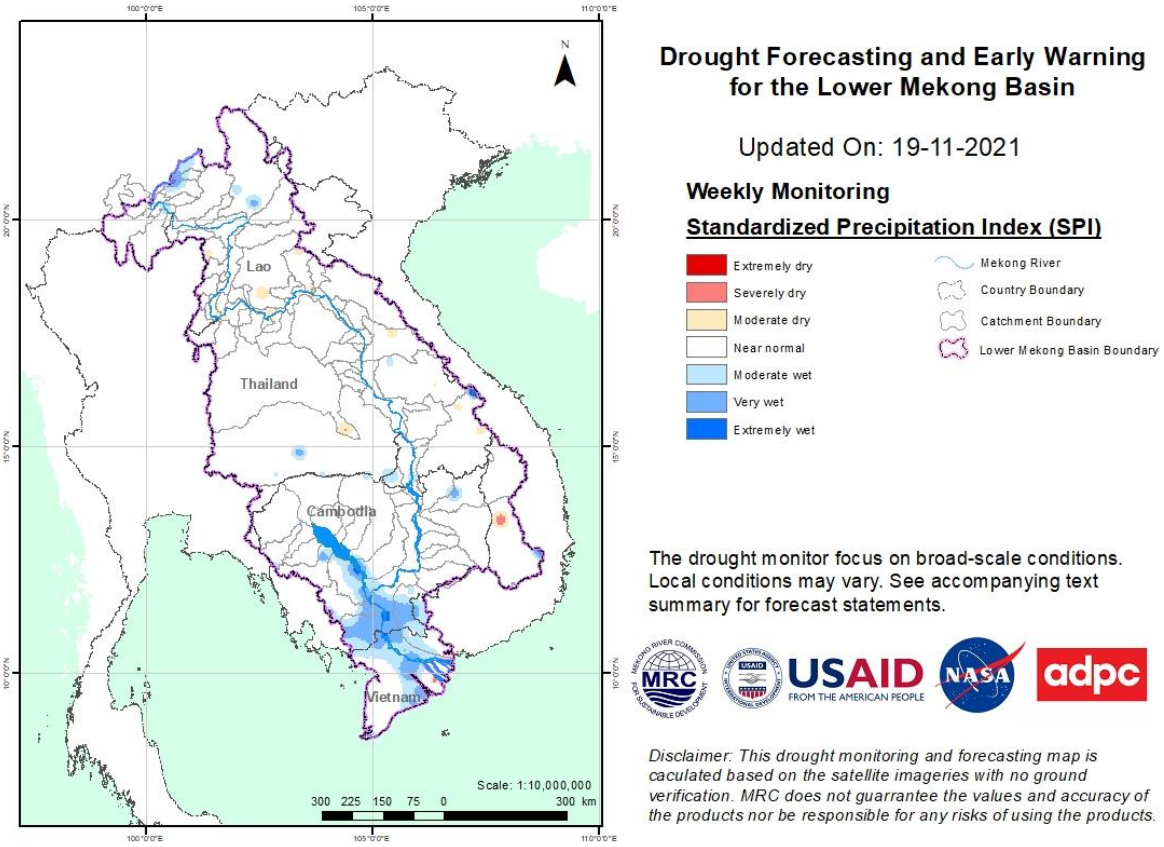


Figure 15: Weekly standardised precipitation index from Nov 13 to 19.

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

Soil moisture conditions from Nov 13 to 19, as displayed in Figure 12, were abnormally dry in some areas of the northern and eastern LMB covering Phongsaly, Xayaburi, Luang Prabang, Xieng Khuang, Xaysomboun, Vientiane, Borikhamxay, Khammuane, Savannakhet, Saravane, Champasack, and Attapeu of Lao PDR and Nong Khai, Nakhon Phanom, Sakon Nakhon, and Ubon Ratchathani, Si Saket, and Burirum of Thailand with moderate and severe dry conditions. They also took place in Ratana Kiri and Kratie of Cambodia down in the south of the LMB. However, they were not significant as they lasted for very short period.

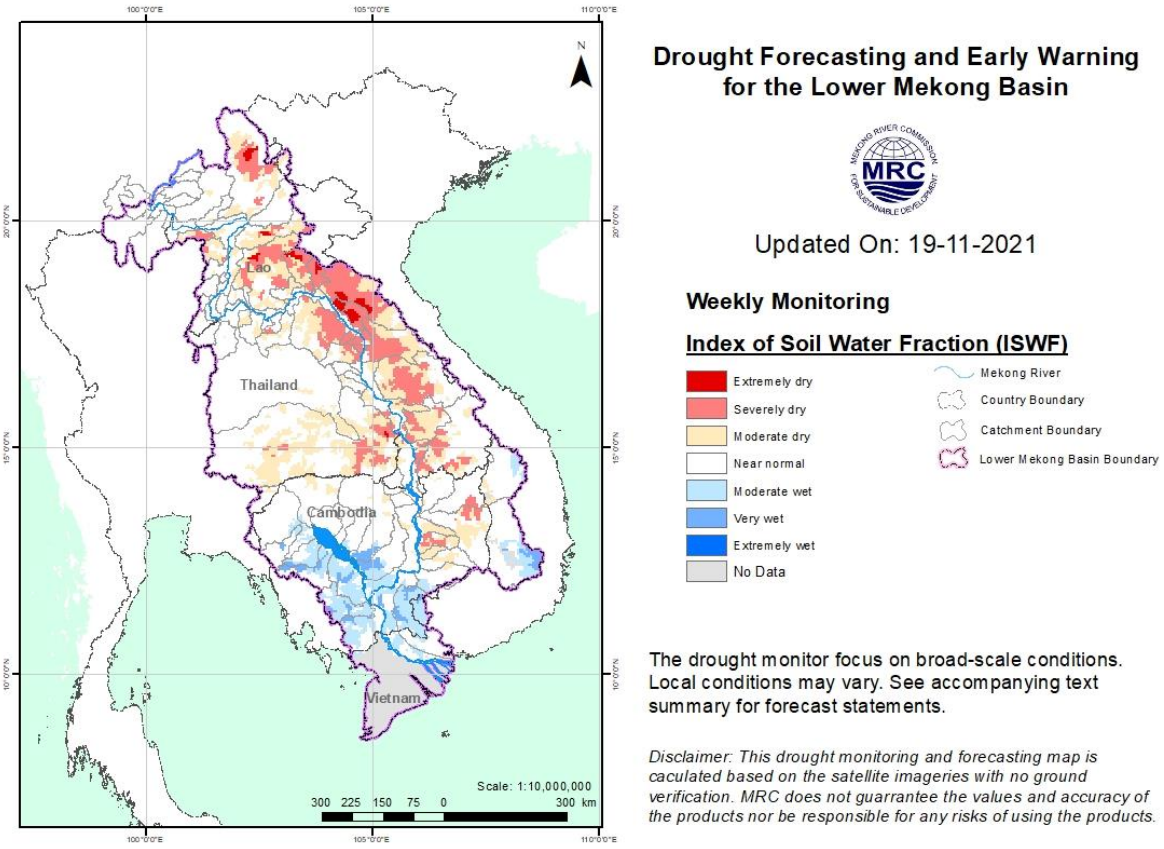


Figure 16: Weekly Soil Moisture Anomaly from Nov 13 to 19.

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

The combined drought indicator, as displayed in Figure 13, reveals that during Nov 13-19 the LMB was facing moderate drought mainly in Borikhamxay due to severely dry soil moisture. The other areas, however, were normal during the reporting week. No serious drought risk was detected during the reporting week.

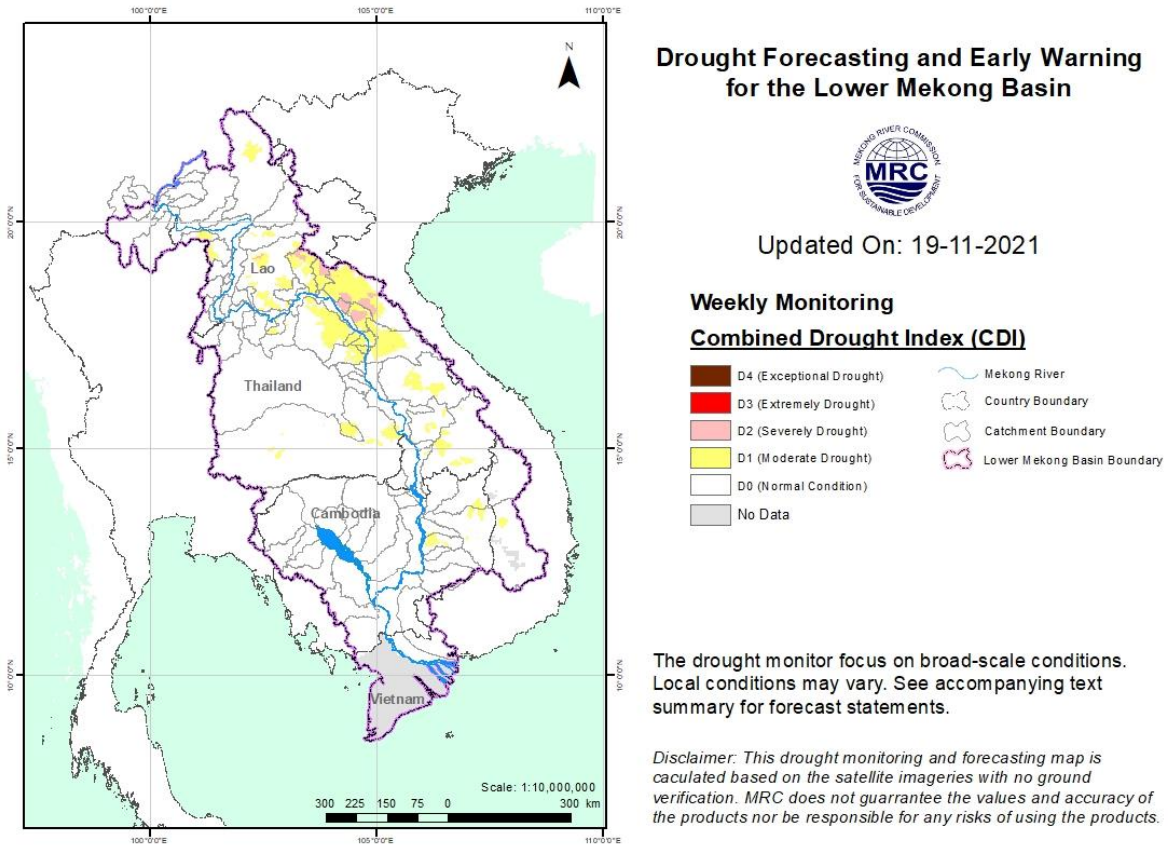


Figure 17: Weekly Combined Drought Index during Nov 13-19.

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.

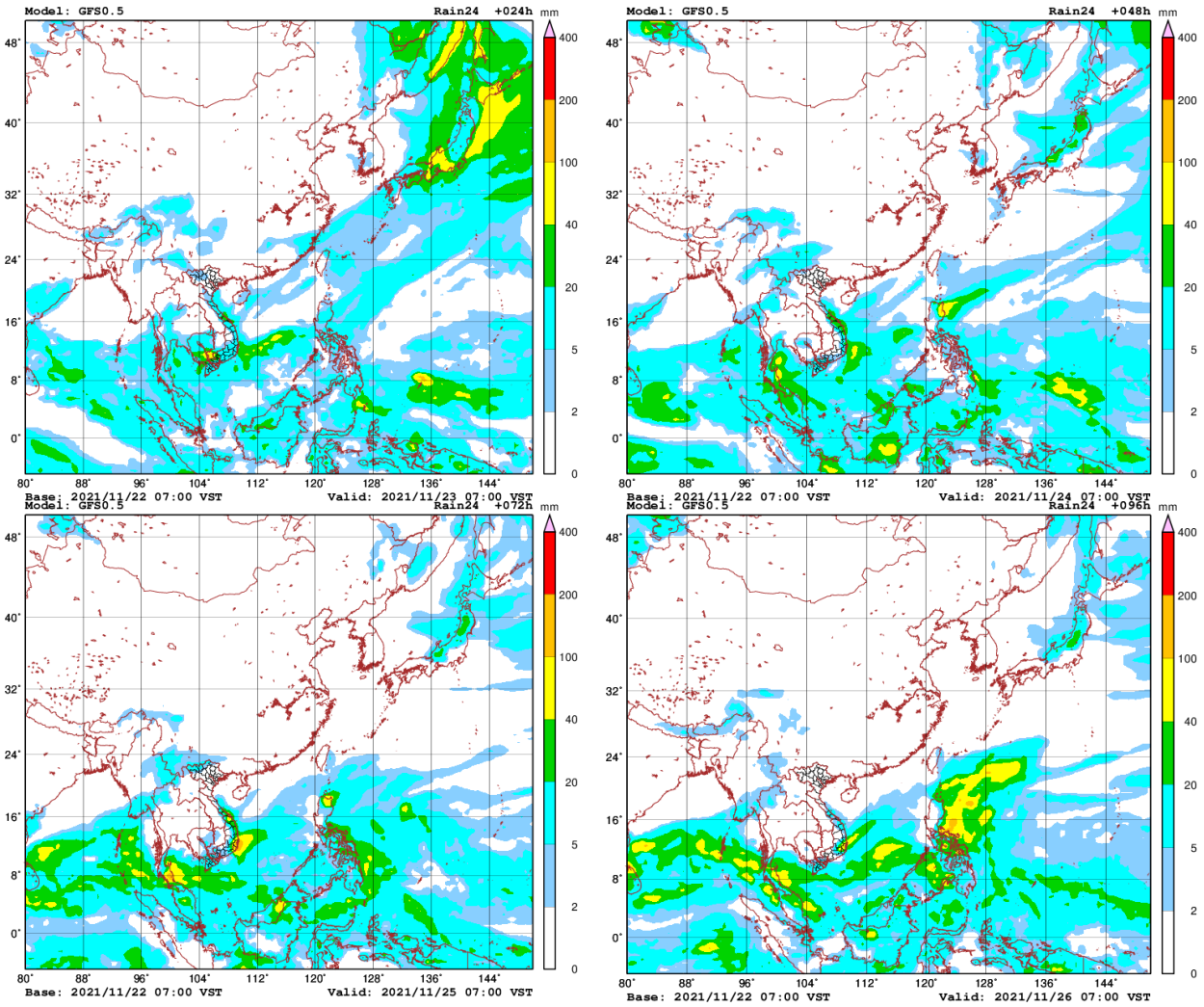
6 Weather and Water Level Forecast and Flash Flood Information

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, three main factors might affect the LMB. They include (i) high pressure from China, (ii) the on-going prevailing Southwest Monsoon from the Gulf of Thailand to the lower part of the LMB, and (iii) the low pressure cell covering the middle and lower southern part of LMB.

During November 23-29, small rainfall (5-20 mm/24h) may occur in some areas of the LMB.

Figure 14 shows accumulated rainfall forecast (24hrs) of the GFS model from November 16 to 22.



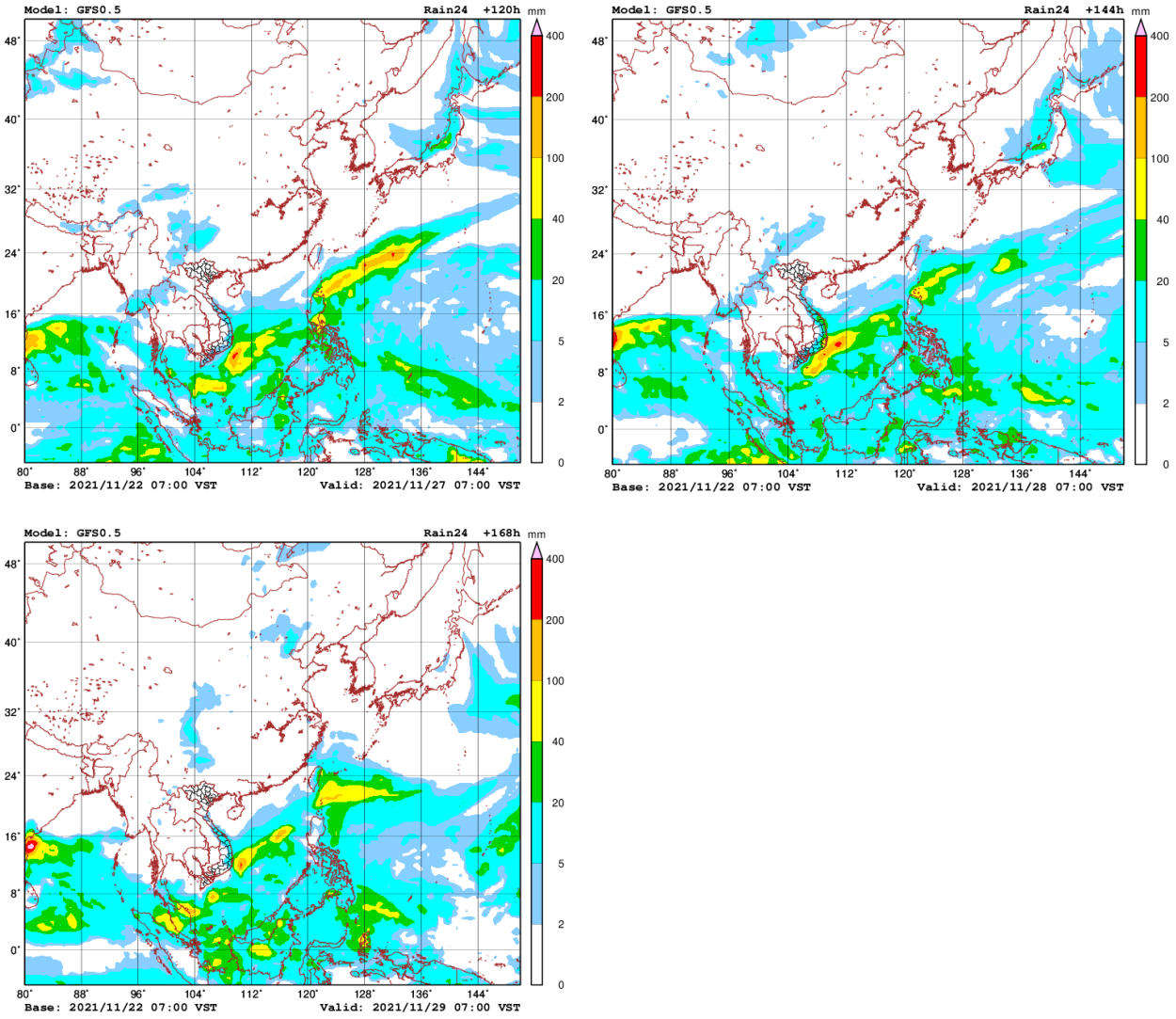


Figure 18: Accumulated rainfall forecast (24 hrs) of model GFS.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on November 22's weekly river monitoring bulletin, the weekly forecast water level at Chiang Saen in Thailand is expected to slihglty decrease from 2.45 m to 2.36 m in the next seven days. Even so, the trend of water levels at these stations will continue staying below their LTA.

For Luang Prabang in Lao PDR, the water level is likely to increase, staying between 9.32 m and 9.78 m during the same period. The current water levels are higher than their LTA.

Chiang Khan, Vientiane-Nong Khai and Paksane

Water level at Chiang Khan station in Thailand is forecasted to be up about 0.42 m for the next seven days. Also, Vientaine in Lao PDR and Nong Khai in Thailand will see a very slight increase about 0.3 m in the next seven days. At Paksane in Lao PDR, water level will increase about

0.15 m due to less inflow from the upper catchments. Below average rainfall is forecasted in the area. The water levels here will remain lower than their LTA.

Nakhon Phanom to Pakse

Water levels from Nakhon Phanom in Thailand and Savannakhet in Lao PDR will decrease by about 0.10 m in the next seven days. From Khong Chiam in Thailand to Pakse in Lao PDR the water will drop by about 0.15 m. Water level at these stations will stay lower than their LTA level. Next week average quantity of precipitation is forecasted in the area.

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 in between 0.10 m and 0.40 m over the next seven days. Precipitation is forecasted for the area between Stung Treng and Kampong Cham during next week.

The water levels of the Tonle Sap Lake at Prek Kdam and Phnom Penh Port as well as at Phnom Penh's Chaktomuk on the Bassac River will decrease about 0.30 m over the next seven days.

Water levels at most of the stations will continue to stay lower than their LTA value, particularly in the lower part of the region from the Bassac at Phnom Penh to Koh Khel as well as from Tonle Sap at Prek Kdam to Phnom Penh Port, including the Tonle Sap Lake. Precipitation is forecasted for the low-lying area of Cambodia next week.

Tidal stations at Tan Chau and Chau Doc

For Viet Nam's Tan Chau on the Mekong River and Chau Doc on the Bassac River, water levels will be moving down below their LTA, following daily tidal effects from the sea.

Table 3 shows the weekly River Monitoring Bulletin issued on November 22. Results of the started weekly river monitoring bulletin are also available at http://ffw.mrcmekong.org/bulletin_wet.php.

6.3 Flash Flood Information

Flash flood events are not likely to happen in the LMB. However, local heavy rain in a short period of time might still be possible with unexpected short flash floods. During the dry season if extreme weather occurs, the information on flash flood guidance for the next one, three, and six hours is updated at http://ffw.mrcmekong.org/ffg.php.

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

6.4 Drought forecast

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

The global scale of rainfall prediction is used to see how the rain distribution looks like for the coming months. Figure 15 shows the ensemble mean of daily average precipitation (mm/day) each month from November 2021 to January 2022 produced by the NMME.

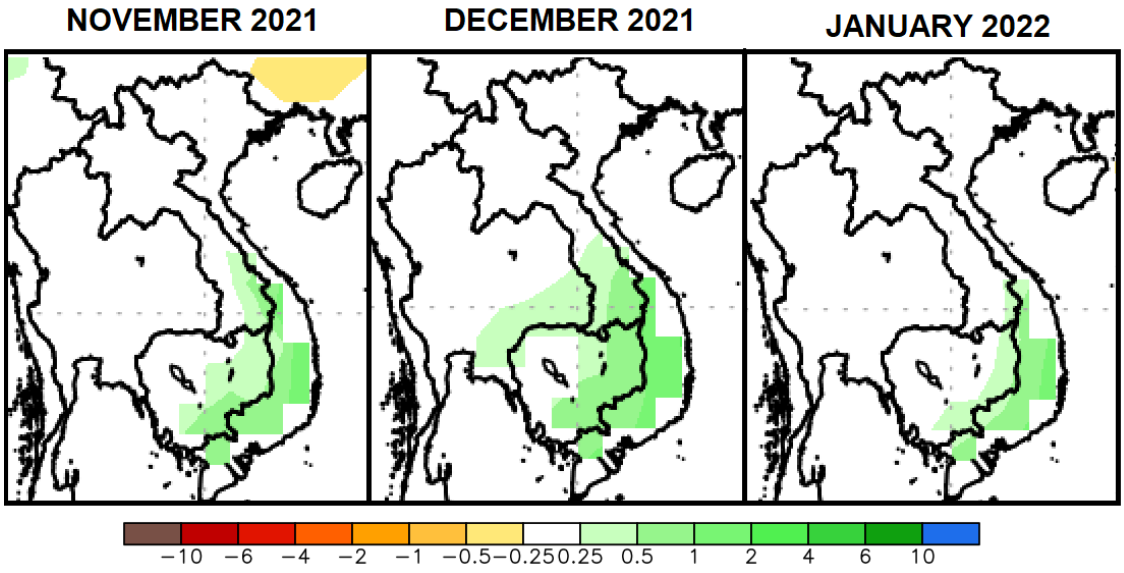


Figure 195. Daily average of monthly rainfall anomaly forecast from November 2021 to January 2022.

The ensemble prediction model based on the initial conditions in October reveals that the LMB is likely to receive from average to above average rainfall from November 2021 to January 2022. There will be some more rain dropping over the southern part of the LMB during November and December 2021 making the condition cooler than normal year, while normal condition is likely taking place in the upper and middle parts of the region during the last two months of the year.

The 2021 dry season is relatively wetter than that of 2020 and the monsoon rain in the 2021 wet season has arrived earlier than it did in 2019 and 2020 especially over the upper and central parts of the LMB.

Table 2. Weekly River Monitoring Bulletin.

Mekong Bulletin

Mekong River Commission Secretariat (MRCS)
Regional Flood and Drought Management Centre (RFDMC)
P.O. Box 623 #576, National Road #2, Chak Angre Krom, Meanchey, Phnom Penh, Cambodia
Tel: (855-23) 425353, Fax: (855-23) 425363, Email: floodforecast@mrcmekong.org

Forecast period from: 23 November to 29 November 2021

Date: 22 November 2021

LOCATION	Country	Observed Rainfall (mm)	Zero gauge above M.S.L (m)	Min water level against zero gauge (m)	Observed W. level against zero gauge (m)		Forecasted Water Levels (m)						
		21-Nov			21-Nov	22-Nov	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov	28-Nov	29-Nov
Jinhong		0.0	-	-	535.23	535.23							
Chiang Saen		0.0	357.110	0.00	2.71	2.45	2.40	2.36	2.33	2.31	2.30	2.32	2.36
Luang Prabang		0.0	267.195	2.53	8.82	9.32	9.55	9.47	9.53	9.66	9.60	9.70	9.78
Chiang Khan		0.0	194.118	1.91	5.82	5.76	5.95	6.10	6.02	6.07	6.16	6.10	6.18
Vientiane		0.0	158.040	-0.28	3.10	3.14	3.08	3.27	3.42	3.33	3.38	3.47	3.40
Nongkhai		0.0	153.648	0.33	2.60	2.63	2.61	2.80	2.96	2.87	2.93	3.02	2.95
Paksane		0.0	142.125	0.10	3.30	3.15	3.09	3.05	3.16	3.26	3.20	3.23	3.30
Nakhon Phanom		0.0	130.961	0.18	2.26	2.19	2.11	2.08	2.06	2.12	2.18	2.19	2.21
Thakhek		0.0	129.629	1.38	3.46	3.41	3.34	3.32	3.30	3.36	3.43	3.45	3.48
Mukdahan		0.0	124.219	0.72	2.52	2.48	2.42	2.35	2.33	2.30	2.35	2.40	2.42
Savannakhet		0.0	125.410	-0.65	0.95	0.95	0.92	0.87	0.86	0.85	0.89	0.92	0.93
Khong Chiam		0.0	89.030	1.02	4.41	4.40	4.32	4.23	4.15	4.10	4.06	4.14	4.22
Pakse		0.0	86.490	0.03	3.12	3.08	3.03	2.97	2.92	2.90	2.88	2.93	3.00
Stung Treng		nr	36.790	0.32	4.31	4.31	4.27	4.23	4.18	4.14	4.12	4.12	4.17
Kratie		nr	-1.080	3.06	10.82	10.81	10.78	10.72	10.66	10.59	10.53	10.49	10.47
Kompong Cham		nr	-0.930	0.65	6.50	6.39	6.35	6.30	6.23	6.15	6.07	6.00	5.95
Phnom Penh (Bassac)		0.0	-1.020	1.58	5.25	5.16	5.12	5.08	5.02	4.97	4.92	4.89	4.86
Phnom Penh Port		-	0.000	0.14	4.27	4.18	4.14	4.10	4.04	3.99	3.94	3.91	3.88
Koh Khel		nr	-1.000	1.52	4.93	4.86	4.82	4.77	4.71	4.66	4.62	4.60	4.57
Neak Luong		nr	-0.330	0.81	3.86	3.80	3.75	3.71	3.67	3.63	3.59	3.55	3.51
Prek Kdam		nr	0.080	0.58	5.08	5.03	4.97	4.92	4.86	4.82	4.78	4.73	4.70
Tan Chau		nr	0.000	-0.37	2.10	1.89	1.77	1.69	1.63	1.58	1.54	1.50	1.47
Chau Doc		0.0	0.000	-0.60	1.97	1.87	1.71	1.60	1.53	1.48	1.44	1.41	1.38

REMARKS:

-: not available.
*: reference stations without forecast.
nr: no rain.

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

Rainfall during this reporting week was considered low in the LMB (3.70 mm to 94.00 mm) due to low-pressure line dominating in the LMB. No rainfall in the upper and middle parts of the Mekong region were recorded during this week report. Compared with last week's amount, the rainfall this week was considered low in the Mekong region.

Based on the forecasted rainfall from satellite using GFS data, rainfall is likely to take place in the areas from the lower part of Cambodia, the 3S area and Mekong Delta in Viet Nam during November 23–29, varying from 0.25 mm to 100 mm. This indicates the descending pace of rainfall and starting of the dry season from November over the LMB.

7.2 Water level and its forecast

According to MRC's observed water level data, the outflows at Jinghong hydrological station showed water level changes over the monitoring period from 16 to 22 November 2021. Water levels at this station decreased about 0.58 m from 535.81 m on 16 Nov to 535.23 on 22 Nov 2021 (recorded on 7:00 am) and stayed about 0.36 m lower than its two-year-average (2020-2021) value. The outflow down from 1197.00 m^3/s on 16 Nov to 807.00 m^3/s on 22 Nov 2021.

Water levels in the lower part of the monitoring locations in the LMB during this reporting week were decreasing from Nakhon Phanom in Thailand to Savannkhet in Lao PDR. Also, at Stung Treng, Kratie and Kampong Cham in Cambodia, after the end of the heavy rainfall in October water levels dropped significanlty. Water levels at Neak Luong, Bassac at Phnom Penh, and Prek Kdam in Cambodia were still lower than their LTA level. The low level was due to low inflows from upstream and less rainfall in the region from November 16 to 22. Generally, this week's water levels were relatively lower than those of last week from the upper to the lower part of the LMB.

The flow volume of the Tonle Sap Lake is lower than its LTA. From next week, the flow is expected to continue decreasing due to the less rainfall forecasted in the inflow catchments of the Tonle Sap Lake.

From Stung Treng to Kampong Cham, the water levels will go down lower than their LTA. The water levels – at Neak Luong on the Mekong River, from Prek Kdam to Phnom Penh Port on the Tonle Sap, and from Chaktomuk to Koh Khel on the Bassac – are forecasted to continue lower than their LTA.

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

Since the fourth week of October 2021, water levels across most monitoring stations in the LMB have significantly dropped to the level lower than their LTA (from upper to lower stretches within the LMB). For a more complete preliminary analysis of the hydrological

conditions in the LMB over July–December 2020 and November 2020 to May 2021 see this Situation Report.

The contribution to the Mekong River's flow from the UMB in China (Yunnan component) is about 16% by the time the river discharges through the Mekong Delta into the Sea. By far the major contribution comes from the two major 'left-bank' (Eastern) tributaries between Vientiane – Nakhon Phanom and Pakse – Stung Treng, which together contribute more than 40% of the flows.

7.3 Flash flood and its trends

With the predicted of rainfall for the coming week as mentioned earlier in section 6.1, major flash floods are not likely to happen in the LMB.

7.4 Drought condition and its forecast

Drought condition of the LMB from November 13-19 was normal all over the LMB except moderate drought in Borikhamxay due to severely dry soil moisture. The region showed no drought threat except some moderate and severe dry soil moistures in the upper and eastern parts of the LMB.

For the upcoming thee-month forecast, the LMB is likely to receive from average to above average rainfall from November 2021 to January 2022. There will be some more rain dropping over the southern part of the LMB during November and December 2021 making the condition cooler than normal year, while normal condition is likely taking place in the upper and middle parts of the region during the last two months of the year.

Annex A: Tables for weekly updated water levels and rainfall at the Key Stations

Table A1: Weekly observed water levels

2021	Jinghong	Chiang Saen	Luang Prabang	Chiang Khan	Vientiane	Nongkhai	Paksane	Nakhon Phanom	Mukdahan	Pakse	Stung Treng	Kratie	Kompong Cham	Phnom Penh (Bassac)	Koh Khel	Neak Luong	Prek Kdam	Tan Chau	Chau Doc
16-11-2021	535.81	2.27	8.90	6.03	3.28	2.78	3.51	2.40	2.73	3.48	4.53	11.19	6.72	5.37	4.97	4.00	5.19	2.23	2.23
17-11-2021	535.67	2.58	8.80	6.12	3.35	2.85	3.45	2.33	2.62	3.40	4.52	11.28	6.73	5.35	4.99	3.96	5.17	2.23	2.22
18-11-2021	535.66	2.79	8.72	5.92	3.42	2.90	3.44	2.29	2.59	3.30	4.49	11.28	6.76	5.38	4.99	3.95	5.16	2.19	2.21
19-11-2021	535.86	2.82	8.66	5.74	3.29	2.83	3.45	2.24	2.54	3.20	4.40	11.20	6.72	5.37	5.01	3.92	5.16	2.09	2.11
20-11-2021	535.31	2.76	8.70	5.78	3.12	2.66	3.42	2.25	2.52	3.16	4.29	11.00	6.64	5.33	4.98	3.92	5.15	2.10	2.09
21-11-2021	535.23	2.71	8.82	5.82	3.10	2.60	3.30	2.26	2.52	3.12	4.31	10.82	6.50	5.25	4.93	3.86	5.08	2.10	1.97
22-11-2021	535.23	2.45	9.32	5.76	3.14	2.63	3.15	2.19	2.48	3.08	4.31	10.81	6.39	5.16	4.86	3.80	5.03	1.89	1.87

Table A2: Weekly observed rainfall

2021	Jinghong	Chiang Saen	Luang Prabang	Chiang Khan	Vientiane	Nongkhai	Paksane	Nakhon Phanom	Mukdahan	Pakse	Stung Treng	Kratie	Kompong Cham	Phnom Penh (Bassac)	Koh Khel	Neak Luong	Prek Kdam	Tan Chau	Chau Doc
16-11-2021	0	0	0	0	0	0	0	0	0	0	26	3.2	1.5	30.5	9.6	35.3	37.3	5	18
17-11-2021	13	0	0	0	0	0	0	0	0	0	0	0	0	5.2	39	0	0	10	0.8
18-11-2021	3	0	0	0	0	0	0	0	0	0	5	5	1.2	36.1	9.7	62	0	72	19.2
19-11-2021	0.5	0	0	0	0	0	0	0	0	0	0	0	1	2.5	0	0	12.4	5	5.1
20-11-2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-11-2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
22-11-2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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