



Mekong River Commission

Weekly Wet Season Situation Report in the Lower Mekong River Basin 1-6 June 2023

Prepared by
The Regional Flood and Drought Management Centre
07 June 2022

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Key Messages

Key messages for this weekly report are presented below:

Rainfall and its forecast

- Rainfall focused in the areas from Chiang Saen in Thailand to Tan Chau and Chau Doc in Viet Nam, including the upper, middle and lower parts of the LMB covering Lao PDR and Cambodia, varying from 1.30 millimetres (mm) to 179.50 mm.
- There will be moderate rainfall for the next 5 days over the Mekong region from 8 to 12 June 2023 although there is not 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 increased water levels from **536.37 m** to **536.71 m** during 1-6 June 2023. The current level is staying about 0.54 m lower than its LTA: 2015-2022 value. The outflow at Jinghong station increased between 1,610.00 m³/s and 1,910.00 m³/s between 1-6 June 2023.
- With the increased outflow from Jinghong upstream and rainfall at catchment inflow, water levels of monitoring stations at Chiang Saen in Thailand increased about 0.44 m from 1 to 6 June 2023, staying about 1.53 m lower than its LTA level. WLS at Xieng Kok upstream of Chiang Saen also increased about 0.94 m.
- Water level at Chiang Khan in Thailand from 1 to 6 June 2023 decreased about 0.10 m and stayed about 2.37 m lower than its LTA value, while water level at Vientiane increased about 0.12 m but still stayed about 1.53 m lower than its LTA level. Water levels at Nong Khai increased 0.09 m and stayed about 1.53 m lower than its LTA, while at Paksane it increased about 0.04 m, staying about 2.31 m lower than its LTA value. Water levels at these stations are still considered low levels.
- Water levels from Nakhon Phanom in Thailand and Pakse in Lao PDR increased from 0.03 m to 0.17 m due to the contributions of rainfalls and inflows from upstream. The current WLS at these stations are staying lower than their LTA values, considering low levels.
- From the stretches of the river from Stung Treng, Kratie to Kompong Cham, water level decreased and stayed higher than their LTA value, which was also considered normal.
- The water volume of the Tonle Sap Lake was lower than its LTA (about 60%) during the same period from 1 to 6 June 2023, which is still considered normal.

- Water levels from downstream at Chaktomuk, Koh Khel on the Bassac and Phnom Penh Port to Prek Kdam in Cambodia fluctuated and stayed close or higher than their LTA level, considered normal.
- The current water levels for most of the stations are lower than their LTA values, excepted at Luang Prabang. WLs at the 2 tidal stations at Tan Chau and Chau Doc were fluctuating lower than their minimum 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 Pakse and those in downstream from Stung Treng down to the Mekong floodplain area are expected to go up due to moderate rainfall and dam operation upstream.

Drought condition and its forecast

- During May 29-June 4, moderate and severe droughts took part mainly in the central area of the LMB. They specifically covered Chiang Rai, Phayao, Phongsaly, Oudomxay, Xayaburi, Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nakhon Phanom, Nong Khai, Borikhamxay, Khammuane, Savannakhet, Ubon Ratchathani, Amnat Charoen, Roi Et, Kalasin, Khon Kaen, Chaiyaphum, Surin, Otdar Meanchey, Sa Kaeo, Chanthaburi, Pailin, Battambang, and Pursat.
- In **June** the central and eastern parts covering mainly Thailand and the 3S areas are likely hit by severe and extreme droughts. They specifically cover Phongsaly, Vientiane, Xaysomboun, Borikhamxay, Chaiyaphum, Khon Kaen, Maha Sarakham, Roi Et, Surin, Buriram, Nakhon Ratchasima, Sa Kaeo, Banteay Meanchey, Battambang Pursat, Otdar Meanchey, Saravane, Champasack, Stung Treng, Ratanakiri, Gia Lai, Kon Tum, Attapeu, and Sekong. In **July** the upper and 3S areas are likely experiencing some extreme and severe droughts. They cover Phongsaly, Luangnamtha, Bokeo, Chiang Rai, Phayao, Oudomxay, Luang Prabang, Xayaburi, Vientiane, Xaysomboun, Borikhamxay, Nongkhai, Saravane, Sekong, Attapeu, Champasack, Ratanakiri, Kon Tum, Gia Lai, Pursat, Battambang, Kampong Speu, Kien Giang, Ca Mau, Bac Lieu, Soc Trang, and Dak Lak. While in **August** from moderate to extreme droughts are forecasted for Vientiane, Borikhamxay, Xaysomboun, Nong Khai, Saravane, Sekong, Attapeu, Champasack, Ratanakiri, Kon Tum, Gia Lai, Dak Lak, Mondul Kiri, Kratie, and Stung Treng.

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 **01-06 June 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 (June, July and August) and the weather maps issued by the Thai Meteorological Department (TMD) were used to verify weather conditions in the LMB.

Since the beginning of June 2023, moderate 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 June and July 2023, the moderate high-pressure system from China will extend to upper Thailand and the South China Sea. Moderate rains, strong wind and decreasing temperature are likely to take place in the upper of LMB. Temperature will decrease in the Northeast first and move to other places of the region. The monsoon trough lies across the middle and the lower parts of the south throughout the period with rainfall and isolated heavy rains in the South.

[Figure 1](#) presents the weather map during 29 May – 01 June 2023, indicating that a high-pressure cell was active in the East-Sea of Viet Nam, but did not impact the LMB. Generally, the Mekong region was influenced by the southwest monsoon wind bringing more moisture and rainfall to the region. Under this weather condition, moderate to heavy rainfall occurred in northern part of LMB, and southern part of LMB from 3S area southwards.

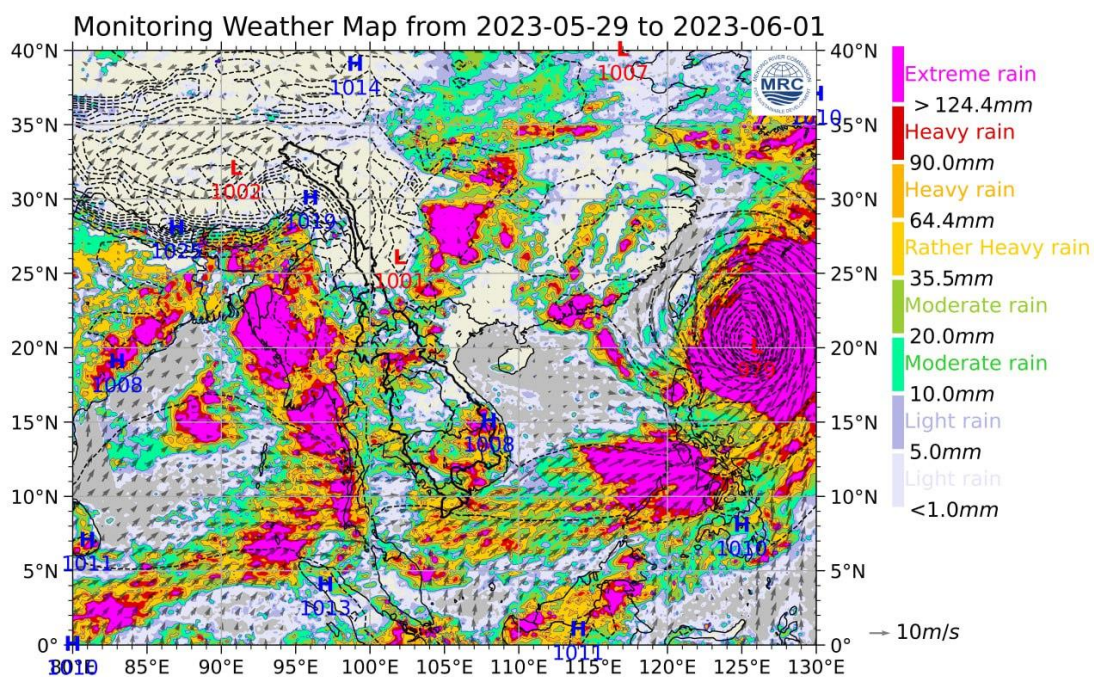


Figure 1. Summary of weather conditions over the LMB.

According to the ASEAN Specialised Meteorological Centre (ASMC), the highest probability of warm and wet conditions is predicted over the lower part of the Mekong region from 29 May to 11 June 2023. Therefore, the Mekong region is likely dominated by warm conditions, which may bring more rainfall and warm temperatures in general to the upper and lower parts of the LMB. **Figure 2** shows the outlook of weather condition from 29 May to 11 June 2023 in Southeast Asia based on results from the NCEP model (National Centres for Environmental Prediction).

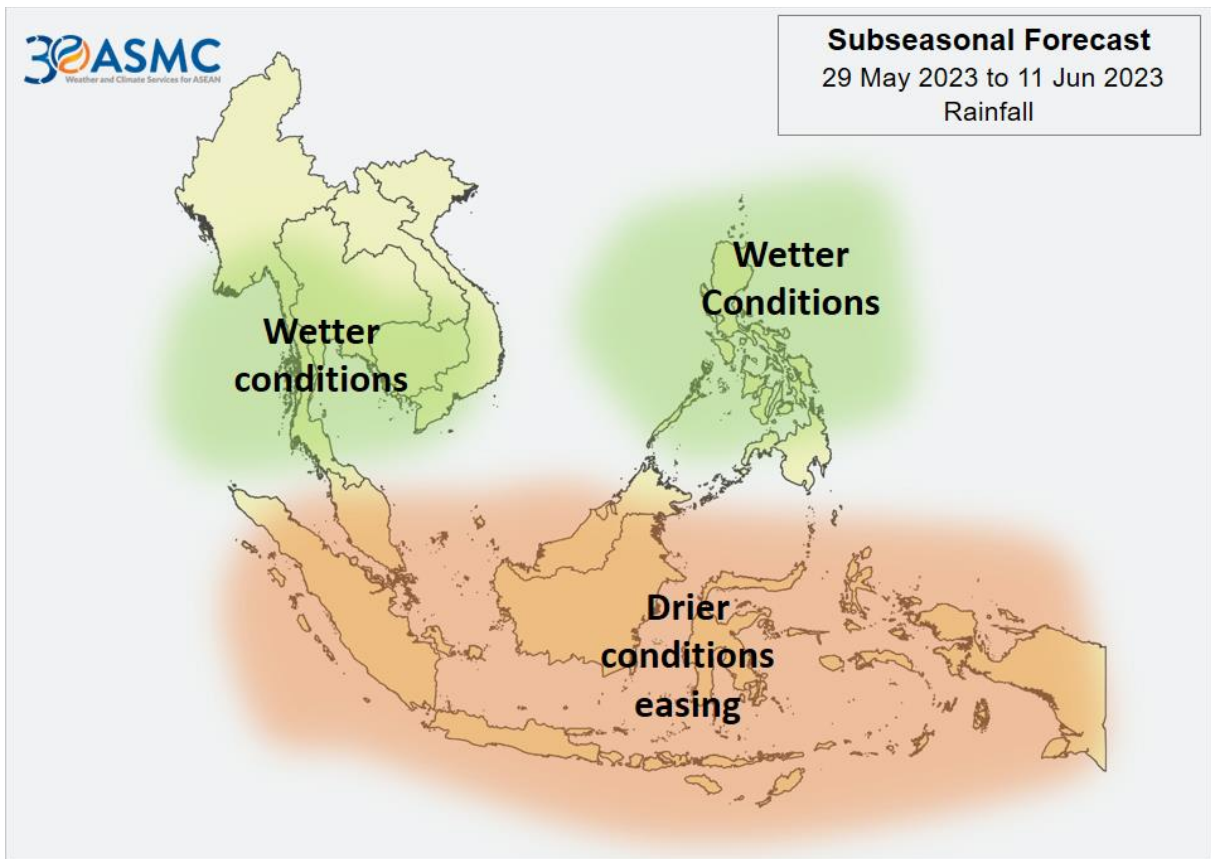


Figure 2. Outlook of wet and dry conditions over the Asian countries by ASMC.

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

There was no movement of any Storm from the Sea to the LMB between 1 and 6 June 2023. No low-pressure line was observed over the Mekong region as shown in [Figure 1](#). The active system for the LMB on 6 June is displayed in [Figure 3](#).

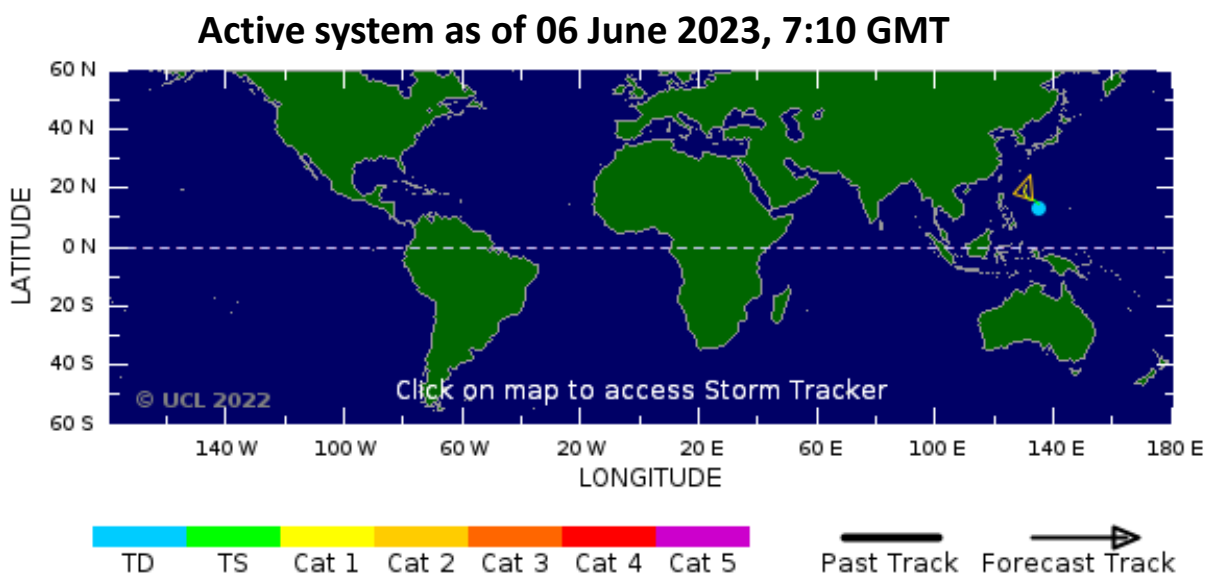


Figure 3. A tropical depression risk observed on 06 June 2023.

2.2 Rainfall patterns over the LMB

This week from 30 May to 6 June 2023, rainfall was observed at the key stations along the mainstream from Chiang Saen in Thailand to the lower part at Stung Treng in Cambodia and Tan Chau and Chau Doc in Viet Nam of the Lower Mekong Basin, varied from 1.30 mm to 179.00 mm. The highest rainfall of this week report concentrated Nong Khai in Thailand which reached up to 179.00 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 low, compared with its LTA and last week rainfall in most of the stations.

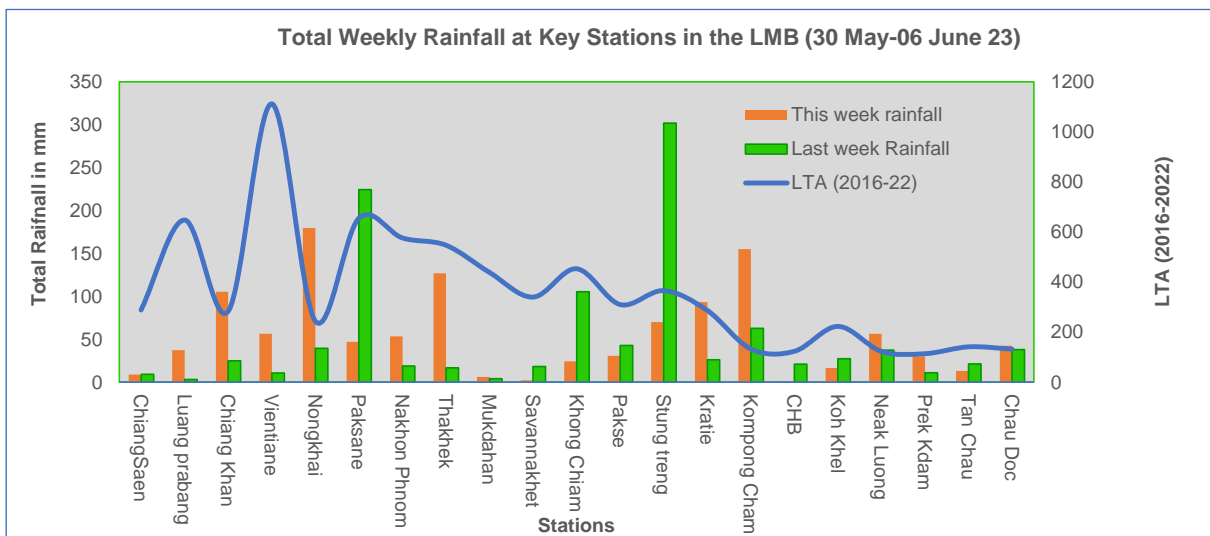


Figure 4. Weekly total rainfall at key stations in the LMB during 1-6 June 2023.

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 1 to 6 June 2023.

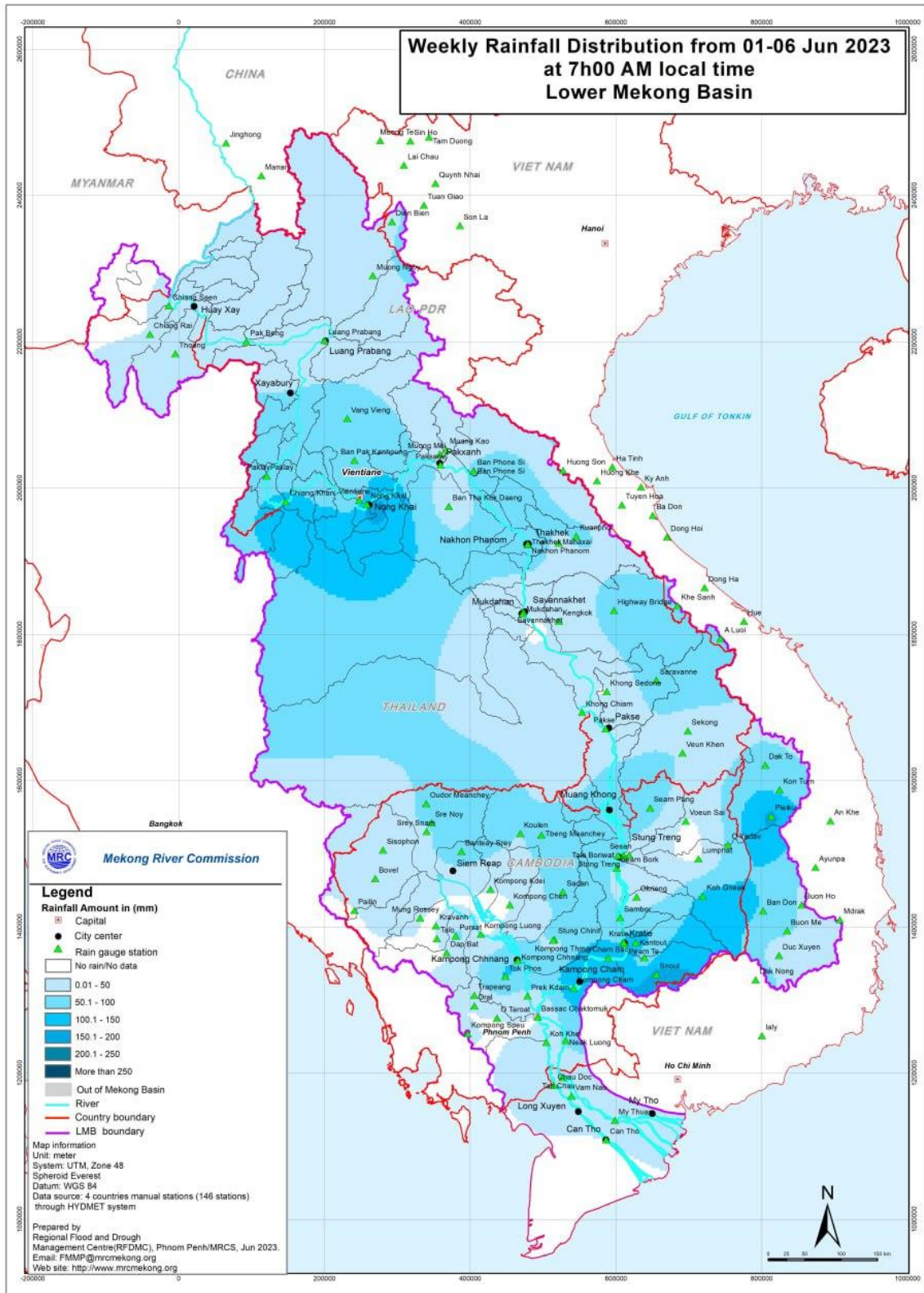


Figure 5. Weekly rainfall distribution over the LMB during 1-6 June 2023.

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](#).

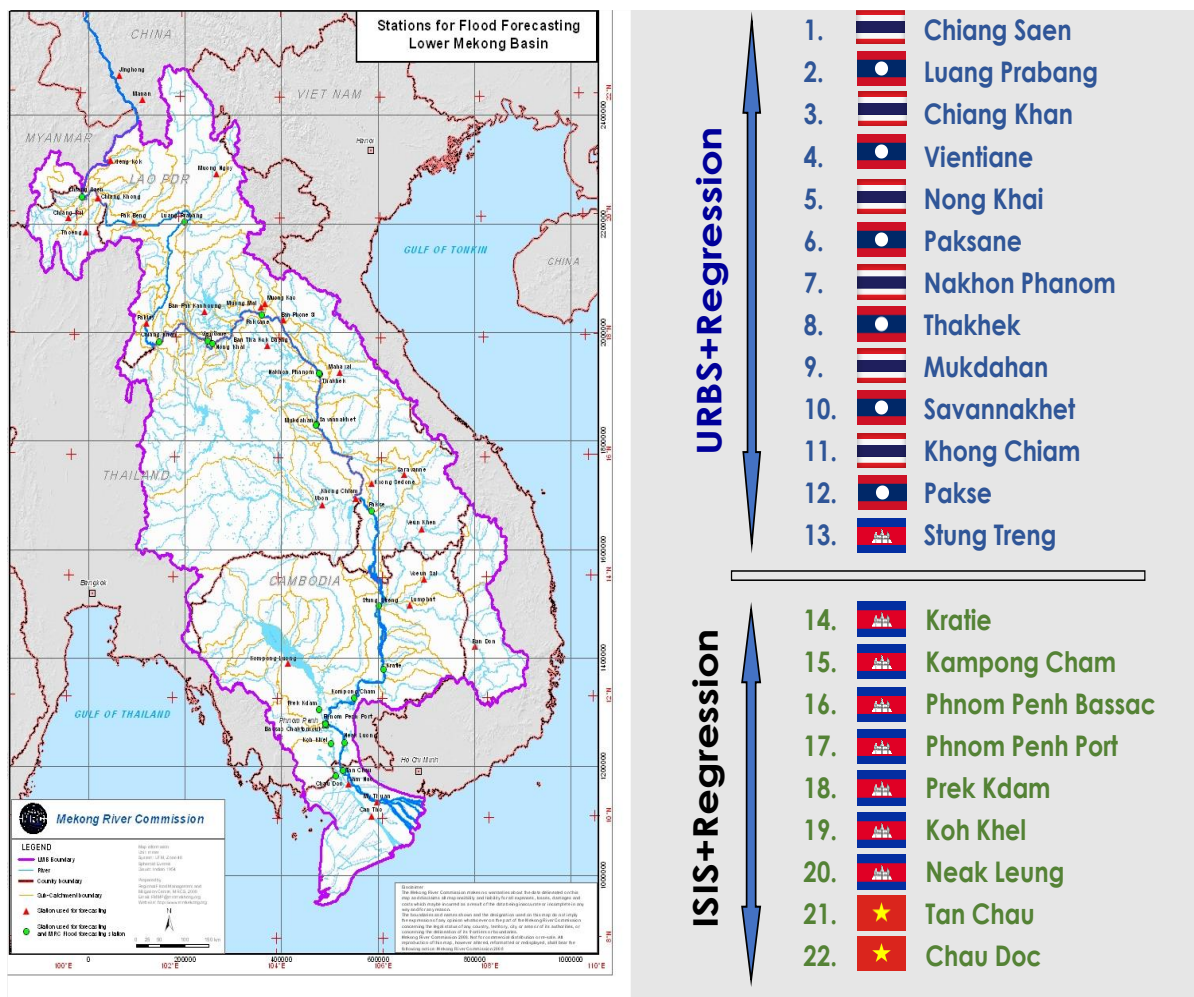


Figure 6. Key stations and model application for River Monitoring and Flood Forecasting.

According to MRC’s observed water level at Jinghong, it showed increased water levels from **536.37 m** to **536.54 m** during 1-6 June 2023 (recorded on 7:00 am). The current level is staying about 0.54 m lower than its Long-Term Average (LTA: 2015-2022) value. The outflow at Jinghong station increased between 1,650.00 m³/s and 1,910.00 m³/s between 1 and 6 June 2023. [Figure 7](#) below presents water level that fluctuated at the Jinghong hydrological station¹, indicating the trend of fluctuating water level up to 6 June 2023.

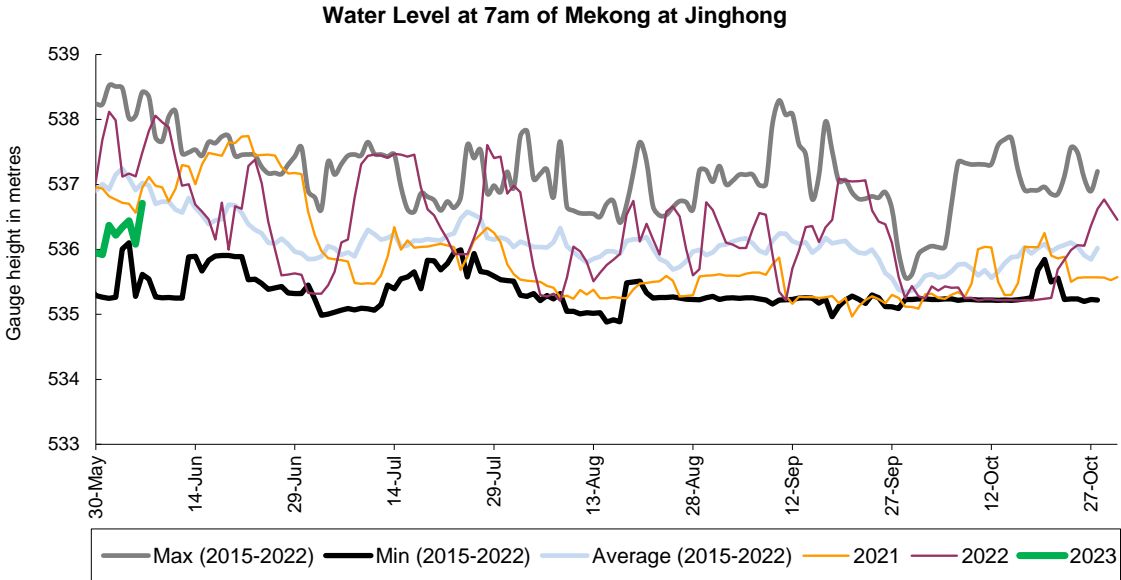


Figure 7. Water level at the Jinghong hydrological station up to 6 June 2023.

Along with the increased outflow from Jinghong upstream, water levels of monitoring stations at Xieng Kok in Lao PDR upper of Chiang Saen increased about 2.04 m, while at Chiang Saen in Thailand it showed also an increase of about 0.78 m from 29 May to 6 June 2023, staying about 1.53 m lower than its LTA level, which considered low level.

Water level at Chiang Khan in Thailand from 1 to 6 June 2023, however, decreased about 0.10 m and stayed about 2.37 m lower than its LTA value, while water level at Vientiane station increased about 0.12 m and stayed about 1.53 m lower than its LTA level, which was still **considered a low water level**. Water levels at Nong Khai increased 0.09 m and at Paksane it decreased about 0.04 m, staying about 1.63 m and 2.31 m lower than their LTA value respectively, **which was considered a low water level situation**.

Water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR increased from 0.02 m to 0.20 m. The current WLs at these stations are staying lower than their LTA level, **considered low water levels**. From the stretches of the river at Stung Treng, WL decreased 0.13 m and stayed about 0.54m lower than its LTA, while at Kratie water level was down about 0.28 m, staying 1.23 m lower than its LTA level, **considered normal**.

Water level at Kompong Cham was down about 0.10 m and stayed 1.70 m lower than its LTA value. Water levels at Chaktomuk, Koh Khel and 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>.

increased between 0.02 m and 0.28 m, and the remaining WLs at these stations were still lower than their LTA level, **considered normal**.

Water levels at all stations along the Mekong River are staying lower than their LTA value, except at Luang Prabang during this week report. The tidal stations at Chau Doc have WL lower than their LTA value, due to tidal effect during this monitoring period.

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

Chiang Saen and Luang Prabang

The water level from 1 to 6 June 2023 at Thailand’s Chiang Saen station increased from 2.00 m to 2.44 m, showing 1.53 m lower than its Long-Term-Average (LTA) value, which considered low level. The water level at Luang Prabang station in Lao PDR was also up about 0.04 m from 8.92 m to 8.96 m during the reporting period. This level still shows 1.32 m higher 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.**

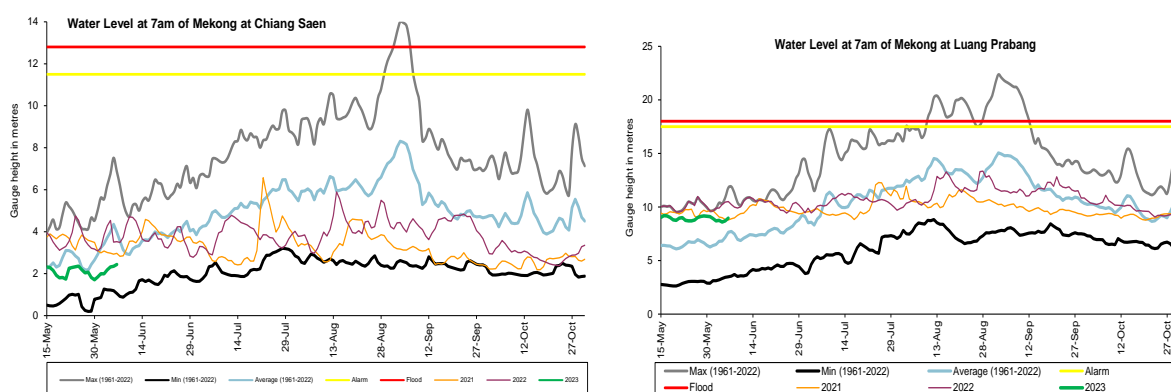


Figure 8. Water levels at Chiang Saen in Thailand and Luang Prabang in Lao PDR.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand (downstream of the Xayaburi dam) decreased about 0.10 m staying about 2.37 m lower than its LTA value, while at Vientiane in Lao PDR increased about 0.12m and it showed about 1.53 m lower than its LTA during the reporting week of 1-6 June 2023. At Nong Khai station in Thailand, the water level was also up about 0.09 m from 1.64 m to 1.73 m, staying about 1.63 m during the reporting period. At Paksane

in Lao PDR, water level decreased about 0.04 m from 2.66 m to 2.62 m. The water level at this station was about 2.31 m lower than its LTA value. The recently decreased water levels were obviously due to the less rainfall contribution from the sub-catchment area along with the less inflows and water stored at upstream parts. The water levels at Vientiane and Paksane are shown in [Figure 9](#) below.

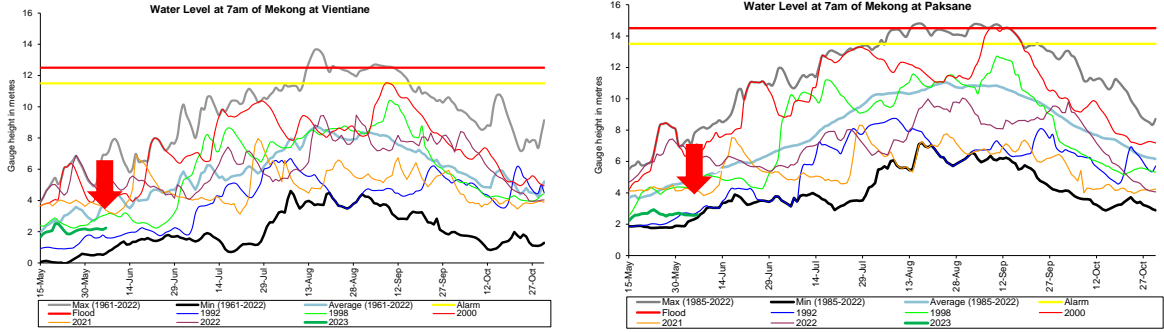


Figure 9. Water levels Veintiane and Paksane in Lao PDR.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR increased between 0.02 m and 0.17 m. Based on the observation, water levels at these stations are still staying lower than their LTA values, which **considered low levels**. [Figure 10](#) shows the water levels at Nakhon Phanom and Pakse stations.

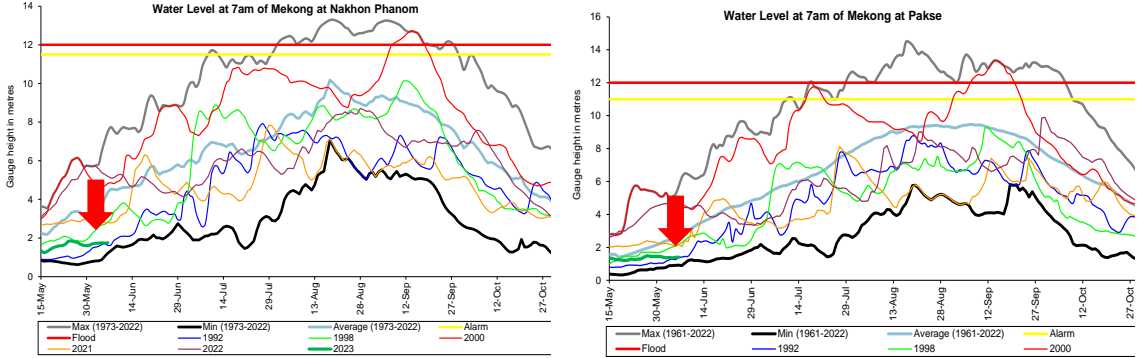


Figure 10. Weekly water levels at Nakhon Phanom in Thailand and Pakse in Lao PDR

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 were decreasing during 1-6 June 2023. The water levels at Stung Treng decreased about 0.13 m and stayed about 0.54 m lower than its LTA, while at Kratie it decreased about 0.28 m, staying about 1.23 m lower than its LTA (as showed in [Figure 11](#)). The water level at Kompong Cham station also decreased about 0.10 m and was about 1.71 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.

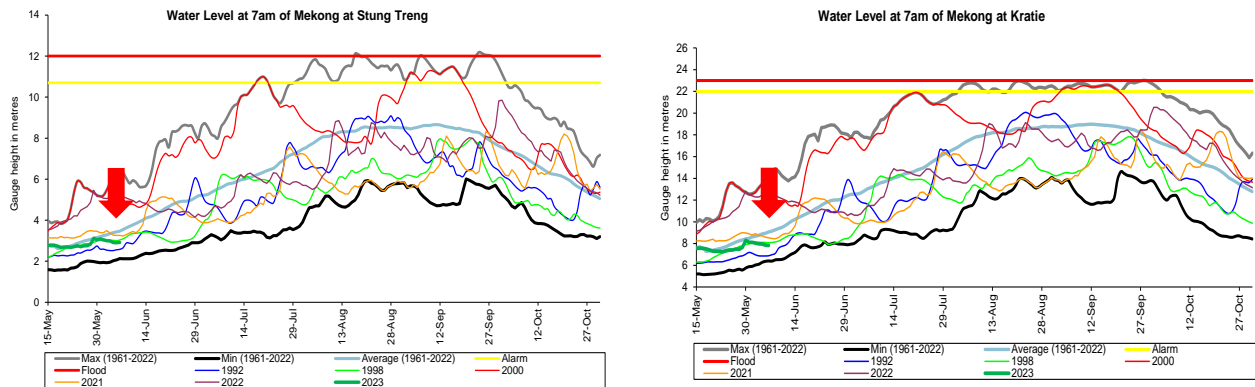


Figure 11. Water levels at Stung Treng and Kratie on the Mekong River.

At Chaktomuk on the Bassac River, due to accumulated rainfall and contributed flows from upstream catchment, the water level increased by about 0.15 m and stayed 0.98 m lower than its LTA value; while at Koh Khel, water level increased about 0.16 m, staying 0.83 m lower than its LTA value. The water level at Prek Kdam on the Tonle Sap Lake increased about 0.29 m and was about 0.83 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 increased water level at Prek Kdam was due to 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 those stations will continue to rise and is considered normal.**

Tidal stations at Tan Chau and Chau Doc

Like last week, the water levels from 1 to 6 June 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 0.00 m and 0.77 m; they were below the range of their LTA and historical minimum levels and were **considered critical.**

The Tonle Sap Flow

At the end of the dry season, when water levels along the Mekong River rise and the inflows of the Mekong River return to the Tonle Sap Lake. This phenomenon normally takes place from end of May to July. Based on flow observation at Prek Kdam, the inflow of the Tonle Sap Lake is not taking place yet up to 06 June 2023.

The flows of the Tonle Sap Lake were calculated based on a formula of rating-curves using 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:

$$\text{Flows} = (\text{WL at Prek Kdam})^{1.2} * \text{SQRT} (\text{WL difference between PP port and Kampong Luong})$$

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, 2021, 2022 and their LTA level (1997-2020). Up to June 6 of this reporting period, **it was observed that the main outflow from the Tonle Sap Lake increased due to rainfall and inflows from upstream.** This increased outflow into the Tonle Sap Lake was most likely caused by inflows and rainfall from the catchment area. Up to present, the outflow from the Tonle Sap Lake condition in 2023 is higher than 2020, 2021 and 2022 but still lower than its LTA (1997-2022) inflow conditions. For next week, less rainfall is forecasted for the Tonle Sap area; but, the outflow into the Tonle Sap Lake is likely expected to go up from the current level.

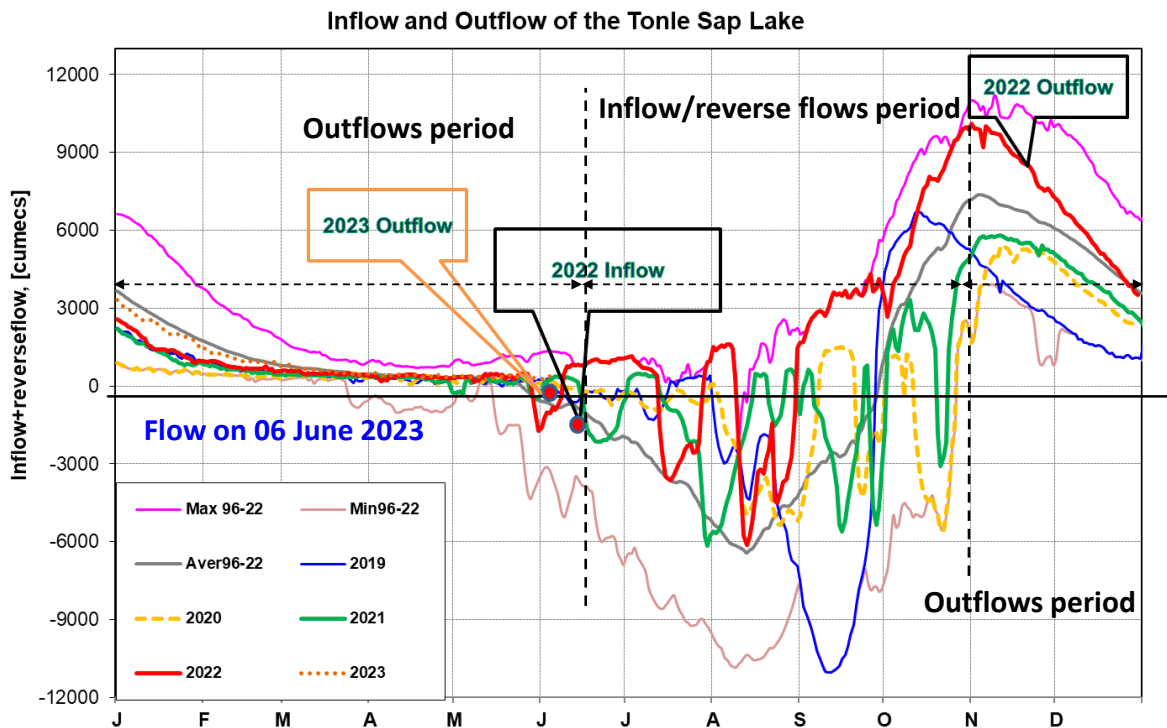


Figure 12. Seasonal change of inflows and outflows of Tonle Sap Lake

[Figure 13](#) shows seasonal changes in monthly flow volumes up to 06 June 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 June 6, **the water volume of the Tonle Sap Lake was slightly higher than 2020, 2021 but lower than 2022 and its LTA (about 60%), 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 as 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.

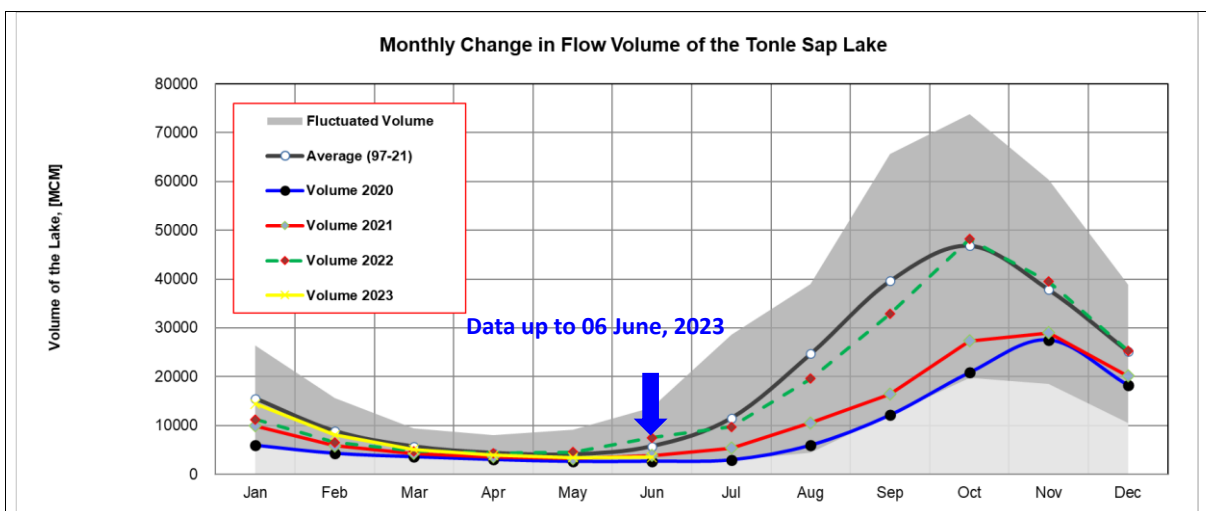


Figure 13. The seasonal change in monthly flow volume of Tonle Sap Lake.

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	3441.01	85.38
Jun	5708.30	13635.01	2468.70	3517.06	2641.88	3798.29	7489.04	3477.63	60.92
Jul	11493.25	28599.56	2925.86	4001.99	2925.86	5346.73	9703.79		
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, compared with historical Min values								
	Normal condition, compared with LTA (Long term average)								
	Low volume situation, compared with LTA values								
Unit: Million Cubic Meter (1 MCM= 0.001 Km ³)					LTA: Long-Term-Average				

4 Flash Flood in the Lower Mekong Basin

During the weekly monitoring period from June 1 to 6, the LMB was affected by two main weather factors being (1) the rather strong Southeast monsoon and (2) the Inter Tropical Convergence Zone (ITCZ). These conditions caused light to heavy rain and isolated thundershowers in some areas of the LMB.

According to the MRC-Flash Flood Guidance System (MRC-FFGS) and analysis, low-risk and moderate-risk of flash flood events were detected during the reporting period in several areas of Lao PDR, Thailand and Viet Nam as shown in [Figure 14](#) and [Table 2](#).

Table 2. Detected low-risk flash flood in Lao PDR, Cambodia, and Viet Nam during June 1-6.

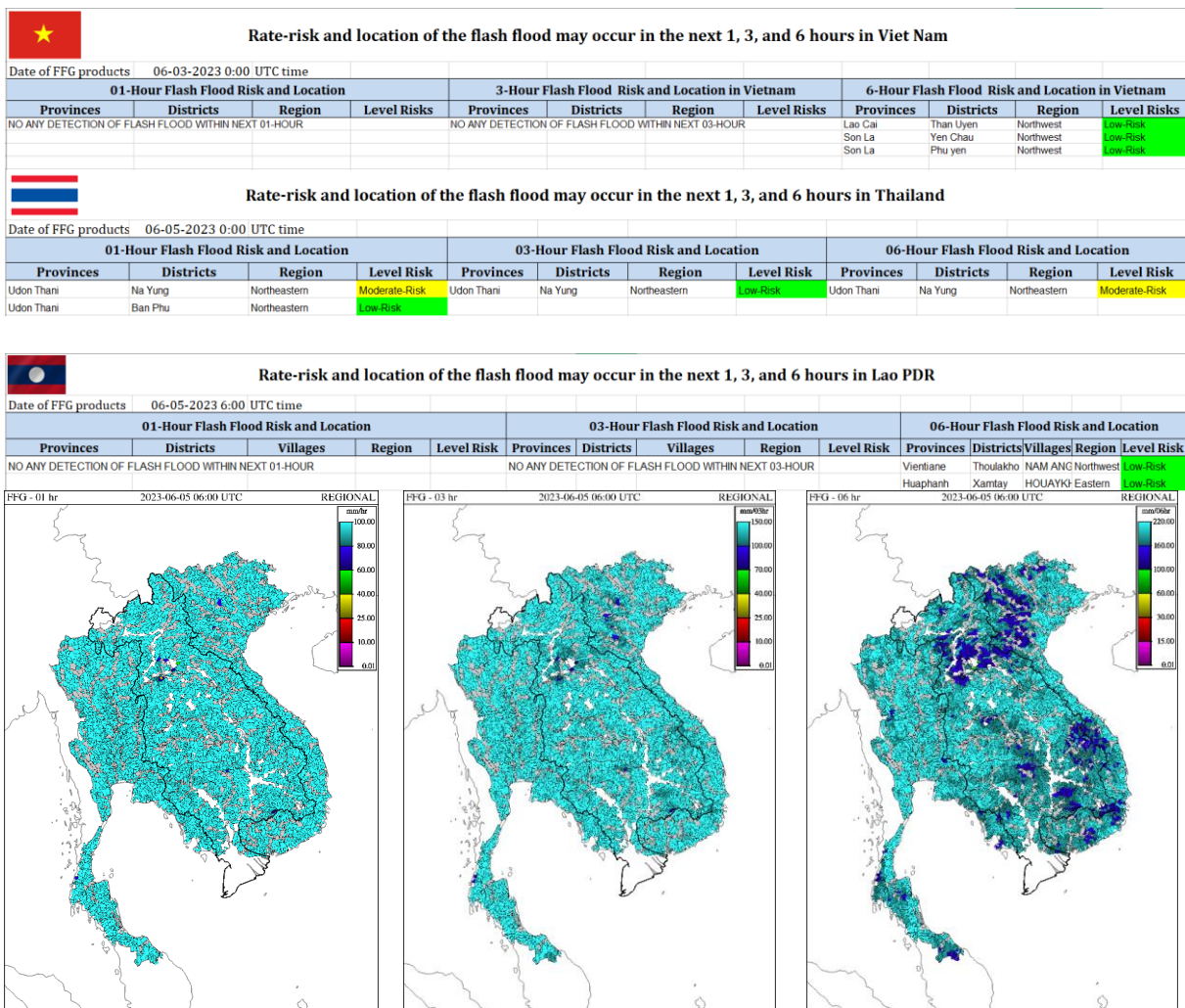


Figure 14. Flash Flood Guidance for the next 1-hr, 3-hr and 6-hr on June 5

5 Drought Monitoring in the Lower Mekong Basin

Weekly drought monitoring from 29 May to 4 June 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 May 29 to June 4, as displayed in [Figure 15](#), shows that the LMB was facing moderate and severe meteorological droughts mainly in the north and middle. Some areas in the south were also experiencing some moderate and severe meteorological droughts. The figure shows that drought took pace in Chiang Mai, Chiang Rai, Bokeo, Phayao, Xayaburi, Luangnametha, Oudomxay, Phongsaly, Luang Prabang, Vientiane, Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nakhon Phanom, Nong Khai, Borikhamxay, Khammuane, Savannakhet, Saravane, Champasack, Ubon Ratchathani, Amnat Charoen, Yasothon, Roi Et, Maha Sarakham, Khon Kaen, Chaiyaphum, Nakhon Ratchasima, Buriram, Surin, Attapeu, Preah Vihea, Otdar Meanchey, Sa Kaeo, Chanthaburi, Pailin, Battambang, Pursat, Kampong Speu, Kampong Thom, Kratie, Tay Ninh, Takeo, Kandal, Svay Rieng, and Ca Mau.

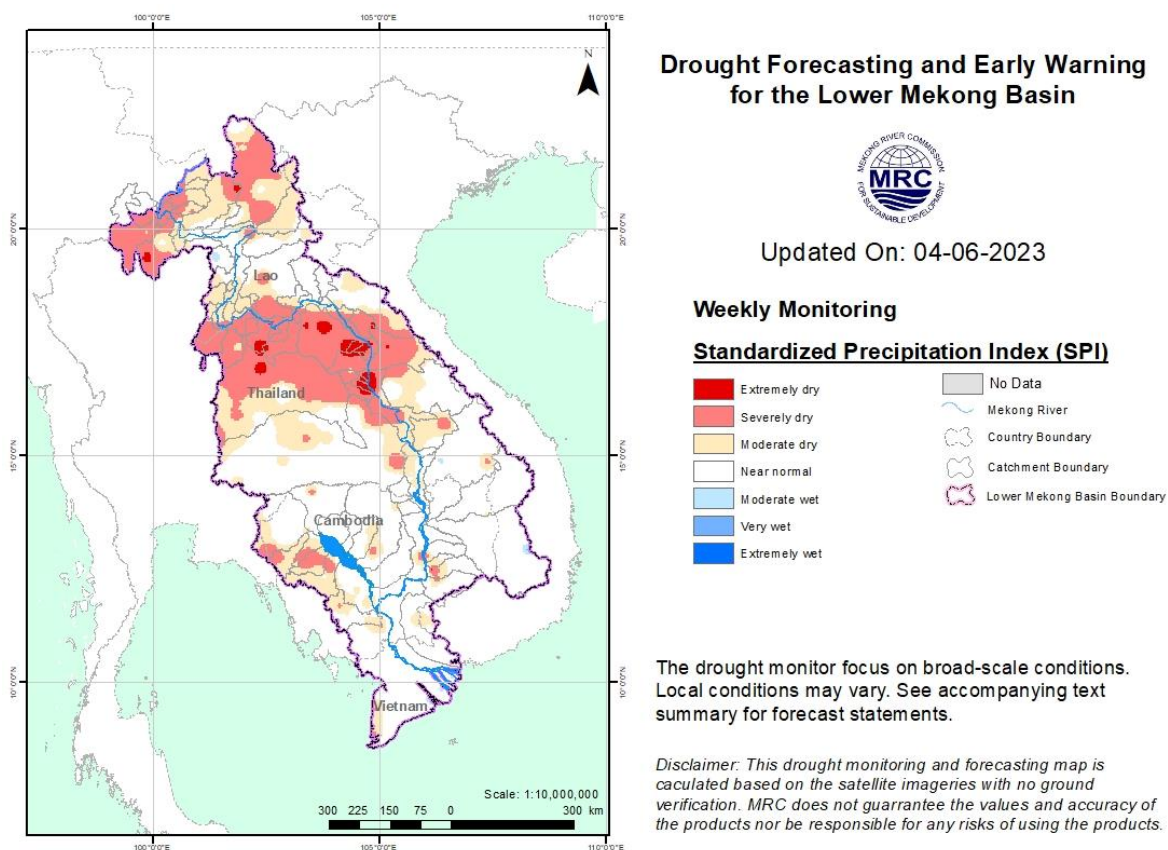


Figure 15. Weekly standardized precipitation index from 29 May to 4 June 2023.

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

For the agricultural indicator, the nowcast this week from May 29 to June 4 indicates that some moderate and severe droughts were taking place in the central part and some in the lower part of the LMB. [Figure 16](#) of weekly ISWF shows that drought took place specifically in Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nong Khai, Nakhon Phanom, Khammuane, Savannakhet, Surin, Burirum, Sa Kaeo, Otdar Meanchey, Banteay Meanchey, Battamban, and Dak Lak.

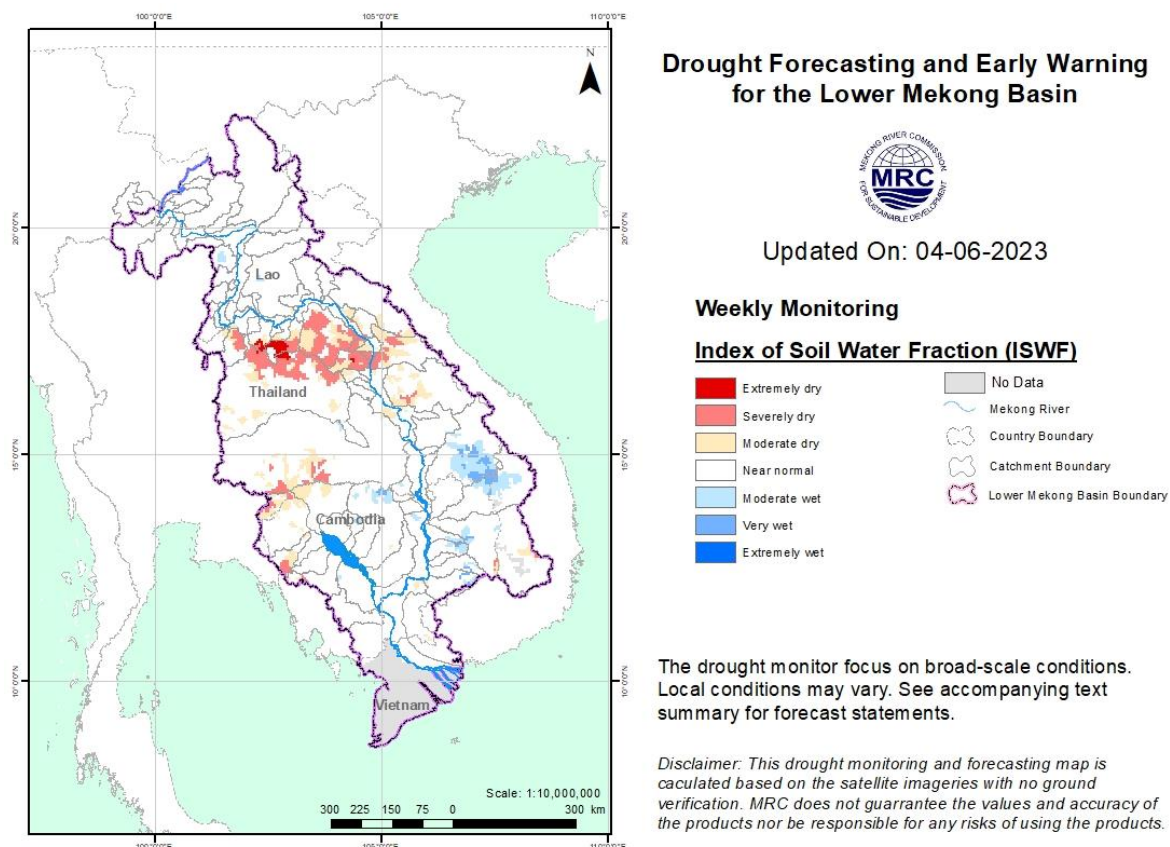
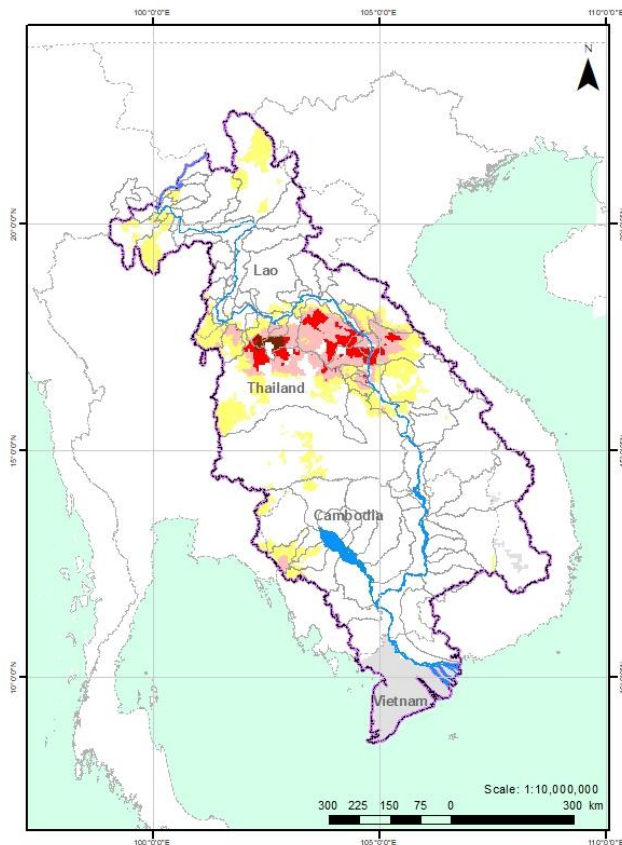


Figure 16. Index of Soil Water Fraction from 29 May to 4 June 2023.

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

The combined drought indicator from the meteorological and agricultural indices from May 29 to June 4, as displayed in [Figure 17](#), shows that moderate and severe droughts took part mainly in the northern and central areas of the LMB. They specifically covered Chiang Rai, Phayao, Phongsaly, Oudomxay, Xayaburi, Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nakhon Phanom, Nong Khai, Borikhamxay, Khammuane, Savannakhet, Ubon Ratchathani, Amnat Charoen, Roi Et, Kalasin, Khon Kaen, Chaiyaphum, Surin, Otdar Meanchey, Sa Kaeo, Chanthaburi, Pailin, Battambang, and Pursat.



Drought Forecasting and Early Warning for the Lower Mekong Basin



Updated On: 04-06-2023

Weekly Monitoring

Combined Drought Index (CDI)

D4 (Exceptional Drought)	No Data
D3 (Extremely Drought)	Mekong River
D2 (Severely Drought)	Country Boundary
D1 (Moderate Drought)	Catchment Boundary
D0 (Normal Condition)	Lower Mekong Basin Boundary

The drought monitor focus on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Disclaimer: This drought monitoring and forecasting map is calculated based on the satellite imageries with no ground verification. MRC does not guarantee the values and accuracy of the products nor be responsible for any risks of using the products.

Figure 17. Weekly Combined Drought Index from 29 May to 4 June 2023.

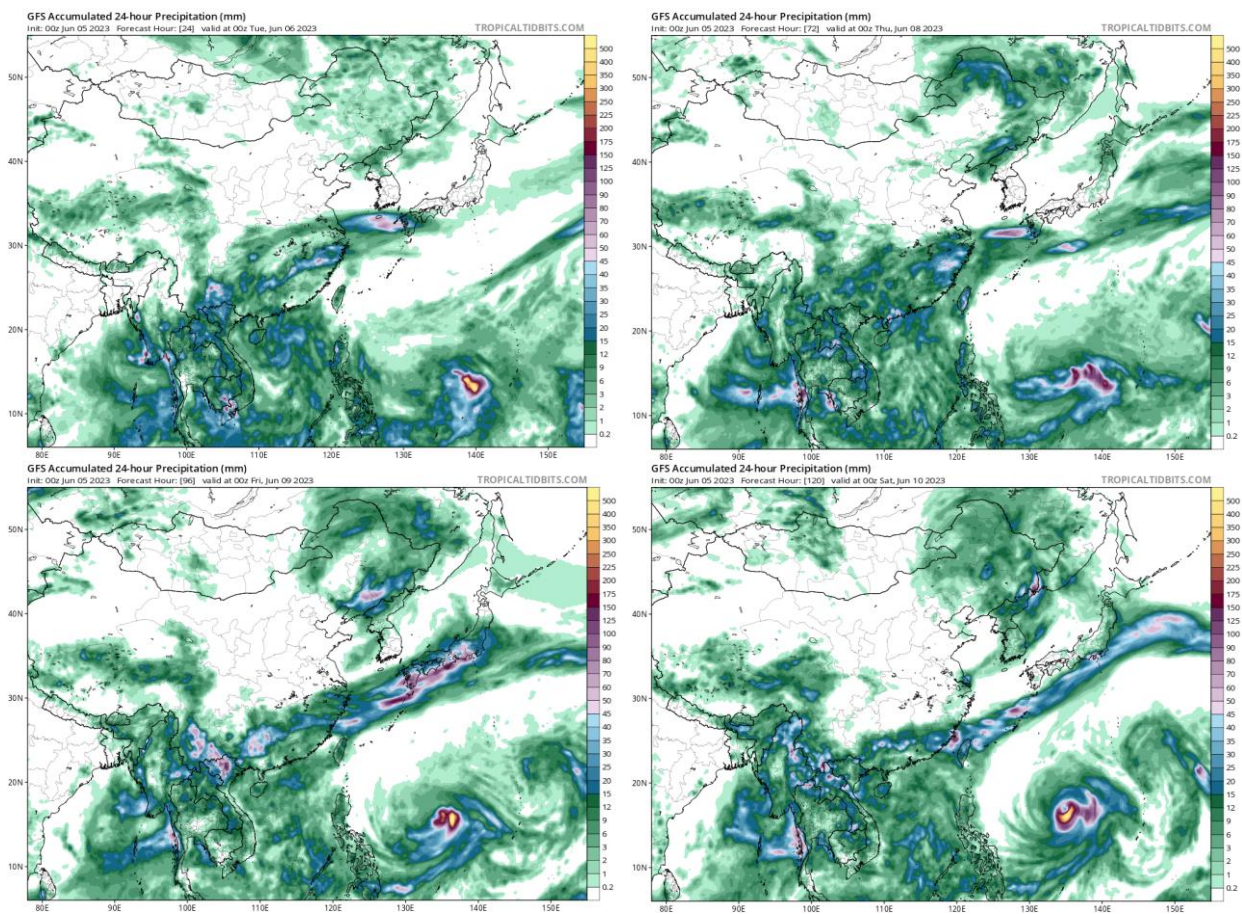
More information on Drought Forecasting and Early Warning (DFEW) as well as the explanation is available here: <http://droughtforecast.mrcmekong.org/templates/view/our-product>. DFEW provides not only weekly monitoring and forecasting information but also a three-month forecast of drought indicators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

Based on the analysis of the synoptic meteorological information and result from the Global Forecast System (GFS) model, in the coming week, the southwest monsoon and the Inter Tropical Convergence Zone (ITCZ) will continue prevailing over the LMB.

In general, during June 07-13, moderate to rather heavy rain (5-70 mm/24h) will likely occur in the LMB. [Figure 18](#) shows accumulated rainfall forecast (24 h) of the GFS model from June 7 to 13.



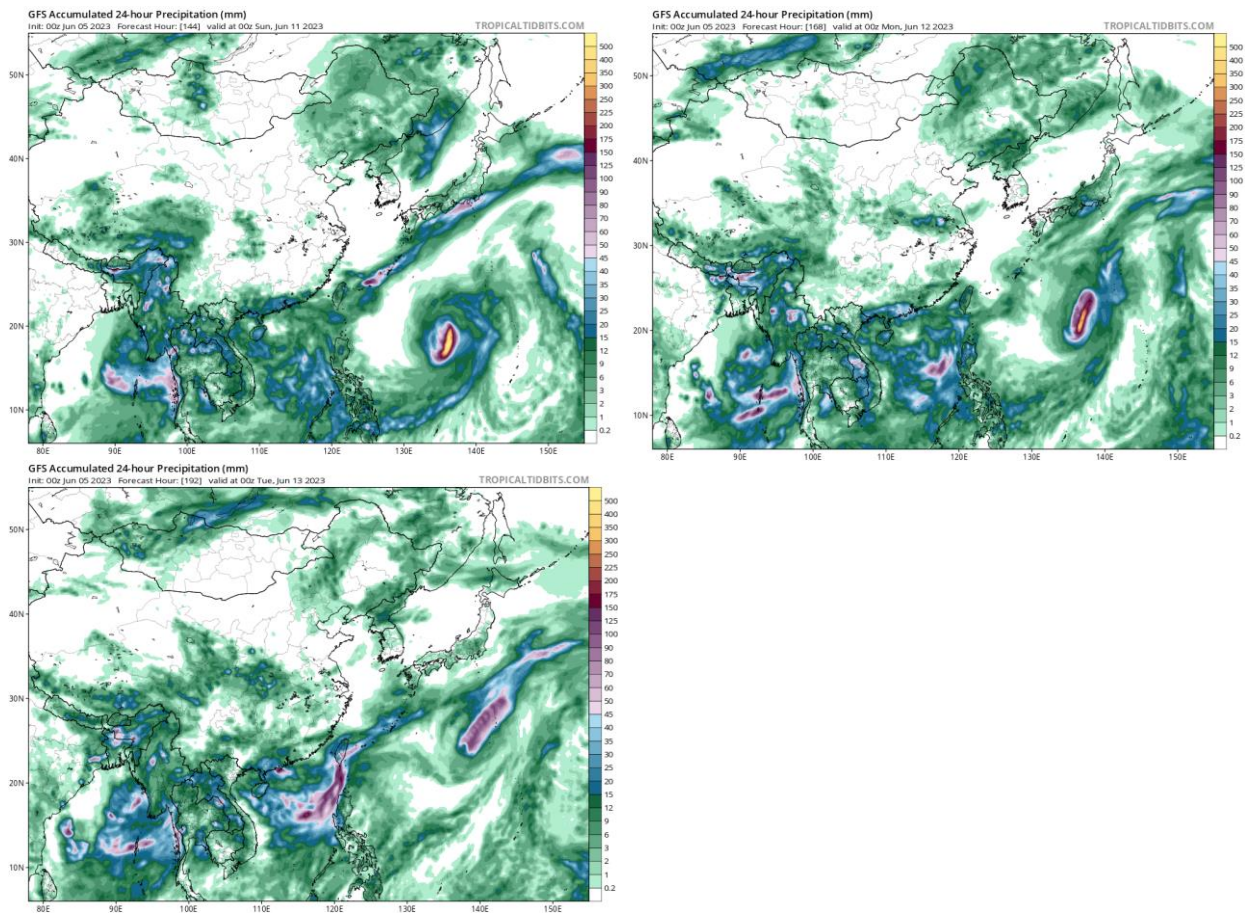


Figure 18. Accumulated rainfall forecast (24 h) based on a GFS model.

6.2 Water level forecast

Chiang Saen and Luang Prabang

Based on June 6's daily flood forecasting bulletin, the daily forecasted water level at Chiang Saen in Thailand shows an increase of water level between 2.44 m and 2.90 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 increase about 0.39 m during the next five days. The current water level is higher than its LTA. Precipitation is forecasted for the area between Chiang Saen and Luang Prabang next week.

Chiang Khan, Vientiane-Nong Khai and Paksane

The water level at Chiang Khan in Thailand is forecasted to go up approximately 0.33 m, while water level at Vientiane in Lao PDR will increase about 0.23 m. Furthermore, in Nong Khai in Thailand the water level will increase about 0.27 m over the next five days; at Paksane in Lao PDR water level will increase about 0.37 m due to forecasted 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 lower than their LTA value.

Nakhon Phanom to Pakse

The water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR are forecasted to go up over 0.45 m, because of moderate rainfall predicted in these areas. Water level at Khong Chaim and Pakse will stay lower than their LTA level. Rainfall is forecasted for the area next week.

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

WL at Stung Treng and Kratie in Cambodia will go up about 0.33 m, while at Kompong Cham along the Mekong River the water level will also go up about 0.28 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 up in between 0.13 m and 0.20 m over the next five days.

Water levels at most of the stations will go up during next week. However, those WLs will be still staying lower than their LTA value, particularly in the upper part of the region from Chiang Saen to Paksane. From Khong Chiam down to Pakse, Stung Treng, Kratie, and Kompong Cham, water levels will be still staying lower than their LTA values. 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 down over their LTA and Minimum levels, following daily tidal effects from the sea. Rainfall is forecasted for the Delta area next week.

The performance of the weekly flood forecast, with an accuracy and data input evaluation from 1-6 June 2023, is presented in **Annex 1**.

[Table 2](#) shows the daily flood forecasting Bulletin issued on 06 June 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 moderate and heavy rainfall forecasted 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 June, July, and August 2023. CDI is a combination of meteorological and agricultural indicators.

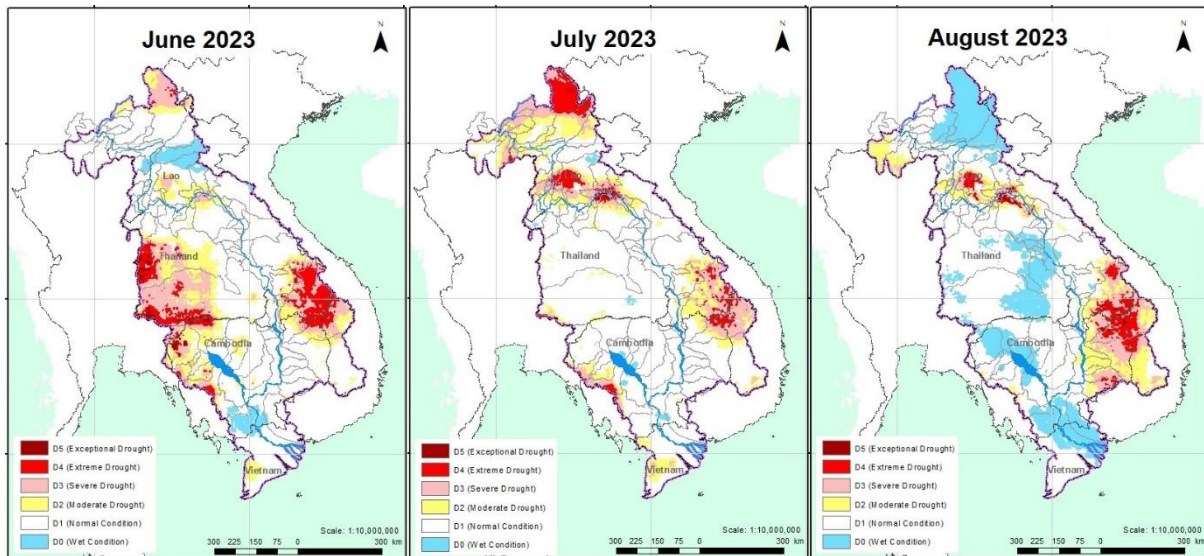


Figure 19. Monthly forecast of CDI for July, August, and September 2023.

Figure 19 above shows that in **June** the central and eastern parts covering mainly Thailand and the 3S areas are likely hit by severe and extreme droughts. They specifically cover Phongsaly, Vientiane, Xaysomboun, Borikhamxay, Chaiyaphum, Khon Kaen, Maha Sarakham, Roi Et, Surin Burirum, Nakhon Ratchasima, Sa Kaeo, Banteay Meanchey, Battambang Pursat, Otdar Meanchey, Saravane, Champasack, Stung Treng, Ratanakiri, Gia Lai, Kon Tum, Attapeu, and Sekong. In **July** the upper and 3S areas are likely experiencing some extreme and severe droughts. They cover Phangsaly, Luangnamtha, Bokeo, Chiang Ria, Phayao, Oudomxay, Luang Prabang, Xayaburi, Vientiane, Xaysomboun, Borikhamxay, Nongkhai, Saravane, Sekong, Attapeu, Champasack, Ratanakiri, Kon Tum, Gia Lai, Pursat, Battambagn, Kampong Speu, Kien Giang, Ca Mau, Bac Lieu, Soc Trang, and Dak Lak. While in **August** from moderate to extreme droughts are forecasted for Vientiane, Borikhamxay, Xaysomboun, Nong Khai, Saravane, Sekong, Attapeu, Champasack, Ratanakiri, Kon Tum, Gia Lai, Dak Lak, Mondul Kiri, Kratie, and Stung Treng.

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 June 1-6, including the lower part in Lao PDR and Cambodia, varying from 1.30 mm to 179.50 mm due to moderate rainfall over the LMB during the report period. However, this week rainfall was considered low in the middle and lower parts of the LMB compared with last week rainfall.

Based on the forecasted satellite data, rainfall is forecasted for some areas of the LMB with the value range from 45.00 mm to 150.00 mm for the next seven days. The forecasting model using CHIRPS-GEFS data, moreover, shows significant rainfall (>100 mm) is likely to take place in the Mekong region from 8 to 12 June 2023.

7.2 Water level and its forecast

According to MRC's observed water level at Jinghong, it showed increased water levels from 536.37 m to 536.71 m during 1-6 June 2023. The current level is staying about 0.54 m lower than its LTA value. The outflow at Jinghong station increased between 1,310.00 m³/s and 1,910.00 m³/s between 1 and 6 June 2023.

Along with the increased outflow from Jinghong upstream, water levels of monitoring stations at Chiang Saen increased 0.44 m from 1 to 6 June 2023. Furthermore, at Chiang Khan and at Vientiane stations water levels increased 0.10 m and decreased 0.12 m respectively from 1 to 6 June 2023 due to the influence of rainfall and dam operation upstream. Water levels from Nakhon Phanom in Thailand to Pakse in Lao PDR increased from 0.02 m to 0.20 m. The current WLs at these stations are staying lower than their LTA level, **considered low water levels**. From the stretches of the river at Stung Treng, WL decreased 0.13 m and stayed about 0.54m lower than its LTA, while at Kratie water level was down about 0.28 m, staying 1.23 m lower than its LTA level, **considered normal** due to the less contributed rainfall from upstream parts including Pakse and 3S area in Viet Nam.

The flow volume of the Tonle Sap Lake is lower than its LTA up to June 6 (60%). 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 increase about 0.15 m but will stay lower than their LTA value. 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 stay 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 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 May 29-June 4, the LMB was facing some moderate and severe droughts mainly in the central area of the LMB. The affected areas include Chiang Rai, Phayao, Phongsaly, Oudomxay, Xayaburi, Loei, Nong Bua Lamphu, Udon Thani, Sakon Nakhon, Nakhon Phanom, Nong Khai, Borikhamxay, Khammuane, Savannakhet, Ubon Ratchathani, Amnat Charoen, Roi Et, Kalasin, Khon Kaen, Chaiyaphum, Surin, Otdar Meanchey, Sa Kaeo, Chanthaburi, Pailin, Battambang, and Pursat.

The three-month forecast shows that in **June** the central and eastern parts covering mainly Thailand and the 3S areas are likely hit by severe and extreme droughts. Those affected areas specifically are Phongsaly, Vientiane, Xaysomboun, Borikhamxay, Chaiyaphum, Khon Kaen, Maha Sarakham, Roi Et, Surin Burirum, Nakhon Ratchasima, Sa Kaeo, Banteay Meanchey, Battambang Pursat, Otdar Meanchey, Saravane, Champasack, Stung Treng, Ratanakiri, Gia Lai, Kon Tum, Attapeu, and Sekong. In **July** the upper and 3S areas are likely experiencing some extreme and severe droughts. They cover Phongsaly, Luangnamtha, Bokeo, Chiang Rai, Phayao, Oudomxay, Luang Prabang, Xayaburi, Vientiane, Xaysomboun, Borikhamxay, Nongkhai, Saravane, Sekong, Attapeu, Champasack, Ratanakiri, Kon Tum, Gia Lai, Pursat, Battambang, Kampong Speu, Kien Giang, Ca Mau, Bac Lieu, Soc Trang, and Dak Lak. While in **August** from moderate to extreme droughts are forecasted for Vientiane, Borikhamxay, Xaysomboun, Nong Khai, Saravane, Sekong, Attapeu, Champasack, Ratanakiri, Kon Tum, Gia Lai, Dak Lak, Mondul Kiri, Kratie, and Stung Treng.

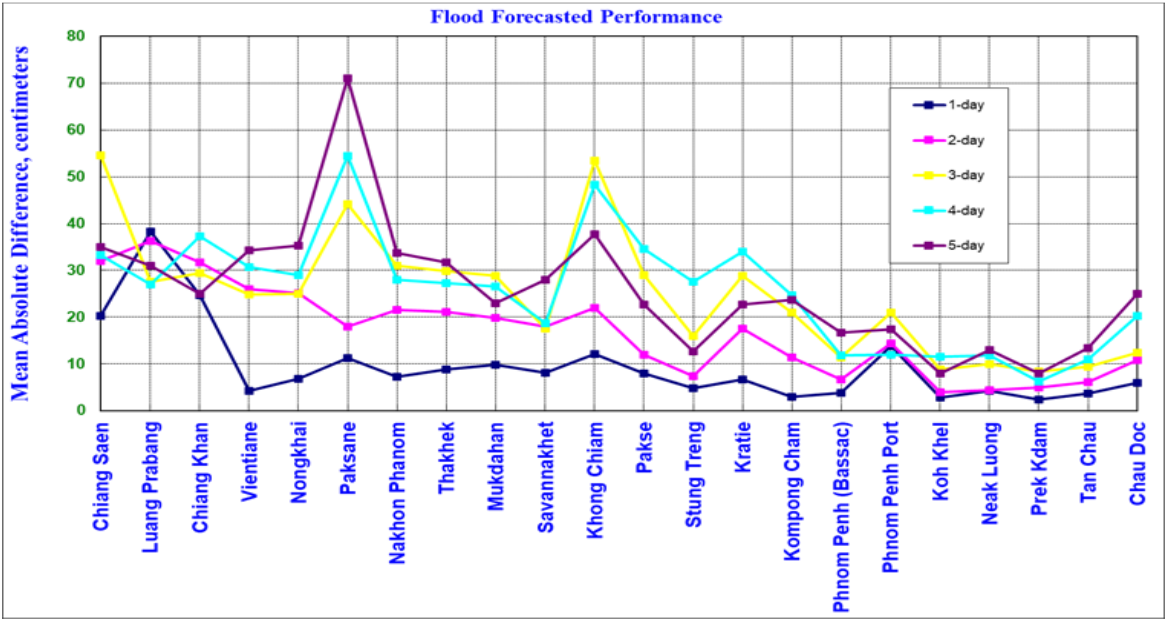
Annex 1: Performance of the weekly flood forecasting

Accuracy

“Accuracy” here refers to the state where data recorded in the MRC’s Mekong River Flood Forecasting System are cleaned and verified.

The adjustment of flood forecasting outcomes from the flood forecasting system requires flood forecasters to have extensive knowledge in hydrology and statistical modelling for estimating the relationships between stations upstream and downstream in the Mekong River Basin. Flood forecasting performance presented in the graph below shows the average flood forecasting accuracy at each key station along the Mekong mainstream from 1 to 6 June 2023.

The forecasting values from 1 to 6 June 2023 show that the overall accuracy is fair for a four-day to five-day forecast in lead time (less than 75 cm) at stations in the upper part of the Mekong River at Paksane station because of rainfall and dams' operation in this area during the report period.



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

- Missing rainfall in Cambodia (DOM) data and data input are not sufficient to be used for inputting into the flood forecasting model system.
- Luang Prabang to Chiang Khan and 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 6 to 6 June 2023.

Table B1: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 1 to 6 June 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	2	14	19	4	4	6	3	6	6	6	9	14	6	9	9	4	9	2	4	2	3	4
2-day	4	<u>23</u>	<u>23</u>	18	18	14	6	11	12	10	<u>26</u>	<u>24</u>	16	<u>26</u>	16	5	8	4	9	4	6	9
3-day	10	<u>24</u>	10	<u>21</u>	<u>22</u>	20	11	15	9	10	<u>44</u>	<u>38</u>	<u>29</u>	<u>47</u>	<u>29</u>	10	11	7	12	5	5	9
4-day	<u>20</u>	<u>26</u>	<u>23</u>	18	20	<u>24</u>	10	14	8	8	59	<u>50</u>	<u>45</u>	66	<u>46</u>	16	15	10	17	8	4	8
5-day	<u>20</u>	<u>32</u>	<u>26</u>	<u>21</u>	<u>24</u>	<u>31</u>	14	9	14	5	71	71	58	100	65	<u>25</u>	<u>20</u>	18	19	10	2	7

Table B2: The Mean Absolute Difference (Error) of Flood Forecasting base on old defined Benchmark from 1 to 6 June 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	85.7	71.4	<u>42.9</u>	<u>42.9</u>	71.4	57.1	57.1	<u>42.9</u>	57.1	57.1	71.4	57.1	71.4	57.1	71.4	57.1	71.4	<u>42.9</u>	71.4	<u>42.9</u>	57.1	57.1	<u>59.7</u>
2-day	66.7	66.7	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	66.7	<u>50.0</u>	66.7	66.7	66.7	<u>50.0</u>	83.3	66.7	<u>50.0</u>	83.3	<u>33.3</u>	66.7	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>58.3</u>
3-day	60.0	60.0	80.0	60.0	60.0	<u>40.0</u>	60.0	<u>40.0</u>	60.0	60.0	60.0	60.0	<u>40.0</u>	60.0	60.0	<u>40.0</u>	60.0	60.0	60.0	<u>20.0</u>	60.0	<u>40.0</u>	<u>54.5</u>
4-day	<u>50.0</u>	75.0	<u>50.0</u>	<u>25.0</u>	75.0	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	75.0	<u>50.0</u>	<u>50.0</u>	<u>50.0</u>	<u>25.0</u>	75.0	<u>52.3</u>
5-day	<u>33.3</u>	66.7	<u>33.3</u>	<u>33.3</u>	66.7	<u>33.3</u>	66.7	66.7	66.7	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	66.7	66.7	66.7	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>33.3</u>	<u>45.5</u>

Table B3: Overview of performance indicators for the past 7 days from 1 to 6 June 2023

2023	FF time sent				Arrival time of input data								Missing data (number-mainstream and trib.st.)							
	FF completed and sent (time)	Stations without forecast	FF2 completed and sent (time)	Weather data available (time)	NOAA data	China	Cambodia - DHRW	Cambodia - DOM	Lao PDR - DMH	Thailand - DWR	Viet Nam - SRHMC	Viet Nam - HMS	NOAA data/2dataset	China/2	Cambodia - DHRW/15	Cambodia - DOM/34	Lao PDR - DMH/32	Thailand - DWR/13	Viet Nam - SRHMC/6	Viet Nam - HMS/39
week	10:26	#DIV/0!	-	-	08:15	07:10	07:03	07:57	08:33	08:23	07:21	08:17	0	0	0	0	16	0	0	0
month	10:31	#DIV/0!	-	-	08:15	07:10	07:32	07:51	08:32	08:23	07:21	08:18	0	0	0	34	0	0	0	2

Fig. B4: Data delivery times for the past 7 days from 1 to 6 June 2023

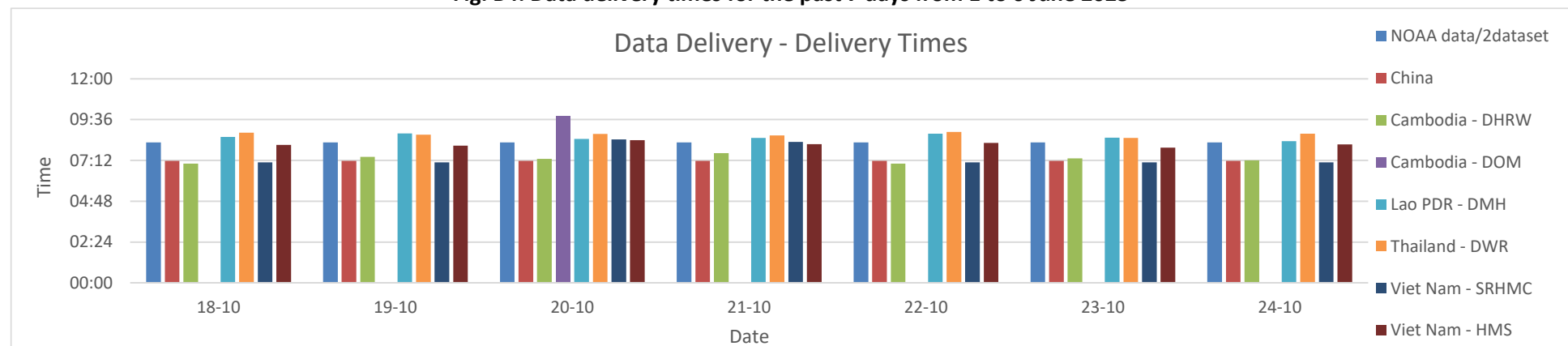


Fig. B5: Missing data for the past 7 days from 1 to 6 June 2023

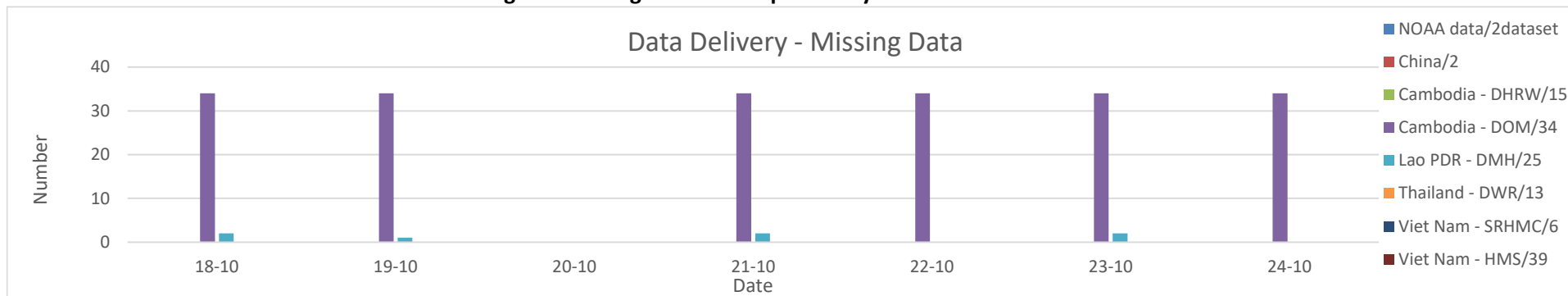
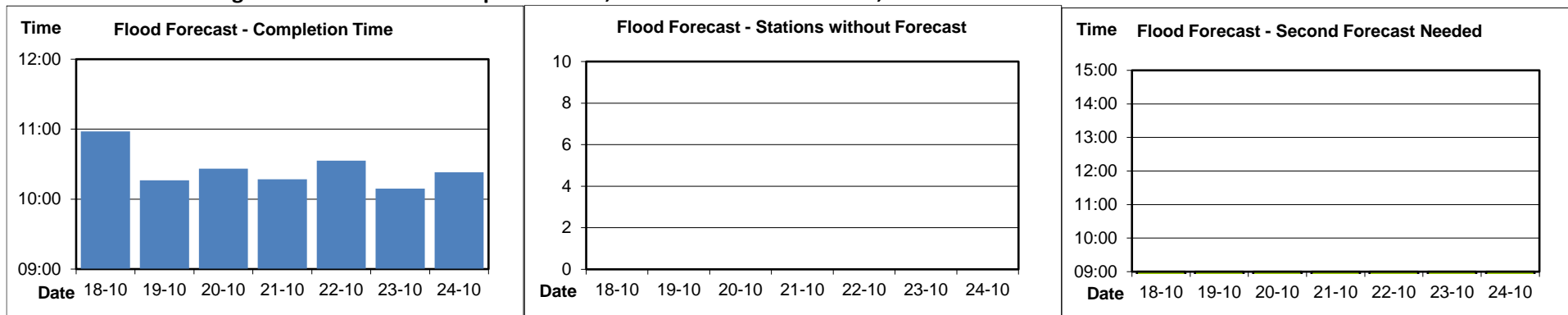


Fig. B6: Flood forecast completion time, stations without forecasts, and second forecasts need from 1 to 6 June 2023





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