Mekong River Commission
For Sustainable Development

Situation Report

Hydrological Conditions in the Lower Mekong River Basin in July–December 2020

May 2021

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Abbreviations

ASMC	Asian Specialised Meteorological Centre
CCS	Cloud Classification System
ENSO	El Niño Southern Oscillation
ISH	Initiative for Sustainable Hydropower
JMA	Japan Meteorological Agency
LMB	Lower Mekong Basin
LMC	Lancang–Mekong Cooperation
LTA	Long Term Average
MMTA	Monthly Mean Temperature Anomaly
MRC	Mekong River Commission
MRCS	Mekong River Commission Secretariat
NMC	National Mekong Committee
NMME	North America Multi Model Ensemble
PMFM	Procedures for the Maintenance of Flows on the Mainstream
PNPCA	Procedures for Notification, Prior Consultation and Agreement
SPI	Standardised Precipitation Index
TCC	Tokyo Climate Center
TMD	Thai Meteorological Department
TPA	Total Precipitation Anomaly
UCI	University of California, Irvine
UMB	Upper Mekong Basin
UNESCO	United Nations Educational, Scientific and Cultural Organization
WMO	World Meteorological Organization

Executive Summary

This Situation Report presents a preliminary analysis of the hydro-meteorological conditions in the Lower Mekong River Basin (LMB) over a six-month period, spanning **July–December 2020** and compares the data to 2019 (a 'drought' year) and 2018 (a 'normal' year).

According to the monitoring, rainfall and weather data, the LMB experienced a second year of low flows at the beginning and a delayed onset of the wet season in 2020, with some parts experiencing low flows and appearing to be worse than that in 2019. The low flows resulted from low rainfall across the LMB and were partly caused by Upper Mekong Basin (UMB) dam storages infilling during the early months of the wet season. From August to October, however, rainfall increased drastically to be higher than both 2019 and Long-Term Average (LTA).

A critical hydrological situation in the 2020 wet season is that reverse flows into the Tonle Sap Lake were slower than they were in 2019, and considerably lower than those in 2018. The low flows could have severe negative impacts, causing losses of fishery production and irrigation potential in Cambodia, and reduced productivity in the Delta rice bowl of Viet Nam. However due to storms in August–October, the reverse flow into the Tonle Sap Lake gradually picked up, making the Lake water level to become normal at the end of October.

Cooperation with the upstream countries – China and Myanmar – is crucial for a comprehensive assessment of rainfall in the UMB or Lancang River Basin, including information about releases from storages. Information and data sharing between all the six riparian countries continues to play a vital role in the MRC's ascertaining the causes of the low flows and for countries to implement the suggested mitigation options that they consider viable.

Building on the recent whole year data sharing agreement between Mekong River Commission (MRC) and China, the MRC Member Countries (MCs) will need to work more with China to share water storage and release information especially during the early onset of the wet season and the low flow conditions in order for the MRC Secretariat (MRCS) to conduct sound analysis for the mainstream and timely provide warning information to the MCs.

In the medium-term, the MRC should explore better options for drought and flood forecasting and mitigation, coordinated operations of mainstream and tributaries dams, as well as additional jointly operated storages. These solutions will depend on effective water diplomacy and institutional considerations but will ultimately result in the development of comprehensive drought and flood management cooperation mechanisms. The Basin Development Strategy 2021–2030 and MRC Strategic Plan 2021–2025 point to these directions. A recent joint project between Cambodia and Thailand on flood and drought management could be a step forward to the establishment of the cooperation mechanism.

Transparent and timely data and information sharing and exchange continue to be a critical part for successfully mitigating the flood and drought impacts. The MRCS continues to identify additional key data and information necessary for water resource management and development. Additional efforts in data and information sharing and exchange by the MRC MCs and Dialogue Partners are highly encouraged, in line with the new BDS and the recently established Lancang Mekong Information Sharing Platform.

1 Introduction

The Mekong River and its tributaries support over 65 million people in the LMB, providing livelihoods, food security and rich ecosystem services. Countries in the LMB suffered record low water levels along the Mekong River in 2019 and 2020 and saw livelihoods disrupted. As a score of news reports have shown, such conditions had numerous adverse impacts on the local communities who depend on the river for their livelihoods, on the river system and the river life that supports the river's functions, and on the governments of the four countries that manage it.

As one of the MRC's core functions is to monitor and report on basin conditions, it is our responsibility to provide the MCs – Cambodia, Lao PDR, Thailand and Viet Nam – and the public with information on possible causes of flow variation and to suggest measures that could be taken to minimise or mitigate the associated environmental, social and economic impacts in the future. This in turn requires a sound understanding of the drivers behind droughts and floods in the basin.

This Situation Report, therefore, presents a preliminary analysis of the general hydro-meteorological conditions in the LMB over a six-month period from July to December 2020. The report covers five main areas:

- Rainfall conditions;
- Mainstream flow and reverse flows into the Tonle Sap Lake, and the alignment with the Procedures for the Maintenance of Flows on the Mainstream (PMFM);[1]
- Drought monitoring; and
- impacts of low flows and mitigation measures.

2 Rainfall Conditions

Based on available rainfall data from 119 ground rainfall stations in the LMB that contribute information to the MRCS, it was observed that the average basin rainfall pattern for 2008–2016 was typically bi-modal, with peaks in July and September (see Figure 1). Typically, the Southwest Monsoon season lasts from mid-May untill mid-October. The Southwest Monsoon season in 2020 began on 18 May 2020 as announced by Thai Meteorological Department (TMD). The total rainfall in May (102 millimetres), June (123 mm) and July (117 mm) was lower than the long-term average values by 33%, 37% and 57%, respectively. But the rainfall in August (232 mm), September (249 mm), and October (260 mm) was as high as the long-term averages or even above them. For illustration purposes, the rainfall maps for July–December 2020 are depicted in Figure 2, indicating the highly uneven spatial distribution of rainfall over the LMB.

In 2020, there were 10 tropical depressions and cyclones traversing the LMB from the West Pacific Ocean. During 1–3 August, there was one storm named *Silagu*. During 15–19 September, there was another one called *Noul*. In October, there were six more, namely *Linfa* occuring

[1] See MRC (2006) for certain procedures on flow maintenance.

during 10–12; *Nangka* during 12–14, a depression storm during 14–16; *Saudel* during 18–26; *Molave* during 23–29; and *Goni* during 28 October–5 November. In November, there were two others, namely *Athan* and *Vamco* occuring during 8–10 and 9–15, respectively.

The observed high rainfall for August–October was associated with eight of the storms, making landfall in the LMB (one in August, one in September, and six in October). In November and December 2020, the rainfall was generally minimal.

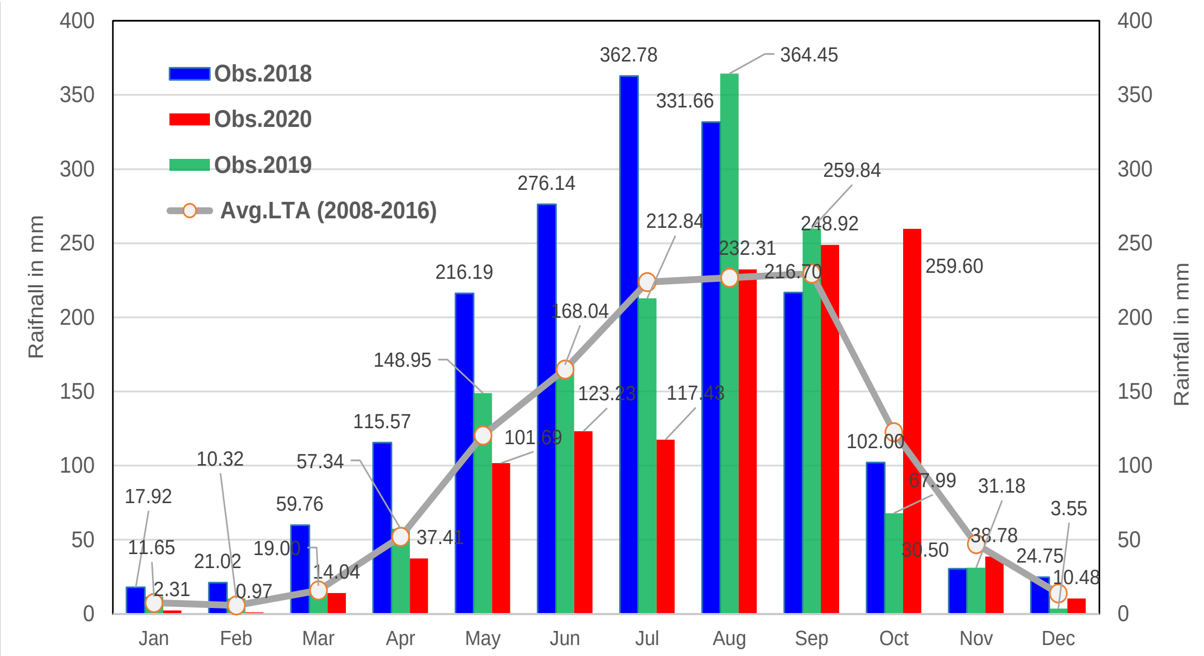

Figure 1. Overall monthly rainfall of 2018–2020 over the LMB, compared to the long-term conditions of 2008–2016 generated and interpolated from 119 stations in the LMB.

Additionally, an analysis of surplus or deficit in the monthly rainfall compared to the LTA indicates that more than half of the LMB areas was subject to rainfall deficits even in the wet season.

As Figure 1 shows, the total amount of rainfall for the 2020 wet season (May to December) was about 1,132 mm. This was only 1.5% less than the LTA, which is 1,149 mm and some 9.8 % less than that of 2019, which is 1,257 mm. The 2020 wet season was in general drier than that in 2019 and even much drier than the 2018's due to the fact that the wet season rainfall of 2018 was as high as 1,376 mm (or the 2020 value was 17.7 % less than the 2018 value).

Abnormally low rainfall conditions in the LMB were the result of the effect of an El Nino phenomenon, taking place since 2019 (normally an El Nino event lasts two years), according to the *El Niño Southern Oscillation* (ENSO) monitoring and forecasting by Tokyo Climate Centre (TCC) of Japan Meteorological Agency and the World Meteorological Organization (JMA & WMO, 2021).

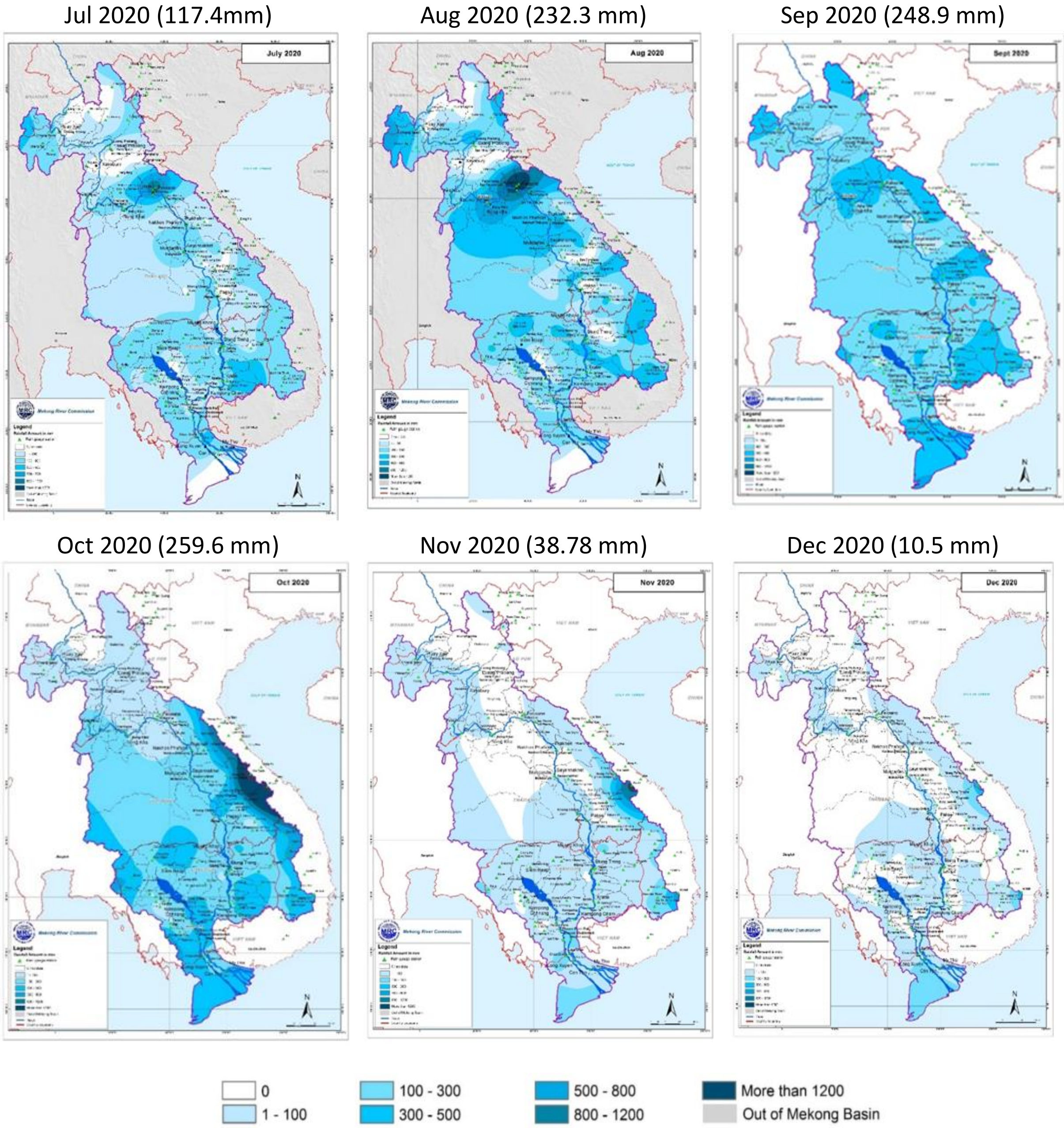

Figure 2. Maps of spatial rainfall (mm) for Jul to Dec 2020.

3 River Monitoring

3.1 Flow monitoring and PMFM Assessment

The mainstream flows tended to be lower than the averages throughout the wet season of 2020. By considering the date the river flows surpassed their annual average value as the onset date of the wet season, this 2020 wet season onset date was found to be about three weeks later than the average for all the mainstream stations of the LMB (see Table 1). This is also true for the offset date.

Table 1. Onset and offset of wet season determined mainstream flow values at key hydrological stations.

Station	Average (2007–2016)		2018		2019		2020	
	Onset	**Offset**	**Onset**	**Offset**	**Onset**	**Offset**	**Onset**	**Offset**
Chiang Saen	02 May	13 Oct	04 May	06 Oct	01 Jun	21 Sep	29 May	04 Oct
Vientiane	07 May	08 Oct	27 May	10 Oct	03 Jun	24 Sep	29 May	15 Oct
Khong Chiam	08 May	14 Oct	30 May	12 Oct	05 Jun	25 Sep	02 Jun	29 Oct
Stung Treng	18 May	21 Oct	29 May	18 Oct	04 Jun	29 Sep	03 Jun	12 Nov
Phnom Penh Port	21 May	06 Nov	31 May	15 Oct	05 Jun	12 Oct	11 Jun	21 Oct
Prek Kdam	24 May	02 Nov	31 May	17 Oct	03 Jun	16 Oct	11 Jun	18 Oct
Tan Chau	28 May	06 Nov	02 Jul	22 Oct	04 Jun	25 Oct	11 Jun	12 Nov
Chau Doc	28 May	06 Nov	02 Jul	22 Oct	04 Jun	25 Oct	11 Jun	13 Nov

Recorded water levels illustrate the hydrological regimes of the Mekong mainstream (see Figure 3) at key mainstream stations: at Chiang Saen to capture mainstream flows entering from the 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 to capture overall flows of the Mekong Basin; and at Tan Chau and Chau Doc to monitor flows to the Delta. In the Figure 3, the water level hydrographs of two stations of Tonle Sap system are also included. In addition, the rated monthly flows of selected four mainstream stations are shown in Figure 4.

It has been observed that Chinese mainstream dams' operations influenced the mainstream flows. From Figures 3 and 4, it was already observed that the mainstream flows at Chiang Saen in the 2020 dry season were generally higher than the LTA due to the dry season water release from Chinese dams. However, in the 2020 wet season, the flows at Chiang Saen were below the LTA. Such the low flow conditions were partly due to infilling of the dam storages. In fact, the influence of hydropower operations in China was gradually less evident as the mainstream flows moved further downstream due to gradual increase of Mekong tributaries' flow contribution. In 2020, the effect was still clearly observed at the Chiang Saen station but became less clear at the Luang Prabang station due to the backwater effect of the Xayaburi dam in Lao PDR. Generally, the observed 2020 wet season mainstream flows were less than the averages. The flows, however, increased for certain durations due to the tropical storms; for example, in August there was a storm called *Silagu*; in September *Noul*; and in October *Linfa*, *Nangka*, *Saudel* and *Molave*.

By comparing with 2019 which was considered a dry year, the mainstream flows from Chiang Khan to Pakse were slightly higher than those in 2019 but still lower than the LTA. From Kratie down to the Mekong Delta, flows were comparable with those in 2019. Nevertheless, the low water level situation in the Tonle Sap River (Prek Kdam station) and Tonle Sap Lake (Kampong Luong station) during September and October 2020 was more severe than it was in 2019.

The observed 2020 mainstream peak water levels were considerably less than the average (see Figure 3). In early September, the peak flows occurred as usual, except for downstream stations from Pakse in Lao PDR and Kratie in Cambodia to Delta areas, whose peak flows occurred in late October as strongly influenced by the tropical storms that came into the LMB during the month.

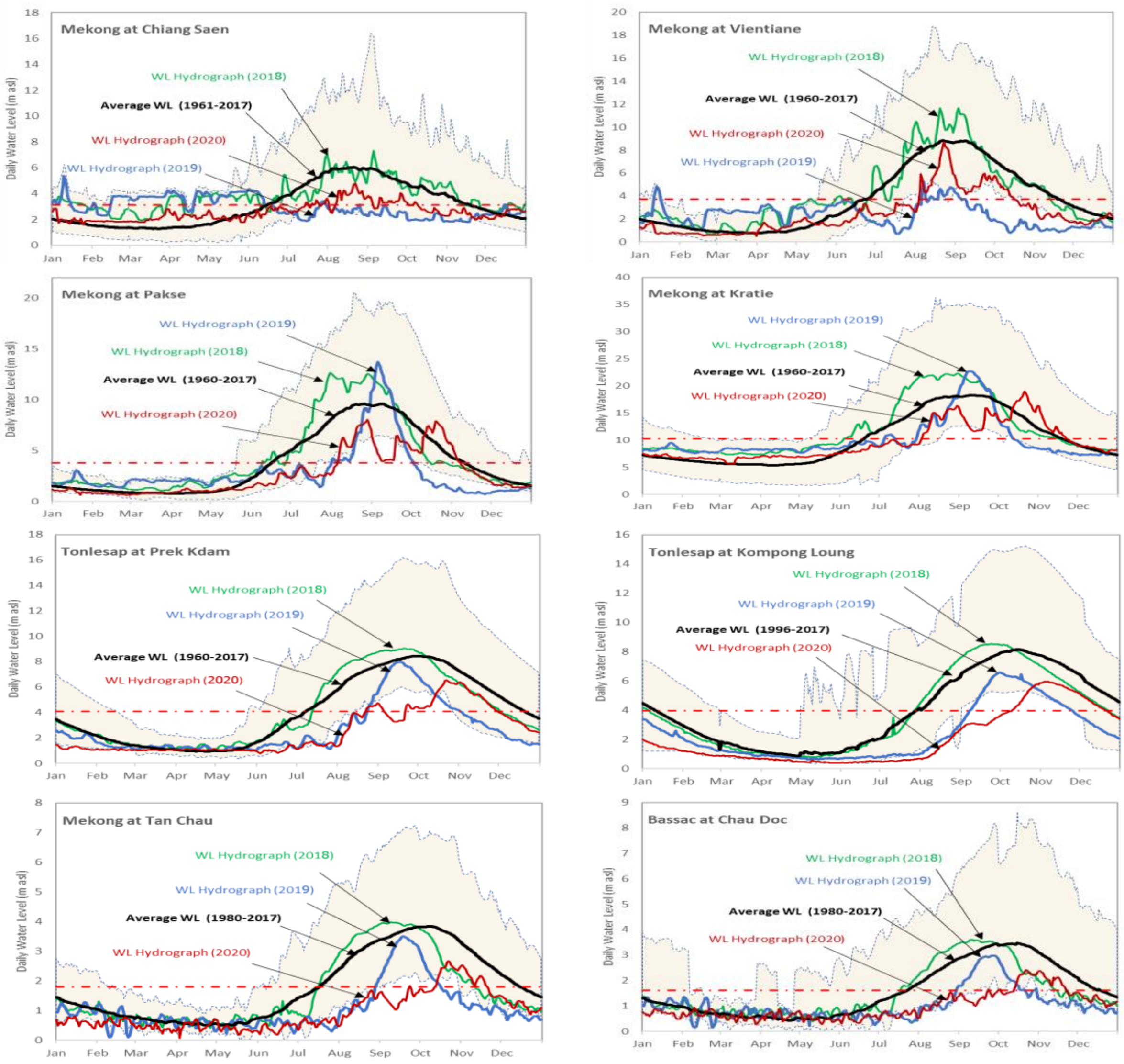

Figure 3. The 2018, 2019 and 2020 daily water level hydrographs observed at selected key sites on the Mekong mainstream including the Tonle Sap compared to long-term averages.

Recorded flows in selected tributaries are presented in Figure 5 in which the 2018, 2019 and 2020 daily water level hydrographs observed are plotted and compared with LTAs. The Nam Mae Ing and Wang Saphung stations in Thailand represent tributaries in the upper LMB. The Se Bang Fai station in Lao PDR represents the tributary in the middle of the LMB. The Se Kong station represents tributaries in lower LMB. The tributary flows were more or less affected by the operations of existing tributary storage infrastructures and abstractions for irrigation, depending on the capacities of the flow control structures.

In Figure 5, the Loei River of the Wang Saphung station has the Nam Loei Reservoir, a storage capacity of 35 million m^3 with a planned irrigation area of about 9,600 ha. The Wang Saphung station is located some 60 km downstream of this dam. In August, the Wang Saphung station peak discharge was due to the dam release, which was not the response to the storm in early August. Similarly, the storm in mid-September did not result in high flows at the station either because the dam had stored parts of storm runoffs collected in the reservoir. Subsequently in October, the reservoir water levels were high, thus the storm runoffs were not stored but released to downstream under reservoir operation rules. As a result, flow peaks were observed at the station in October as a response to the storms.

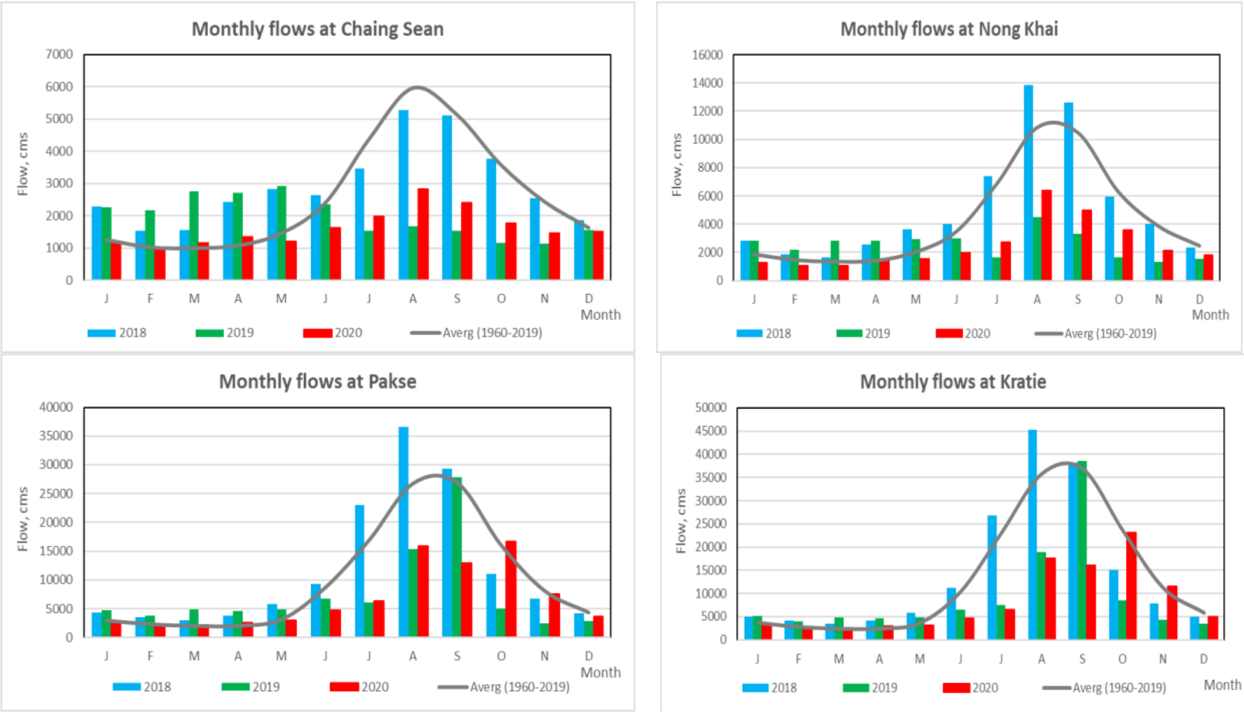

Figure 4. The 2018, 2019 and 2020 rated monthly flows at selected sites on the Mekong mainstream from Chiang Saen to Stung Treng compared to long-term averages.

Unlike the other three stations (see Figure 5) located at the Nam Mae Ing, Se Bang Fai and Se Kong Rivers in which there are only tiny reservoirs and weir, the river flows were not so regulated. Thus, the flow regimes behaved more naturally, and the existing flow control structures had very low influences on the runoffs particularly those resulting from the tropical storms.

Generally, the observed tributary water levels in 2020 were close to the averages in the dry season and lower than the average in the wet season. Some of the observed water level values were close to the minimum recorded flows, particularly during July and August in lower reaches of the LMB. However, observed peak water levels clearly occurred in accordance with the rainfall from the tropical storms in August, September and October. As a result, a number of flooding cases in tributary basins were reported in all four Member Countries of the LMB following the storm events, some of which are summarised below:

- **Cambodia:** The National Committee for Disaster Management reported on 21 November 2020 that the impact of typhoon *Noul* caused devastating flooding across Pursat, Ouddor Meanchey, Koh Kong and Pailin provinces, as well as Preah Sihanouk.[2] In October 2020, Cambodia faced even more widespread flooding in 19 provinces out of 25.[3]

[2] For detailed impact in Cambodia, see Floodlist (2020, 22 September).
[3] See Floodlist (2020, 19 October) for detail on the impact in Cambodia.

- **Lao PDR:** Nine districts in three provinces, namely Salawan, Savannakhet and Sekong, were reportedly affected by the floods as of 20 October 2020.[4]
- **Thailand:** Flooding occurred in Nakhon Ratchasima (Lam Phra Ploeng river), Khonkaen-Roi Et (Chi River) and Ubon Ratchathani (Mun River) in September and October 2020.[5]
- **Viet Nam:** The country experienced flooding in central provinces, in particular Quang Tri province, as of October 2020.[6]

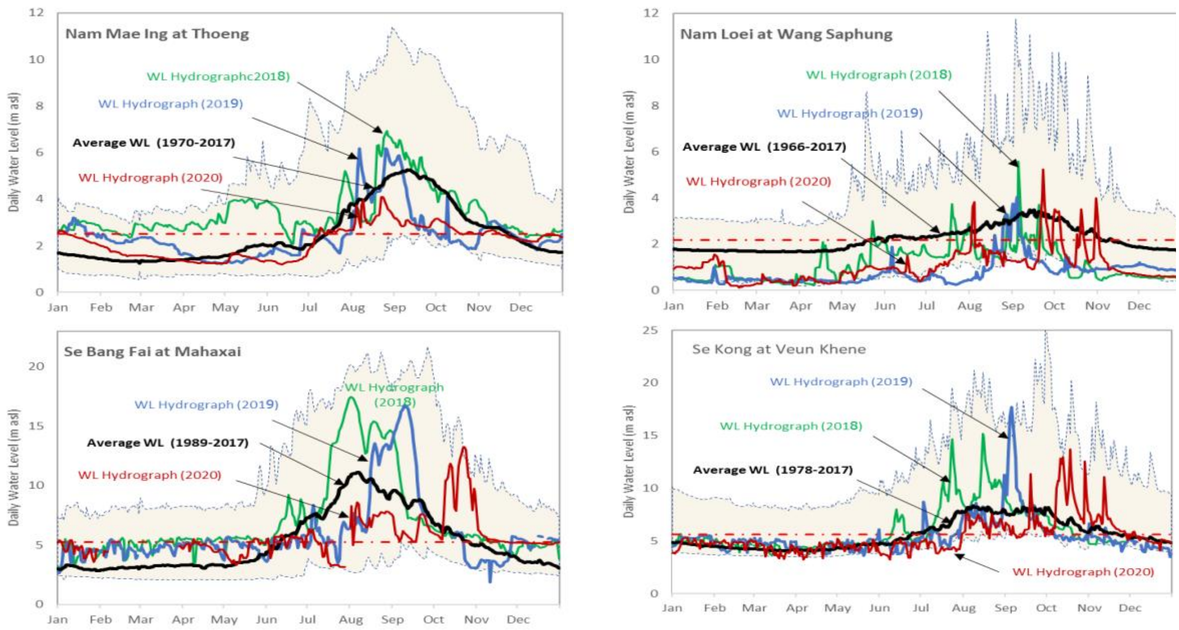

Figure 5. The 2018, 2019 and 2020 daily water level hydrographs observed at selected sites on Mekong tributaries compared to long-term averages.

Regarding the PMFM, in principle, mainstream water levels or flows have been monitored and compared with the set-up criteria to assess current water conditions and actions to be taken under each condition. On the MRC website, the PMFM webpage shows a framework for maintaining the flows and illustrates the comparisons for the wet and dry seasons for eight mainstream stations from Chiang Saen in Thailand to Chau Doc in Viet Nam. There are three PMFM related Articles (6A, 6B and 6C) in the Mekong Agreement for the mainstream flows to be maintained. The criteria were already set up separately for planning and monitoring purposes. In this report, as concluded from the PMFM webpage, only the monitoring purpose is discussed below.

Article 6A: Aiming to maintain at least minimum acceptable monthly natural flows in the dry season. The Article 6A is for the dry season, thus not relevant for this reporting period of the wet season 2020.

Article 6B: To enable the acceptable natural reverse flow of the Tonle Sap River to take place during the wet season. The Tonle Sap River connects the mainstream and the Tonle Sap Lake.

[4] See IFRC (2020) on the extent of impact in Lao PDR.

[5] See Post Reporters (2020, 18 October) and Thai PBS (2019, 14 September & 2019, 31 August) for detail on the magnitude of flood impact in Thailand.

[6] See Floodlist (2020, 9 October) for detailed flood impact in Viet Nam.

The reverse flow is a unique phenomenon that happens during the flood season when the Tonle Sap River flows backwards and pushes its excess water into the lake, causing the lake to expand to six times of its normal size. The monitoring result for the wet season 2020 is discussed further in Section 3.2.

Article 6C: To prevent average daily peak flows greater than what naturally occur on the average during the flood season. All the daily observed water levels at the specified stations lied below ARI 1:2 throughout the wet season 2020. This means "normal hydrological conditions". There is no need for action.

3.2 Reverse flows into the Tonle Sap Lake

The Tonle Sap Lake is the largest and most productive inland lake in Southeast Asia (Allen et al., 2012; MRC, 2005; UNESCO, 2018). Water sources for the lake include the Mekong River (54%), the lake's tributaries (34%), and precipitation (Kummu et al., 2014). The lake expands in the wet season due to inflows (reverse flow) from the Tonle Sap River and lake tributaries, and shrinks in the dry season due to the outflows through the Tonle Sap River into the Mekong River at the capital, Phnom Penh. Inundation of the vast lake floodplains during the inflow period enables many fish species to gain temporary access to large areas for breeding (Poulsen et al., 2002), rearing, and foraging an enormous fishery production for food security, livelihoods and economies in Cambodia. The total duration of the reverse flows is about 120 days, and the acceptable reverse flow volume is about 43 km^3 (average of 1996–2005) (see MRC, 2016).

In 2020, the reverse flows into the lake occurred intermittently during the wet season. The first instance started on 7 July and ended on 15 July, with a total volume of just 0.21 km^3. The reverse flow onset in 2020 significantly delayed (about two weeks later than in 2019 and 40 days later than a 1997–2017 average) as shown in Figure 6. The second instance occurred in the last week of July. The major reverse flows occurred in August 2020, resulting in a total accumulated reverse flow volume of some 12 km^3. Two more reverse flow events occurred in late September and the third week of October. The reverse flow finally stopped in the last week of October. The total volume of the reverse flow in 2020 was only 18.89 km^3 or about 44% of the acceptable annual volume of 43 km^3 (average condition for 1997–2005). As a result, at the end of October 2020, the Tonle Sap Lake experienced extremely dry conditions with reverse flows at their lowest records since 1997.

As seen in Figure 6, the actual accumulated reverse flow volume at Prek Kdam in Cambodia lies below the minimum band for the whole period of the reverse flow. As stipulated in Article 6B of the PMFM, in 2020 the wet season reverse flow into the Tonle Sap was considered 'unstable'. The MRCS made a number of alerts through news release posted in the MRC website and other channels including social media. The reverse flow volume appeared to be low due to the low rainfall in May–July and late arrival of the usual Monsoon rain (when monthly rainfall was more or less equal to monthly LTA) which lasted from August to October (also see Figure 1). This rainfall pattern was well captured by characteristics of the reverse flows into the Tonle Sap Lake.

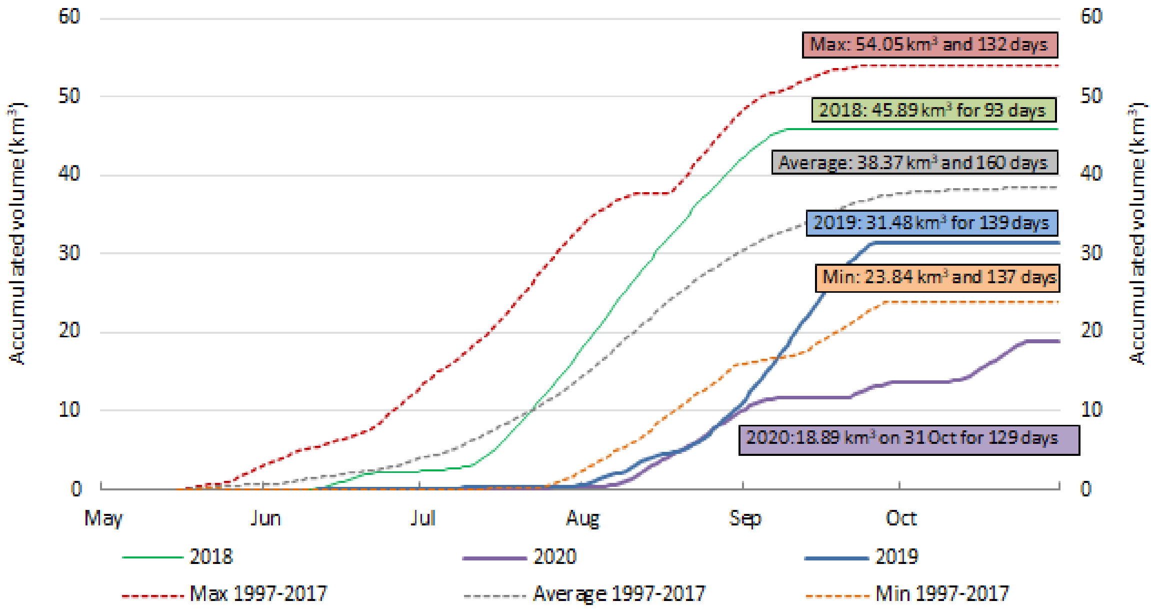

Figure 6. Characteristics of accumulated reverse flows for 2018, 2019 and 2020, compared to the minimum, maximum and average values of 1997–2005.

The water level at Kompong Luong in Cambodia represents the water level of the Tonle Sap Lake. By comparing with 2019, the lake water levels were slightly lower (0.1–0.5 m) during May to the first week of September (see Figure 7), then continued to be increasingly lower to a maximum by about 2.5 m at the end of September. It then rose gradually to be the same as the 2019 level in the fourth week of October, and remained somewhat higher than that of the 2019 from November onward.

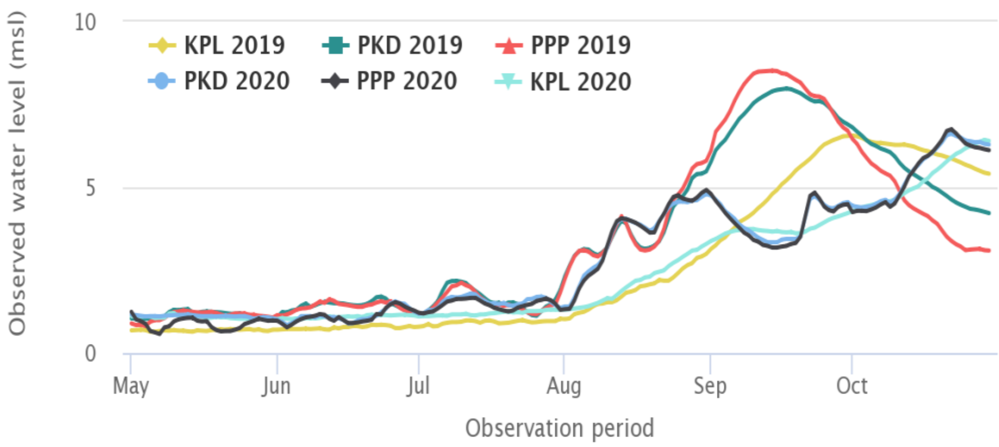

Figure 7. Observed water levels of the Tonle Sap River at Phnom Penh, Prek Kdam and Kompong Luong.

4 Drought Monitoring and Flood Assessment Using SPI Indicator

The Standardised Precipitation Index (SPI) was derived from satellite rainfall data by a method developed by the University of California at Irvine (UCI). The SPI helps determine the frequency and magnitude of major wet and dry periods in the time frame of consideration (July to December 2020). The feature of this SPI method is that data are standardised (mean = 0 and standard deviations from the mean show increasingly severe levels of precipitation anomaly). Furthermore, since the SPI has both positive and negative values, it equally represents potential flood and/or drought periods. Therefore SPI-1, 2 or 3 (1, 2 or 3-month SPI) can be a good indicator of hydrological drought, or increased flood risk potential.

The meteorological (SPI) indicator (see Figure 8) shows that the LMB experienced moderate to severe drought during July 2020 in some areas in the northern, central, and southern parts of the region. In August, the LMB experienced some moderate and severe dry conditions only in some areas of the southern part, mainly in Cambodia. However, the three-month SPIs, both July–September and October–December, and the six-month SPI from July to December show only average and above average precipitation compared to its LTA (see Figure 9).

Within the MRCS, the SPI indicators are applied through a combined drought index (a combination of meteorological SPI and agricultural SMA indicators). Figure 10 shows moderate and severe droughts in July covering parts of Thailand, Lao PDR, and northern Cambodia. In August, moderate and severe drought took place only in some areas of the southern part of the LMB. The low flow in the Mekong mainstream and lowest reverse flow into the Tonle Sap Lake are likely associated with this drought condition.

A preliminary flooding assessment was made to compare the SPI-1 indicator (see Figure 8) with actual flooding. In the 2020 wet season, flood took place in tributary basins during September and October when the SPI-1 maps indicated very and extremely wet areas over the southern part of Lao PDR, Chi and Mun basins of Thailand, central part/highland of Viet Nam, and northern Cambodia. The tropical storms caused prolonged rainfall, resulting in saturated soil surface and surface runoff which consequently caused flash flood and river flood in the tributary systems.

The SPI-1 for July shows that the LMB was generally near normal, with moderate and severely dry in some parts of Thailand, Lao PDR and Cambodia. In August, the SPI-1 indicates that much of the LMB was still near normal. The total rainfall in August was near average (see Figure 18), bringing the flow of the Mekong mainstream to a state within the channel capacity. Usually, heavy rainfall in upper LMB tends to create bank-full flow in the mainstream in the middle reaches of the LMB (such as Vientiane, Nong Khai, Bueng Kan and Nakhon Phanom). Due to average rainfall in August and September, the mainstream flow did not overtop the banks this year. However, with very wet and severely wet in October (SPI-1 for October), flooding in tributary basins were observed in many parts of the basin. National and regional news reported hundreds of thousands of people affected, thousands displaced and hundred plus fatalities in many countries in October 2020.[7] The national governments made flood warnings and responses in the flood areas to mitigate potential impacts.

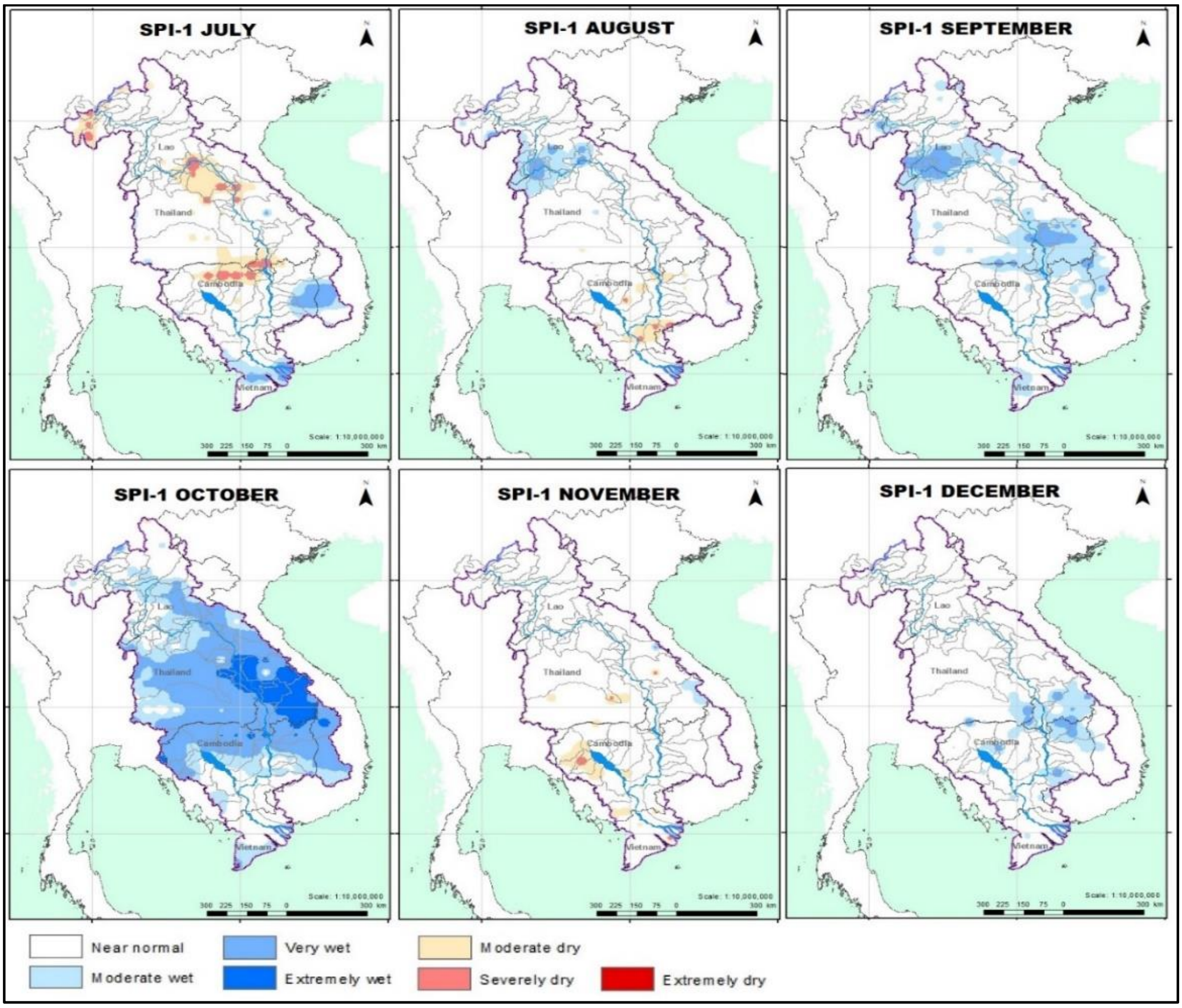

Figure 8. One-month SPI from Jul to Dec 2020.

[7] See Floodlist (2020, 11 October & 2020, 14 October), Hollingsworth (2020, 21 October), IFRC (2020), and Thai PBS (2020, 16 October & 2020, 20 October) for more information on the extent of impact caused by flooding in the Mekong countries.

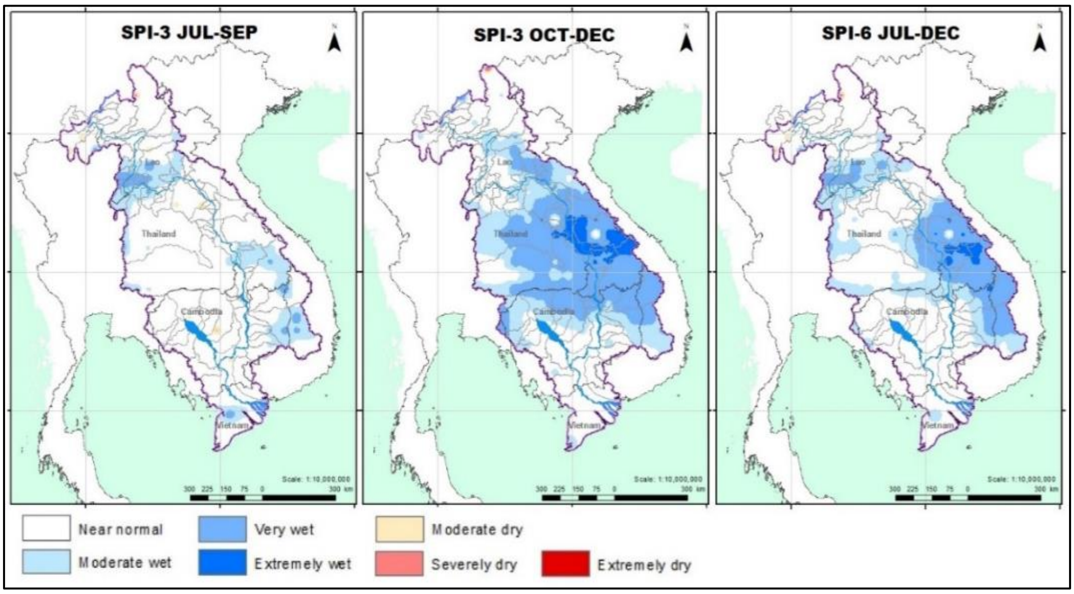

Figure 9. A three-month and six-month SPI map of Jul–Sept, Oct–Dec, and Jul–Dec 2020.

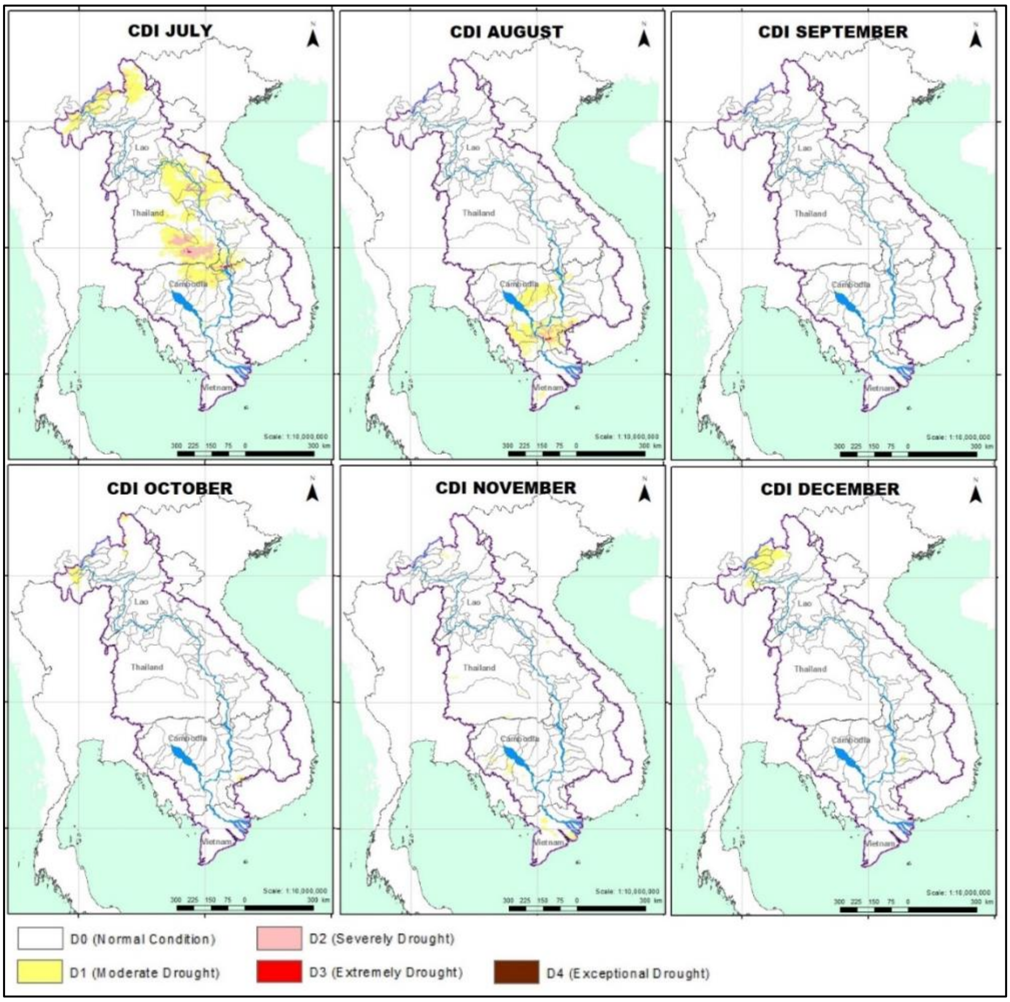

Figure 10. Monthly Combined Drought Index for the LMB from Jul to Dec 2020.

5 Impacts

The main feature of the situation in 2020 was low flow conditions during May, June and July, resulting in significant impacts on the Tonle Sap Lake and the Mekong Delta. With the prevailed low flow conditions, the following adverse impacts might have happened:

- **Agricultural impacts** due to insufficient rainfall to meet field water demands particularly in rainfed cropping areas for land preparation, nursery water requirement for rice, and crop water requirement. Some farmers replanted the rice with short growing duration rice varieties as the first planting had failed. The rainfed rice fields generally will have more weeds due to minimal standing water in the fields, negatively affecting the rice yields at the end of the season or increasing farmers' expenses to eliminate the weeds. Rice fields and orchards in the Delta areas were prone to sea water intrusion as the Mekong river flows to counter saltwater intrusion was relatively lower.

- **Ecological imbalance** due to significant changes of timing, duration and extent of inundations of the Tonle Sap Lake and its surrounding floodplains. This might lead to reduced reproduction, nursery areas and growth of fish and other aquatic animals (OAAs) and plants, including the flooded forests, which are key habitats for fish and OAAs.
- **Reduced nutrient-rich sediment mobilisation and transportation**, which enriches the Tonle Sap Lake and its floodplains leading to reduced primary productivity and impacts further up the food chain.

- **Significantly decreased household fish catches** in the Tonle Sap Lake and its floodplains. The household fish catch in Kampong Chhnang province was decreased by about 35% in 2019 (dry year) compared to the average over the previous eight years (2011–2018).[8] There is a correlation between fish catch and water flows, coupled with the timing and duration of the flows from the Mekong mainstream. The 2020 condition was similar to the 2019.[9]

- **Socio-economic impacts.** The Tonle Sap Lake fisheries contribute to more than 60% of total annual fish catch in Cambodia (for example, 770,000 tonnes). The significant delay and lower reverse flow in 2020 might further reduce the fish catch in Cambodia, leading to reduced food security for the most vulnerable peoples in the country and in the region.

[8] See Haffner (2020, 11 August) for more information.
[9] See Sun (2020, 20 August) for more information.

6 Potentials for Mitigation Measures of the Tonle Sap Lake Impact

There are potentials for mitigating the impact to the Tonle Sap Lake in the case of low reverse flow in the early wet season of 2020. The potentials may range from compensating victims of the low flow (those directly affected by low water level/flow, for example farmers and fishers in the Tonle Sap Lake vulnerable areas) to establishing new water control structures for the Tonle Sap River, and to increasing water storages and curtailments to diversions for irrigation that are already ambitious schemes under drought and flood management of the LMB. Regarding water resources management, the Basin Development Strategy for the Mekong River Basin 2021–2030 (BDS 2021–2030) and the MRC Strategic Plan 2021–2025 (MRC SP 2021–2025) place an increasing emphasis on the operational management of the LMB and recommend investigating the potential for jointly owned storage infrastructure and increasing storage capacity (both human-made and natural ones) (see MRC, 2021). The storages in both UMB and LMB have limited capacities, but it is possible to correct the timing and volume of the reverse flows into the Tonle Sap Lake in a typical year, should an operation of the dams to mitigate the adverse effect of upstream storages on the Tonle Sap reversal be considered.[10]

The MRCS has approached the National Mekong Committees (NMCs) to coordinate the provision of near real-time monitoring of active storage and any large-scale diversions by communicating and engaging their relevant line agencies. In addition, the MRCS has kept reporting to the public regarding possible actions to minimise impacts, which require MCs cooperation at the national level.

It is one of the functions of the MRCS is to monitor the flow conditions on the Mekong mainstream and to share information with the MCs. At the same time, the MRC MCs can also engage the MRC Dialogue Partners (China and Myanmar) to ease extreme low flow conditions in the LMB by having water supplement similar to 2019 low flow conditions.[11] As such, using the MRC monitoring system to detect or predict the river flow anomaly and the expected hydrological conditions similar to 2019 should constitute a basis for the MRCS to provide timely advice to the MCs to engage China in water supplement.

[10] See MRC (2017) for detail.

[11] See Tanakasempipat and Johnson (2020, 20 February) for more information.

7 Conclusion and recommendations

7.1 Conclusion

The 2020 wet season in the LMB is characterised by low rainfall, a prolonged dry period with a late arrival of the Monsoon rains, and the river low water-level conditions in 2019. Low rainfall was observed in May–July. The rainfall amount increased to normal in August, and to above average in September and October. Tropical storms made landfalls over the LMB in these three months and helped replenish flows on the Mekong mainstream. Flooding occurred in tributary basins in all the four MCs, which were influenced by those storms that did damages to properties and lives.

The low rainfall and river flow condition in the early wet season seriously affected the natural reverse flow into the Tonle Sap Lake. The reverse flow again did experience a new low record in 2020. As a result, the Lake boundary expanded slowly, resulting in low fish habitat, which in turn brought low fishery production in Cambodia. The acceptable natural reverse flow in accordance with the PMFM requirements (under Article 6B of the 1995 Mekong Agreement) was compromised, and as such the MRC should comprehensively conduct a study on the causes of the low flows in 2019 and 2020 and explore adaptation options as well as suggest mitigation measures for both short-term and long-term.

The long dry spell in the early months of the 2020 wet season had resulted in negative impacts on the economies of Cambodia due to the loss of fisheries and irrigation potential, of Viet Nam due to reduced productivity in the Delta rice bowl, and of Lao PDR and Thailand on rain-fed cropping damages.

7.2 Recommendations

The mitigation options for the severe situation of low reverse flow into the Tonle Sap Lake should be carefully studied with recommendations for viable management options. Proper decision support options should be well developed.

Based on the BDS 2021–2030 and the MRC SP 2021–2025, the MRC will explore potential operational management options for drought and flood mitigation, as well as the potential for additional jointly operated storage. This will include technical viability, water diplomacy and institutional considerations. Effective water diplomacy and institutional considerations should ultimately result in comprehensive drought and flood management cooperation mechanisms strongly supported by the Member Countries and active cooperation from the MRC Dialogue Partners. A recent joint project between Cambodia and Thailand on flood and drought management has marked a good step toward establishing a cooperation mechanism between the two countries. This is worthy because although this project involves small areas of the entire LMB, what is being conducted in this project will provide an insight of water resource management for other parts of the Mekong basin.

Transparent and timely notifications of water release, and data and information sharing and exchange are crucial for successfully mitigating the flood and drought impacts. The MRCS continues to identify the additional key data and information necessary for water resource management and development. Additional efforts in data and information sharing and exchange by the MRC Member Countries and Dialogue Partners are highly encouraged.

The Member Countries could also consider requesting China to provide “water supplement” into the mainstream under the low flow conditions or similar situation while the MRCS supplies timely information on the crisis.

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