Mekong River Commission
For Sustainable Development

Situation Report

Hydrological Conditions in the Lower Mekong River Basin in January-July 2020

August 2020

The MRC is funded by contributions from its Member Countries and Development Partners, including Australia, Belgium, the European Union, Finland, France, Germany, Japan, Luxembourg, the Netherlands, Sweden, Switzerland, the United States and the World Bank.

Situation Report

Hydrological Conditions in the Lower Mekong River Basin in January-July 2020

August 2020

Title: Situation report on hydrological conditions in the Lower Mekong River Basin in January-July 2020

ISSN: 1728-3248

Keywords: floods/precipitation/ENSO/water level

For bibliographic purposes, this volume may be cited as:
Mekong River Commission. (2020). *Situation report on hydrological conditions in the Lower Mekong River Basin in January-July 2020*. Vientiane: MRC Secretariat.

Information on MRC publications and digital products can be found at
http://www.mrcmekong.org/publications/

Cover photo: MRC

Graphic designer: Anouvong Manivong

All queries on rights and licenses should be addressed to:
Mekong River Commission
Documentation and Learning Centre
184 Fa Ngoum Road, Unit 18, Ban Sithane Neua, Sikhottabong District, Vientiane 01000, Lao PDR
Telephone: +856-21 263 263 | E-mail: mrcs@mrcmekong.org | www.mrcmekong.org

Contents

Figures

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
NMC	National Mekong Committee
MMTA	Monthly Mean Temperature Anomaly
MRC	Mekong River Commission
PNPCA	Procedures for Notification, Prior Consultation and Agreement
PMFM	Procedures for the Maintenance of Flows on the Mainstream
SPI	Standardised Precipitation Index
TCC	Tokyo Climate Centre
TMD	Thai Meteorological Department
TPA	Total Precipitation Anomaly
UCI	University of California, Irvine
UNESCO	United Nations Educational, Scientific and Cultural Organization
UMB	Upper Mekong Basin

Executive Summary

This Situation Report presents a preliminary analysis of the hydro-meteorological conditions in the Lower Mekong River Basin (LMB) for January-July 2020 and compares the data to 2019 (a 'drought' year) and 2018 (a 'normal' year).

According to monitoring, rainfall and weather data, the LMB is experiencing a second year of low flows and a delayed onset of the wet season in 2020, with the situation appearing to be worse than that in 2019. The low flows appear to be driven by a reduction in rainfall across the LMB due to a delay in the Monsson rains. The data also suggests that temperatures may be higher than normal, with parts of the LMB appearing to be experiencing less rainfall in August and September.

Reverse flows into the Tonle Sap Lake are lower than they were at this time last year, and considerably lower than those in 2018. The low flows could have severe impacts on Cambodia due to a loss of fisheries and irrigation potential. Viet Nam may experience reduced productivity in the Delta rice bowl. Agricultural productivity in Lao PDR and Thailand are also likely to be affected. But with some depressions or storms forecast in August-September, it is expected that the reverse flows will occur around the first week of August 2020.

Cooperation with the upstream countries China and Myanmar is crucial for a comprehensive assessment of rainfall in the Upper Mekong Basin (UMB) or Lancang River Basin, including information about releases from their storage. Information and data sharing between all the six riparian countries is vital for the MRC to ascertain the causes of the low flows and for countries to implement the suggested mitigation options that they consider viable.

Recommendations

The immediate mitigation options are for the Member Countries to implement their drought management plans, and request storage operators to consider additional releases and irrigators to reduce their abstractions if the water levels during this flood season do not improve significantly. Like what they did in 2016, the Member Countries could also consider requesting China to have a "water supplement" if the current conditions persist.

Over the long-term, the Mekong River Commission (MRC) will explore options for drought and flood mitigation, as well as additional jointly operated storage. 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.

Transparent data and information sharing is fundamental both in the short and long run. The lack of information on the operations of water infrastructures in the Mekong River Basin has presented a significant challenge to comprehensive assessment and accurate forecasting.

To increase the transparency of dam operations in the UMB and to demonstrate cooperation in good faith, China should consider providing more data that covers more stations and includes dry season information. In the LMB, the MRC Member Countries - Cambodia, Lao PDR, Thailand and Viet Nam - also need to provide more data on their dam operations on the mainstream and key tributaries. These will enable the Commission to produce more comprehensive and accurate

monitoring reports, covering the entire Mekong River basin. This in turn will support the MRC Member Countries to better plan and manage water resources to capture the promising benefits and address potential short-term risks, help riparian communities to avoid potential adverse impacts on their livelihoods, and aid China and Member Countries to clear misperceptions.

1 Introduction

The LMB, which covers Lao PDR, Thailand, Cambodia and Viet Nam, drives development and supports the livelihoods of millions of people. This year, it is experiencing a second year of low flows and the delayed onset of the wet season. Such conditions could have 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 Member Countries and public with information on what causes the low flows and what measures could be taken to minimise or mitigate the associated environmental, social and economic impacts. This is paralleled by the MRC's increasing pivot towards providing operational advice to its Member Countries to help address the impacts of droughts and floods and other climate-related risks. Both the new Basin Development Strategy 2021-2030 and the Strategic Plan for 2021-2025 identify actions towards this end. 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 for the period from January to July 2020, and how this year compares to 2019 (a 'drought' year), and 2018 (a 'normal' year). The report primarily focuses on the causes of the current low flow conditions in the LMB.

The report covers six main areas:

- Rainfall and general weather information;
- River flow on the mainstream;
- The Mekong 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);
- Drought monitoring;
- Outlook of the 2020 wet season; and
- Potential impacts of low flows and mitigation measures.

The MRC has ready access only to data held in its data portal (https://portal.mrcmekong.org/). This Situation Report, therefore, covers only the conditions in the LMB and does not address the hydro-meteorological conditions in the UMB in China or Myanmar, or the effects they may have had on flows in the LMB.

2 Rainfall Conditions

Daily rainfall data over the LMB are available from 119 ground stations in the basin. The observed rainfall was quality controlled and analysed to represent overall precipitation in the LMB. The daily rainfall data were aggregated to generate total monthly rainfall patterns for the years 2018, 2019 and 2020 (Figure 1). The cumulative monthly rainfall over the LMB for 2020 until July is presented in Figure 2 and Figure 3. Additionally, the analysis of any surplus or deficit in the cumulative monthly rainfall is illustrated in Figure 4 and Figure 5.

The rainfall pattern for 2008-2017 is typically mono-modal with a peak in July. Usually, the rains start in earnest from mid-May to mark the onset of the southwest Monsoon. However, there is a high degree of variation between months. But, as indicated in Figure 1 and Table 1, for 2019 and 2020 to date, the 'wet season' started about half a month later than normal.

Furthermore, the 2020 wet season to date has been drier than that in 2019 (Figure 1). Total cumulative rainfall for January to July 2020 was 397 mm. This is 672 mm and 231 mm less than that for 2018 (1,069 mm) and 2019 (628 mm), respectively. The year 2018 is considered as a wetter year and 2019 as a drought year. The first seven months of rainfall in 2020 was 334 mm lower than the average between 2008-2017 (731 mm), and the total 2020 cumulative rainfall is shaping up to be worse than that in 2019.

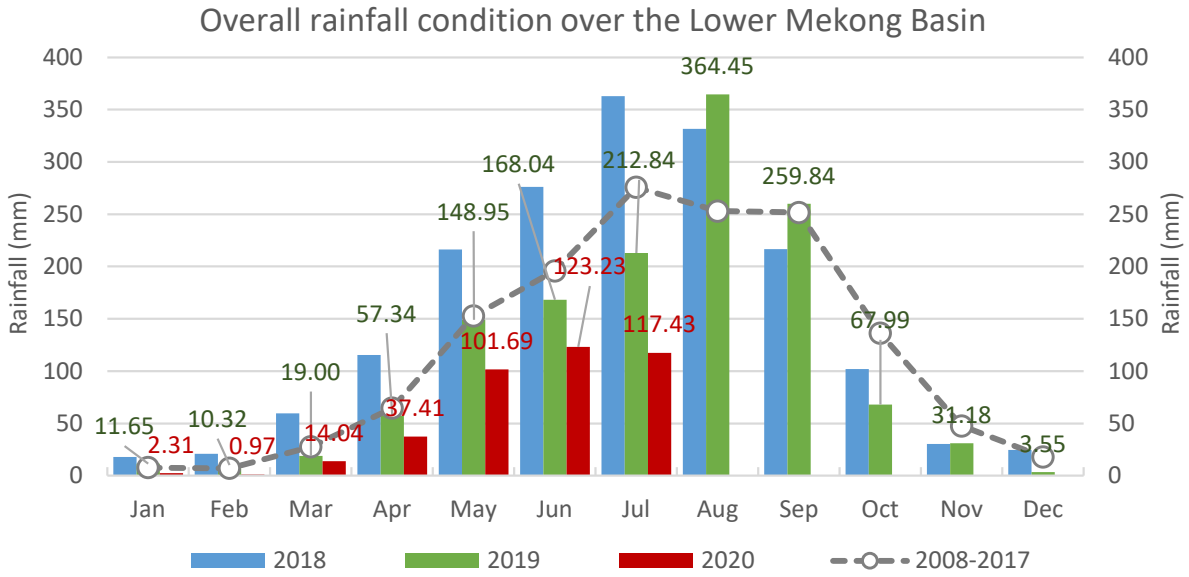


Figure 1. Overall monthly rainfall of 2018-2020 over the Lower Mekong Basin, compared to the long-term condition of 2008-2017, generated and interpolated from 119 stations in the Lower Mekong Basin

Particularly, the southwest Monsoon of 2020 arrived later than normal when compared to the average conditions of the previous ten years. The monthly cumulative rainfall in 2020 was lower than the 10-year average and in 2019.

Table 1. Onset and offset of the southwest Monsoon of 2018-2020 at hydrological stations along the Mekong mainstream compared to the long-term condition of 2007-2017

Station	Average		2018		2019		2020	
	Onset	Offset	Onset	Offset	Onset	Offset	Onset	Offset
Chiang Saen	02-May	13-Oct	04-May	6-Oct	01-Jun	21-Sep	29-May	-
Luang Prabang	04-May	08-Oct	05-May	8-Oct	01-Jun	23-Sep	29-May	-
Chiang Khan	03-May	18-Oct	20-May	9-Oct	02-Jun	24-Sep	29-May	-
Vientiane	07-May	08-Oct	27-May	10-Oct	03-Jun	24-Sep	29-May	-
Nong Khai	08-May	09-Oct	27-May	10-Oct	03-Jun	24-Sep	29-May	-
Paksane	13-May	10-Oct	28-May	10-Oct	01-Jun	24-Sep	29-May	-
Nakhon Phanom	10-May	08-Oct	28-May	11-Oct	02-Jun	24-Sep	30-May	-
Thakhek	10-May	08-Oct	28-May	11-Oct	02-Jun	25-Sep	30-May	-
Mukdahan	10-May	13-Oct	29-May	12-Oct	02-Jun	25-Sep	31-May	-
Savannakhet	11-May	12-Oct	29-May	12-Oct	02-Jun	25-Sep	31-May	-
Khong Chiam	08-May	14-Oct	30-May	12-Oct	05-Jun	25-Sep	02-Jun	-
Pakse	13-May	15-Oct	28-May	11-Oct	06-Jun	26-Sep	03-Jun	-
Stung Treng	18-May	21-Oct	29-May	18-Oct	04-Jun	29-Sep	03-Jun	-
Kratie	21-May	24-Oct	29-May	17-Oct	03-Jun	04-Oct	01-Jun	-
Kompong Cham	18-May	26-Oct	30-May	14-Oct	02-Jun	06-Oct	02-Jun	-
Bassac Chaktomuk	21-May	06-Nov	31-May	15-Oct	05-Jun	12-Oct	02-Jun	-
Phnom Penh Port	21-May	06-Nov	31-May	15-Oct	05-Jun	12-Oct	11-Jun	-
Koh Khel	22-May	06-Nov	31-May	16-Oct	05-Jun	15-Oct	11-Jun	-
Neak Luong	24-May	04-Nov	31-May	17-Oct	05-Jun	16-Oct	11-Jun	-
Prek Kdam	24-May	02-Nov	31-May	17-Oct	03-Jun	16-Oct	11-Jun	-
Tan Chau	28-May	06-Nov	02-Jul	22-Oct	04-Jun	25-Oct	11-Jun	-
Chau Doc	28-May	06-Nov	02-Jul	22-Oct	04-Jun	25-Oct	11-Jun	-

The spatial distribution of rainfall over the LMB, as shown in Figure 2 and Figure 3, reveals that monthly rainfall was 2.3, 1.0, 14.0, 37.4, 101.7, 123.2 and 117.43 mm from January to July 2020, respectively. The monthly total basin rainfall for these seven months was 33% to 86% lower than the 10-year monthly averages. Figure 4 and Figure 5 show that most of the LMB experienced lower than normal rainfall although there were patches of moderately higher rainfall, increasing in extent towards June but dropping slightly in July. However, there were some areas of the LMB that experienced much lower than normal rainfall from May to July 2020.

Most areas in the LMB have experienced drier conditions since January 2020. The late arrival of the Monsoon season caused deficits in rainfall in parts of the basin during May and July. In May, the Mekong tributaries in Northeast Thailand, upper Cambodia and west side of the Mekong Delta received surplus rainfall. In June, significant rainfall deficits occurred in large parts of the LMB, with marked deficits in the areas close to Xayaburi, Nakhon Phanom and Thakhek. The west side of the basin including Northern Thailand, half of Northeast Thailand, the lower basin in Cambodia and Delta in Viet Nam, were wetter than average in June, influenced by the southwest Monsoon. In July, the deficit situation became worse where most parts of the LMB experienced dryer conditions compared with monthly averages. The monthly deficits in 2020 were higher than those in 2019.

More specifically, Figure 6 indicates the cumulative daily rainfall at selected sites in 2018, 2019 and 2020. Rainfall during the beginning of the southwest Monsoon of 2020 over the Lower Mekong region was generally less than the average. By the end of July 2020, accumulated rainfall amounts along the mainstream, from Vientiane down to Phnom Penh (Bassac), were considerably less than the average. At Chiang Saen, Chiang Khan and Chau Doc, rainfall was slightly lower than the average.

The conditions at some inland locations, as shown in Figure 7, were not much different. At most sites, accumulated rainfall amounts were less than the average, except at Wang Saphung (Loei Province, Thailand) and Muong Mai (Paksane, Lao PDR) where the conditions were above average in July, although at other locations they were below average.

General weather information for 2020 (El Nino/ENSO-Neutral/La Nina)

The El Niño Southern Oscillation (ENSO) is a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean. This has profound impacts on global weather patterns. Monitoring and forecasting by the Tokyo Climate Centre (TCC) of the Japan Meteorological Agency (JMA) shows that the ENSO system remained in the 'neutral' state from the beginning of 2020 to now. Sea-surface temperatures (SSTs) over the Nino 3.4 region of the Tropical Pacific Ocean and atmospheric indicators of ENSO (such as cloudiness and wind anomalies) are also in neutral conditions.

Figure 18 shows that the forecast for the remainder of 2020 is for a strengthening La Nina effect. La Nina typically brings colder water to the Pacific and is a harbinger of drought conditions. This is addressed in more detail in the section below.

January 2020 (2.3 mm)

February 2020 (1.0 mm)

March 2020 (14.0 mm)

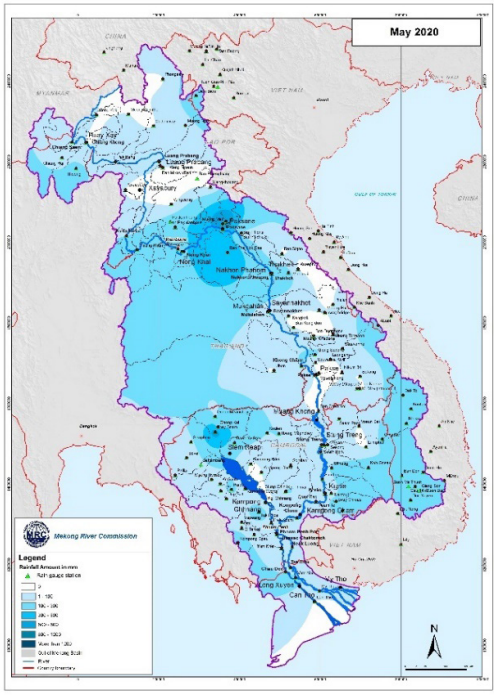
April 2020 (37.4 mm)

Legend

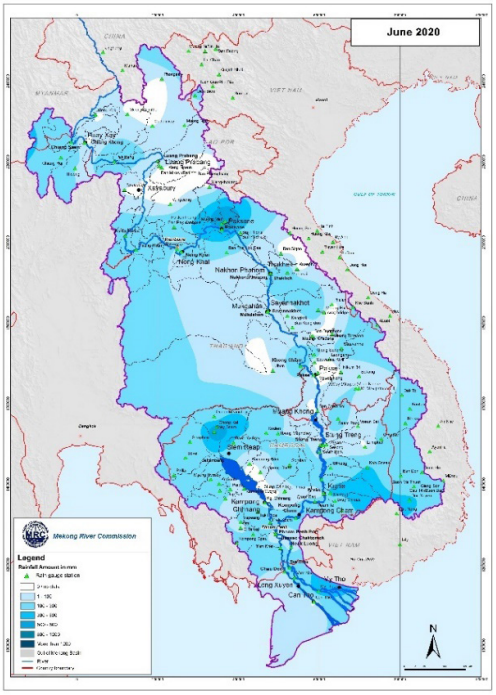
Rainfall Amount in mm
Rain gauge station
0
1 - 100
100 - 300
300 - 500
500 - 800
800 - 1200
More than 1200
Out of Mekong Basin
River
Country boundary

Figure 2. Accumulated monthly rainfall for January – April 2020, generated from 119 rainfall stations in the Lower Mekong Basin. Amount of rainfall presents Figure 19in mm

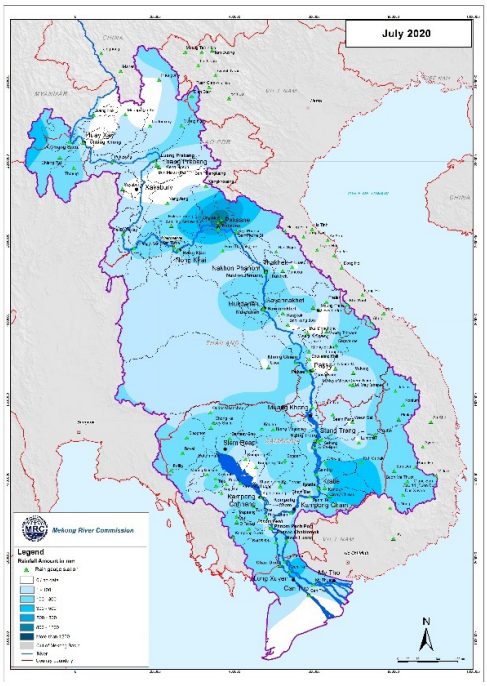
May 2020 (101.7 mm)



June 2020 (123.2 mm)



July 2020 (117.43 mm)

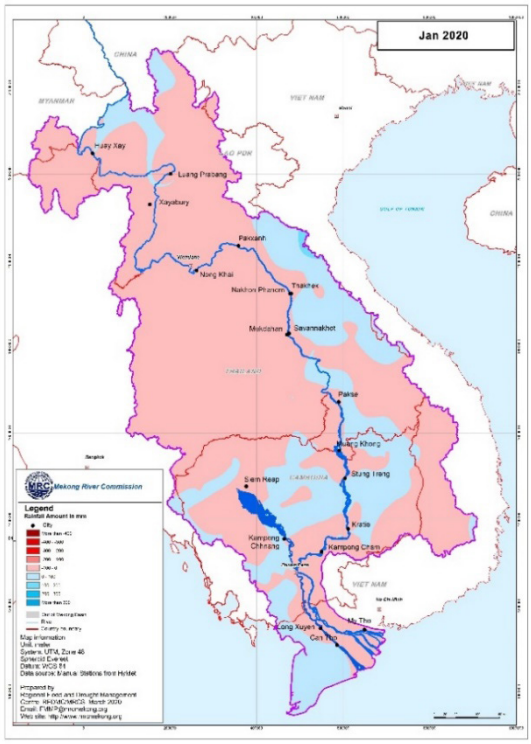


Legend

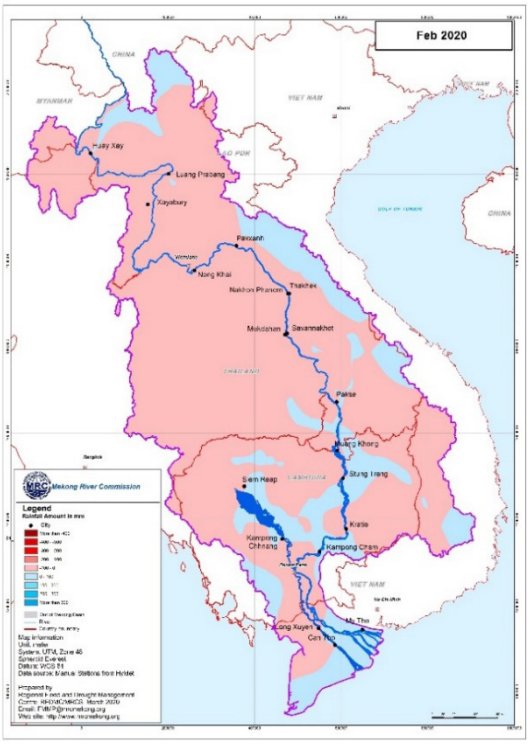
Rainfall Amount in mm
Rain gauge station
0
1 - 100
100 - 300
300 - 500
500 - 800
800 - 1200
More than 1200
Out of Mekong Basin
River
Country boundary

Figure 3. Accumulated monthly rainfall for May - July 2020, generated from 119 rainfall stations in the Lower Mekong Basin. Amount of rainfall presents in mm

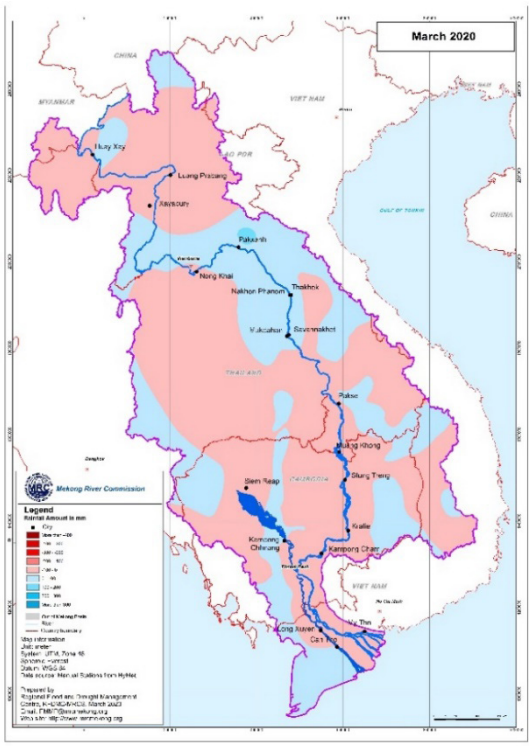
January 2020 (-5.5 mm or -70%)



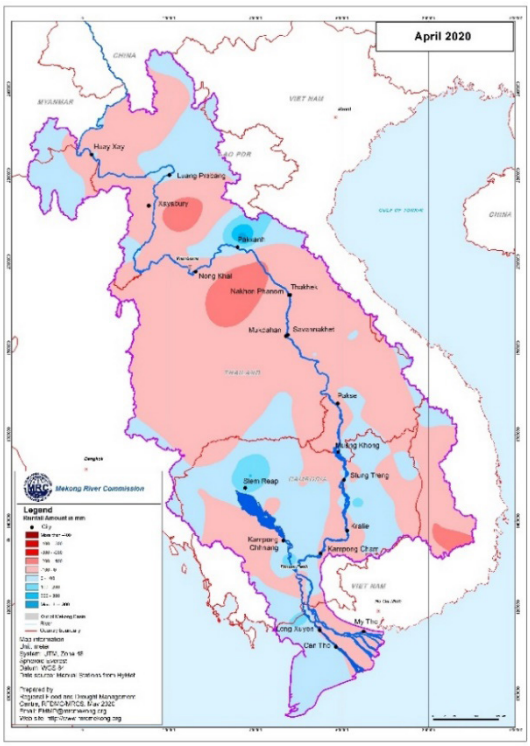
February 2020 (-6.1 mm or -86%)



March 2020 (-13.6 mm or -49%)



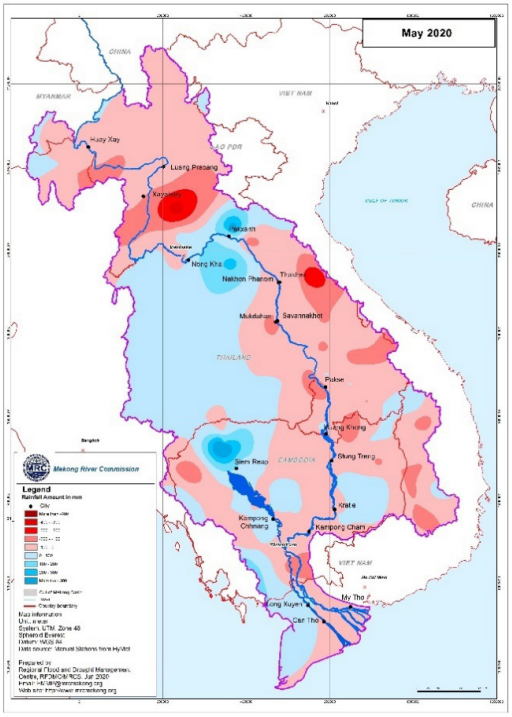
April 2020 (-27.18 mm or -42%)



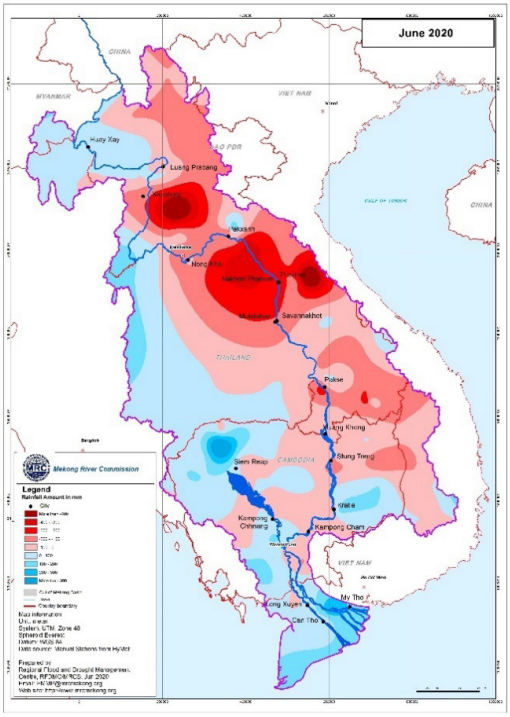
0 - 100
100 - 200
200 - 300
300 - 843
-200 - -100
-100 - 0
-400 - -300
-300 - -200
-3049 - -400

Figure 4. Surplus and deficit of monthly rainfall for January – April 2020 and average of 2008-2017. Amount of rainfall presents in mm and ratio is in %

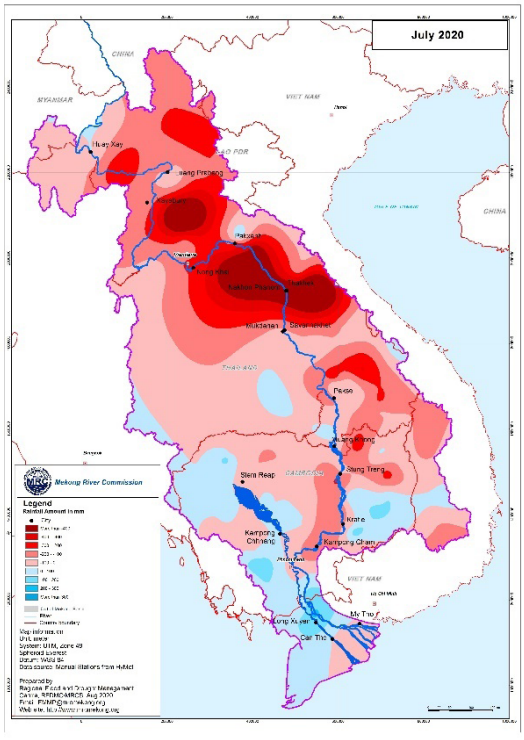
May 2020 (-50.9 mm or -33%)



June 2020 (-72.6 mm or -37%)



July 2020 (-158.3 mm or -57%)



0 - 100
100 - 200
200 - 300
300 - 843
-200 - -100
-100 - 0
-400 - -300
-300 - -200
-3049 - -400

Figure 5. Surplus and deficit of monthly rainfall for May – July 2020 and average of 2008-2017. Amount of rainfall presents in mm and ratio is in %

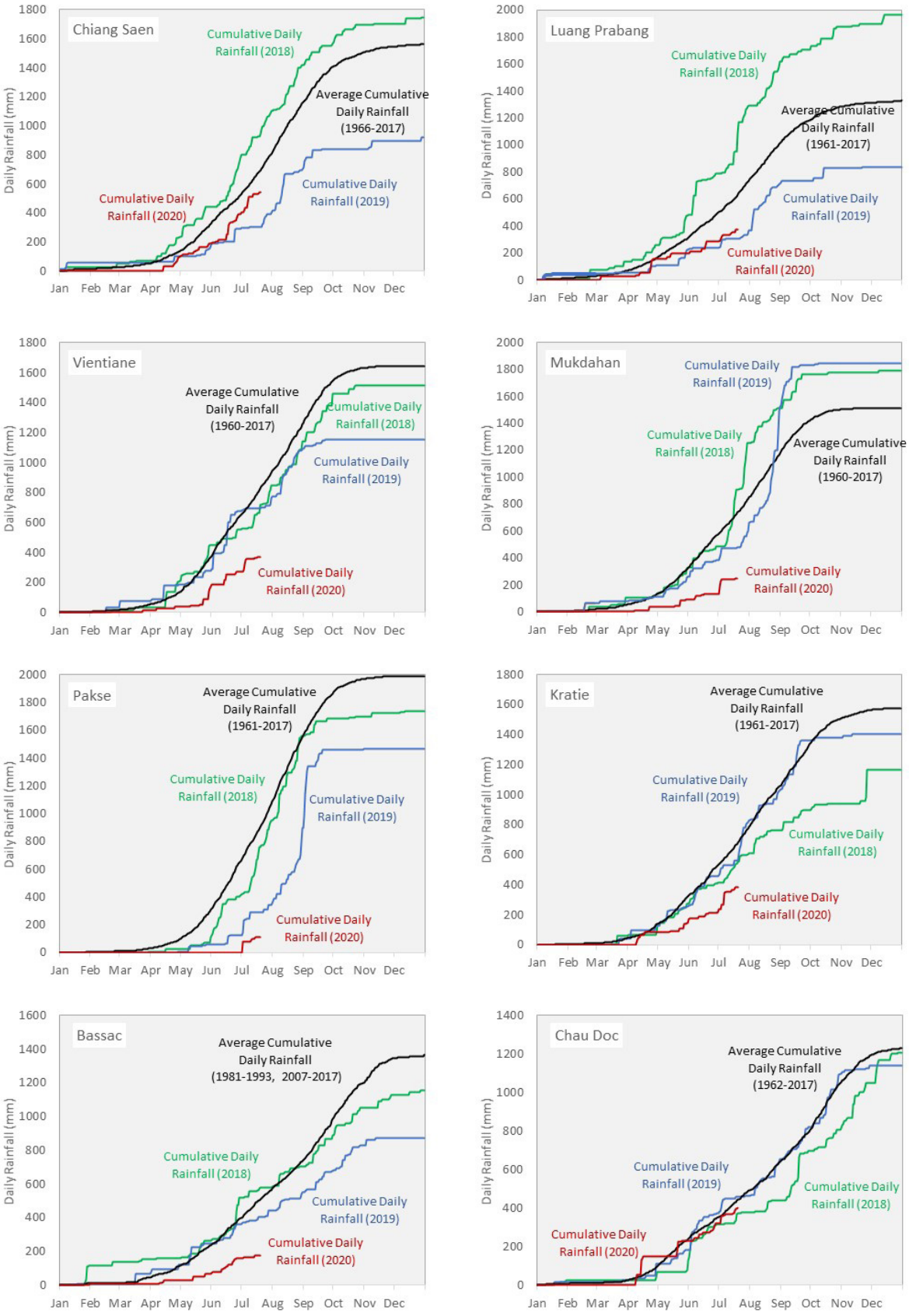


Figure 6. Cumulative daily rainfall at selected sites from Chiang Saen to Chau Doc during 2018, 2019 and 2020 compared to the long-term patterns

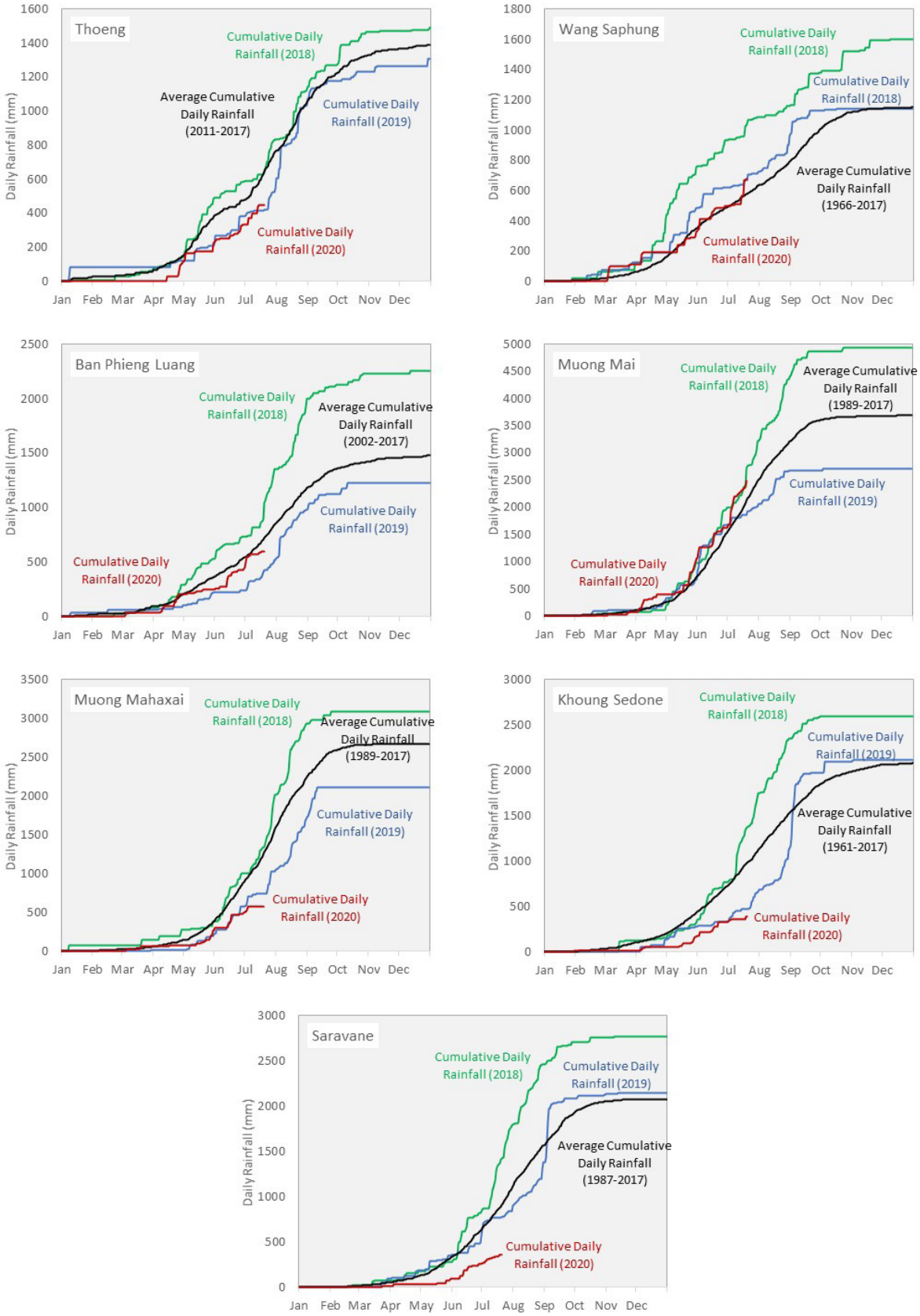


Figure 7. Cumulative daily rainfall at selected sites on Mekong Tributaries during 2018, 2019 and 2020 compared to the long-term patterns

3 River Monitoring

3.1 Flow monitoring

The hydrological regimes of the Mekong mainstream are illustrated by recorded water levels (Figure 8 and Figure 9) and flows (Figure 11) 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.

For the first five months, flows in the Mekong River from Chiang Saen to Kratie were typically higher than the average, and this might be due to the operations of hydropower projects in China. However, the influence of hydropower operations in China is less evident further downstream as the inflows from the tributaries make up a larger proportion of the flow. This is even more marked in the wet season when hydropower plants will be storing water, and as the impacts of droughts in the LMB reduce tributary inflows. As a result, flows downstream of Kratie have been lower than the average throughout 2020 to date.

Currently, the flows from Chiang Khan to Pakse are slightly higher than those in 2019 but are still lower than the long-term average. From Kratie down to the Mekong Delta, flows are comparable to those in 2019. Nevertheless, it should be noted that the situation on the Tonle Sap River is more severe than it was in 2019. Dry season flows in the Mekong mainstream over the last two years can therefore be characterised as ‘exceptionally low’.

Flows in selected tributaries are presented in Figure 10. Tributary flows are affected by the operations of tributary storage infrastructure and abstractions for irrigation. However, for those flow gauging stations not influenced by these projects, current flows are close to or lower than the average. Some of these are close to the minimum recorded flows.

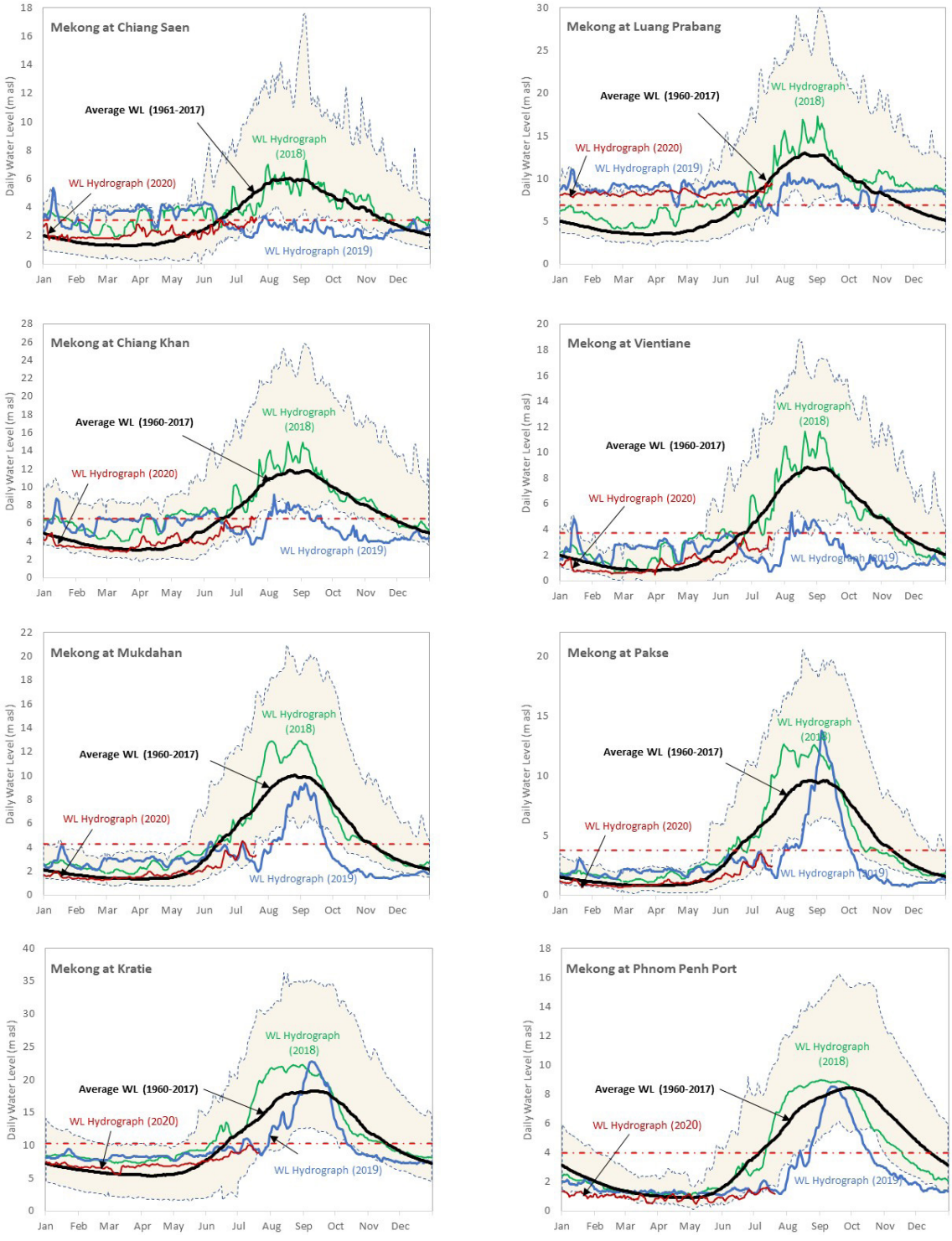


Figure 8. The 2018, 2019 and 2020 daily water level hydrographs observed at selected sites on the Mekong mainstream from Chiang Saen to Phnom Penh Port compared to the long-term averages

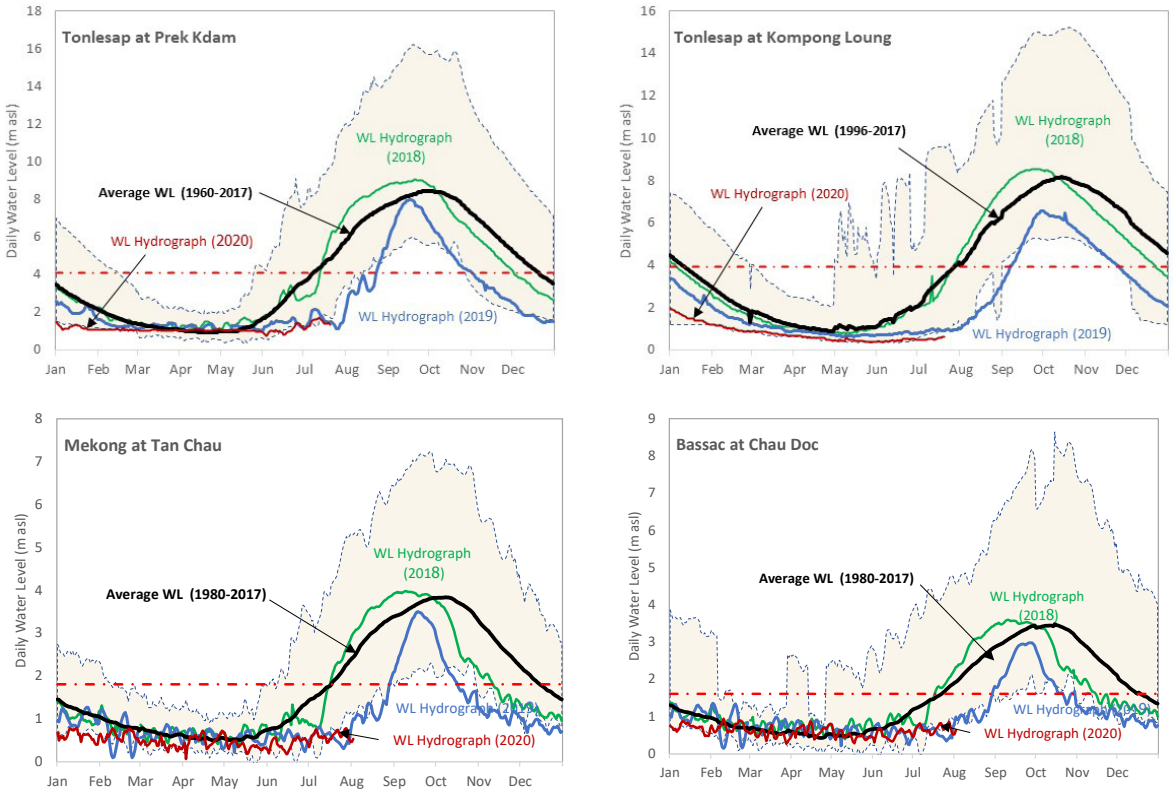


Figure 9. The 2018, 2019 and 2020 daily water level hydrographs observed at selected sites on the Tonle Sap system and the Mekong Delta compared to the long-term averages

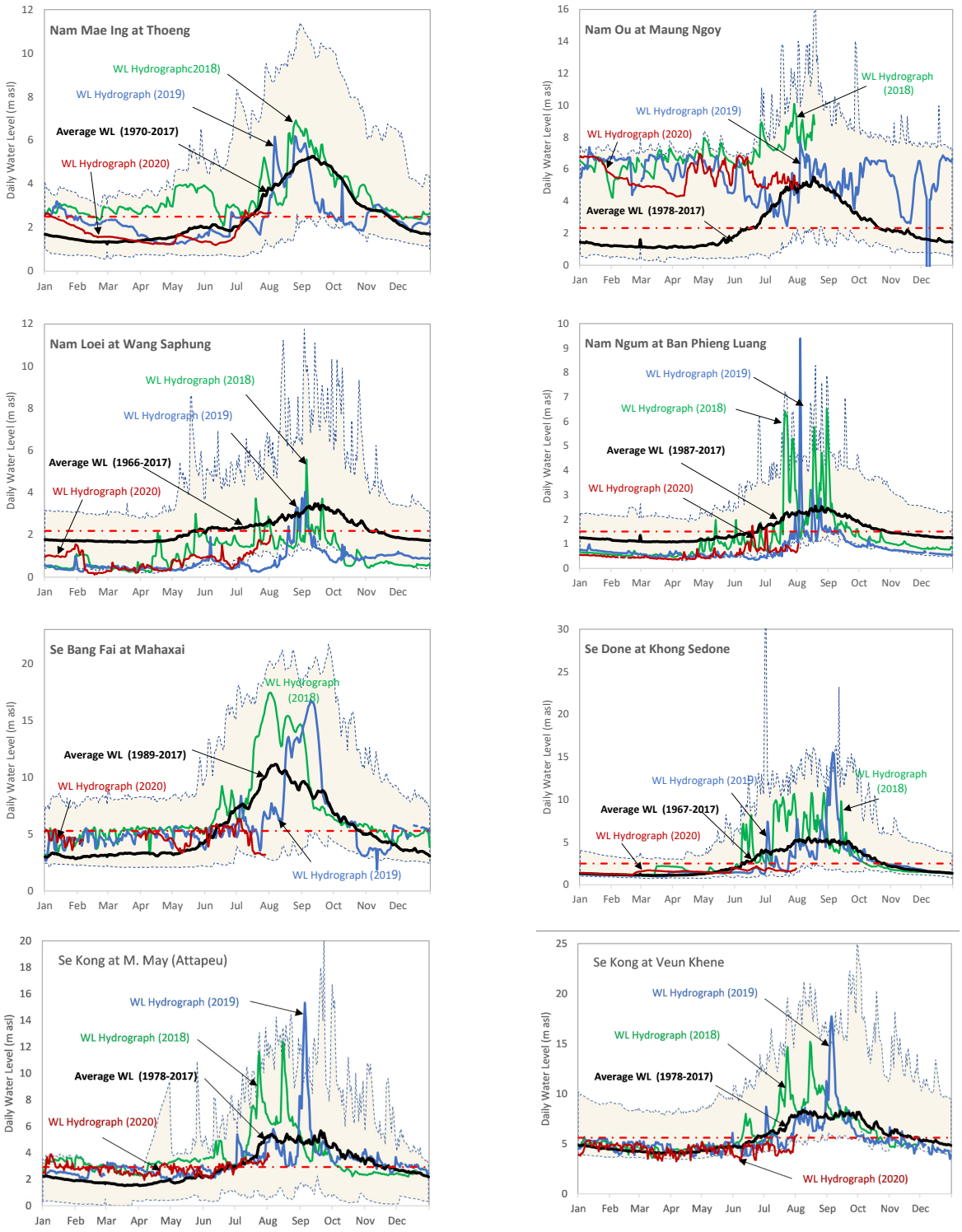


Figure 10. The 2018, 2019 and 2020 daily water level hydrographs observed at selected sites on Mekong tributaries compared to the long-term averages

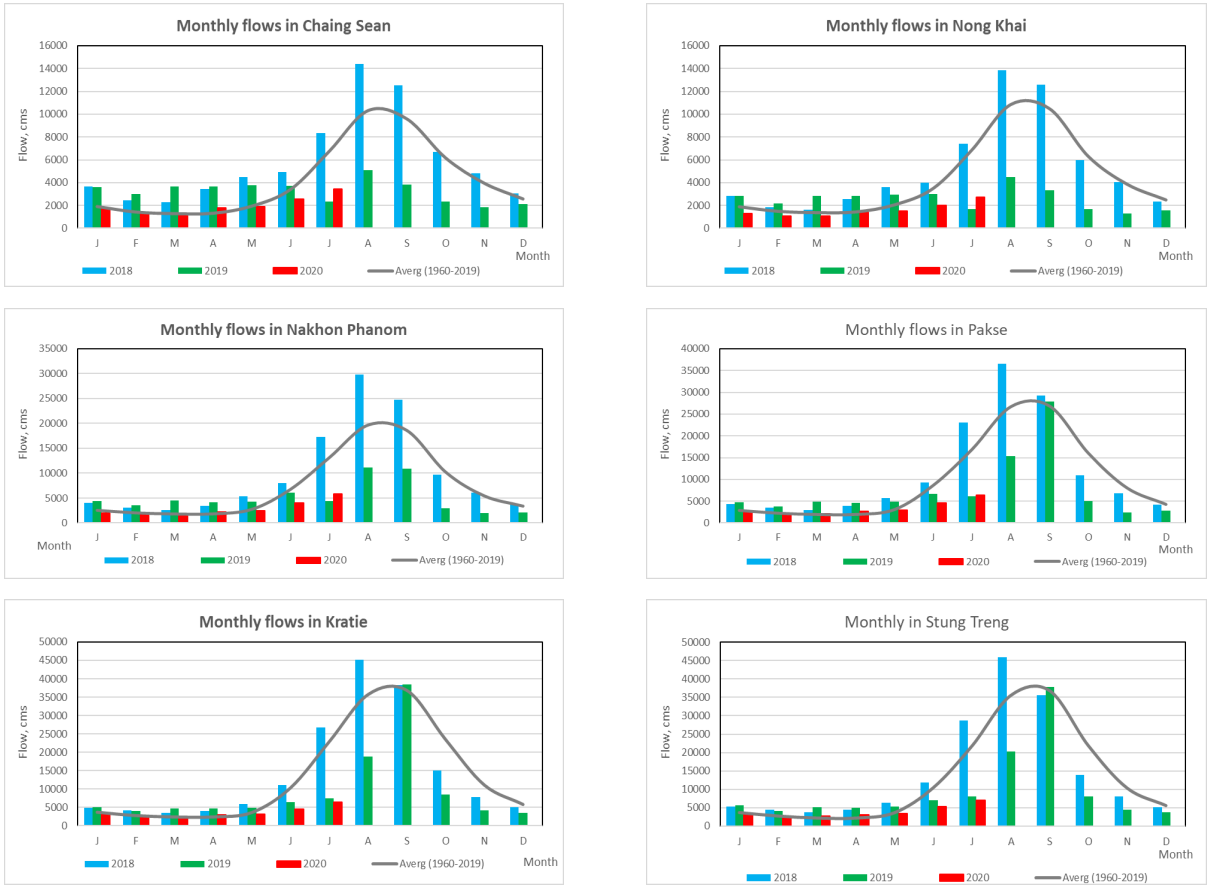


Figure 11. The 2018, 2019 and 2020 monthly flow calculated at selected sites on the Mekong mainstream from Chiang Saen to Stung Treng compared to the long-term averages

3.2 Reverse flows into the Tonle Sap Lake

The Tonle Sap Lake is the largest and most productive inland lake in Southeast Asia (MRC, 2005). It is considered one of the world's biodiversity hotspots (Allen, Smith, & Darwall, 2012), and the Mekong's main fish factory (Poulsen, et al., 2012). It has also been recognised as a world heritage biosphere reserve by the United Nations Educational, Scientific and Cultural Organization (UNESCO) since 1997 (UNESCO, 2018).

Water sources for the lake include the Mekong River (54%), the lake's tributaries (34%), and precipitation (Kummu, et al., 2014). Mean discharge at the lake is estimated at about 83.1 and 81.9 billion m^3 during the inflow and outflow periods, respectively. Inundation of the vast floodplains during the inflow period enables many fish species to gain temporary access to a large area for breeding, rearing and foraging, driving an enormous production of fish for food security, livelihoods and economies in Cambodia.

The reverse flows into the Tonle Sap Lake usually occur from mid-May to mid-October when the water level of the Mekong River swells so much that it forces the Tonle Sap to flow backwards. The total duration of the reverse flow is about 120 days and the inflow volume is about 43 km^3 (average of 1997-2005) (MRC, 2016).

The MRC's PMFM determines the acceptable reverse flows from 1 May to 31 October. The accumulated flows in 2020 were significantly delayed, starting in late June, which is about two weeks later than in 2019 and 40 days later than the average (Figure 12).

In 2019, reverse flows into the Tonle Sap Lake occurred twice. In the first instance, it began on 5 July and ended on July 13, with a volume of 0.40 km^3. In the second instance, it started on 30 July and ended on September 26, lasting for about two months. The total inflow volume for the year was 31.5 km^3.

According to the PMFM's data, so far in 2020, reverse flows into the lake occurred twice, but only so briefly with extremely low volumes that were very difficult to observe. The first instance occurred on 7 July and ended on 15 July, with a total volume of just 0.21 km^3. The second occurred for three days in late July. With depressions, storms or typhoons forecast in August-September 2020, it is expected that the **"usual reverse flows"** will occur again during the first week of August 2020, with a larger volume than the first two.

Figure 13 illustrates observed water levels at Phnom Penh, Prek Kdam and Kampong Luong, which were input for an estimate of reverse flows into the Tonle Sap Lake. A total accumulated volume of 0.26 km^3 was estimated on 31 July 2020. This figure is 16.71 km^3 below the average volume of 16.97 billion m^3 (on the same date) and 0.42 km^3 below the record in 2019 (on the same date) of 0.68 billion m^3. As a result, as of the end of July, the Tonle Sap Lake is now experiencing extremely dry conditions with reverse flows at their lowest on record since 1997.

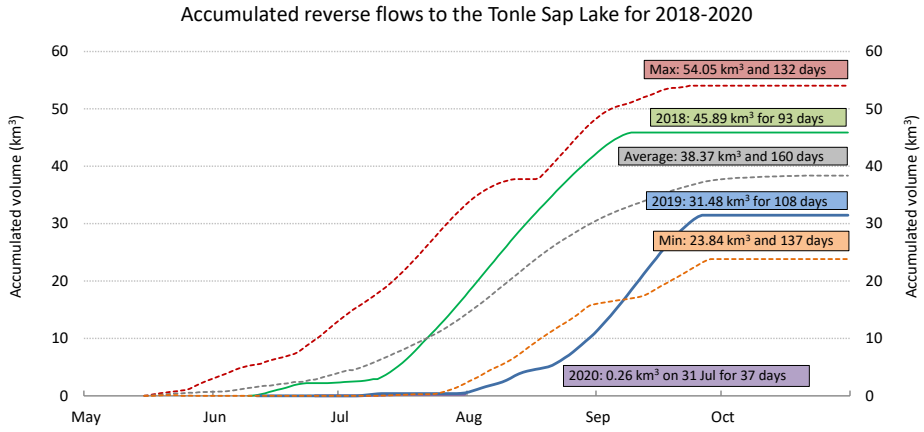


Figure 12. Characteristics of accumulated flows for 2018, 2019 and 2020, compared to the minimum, maximum and average of 1997-2017

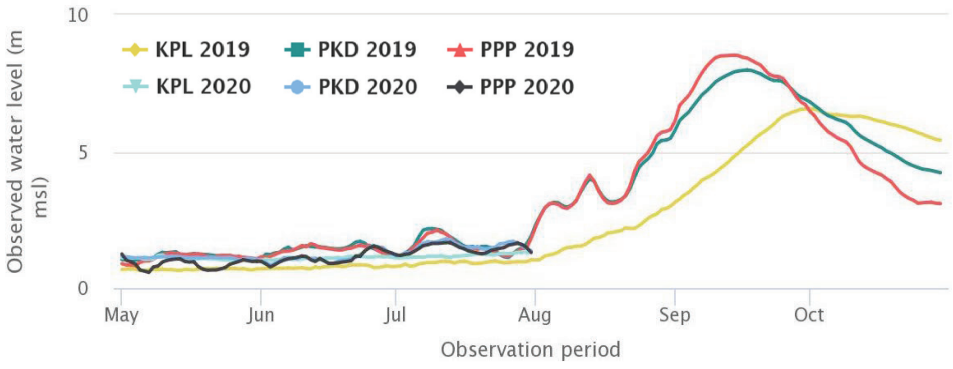


Figure 13. Observed Water Level at Phnom Penh, Prek Kdam and Kampong Luong

3.3 Information from PMFM Monitoring

The PMFM (Article 6A, of the 1995 Mekong Agreement[1], for monitoring purposes during the dry season) includes the requirement to maintain the dry season flow on the mainstream for December to May. It is noted that hydrological conditions had fallen into Zone 4 (severe) for most of the hydrological stations during the start of the 2020 dry season. It is also noted that in Vientiane, the conditions were severe for half of the dry season. The conditions were better for stations further down, including Pakse in Lao PDR. Further downstream in Cambodia, the conditions were generally at the average during the whole dry season.

But the situations started to change as the wet season moved in, which triggers Article 6B of the PMFM.

The PMFM (Article 6B of the 1995 Mekong Agreement) includes the requirement to maintain an acceptable reverse flow into the Tonle Sap Lake in the wet season. The accumulated reverse flow volumes at Prek Kdam (in the Tonle Sap River) were determined by combining the available data at Kampong Luong (in the Tonle Sap Lake) and Phnom Penh Port (in the Tonle Sap River) stations between 1996 and 2005.

As seen in Figure 12, the actual accumulated reverse flow volume at Prek Kdam lies below the minimum-maximum bands. The PMFM for monitoring purposes indicates that these hydrological conditions are considered ‘unstable’ and an alert should be issued. The possible causes and potential mitigation measures should be investigated.

1 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin

4 Drought Monitoring

The HYMET and PERSIANN-Cloud Classification System (CCS), observed rainfall data by the Centre for Hydrometeorology, and Remote Sensing (CHRS) of the University of California, Irvine (UCI) show that, during January-July 2020, July was the hottest month followed by June.

In June, Khammuane, Savannakhet, Nakhon Phanom and Mukdahan were the hottest provinces in the LMB with severe meteorological drought conditions, while Borikhamxay, Nong Khai, Sakon Nakhon, Ubon Ratchathani and Si Saket experienced moderate dry conditions.

In July 2020, over 60% of the areas in the LMB was considered as severely dry according to meteorological indicators. Some 10% of the basin, including Chiang Rai, Phayao, and Bokeo in the North and from Luang Prabang, Vientiane, down to Prey Veng and Svay Rieng in Cambodia in the South (Figure 14 and Figure 15), was moderately dry.

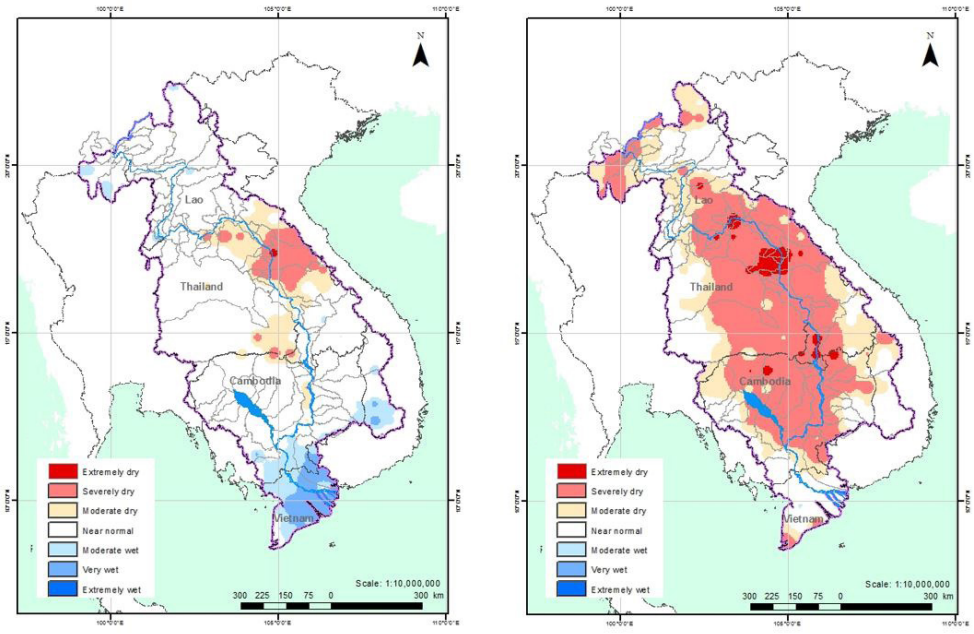


Figure 14. One-month Standardised Precipitation Index (SPI) for June (left) and July (right) 2020

Looking at a three-month Standardised Precipitation Index (SPI) (May-July) and a six-month SPI (February-July), Chiang Rai, Bokeo, Luangnamtha, Vientiane, Nong Khai, Udon Thani, Sokhon Nakhon, Nakhon Phanom, Khammuane, Mukdahan, Savannakhet, Roi Et, Yasothon, Preah Vihear, and Stung Treng received the least rainfall in the first half of the rainy season in 2020.

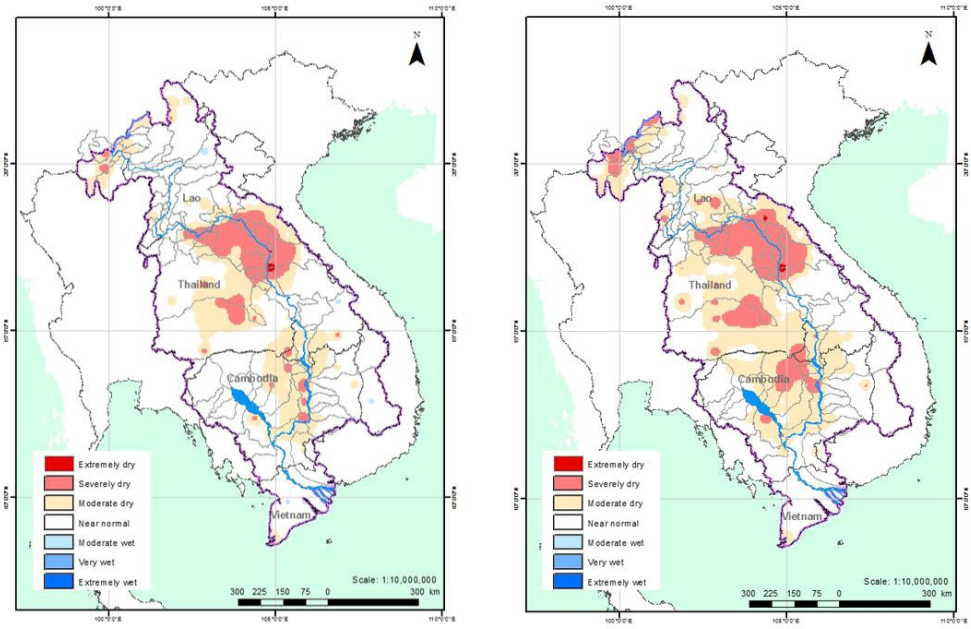


Figure 15. Standardised Precipitation Index (SPI) maps for three months from May-July (left) and six months from January-July 2020 (right)

5 Outlook of the 2020 Wet Season

5.1 Rainfall outlook

National weather services of the Member Countries are actively engaged in providing national climate and weather information, including warnings and forecast information. The Thai Meteorological Department (TMD) issued a three-month climate prediction for Thailand and provided an outlook for the coming three months from August to October 2020.

The forecast indicated that some low-pressure air mass cells will develop around the Andaman Sea, which may strengthen to become depressions and tropical cyclones in the Mekong region. These movements are towards northern to eastern parts and may move closely towards the western side of Thailand. Less rain is likely over Thailand, but isolated heavy rainfall may occur in the northern Mekong region that may contribute to sudden increase of water levels in certain areas.

According to the Asian Specialised Meteorological Centre (ASMC), climatologically, the weather over the Mekong sub-region from August to October 2020 is expected to show an increased chance of above-normal rainfall. Between August and October (ASO) 2020, above-normal rainfall is predicted over many areas north of the equator in the Mekong region. Figure 16 shows above-normal rainfall for a large part of the Mekong region over this period.

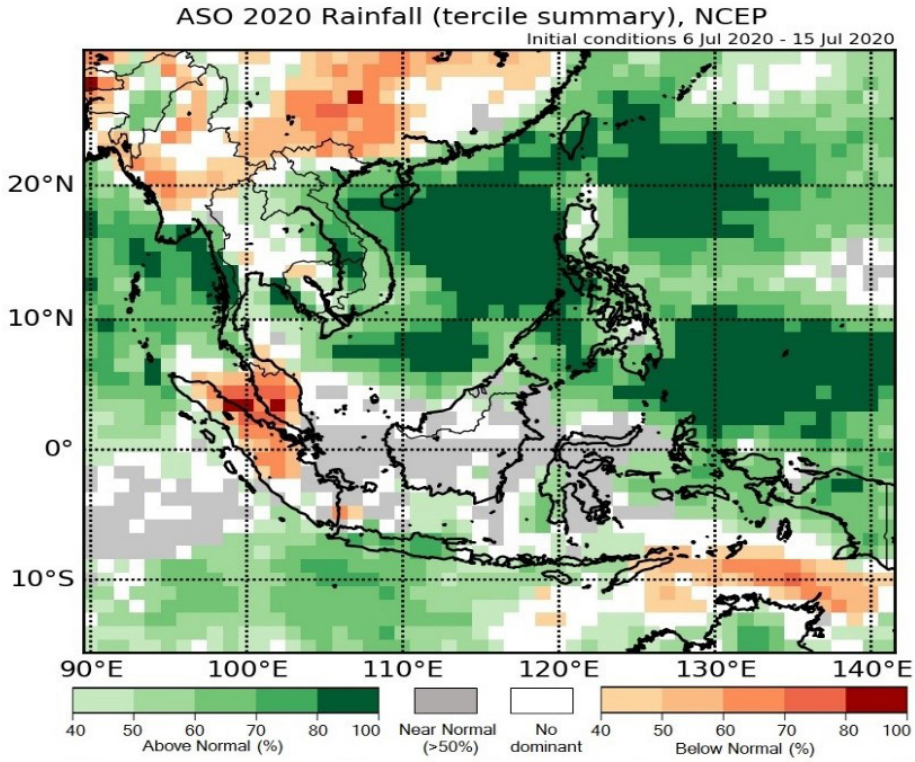


Figure 16. Rainfall tercile summary predictions for three months (August-September-October 2020)

The forecast rainfall from the National Aeronautics and Space Administration (NASA) for the next two months (August-September) also shows above-average rainfall with increases from 45 mm to 100 mm in the LMB. This will result in wetter conditions to those in 2019. Figure 17 shows the forecast rainfall in two months from August to September 2020 over the LMB. These also indicate

that some Depressions or Tropical Depressions (TD), Tropical Storms (TS) or Typhoons (TY) may occur over the LMB from August to September 2020.

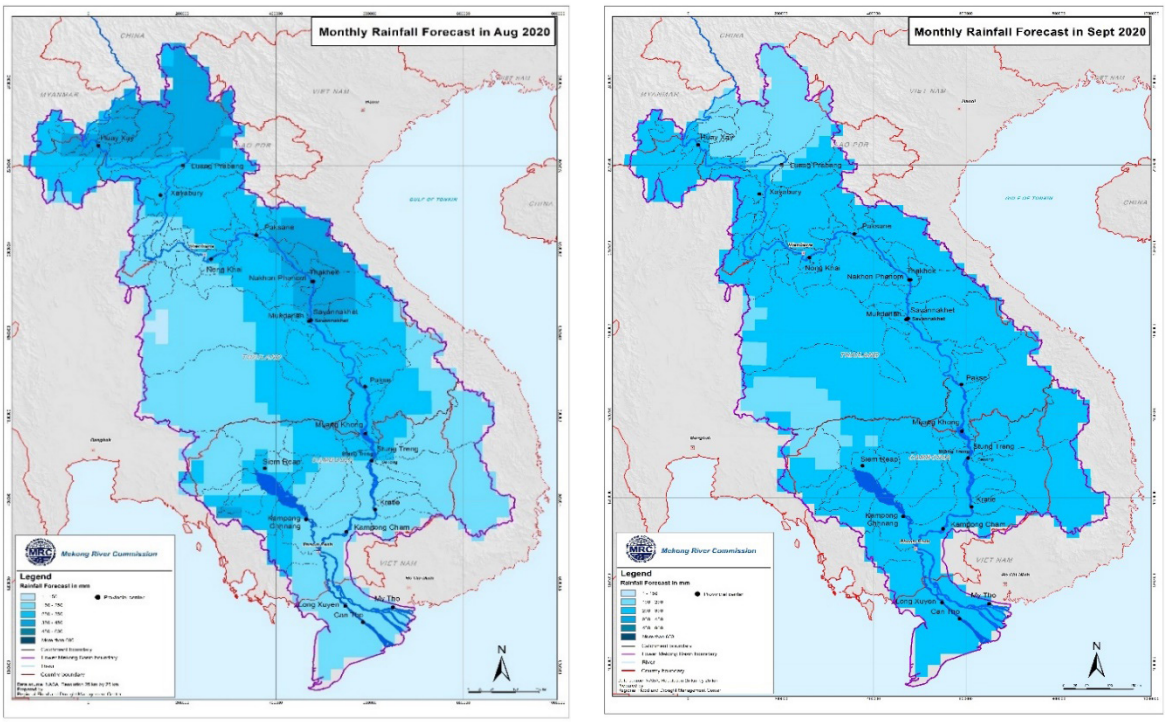
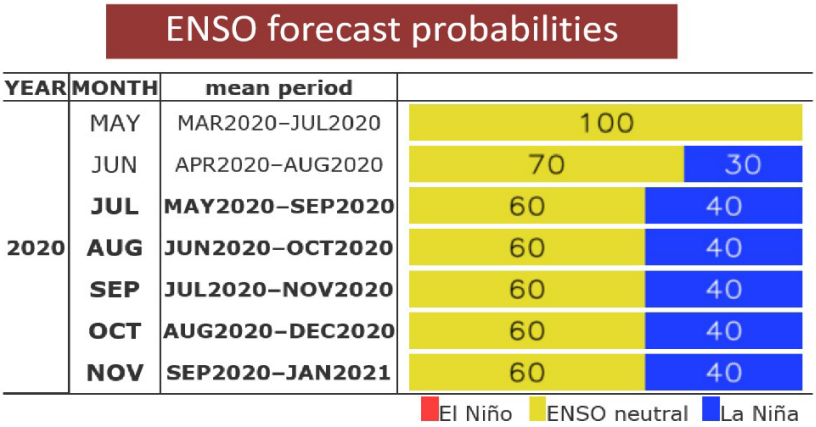


Figure 17. The Forecasted Rainfall from satellite in Aug-Sept 2020 in the LMB

5.2 Predictions for the ENSO for August to November 2020

The El Nino Southern Oscillation (ENSO) modelling shows that:

- In the upper troposphere, large-scale divergence anomalies are predicted over the tropical Indian Ocean, and large-scale convergence anomalies are predicted around the date line in the equatorial Pacific.
- A high probability of above-normal precipitation is predicted over South Asia and over the South China Sea. A high chance of below-normal rainfall is predicted in the seas east of the Philippines.
- A high probability of above-normal temperatures is predicted over Southeast Asia, and part of East Asia.



Red, yellow, and blue bars indicate probabilities that the five-month running mean of NINO.3 SST deviation from the latest sliding 30-year mean is +0.5℃ or above (El Niño), between +0.4℃ and -0.4℃ (ENSO Neutral), and -0.5℃ or below (La Niña), respectively. Labels in lightface indicate the past months, and ones in bold face indicate the current and future months (source: TCC/JMA).

Figure 18. ENSO forecast probabilities based on JMA/MRI-CGCM2 model

5.3 Anomaly of air temperature and total precipitation

The Meteoblue Forecast[2] predicts that in August and September 2020, the Monthly Mean Temperature Anomaly (MMTA) (air temperature) over the LMB will be in the range of 0.5°C to 1°C, while, in October, it will be in the range of -0.2°C to 0.2°C (Figure 19, left).

The prediction on the Total Precipitation Anomaly (TPA) shows that the TPA will be greater than 50 mm over the LMB in August and September 2020. But in October 2020, most parts of the LMB will experience drier conditions; the TPA indicates about 15-20 mm less rain in Cambodia and less than 10 mm in the upper LMB of Thailand (Figure 19, right).

2 The seasonal forecasts were computed by the National Oceanic and Atmospheric Administration (NOAA) and the National Centre for Environmental Prediction (NCEP) (https://content.meteoblue.com/).

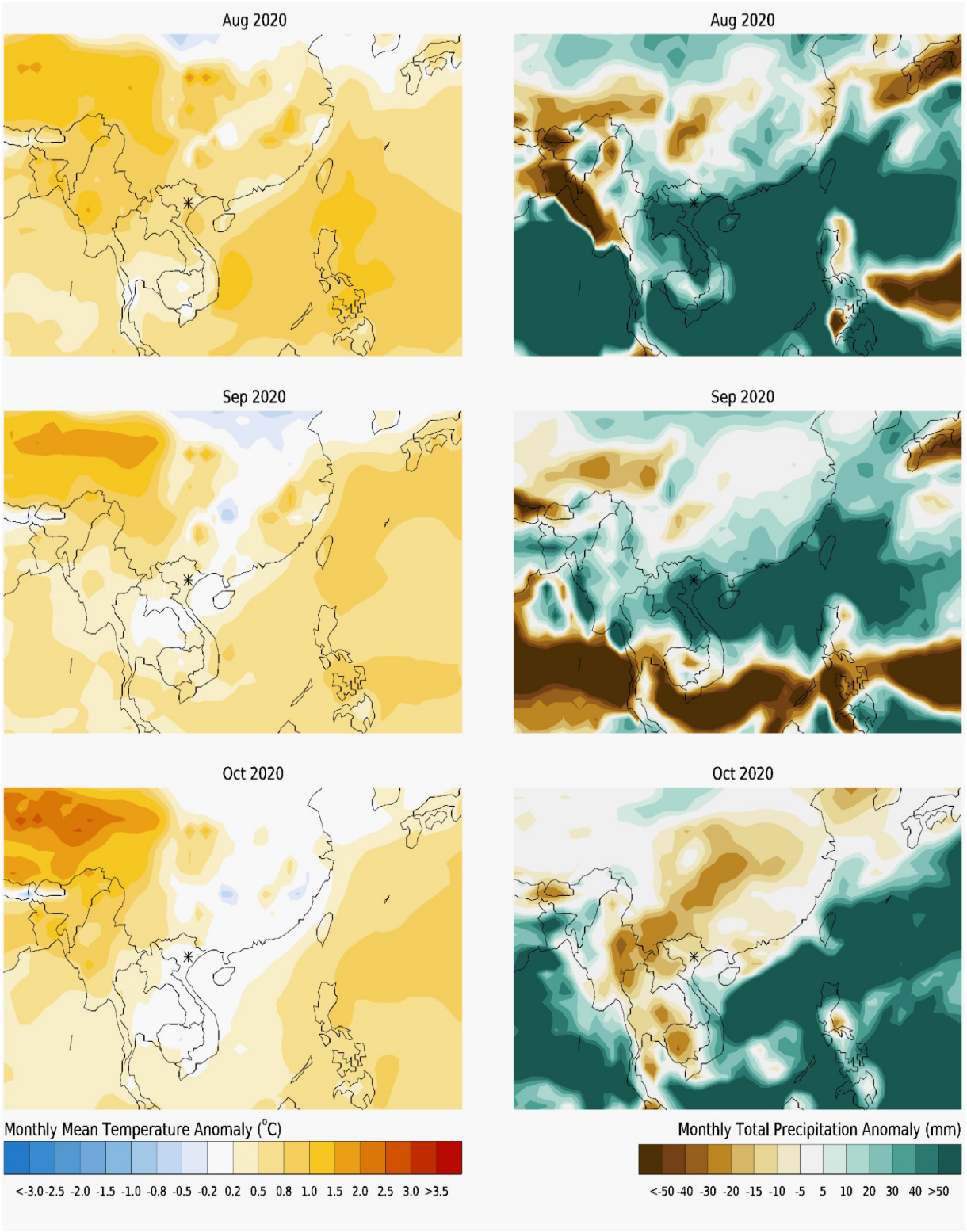


Figure 19. Monthly mean Temperature anomaly and monthly total Precipitation Anomaly

5.4 Drought forecasting

The LMB is forecast to receive a similar rainfall pattern to 2019, with the rains being delayed to August-September; however, these rains may be higher than the average, albeit with a drier than usual October. The forecast areas with a deficit of rainfall during August are around the border area between Lao PDR and Thailand (Vientiane, Borikhamxay and Nong Khai), and from eastern provinces of Cambodia towards 3S areas including Kratie, Mondul Kiri, Dak Lak, Stung Treng, Ratanakiri, Gia Lai, Champasak, Attapeu, Kon Tum, and Sekong with severely dry conditions (Figure 20).

However, the standardised precipitation maps for August 2020 and the three-month forecast from July to September 2020 shows patches of very dry to extremely dry conditions over the LMB. This is particularly evident in the border area between Lao PDR and Thailand, and the eastern part of the LMB over the 3S basin and surrounding areas.

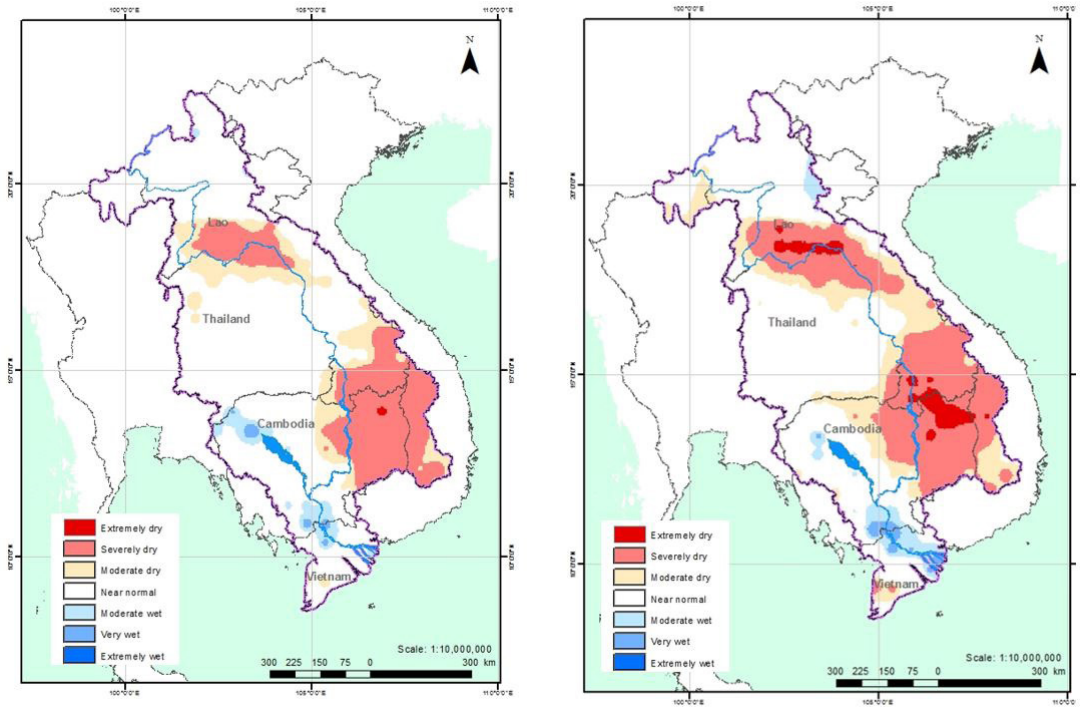


Figure 20. Standardised Precipitation maps of one month for August (left) and three months for July-Sept 2020 (right)

6 Potential Impacts

The LMB has experienced exceptionally low flows for the second consecutive year. The unprecedented drought in 2019 that affected the Mekong region and marked an extraordinarily low flow in the LMB has carried over into 2020 as the catchments are drier, and storage is lower. The situation has been exacerbated by significantly lower rainfall since the beginning of 2020.

Preliminarily, the 2020 low flows and drought appear to be caused by hydro-meteorological conditions including:

- Abnormal low rainfall in the LMB, which has been affected by the El Nino weather phenomenon since 2019 (normally an El Nino event lasts two years) that causes climate variability in the region.
- The prolonging of the low flow conditions from 2019 with drier areas and lower storage.
- Lower water flow contributions from the Mekong tributaries.

However, the current low flow conditions may have been exacerbated or ameliorated by operations of the mainstream dams in the UMB and the tributary dams in the LMB. Unfortunately, the MRC Secretariat does not have the official data and information to verify the potential impacts of storage operations in the upstream basin. A thorough analysis of hydro-meteorological conditions would require increased cooperation from all the six riparian countries through which the Mekong River flows.

Preliminarily, the 2020 low flows conditions will result in significant implications for the Tonle Sap Lake and the Mekong Delta. With the prevailed low flow conditions, the following adverse impacts may come into play:

- **Ecological imbalance** due to significant changes of timing, duration and extent of inundations of the Tonle Sap Lake and its surrounding floodplains. This may 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 MRC Fish Abundance and Diversity Monitoring Programme in the Tonle Sap Lake shows that the household fish catch in Kampong Chhnang Province decreased by about 35% in 2019 compared to the average over the previous eight years (2011-2018). Compared with the wettest or extreme flood year in 2013, the total fish catch has decreased by about 50%. There is a correlation between fish catch and water flows, coupled with the timing and duration of the flows from the Mekong mainstream.
- **Socio-economic impacts.** The Tonle Sap Lake fisheries contribute to more than 60% of total annual fish catch in Cambodia (for example, 770,000 tons). The significant delay and lower reverse flows in 2020 may further reduce the fish catch in Cambodia, leading to reduced food security for the most vulnerable peoples in the country and in the region.

7 Mitigation Measures

Drought and flood management is typically addressed through increased water storage and curtailments to diversions for irrigation. The BDS 2021-2030 as well as the SP 2021-2025 place an increased emphasis on the operational management of the LMB in this regard and recommend investigating the potential for jointly owned storage infrastructure and for increasing storage capacity (both human-made and natural ones).

At present, the Mekong River Basin (both UMB and LMB) has only 66 days of storage, and most of these are to provide for hydropower security. There are, therefore, limited opportunities for managed releases from storage. However, studies by a former MRC Programme, the Initiative for Sustainable Hydropower (ISH), have shown that it is possible to correct the timing and volume of the reverse flow into the Tonle Sap Lake in a typical year, should most of the storage in the LMB be released. The MRC Secretariat is also exploring Water Policy/Water Diplomacy aspects of this kind of operational management through an MRC Joint Platform.

In the interim, the MRC Secretariat will continue to monitor the situation and inform the Member Countries and public of the changing hydro-meteorological conditions in the LMB and will communicate with the public regarding any actions being taken. Member Countries and the public can also closely follow the flow conditions on the MRC website (https://www.mrcmekong.org/), including river monitoring and flood forecasting, drought monitoring and forecasting, and mainstream flows and reverse flow monitoring through the PMFM website (https://pmfm.mrcmekong.org/).

Per the 1995 Mekong Agreement and MRC Procedures, the National Mekong Committee Secretariats (NMCS) in each Member Country should facilitate further assessment by the MRC Secretariat. The NMCS has, therefore, been approached 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. These data should form part of the Procedures for Water Use Monitoring (PWUM) and Procedures for Notification, Prior Consultation and Agreement (PNPCA).

In addition to public reporting by the MRC Secretariat, with regards to possible actions to minimise impacts at the national level, the Member Countries may consider the following:

- Warning **water users and operators** of the forecasts for the coming months if the water levels during this flood season do not improve significantly.
- Requesting **hydropower operators** and/or irrigation operators to make changes in their near-term operations if the water levels during this flood season do not improve significantly.
- Assessment of the readiness of **drought contingency plans and actions,** and the implementation of these drought contingency plans.
- Information dissemination/sharing and building **awareness in targeted communities** living along the Mekong mainstream to make them aware of the causes and forecasts of the low flows, and actions to increase their climate resilience.
- Seeking **alternate water sources** (like groundwater sources) to ensure supplies of water for supplementary or emergency uses.

- For **navigation** purposes, informing the competent authorities and the private sector to prepare for difficult navigation conditions and possible dangerous sections of the river.
- Monitoring **bank erosion**, which has already occurred or is likely to occur along the river, which might affect livelihoods and property.

The MRC Secretariat will continue to share information and engage the MRC Dialogue Partners (China and Myanmar) and the Lancang-Mekong Cooperation (LMC) Water Centre regarding the flow conditions and for possible action by the MRC Member Countries in their consideration to request China to have a water supplement as they did in 2016 in order to relieve the low flow conditions in the LMB in coming dry season if the conditions remain critical.

8 Conclusions and Recommendations

8.1 Conclusions

The LMB is in the grip of a severe two-year drought. The low flows of 2019 have carried over into 2020, and to date (July) the 2020 situation appears to be worse than the 2019 one.

As in 2019, this appears to be driven by reductions in rainfall over the LMB, associated with a delay in the Monsoon rains. However, the Monsoon has been delayed even further in 2020.

While the forecasts of rainfall over the remainder of the 2020 wet season vary[3], the general prognosis is that August and September rainfall may be higher than normal, tapering off in October. This would follow the pattern seen in 2019.

Drought monitoring suggests that temperatures may be higher than normal, and parts of the LMB may experience less rainfall in August and September.

The lack of official rainfall and storage data for the Upper Mekong River Basin has prohibited a comprehensive assessment of whether the upper basin had more rainfall, and whether releases from storage on the Upper Mekong River Basin would be viable – a situation that has been considered a key challenge and which is urgent to address (An, Kittikhoun & Meas, 2020).

Reverse flows into the Tonle Sap Lake are lower than they were at this time last year, and considerably lower than those in 2018. The PMFM requirements of Article 6B (of the 1995 Mekong Agreement) have been compromised, and as such the MRC should explore the causes of the low flows and suggest mitigation options. This is the thrust of this Situation Report.

This could have severe impacts on the economies of Cambodia due to the loss of fisheries and irrigation potential, and Viet Nam due to reduced productivity in the Delta rice bowl. Lao PDR and Thailand are also likely to suffer reductions in agricultural productivity, with rain-fed crops suffering the most losses.

8.2 Recommendations

The immediate mitigation options are for the Member Countries – Cambodia, Lao PDR, Thailand and Viet Nam – to implement in their drought management plans, and to request that storage operators consider additional releases and irrigators reduce their abstractions.

In the long-term, the MRC will explore potential operational management options for drought and flood mitigation, as well as the potential for additional jointly operated storage. This was recommended in the Basin Development Strategy for 2021-2030 and the MRC Strategic Plan for 2021-2025.

3 Between the different agencies.

This will include technical viability as well as water diplomacy and institutional considerations. This should ultimately result in the development of drought and flood management cooperation mechanisms, leading to recommendations to the Member Countries and the MRC Dialogue Partners.

Transparent data and information sharing is fundamental both in the short and long run, as previously pointed out in MRC's Commentary Note (MRC, 2020). Inadequate information on water infrastructures in the Mekong River Basin and the way these infrastructures are operated has made it challenging to forecast impacts.

If the Member Countries share more information with the MRC, especially data and information on water use and infrastructure, the Commission will be in a better position to support seasonal water resources planning and management, and address misperceptions by the public and in the media.

For the past 16 years, China has been providing its water level and rainfall data only during the flood season from two of its many stations on the Upper Mekong. This is useful for flood forecasting but insufficient for other management purposes.

To increase the transparency of dam operations and to demonstrate cooperation in good faith, China should consider providing more data that covers more stations and includes dry season information. The MRC Member Countries will also need to provide more data on their dam operations. This will enable the Commission to produce more comprehensive and accurate monitoring reports, covering the entire Mekong River basin, not just the lower reaches.

In turn, this will support the MRC Member Countries to better plan and manage water resources to capture the potential benefits and address potential short-term risks, and China to clear misperceptions. It will also help the riparian communities to better prepare for any potential negative impacts that could have on their livelihoods.

References

Allen, D. J., Smith, K. G., & Darwall, W. R. T. (2012). *The status and distribution of freshwater biodiversity in Indo-Burma*. Cambridge, UK and Gland, Switzerland: International Union for Conservation of Nature.

An, P.-H., Kittikhoun, A., & Meas, S. (2020). 25 years of Mekong cooperation: Achievements, challenges and the way ahead. *Mekong Connect, 2*(1). Retrieved from https://bit.ly/3kjdxRM

Kummu, M., Tes, S., Yin, S., Adamson, P., Józsa, J., Koponen, J., . . . Sarkkula, J. (2014). Water balance analysis for the Tonle Sap Lake–floodplain system. *Hydrol. Process., 28,* 1722–1733. doi:10.1002/hyp.9718

MRC. (2005). *Overview of the hydrology of the Mekong Basin*. Vientiane: Mekong River Commission Secretariat.

MRC. (2016). *Implementation report for 2011-2015 on the Procedures for the Maintenance of Flows on the Mainstream (PMFM)*. Vientiane: Mekong River Commission Secretariat. Retrieved from https://bit.ly/3a4XH8J:

MRC. (2020). *Understanding the Mekong River's hydrological conditions: A brief commentary note on the "Monitoring the Quantity of Water Flowing Through the Upper Mekong Basin Under Natural (Unimpeded) Conditions" study by Alan Basist and Claude Williams (2020)*. Vientiane: Mekong River Commission Secretariat. Retrieved from http://www.mrcmekong.org/assets/Publications/Understanding-Mekong-River-hydrological-conditions_2020.pdf:

Poulsen, A. F., Ouch, P., Sintavong, V., Ubolratana, S., & Tung, N. T. (2002). *Fish migrations of the Lower Mekong River Basin: Implications for development, planning and environmental management* (MRC Technical Paper No. 8). Phnom Penh: Mekong River Commission Secretariat. Retrieved from https://bit.ly/33pR5jY:

UNESCO. (2018). Tonle Sap biosphere reserve. Retrieved from http://www.unesco.org/new/en/phnompenh/natural-sciences/biosphere-reserves/tonle-sap-biosphere-reserve/

ISSN: 1728-3248

Mekong River Commission Secretariat

P. O. Box 6101, 184 Fa Ngoum Road, Unit 18 Ban Sithane Neua,
Sikhottabong District, Vientiane 01000, Lao PDR
Tel: +856 21 263 263. Fax: +856 21 263 264
ww.mrcmekong.org