Mekong River Commission

Regional Flood and Drought Management Centre

Weekly Situation Report for the Wet Season in the Mekong River Basin

Prepared on: 04/08/2020, covering the week from 28 July to 03 August 2020

Weather Patterns, General Behaviours of the Mekong River and Outlook Situation

General weather patterns

The weather outlook bulletins for the 3 months (Aug-Sep-Oct) and weather maps issued by the Thailand Meteorology Department (TMD) were used to verify the weather condition in the LMB. Since early August 2020, there were moderate rainfalls over the Lower Mekong Basin (LMB). The TMD expected of low pressures and tropical cyclones may move closer to the Mekong Region in August and continue to September which can bring heavy rainfall in the Mekong region. They also predicted of scattered to fairly widespread thundershowers with isolated heavy rain from August to September 2020. **Figure 1** presented the weather map effected on 02 August 2020, which showed the Tropical Storm of SINLAKU moves slowly to West direction. Consequently, flash and forest flood with overflow will inundate at some areas, which need to follow the weather forecast news and tropical cyclone warnings by each National Hydro-meteorological Center.

According to the Asian Specialized Meteorological Centre (ASMC), the increased shower rainfall over the Mekong sub-region, above-normal rainfall and hotspot activities will be happened in August and September 2020. In the southern ASEAN region, rainfall over most parts of the equatorial region is predicted to be above normal in August-September 2020.

Consequently, from August to September 2020, there will increasing chance of moderate rainfall to above average rainfall for most parts of the Asian countries especially in the Mekong region. **Figure 2** showed the outlook of rainfall for 2 months from August to September 2020 in Southeast Asia, which showed the above-normal rainfall for the Mekong region.

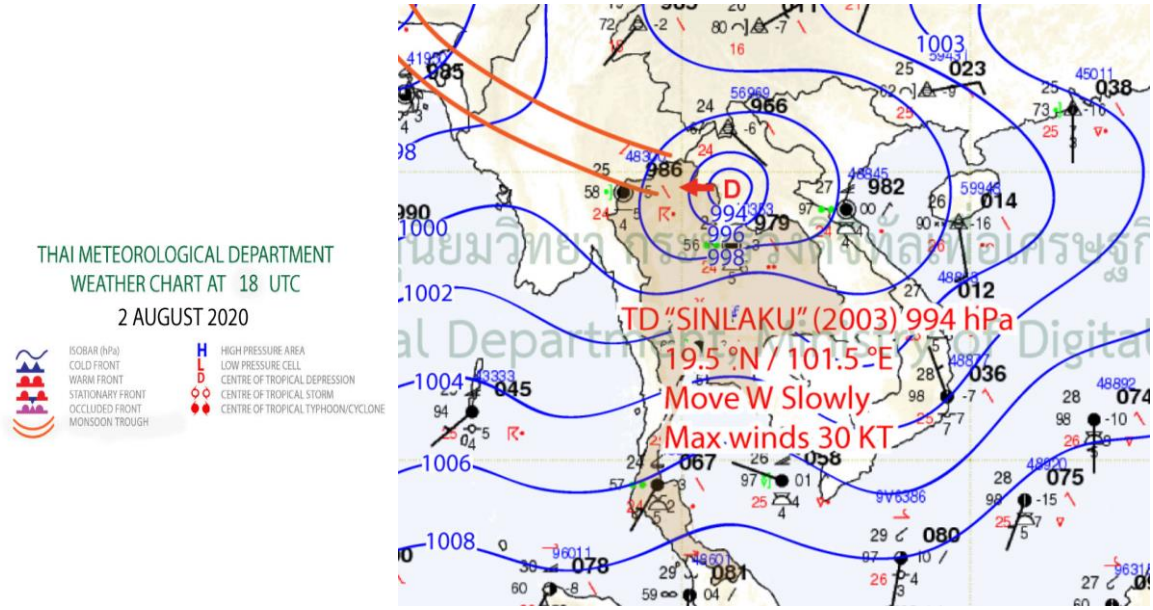


Figure 1 Summary of weather condition over the LMB on 02 August 2020

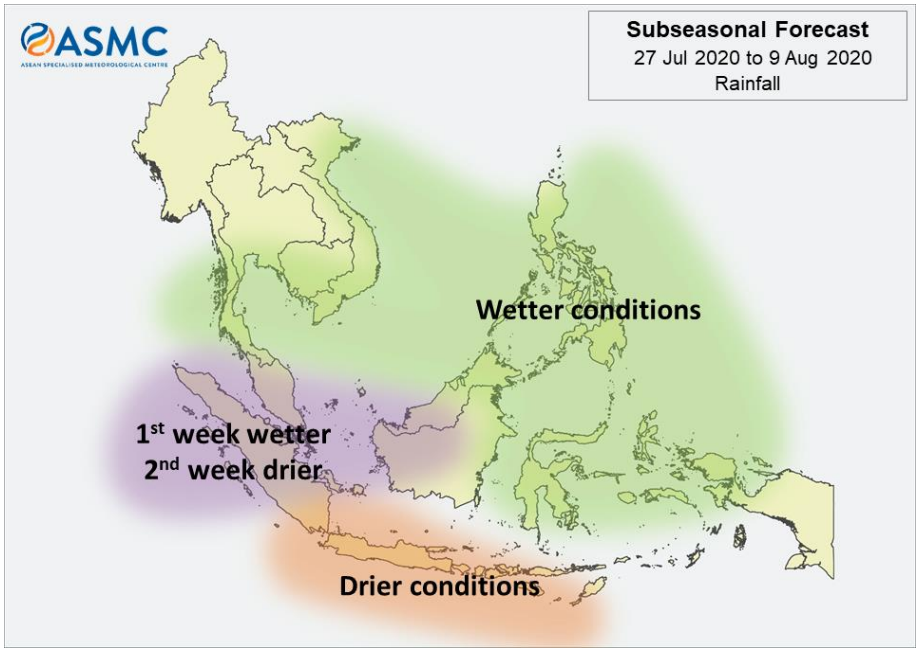


Figure 2 The Aug-Sept 2020 predicted rainfall over Asian Countries by ASMC

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

The TS of SINLAKU has move slowly from the South China Sea toward West direction, which hit North of Vietnam, Nothern part of Lao PDR and North-eastern Thailand. This TS is moving with about 13 km/h according to the Joint Typhoon Warning Centre (JTWC) and PDC Global. **Figure 3** showed the SINLAKU movement and hit the north-eastern part of the LMB.

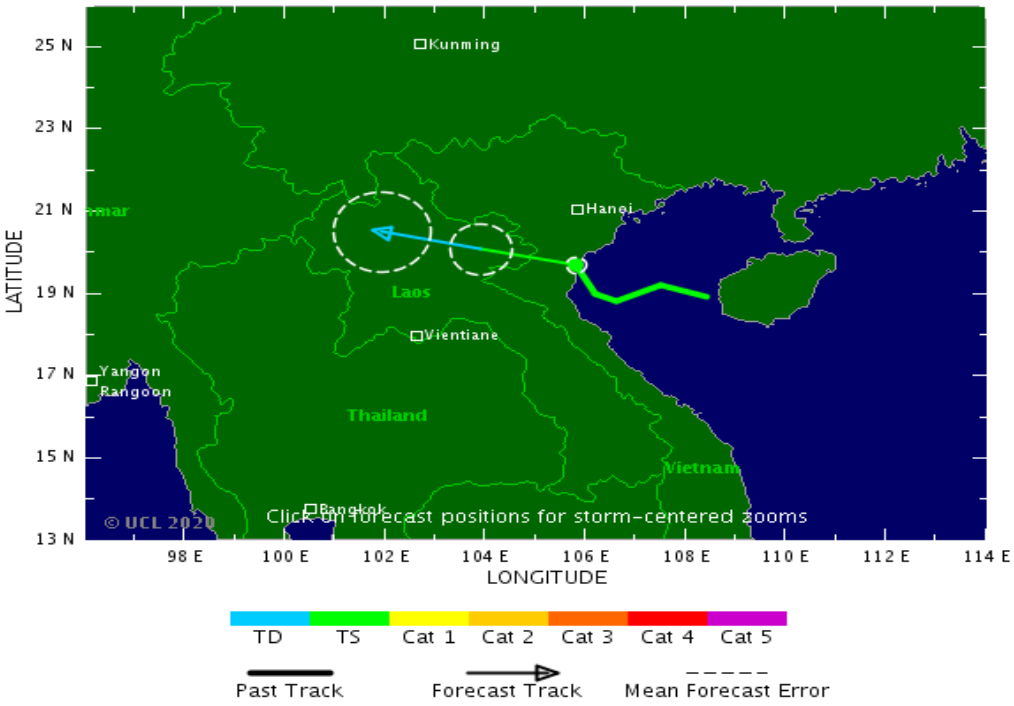


Figure 3 The movement of TS “SINLAKU” from the Sea

The rainfall pattern over the LMB

This week’s rainfall is considered heavy in some parts, which varied from 20 mm to 230 mm in different stations along the Lower Mekong River (LMR). The weekly total observed rainfall at the selected stations

over the LMB from 28 Jul to 03 Aug 2020 is showed in **Figure 4**. To verify the area rainfall, **Figure 5** showed the map of weekly rainfall distribution in the Lower Mekong Basin from 27 July to 03 August 2020**.** It is indicated that the highest rainfalls in this week were focused mostly the upper part of the LMB from Chiang Sean to Khong Chiam, and the 3S area.

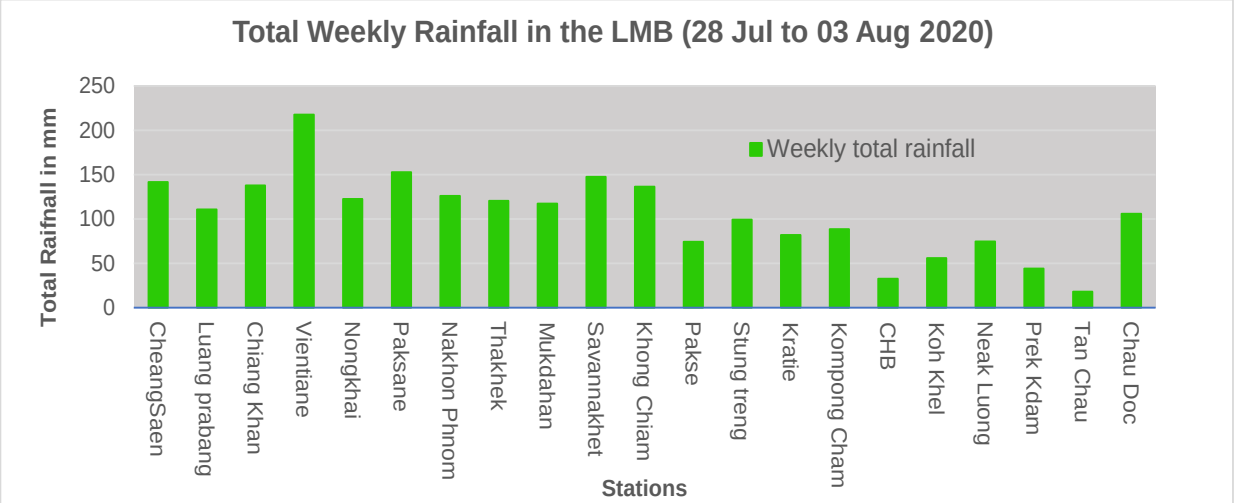


Figure 4 Weekly Total Rainfall over the LMB from 21 to 27 July 2020

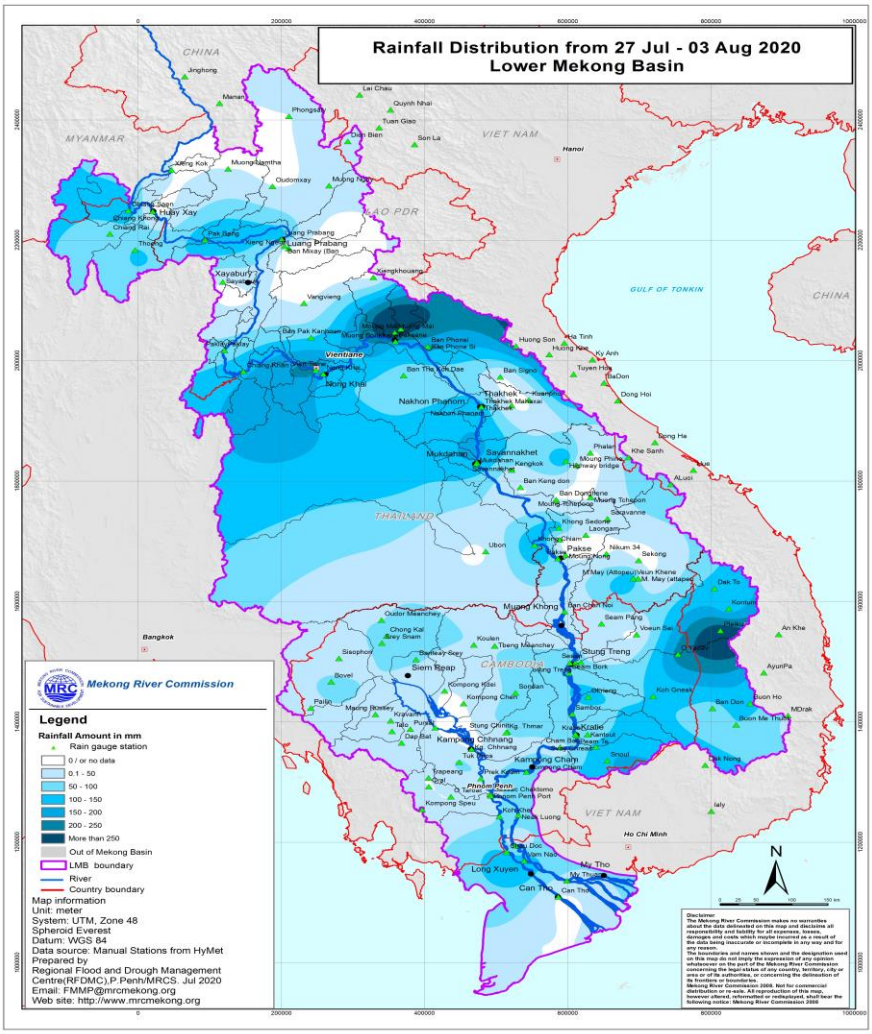


Figure 5 The weekly rainfall distribution from 27 July to 03 August 2020 over the LMB

General Situation of water levels on the Mekong River from 28 July to 03 August 2020

This week water levels at the upper most station at Thailand's Chiang Sean were fluctuated below their Long-Term-Average (LTA) level. This fluctuated water levels were due to the impact of inflow from upstream and the less rainfall within this week from catchments.

Water levels at upper part of Lao's Luang Prabang and Thailand's Chiang Khan are likely influent by hydropower dam at Xayaburi and upstream dams on tributaries inflows on Nam Beng, Nam Ou, Nam Suong and Nam Khan. At Chiang Khan, water levels were below their LTA and even reached to their minimum levels.

Water levels at stations in the middle part of LMB from Laos's Vientiane to Thailand's Nakhon Phanom were followed the same trend from upstream, which the current water levels are below their LTAs and reached to their minimum levels. Also, water levels at Thailand's Mukdahan to Lao's Pakse were fluctuated below their LTAs and reached to the minimum levels. The current water levels at these stations are lower than their historical minimum levels (1961-2019).

This week water levels at stations of Cambodia's Stung Treng, Kratie, Kampong Cham, Neak Luong, on the Mekong, Chaktomuk and Koh Khel on the Bassac and Phnom Penh Port and Prekdam on the Tonle Sap were increased but still below their minimum levels (1960-2019).

For the 2 stations at Vietnam's Tan Chau and Chau Doc, their water levels are fluctuating below their LTAs due to the daily tidal effect from the sea. The attached hydrograph at each key station is showed in **Annex A**. **Figure 6** presented the key stations with model application for river flood forecasting during the wet season from June to October and River Monitoring from November to May for the Dry Season.

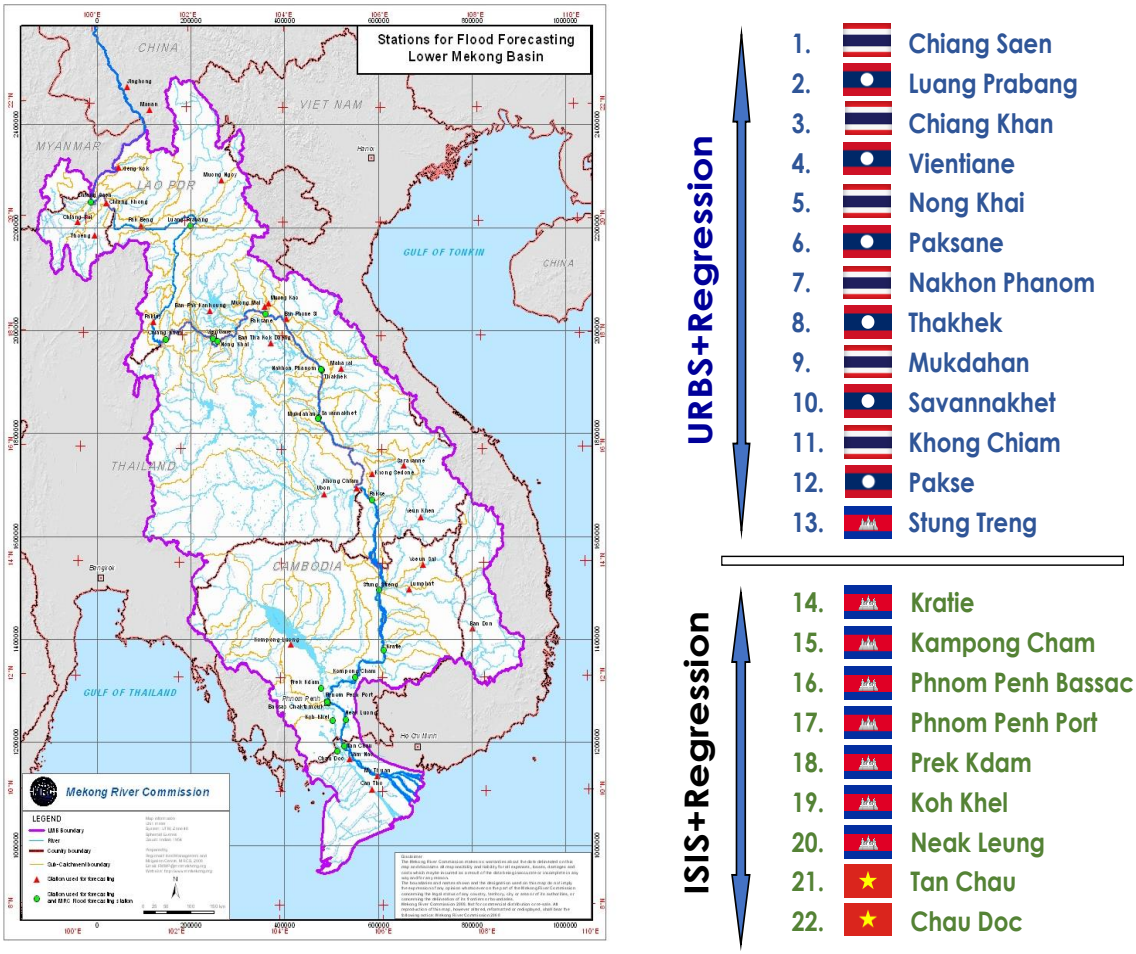


Figure 6 Key stations for River Monitoring and Flood Forecasting with Models Application

For stations from Chiang Saen and Luang Prabang

Water levels from 28 July to 03 August 2020 at Chiang Sean station were fluctuated below their LTA levels, varied from -0.50 m to 0.32 m. Water levels at Lao's Luang Prabang are likely impacted by downstream hydropower dam at Xayaburi and upstream dams from tributaries on Nam Beng, Nam Ou, Nam Suong and Nam Khan. The current water levels at these stations are below their LTAs.

For stations from Chiang Khan, Vientiane-Nong Khai and Paksane

Water levels from 28 July to 03 August 2020 at Chiang Khan station were likely nominated by upstream hydropower dam of Xayaburi, which fluctuated in daily from -0.36 m to 0.70 m. For downstream from Laos's Vientiane to Paksane, water levels are influencing from upstream inflows and rainfall from sub-catchments. The current observed water levels at these stations are lower than their minimum levels, varied from -0.28 m to 0.96 m during this week.

For stations from Nakhon Phanom to Pakse

Water levels from 28 July to 03 August 2020 at Thailand's Nakhon Phanom to Laos's Pakse stations were fluctuated in daily, varied from -0.06 m to 0.50 m, followed the inflow from upstream and less rainfall from upper sub-catchments. The current observed water levels at these stations are lower than their minimum levels.

For stations from Stung Treng to Kampong Cham/ Phnom Penh to Koh Khel/ Neak Luong

Water levels from 28 July to 03 August 2020 at stations of Cambodia's Stung Treng and Kratie Kampong Cham, Chaktomuk, Koh Khel, Phnom Penh Port and Prekdam were fluctuated in daily, varied from -0.16 m to 0.28 m. The current water levels at these stations are lower than their minimum levels.

For the tidal stations at Tan Chau and Chau Doc

From 28 July to 03 August 2020, water levels at these 2 tidal stations of Tan Chau and Chau Doc were fluctuated below their LTAs due to the daily tidal effect from the sea.

The Tonle Sap Flow

At the end of Dry season when water levels of the Mekong are raised up, flows of the Mekong River are being reversed into the Tonle Sap Lake (Reversed flow/inflow). It normally happened in between May to August. **Figure 7** showed the seasonal change of inflow/reversed flows and outflows of the TSL at Prekdam, in comparison with the flows of 2018, 2019 and their LTA level (1997-2019). Up to 03 August 2020, it was observed that the reversed flows into the Tonle Sap Lake (TSL) are not happened yet. The delay of the reversed flows into the Tonle Sap Lake is due to the low water levels of the Mekong mainstream. The low inflow from the Mekong River and the most likely highly affected by less rainfall in the upper sub-catchment areas of the Lake caused the water levels in the Tonle Sap Lake very low.

Figure 8 shown the seasonal change in monthly of volume flows hydrographs up to 03 August 2020 for the Tole Sap Lake, compared with volumes in 2018, 2019 and their LTA and fluctuated levels (1997-2019). It showed this month in July 2020 is in a critical level, compared with last year 2019 and historical minimum levels. **Table 1** showed the monthly change in flow volume of the Tonle Sap Lake, which showed the critical flow volume of the TLS Lake in July 2020, compared to its historical minimum value and volumes of 2018 and 2019. It showed that the Tonle Sap Lake is affected by the low inflow from the Mekong and the less rainfall in the surrounding sub-catchments.

The low inflows (inflows from the Mekong river and inflows from tributaries) in the early wet season of 2020, resulted in a very critical situation of the Tonle Sap Lake. It also demonstrates the influencing of the relationships between reversed flows and water levels of the Mekong river and flow direction in a complex hydraulic environment of the Tonle Sap Lake, during this wet season. It is found that more than half of the annual inflow to the lake originates from the Mekong mainstream. Thus, flow alterations in the mainstream would have direct impacts on the Tonle Sap water levels and hydrology also.

The low volume flow of the Tonle Sap Lake could affect the surrounding floodplain for fish spawning in the flooded forest, ecosystem due to the reduction of inundated area, and could face of water shortage for agricultural production in that area.

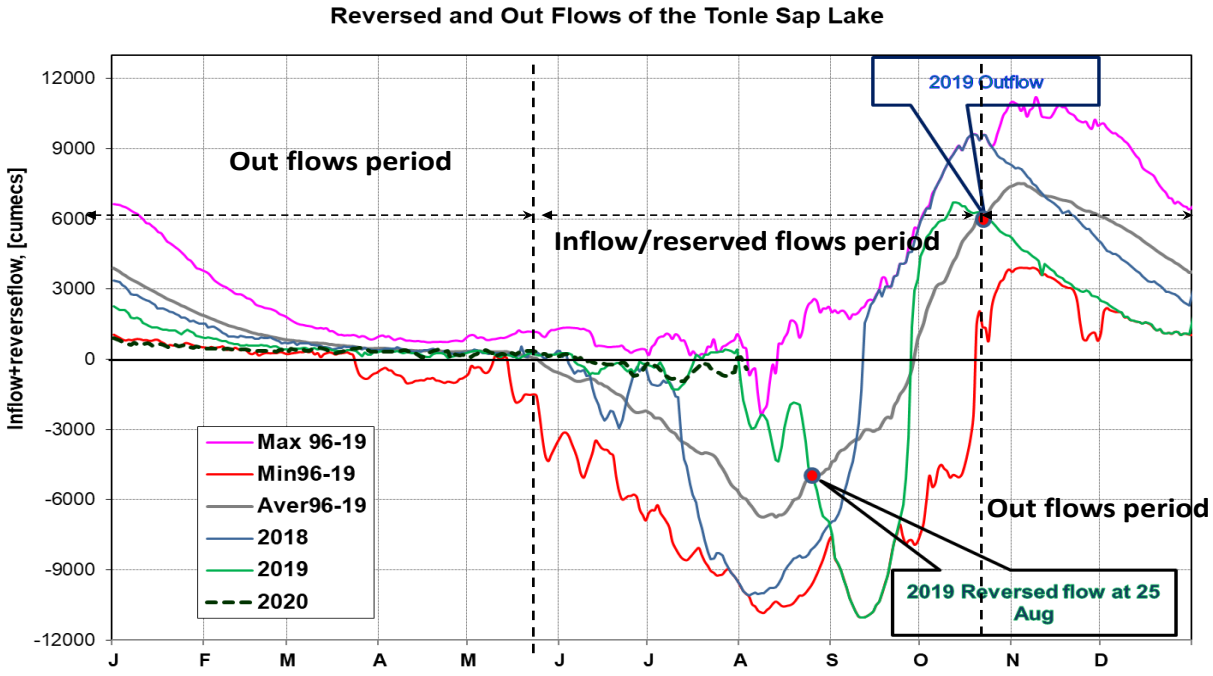


Figure 7 The seasonal change of inflows and outflows of the Tole Sap Lake up to 20 July 2020

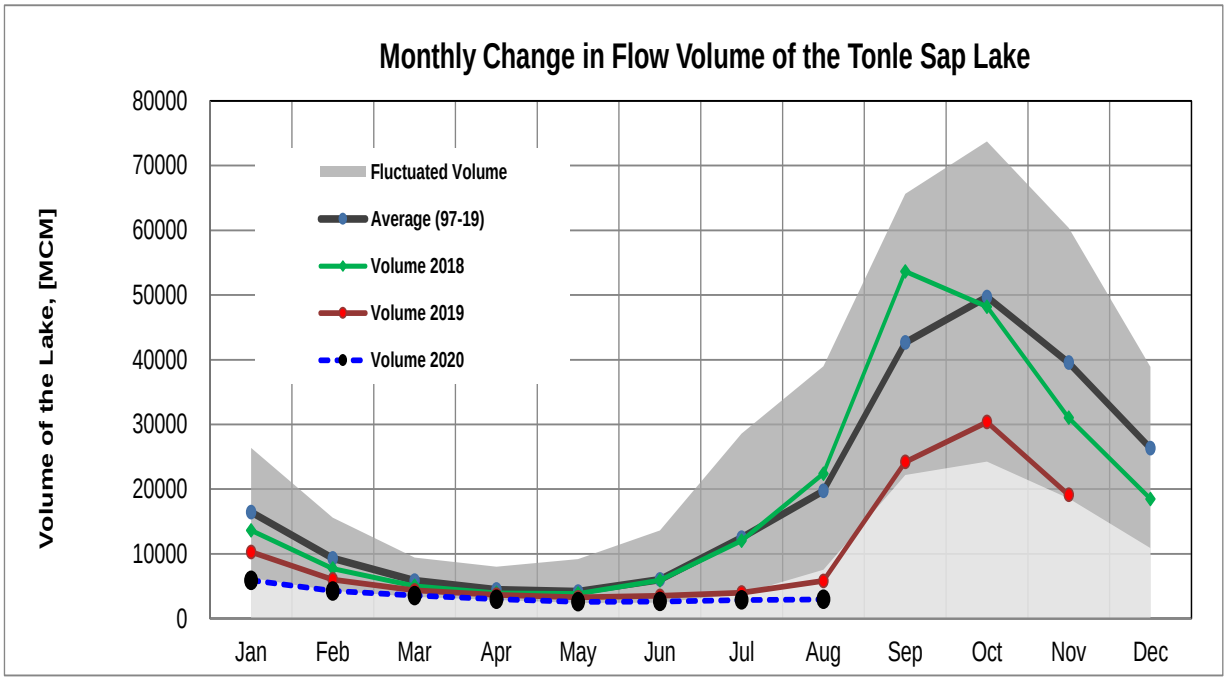


Figure 8 The seasonal change in monthly of Volume Flows of the Tole Sap Lake up to 03 August 2020

Table 1: The monthly change in flow volume of the Tonle Sap Lake up to 03 August 2020

Month	Average Volume (97-19) [MCM]	Max Volume [MCM]	Min Volume [MCM]	Volume 2018 [MCM]	Volume 2019 [MCM]	Volume 2020 [MCM]	Percentage of Volume in 2020 [%]
Jan	16452.95	26357.53	6272.01	13633.41	10285.31	5906.80	35.90
Feb	9312.36	15596.22	4281.41	7729.72	6019.30	4264.19	45.79
Mar	5868.92	9438.24	3350.92	5037.06	4354.62	3553.99	60.56
Apr	4474.98	8009.14	2875.42	3956.47	3667.47	2992.61	66.87
May	4166.07	9176.93	2417.81	3864.00	3266.43	2594.92	62.29
Jun	6034.10	13635.01	2470.54	5919.18	3517.06	2635.32	43.67
Jul	12502.58	28599.56	3832.51	12024.96	4001.99	2882.79	23.06
Aug	19718.46	39015.12	7554.93	22399.65	5812.35	2960.43	
Sep	42644.05	65632.35	22180.73	53639.54	24194.19		
Oct	49698.19	73757.23	24276.79	48193.08	30358.38		
Nov	39542.58	60367.33	18576.01	31036.07	19112.65		
Dec	26325.13	38888.95	10869.43	18469.21	10577.29		
	Critical situation, comapred with historical Min values						
	Normal condition, compared with LTA (Long term average)						
	Low volume situation, comapred with LTA values						

Discussion and Conclusion

From 27 July to 03 August 2020, the trend of water levels at Chiang Sean was fluctuated due to the inflow from upstream and amount rainfall from catchments. Water level at Chiang Sean is relied from inflow at Jinghong Hydropower Station on Lancang and its catchment rainfall.

Luang Prabang station is likely nominated by back water effect due to hydropower dam operation from upstream (tributaries inflow) and downstream at Xayaburi, which showed their water levels are almost stable and fluctuated below their LTA levels. It was observed that water levels at this station have been affected, since the impounding reservoir at Xayaburi in October 2019.

Water levels at stations in the middle part of the Mekong River from Vientiane to Pakse were also fluctuated, following the same trend of upstream and effects by rainfall in catchments. The recent water levels at all these stations are below their minimum levels. These critical low water levels indicated the low inflow from upstream and less rainfall from catchments.

From Stung Treng, Kratie, Kampong Cham and Neak Luong on the Mekong, Phnom Penh Port to Prekdam on the Tonle Sap and Chaktomuk and Koh Khel on the Bassac showed their current water levels are lower than minimum levels, although some rainfall in the low-lying area in this week.

Analysis of the Mekong River Commission's data revealed that the drop of water levels along the Mekong mainstream were resulted from less rainfall from catchments inflows and low inflows from upstream since June 2020 due to reservoir operation and water retention from upstream on the mainstream and tributaries in the LMB.

Moreover, referred to Adamson et al (2010), the contribution to the Mekong river's flow from the Upper Mekong Basin in China (Yunnan component) is about 16% by the time the river discharges through the Mekong Delta into the South China Sea. By far the major contribution comes from the two majors 'left-bank' (eastern) tributaries between Vientiane – Nakhon Phanom and Pakse – Stung Treng, which together contribute more than 40% of the flows.

It was observed that since the beginning of this year 2020, water levels in the lower Mekong River are lower than their LTAs for all stations from up to downstream. Like many parts of the world, the Mekong region has been affected by the prolonged El Nino phenomenon, the phenomenon that usually causes extreme heat and insufficient rain. This climate change impact was observed since 2019. Therefore, a cause of low water levels in the Mekong mainstream in June-July 2020 are likely due to unusual low rainfall and the impact of climate change over the Mekong region.

Another potential important reason of low flow in the mainstream (Jan-Feb-Mar-April-May-June-July) were the contribution from major tributary dams. However, we do not have any official data to quantify their amount of contributions.

The Trend of water level and its Outlook

Based on daily flood bulletin on 03 August 2020, the daily forecasted water levels along the lower Mekong River at Chiang Saen will expect to be increased from 2.45 m to 2.90 m in the next 4 days on 08 August 2020. For Luang Prabang, water levels will be also increased from 9.30 m to 9.99 m at same period.

From Chiang Khan to Vientiane/Nong Khai, water levels will expect of drastically increase due to the heavy rainfall in their catchment inflows. The forecasting water levels at Vientiane station will increase from 4.08 m to 5.82 m in the next 4days, while at Pasksane will increases from 6. 32 m to 7.82 and Nakhon Phanom to Pakse, their water levels will roughly increase in between 0.03 m to 0.94 m in the next 5 days.

From Stung Treng to Neak Loung on the Mekong River, water levels will be also increased in between 0.06 to 0.45 m in the next 5 days.

Water levels of the Tonle Sap Lake at Prekdam and Phnom Penh Port will be increased in between 0.05 m to 0.35 m for the next 5 days. Water levels at Phnom Penh at Chaktomuk and Koh Khel on the Bassac River will be increased 0.30 m at the same period.

For Viet Nam's Tan Chau on the Mekong River and Chau Doc on the Bassac River, water levels will be decreased and fluctuated below their LTAs, followed daily effect tidal from the sea.

Table 2 showed the daily flood forecasting bulletin from 05 to 09 August 2020.Results of daily flood forecasting bulletin is available at http://ffw.mrcmekong.org/bulletin_wet.php.

The weekly flood forecasting performance, the forecasted accuracy and data input evaluation from 27 July to 03 August 2020 are presented in **Annex B**.

It is expected the above-normal rainfall can be occurred at from August and September 2020, which can contribute to the increased flow in the Mekong River.

According to ASMC and TMD, the low pressures and tropical cyclones may move closer to the Mekong Region in August and continue to September which can bring heavy rainfall in the Mekong region. Consequently, flash and forest flood with overflow will inundate at some areas, which need to follow the weather forecast news and tropical cyclone warnings by each National Hydro-meteorological Center.

Remark:

For details information on water levels and rainfall hydrographs at each key station are presented in **Annex A** and **Annex B** showed the Accuracy and performance of weekly flood forecasting activities.

- The water levels hydrographs showing the observed water levels for the Wet Season (**Annex A**)
- Weekly Accuracy and Performance of weekly river flood forecasting (**Annex B**)

Table 2 River Flood Forecast period from: 05 to 09 August 2020

LOCATION	Country	24-hr Observed Rainfall (mm)	Zero gauge above M.S.L (m)	Flood level (m)	Alarm level (m)	Observed W. level against zero gauge (m)		Forecasted Water Levels (m)					There is currently no flood warning in place at monitored sites on the Mekong					
		03-Aug				03-Aug	04-Aug	05-Aug	06-Aug	07-Aug	08-Aug	09-Aug	04	05	06	07	08	09
Jinghong		25.0				535.62	535.54							×	×	×	×	×
Chiang Saen		31.1	357.110	12.80	11.50	2.66	2.45	2.60	2.65	2.74			↓	↑			★	★
Luang Prabang		22.4	267.195	18.00	17.50	9.80	9.30	9.63	9.75	9.89	9.99	10.12	↓	↑	↑	↑		↑
Chiang Khan		0.8	194.118	16.00	14.50	7.10	8.80	8.90	9.05	9.15			↑		↑		★	★
Vientiane		0.0	158.040	12.50	11.50	3.10	4.08	5.43	5.54	5.71	5.82	5.89	↑	↑	↑	↑	↑	
Nongkhai		0.0	153.648	12.20	11.40	3.44	4.20	5.52	5.63	5.82			↑	↑	↑	↑	★	★
Paksane		17.4	142.125	14.50	13.50	5.34	6.32	6.95	7.66	7.72	7.82	7.90	↑	↑	↑		↑	
Nakhon Phanom		1.5	130.961	12.00	11.50	3.80	5.41	6.35	6.70	7.05			↑	↑	↑	↑	★	★
Thakhek		0.9	129.629	14.00	13.00	5.10	6.63	7.57	7.93	8.30	8.36	8.42	↑	↑	↑	↑		
Mukdahan		6.3	124.219	12.50	12.00	3.52	4.34	5.14	5.75	5.92			↑	↑	↑	↑	★	★
Savannakhet		3.4	125.410	13.00	12.00	2.00	2.10	2.45	2.71	2.80	2.92	2.93		↑	↑		↑	
Khong Chiam		26.0	89.030	14.50	13.50	4.32	4.43	4.75	5.53	6.12			↑	↑	↑	↑	★	★
Pakse		5.6	86.490	12.00	11.00	3.34	3.44	3.68	4.15	4.43	4.54	4.65	↑	↑	↑	↑	↑	↑
Stung Treng		2.0	36.790	12.00	10.70	4.58	4.62	4.71	4.91	5.31	5.55	5.64		↑	↑	↑	↑	↑
Kratie		0.0	-0.101	23.00	22.00	10.44	11.10	11.16	11.28	11.50	11.93	12.19	↑	↑	↑	↑	↑	↑
Kompong Cham		4.3	-0.930	16.20	15.20	4.92	5.50	6.15	6.22	6.38	6.61	7.05	↑	↑	↑	↑	↑	↑
Phnom Penh (Bassac)		0.2	-1.020	12.00	10.50	2.41	2.68	3.00	3.04	3.12	3.25	3.47	↑	↑	↑	↑	↑	↑
Phnom Penh Port		nr	0.070	11.00	9.50	1.43	1.70	2.03	2.07	2.17	2.31	2.54	↑	↑	↑	↑	↑	↑
Koh Khel		0.2	-1.000	7.90	7.40	2.41	2.68	2.98	3.02	3.10	3.22	3.45	↑	↑	↑	↑	↑	↑
Neak Luong		0.0	-0.330	8.00	7.50	1.52	1.78	2.03	2.27	2.30	2.38	2.49	↑	↑	↑	↑	↑	↑
Prek Kdam		7.4	0.080	10.00	9.50	1.46	1.78	2.10	2.15	2.24	2.36	2.61	↑	↑	↑	↑	↑	↑
Tan Chau		47.0	0.000	4.50	3.50	0.89	0.91	0.77	0.55	0.26	0.10	0.05		↓	↓	↓	↓	↓
Chau Doc		78.0	0.000	4.00	3.00	1.01	1.02	0.85	0.59	0.31	0.14	0.05		↓	↓	↓	↓	↓

REMARKS:

-: not available.

nr: no rain.

LEGEND	
rising water level	↑
stable water level	
falling water level	↓
alarm stage	
alarm situation	
flood stage	
no data available	×
as suggested by Thailand, forecasted values are not displayed pending further improvement of the system	★

Note: stable water level is defined as a daily change of less than 10 cm from Chiang Saen to Savannakhet; less than 5 cm at Pakse and Stung Treng and no more than 3 cm from Kratie downstream.
Flood stage is when the flood level is exceeded; the flood level is determined by the member states.
Alarm stage is defined of water levels range between alarm and flood levels.
Alarm situation is defined as a situation when water level is forecasted to reach flood stage within the next three days.

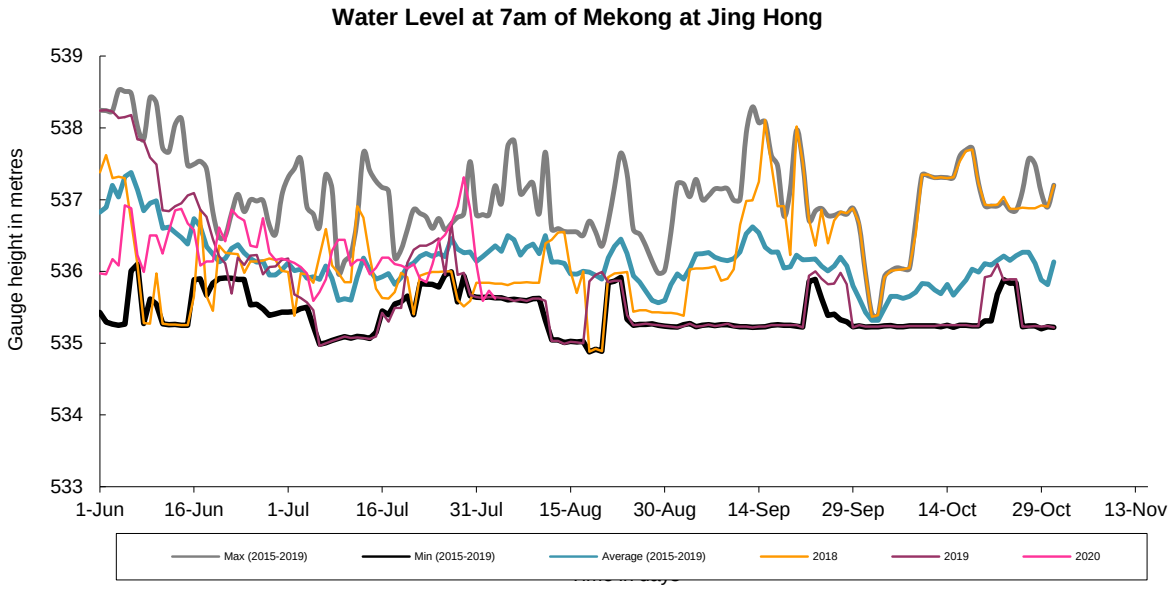
River Flood Forecaster

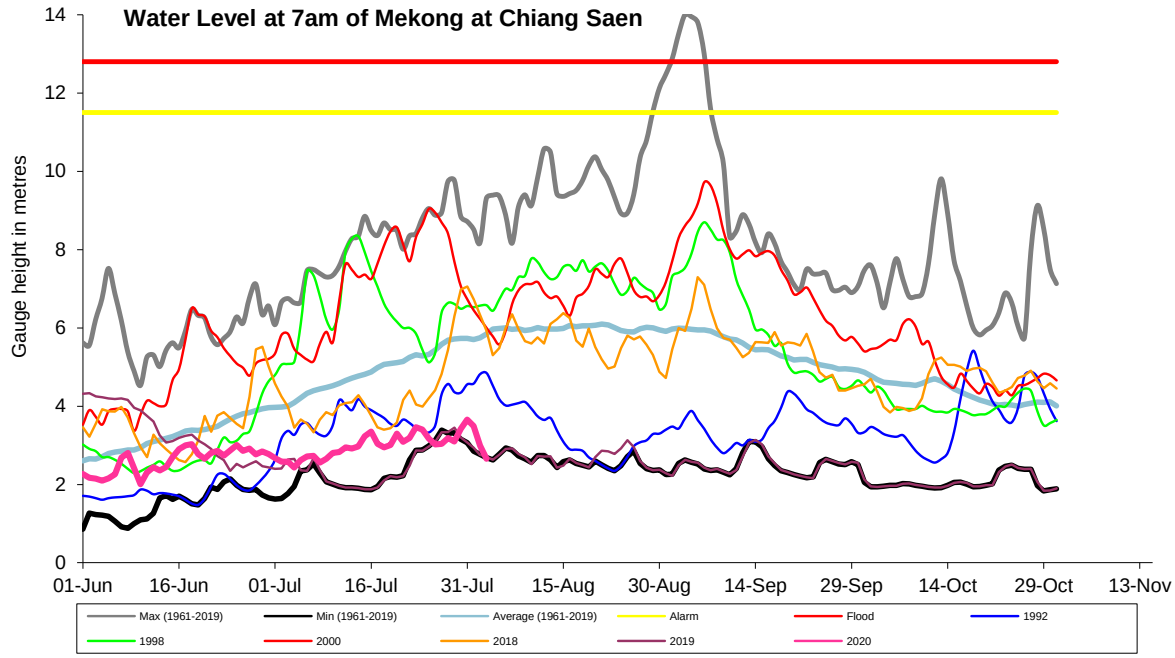
KHEM Sothea

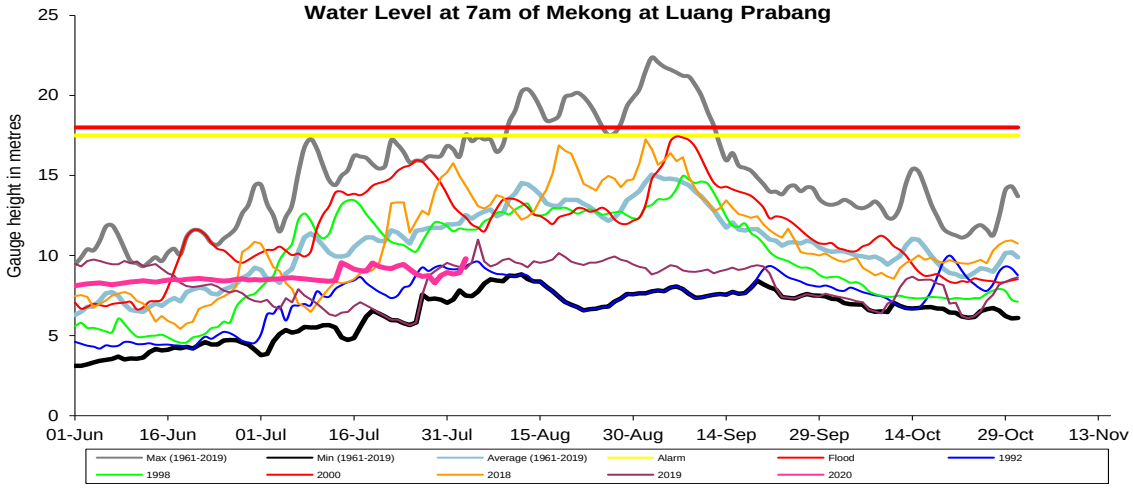
NOTE: Discharge at Luang Prabang is influent by hydropower operation (up and downstream), so the dischages at this station are not takeing into account
For futher detail, please kindly refer to the following links :
http://www.mrcmekong.org/; http://ffw.mrcmekong.org/bulletin_wet.php; http://ffw.mrcmekong.org/reportflood.php

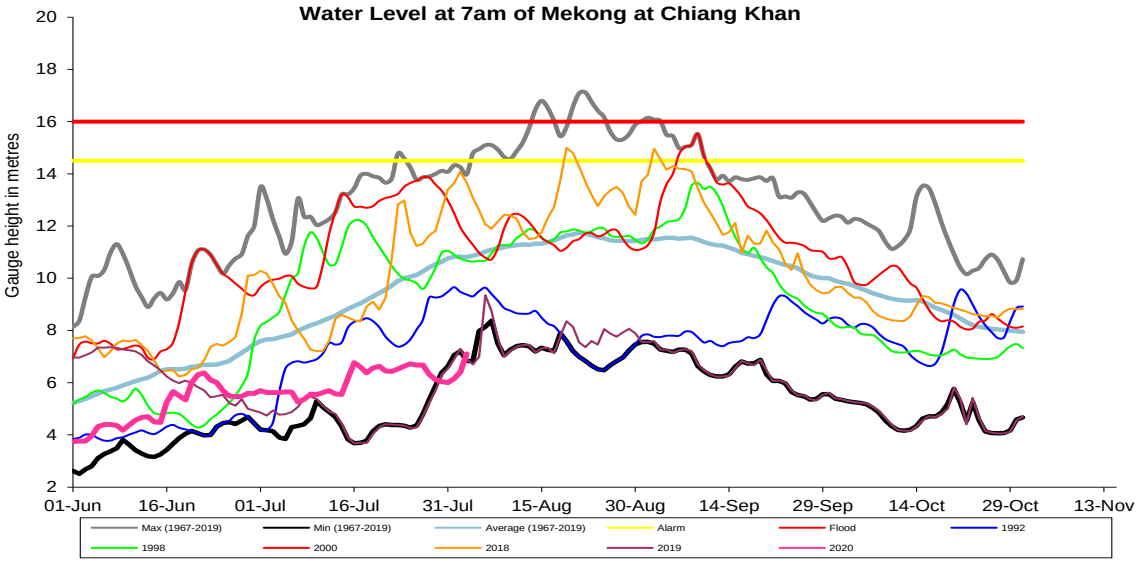
Annex A: Weekly Water Level Hydrographs at each key station

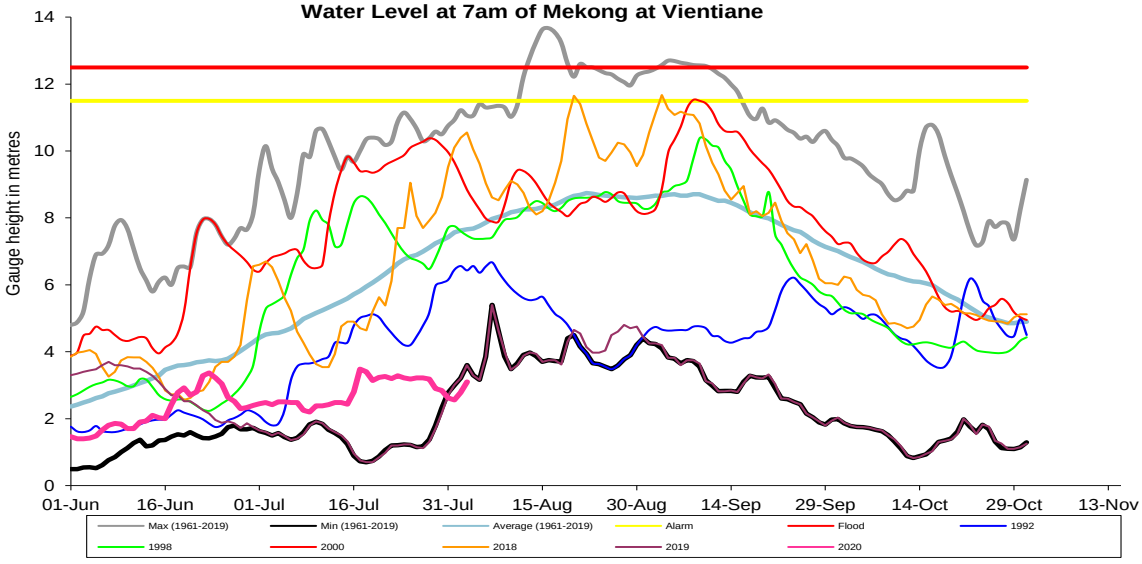
HYDROGRAPHS OF THE MEKONG AT MAINSTREAM STATIONS IN FLOOD SEASON UP TO 31 OCTOBER 2020

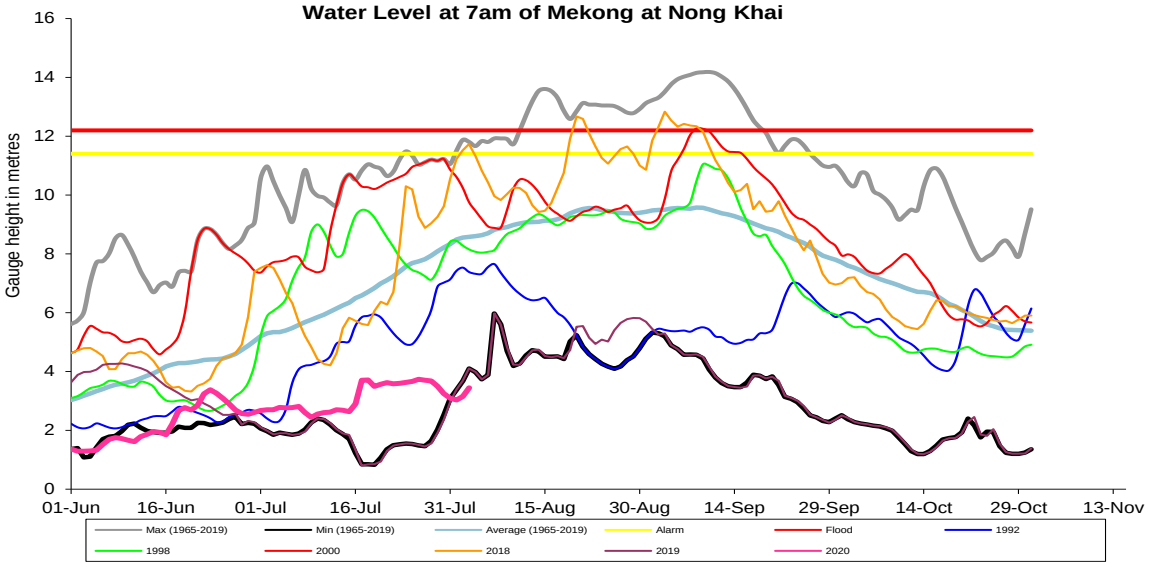


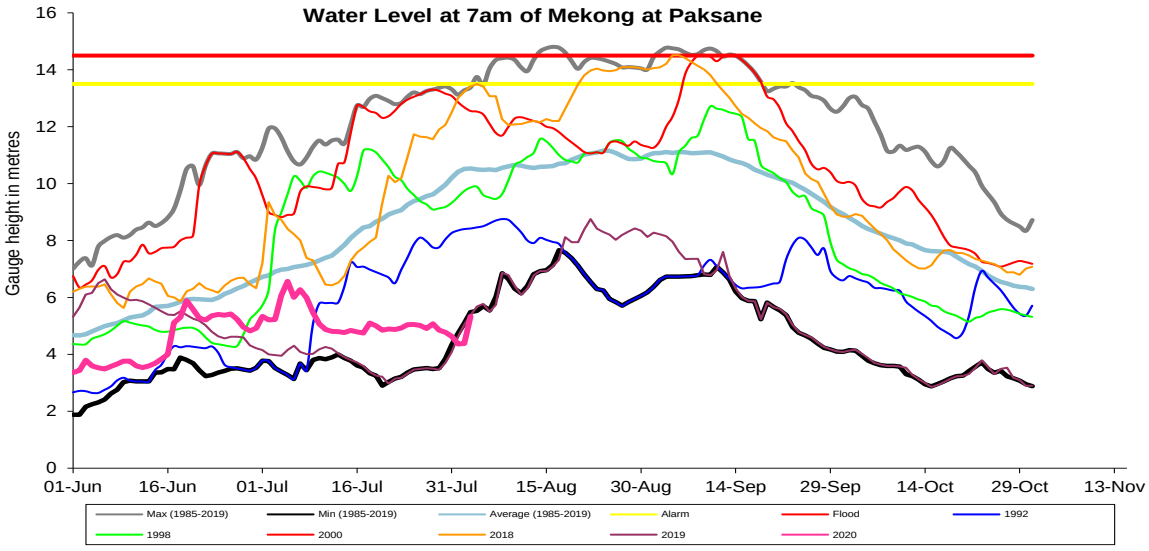


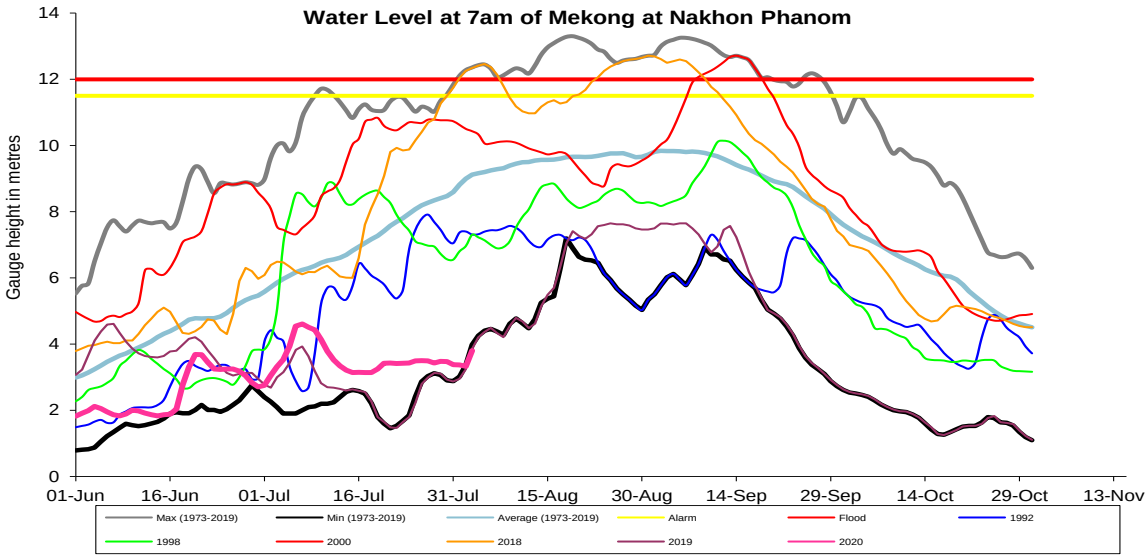

Water Level at 7am of Mekong at Luang Prabang
Gauge height in metres
25
20
15
10
5
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1961-2019)
Min (1961-2019)
Average (1961-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

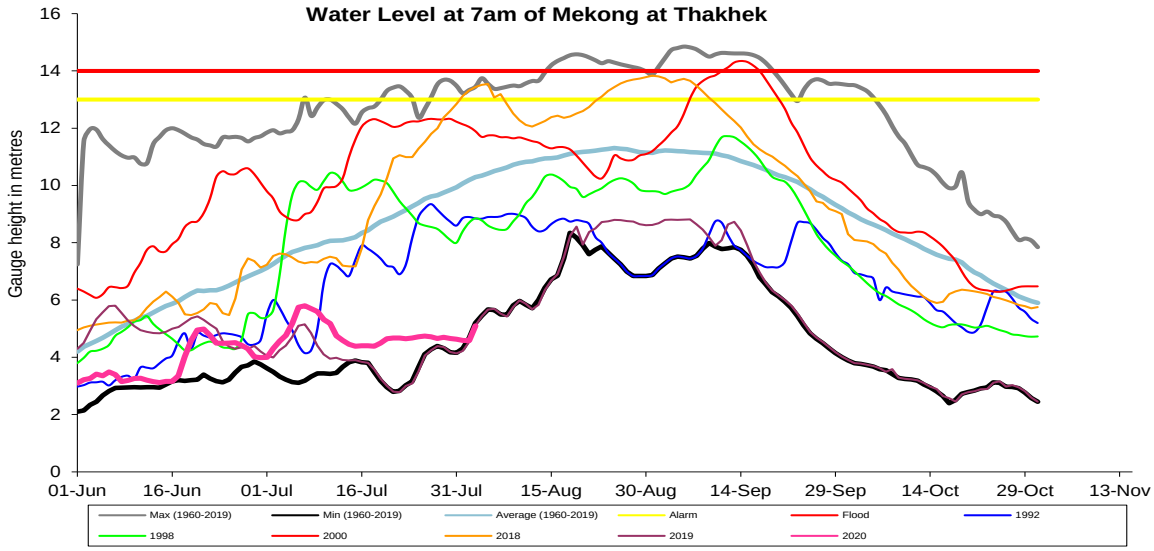

Water Level at 7am of Mekong at Chiang Khan
Gauge height in metres
20
18
16
14
12
10
8
6
4
2
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1967-2019)
Min (1967-2019)
Average (1967-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

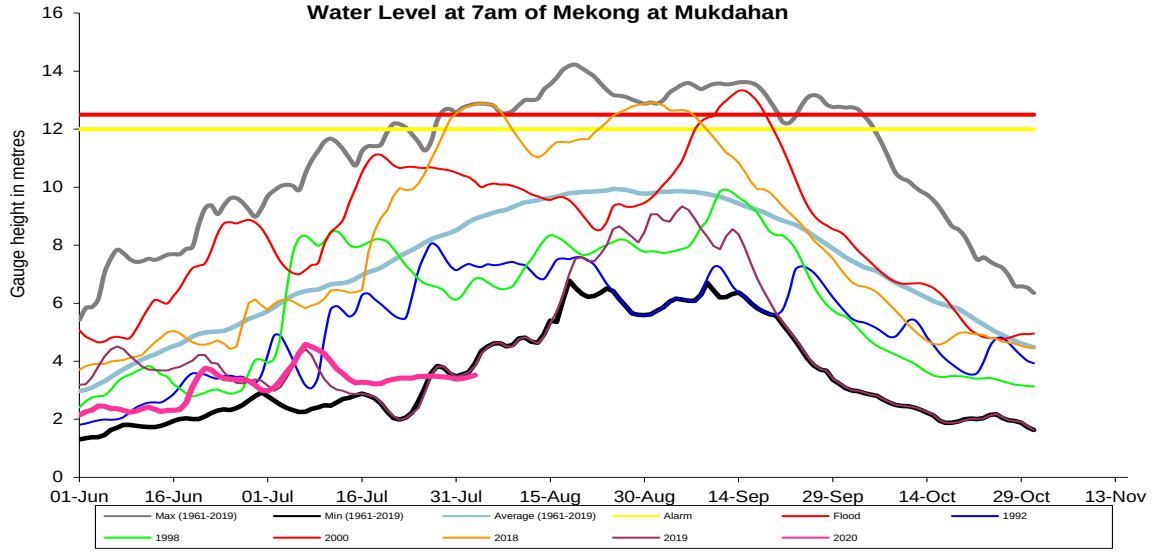

Water Level at 7am of Mekong at Vientiane
Gauge height in metres
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1961-2019)
Min (1961-2019)
Average (1961-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

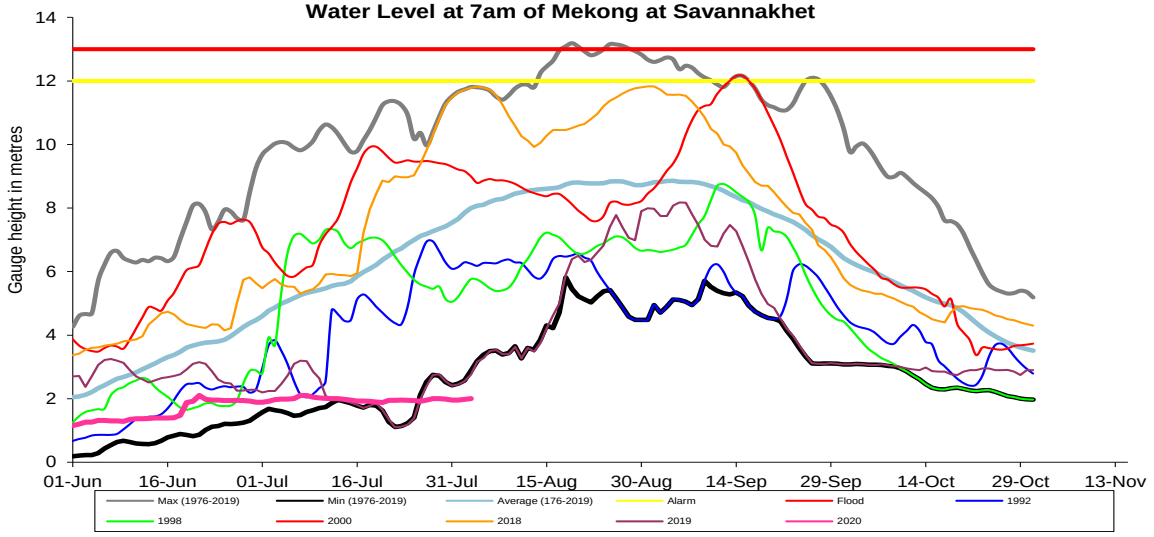

Water Level at 7am of Mekong at Nong Khai
Gauge height in metres
16
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1965-2019)
Min (1965-2019)
Average (1965-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

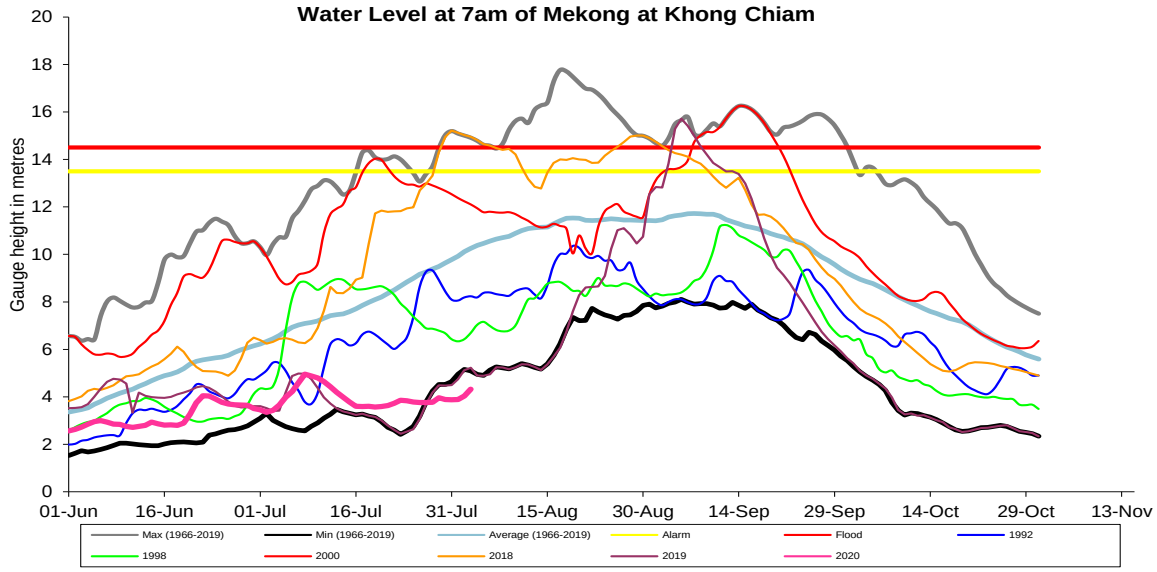

Water Level at 7am of Mekong at Paksane
Gauge height in metres
16
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1985-2019)
Min (1985-2019)
Average (1985-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

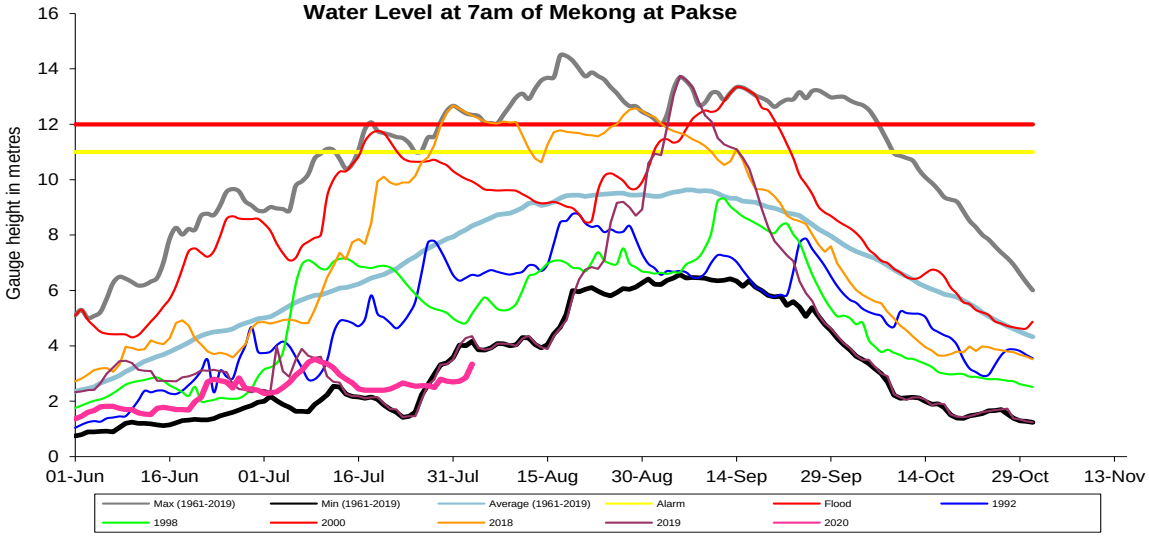

Water Level at 7am of Mekong at Nakhon Phanom
Gauge height in metres
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1973-2019)
Min (1973-2019)
Average (1973-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

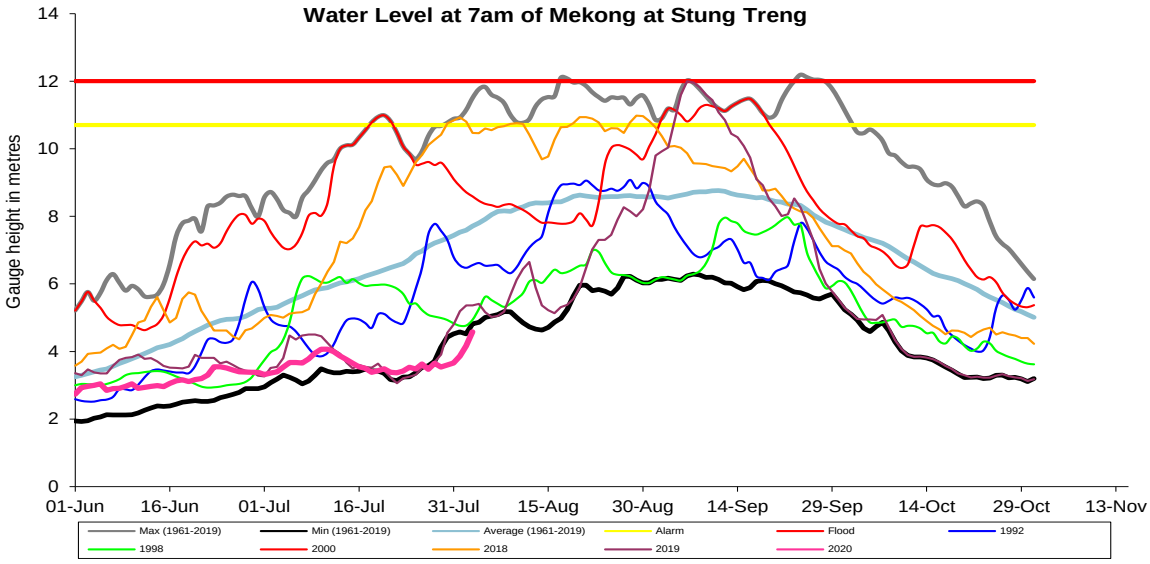

Water Level at 7am of Mekong at Thakhek
Gauge height in metres
16
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1960-2019)
Min (1960-2019)
Average (1960-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020


Water Level at 7am of Mekong at Mukdahan
Gauge height in metres
16
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1961-2019)
Min (1961-2019)
Average (1961-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

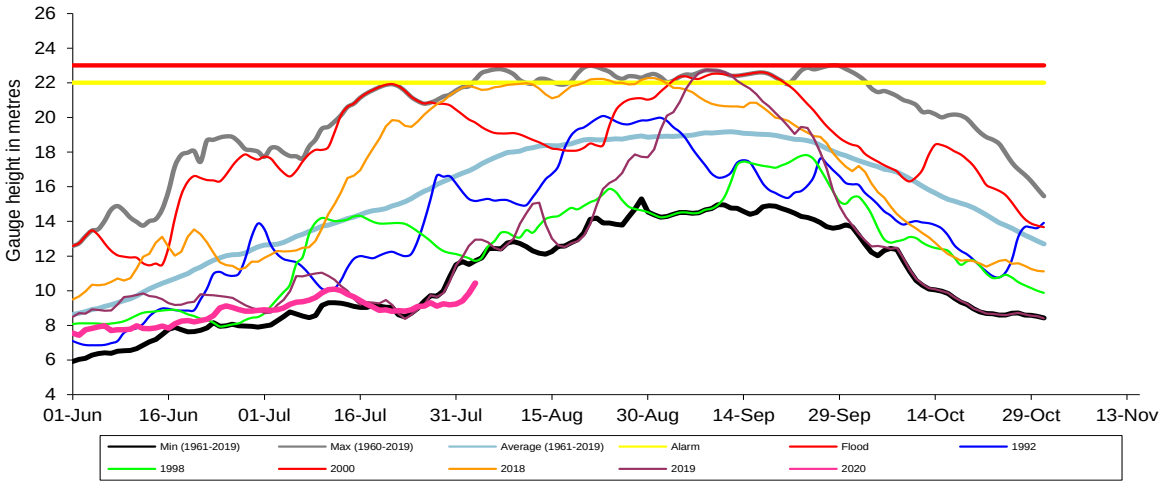

Water Level at 7am of Mekong at Savannakhet
Gauge height in metres
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1976-2019)
Min (1976-2019)
Average (176-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020


Water Level at 7am of Mekong at Khong Chiam
Gauge height in metres
20
18
16
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1966-2019)
Min (1966-2019)
Average (1966-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

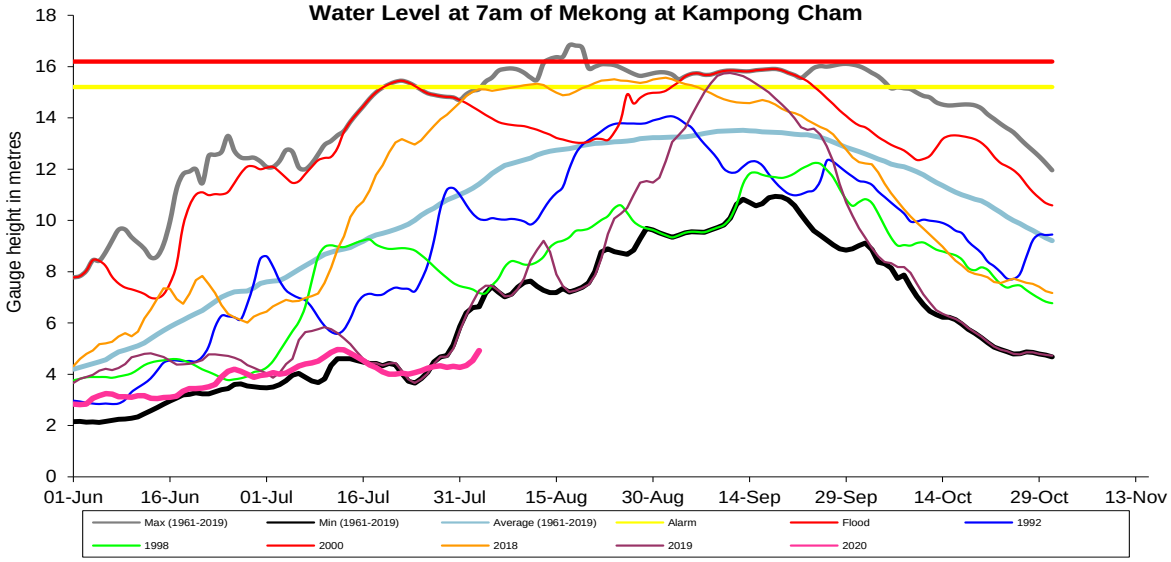

Water Level at 7am of Mekong at Pakse
Gauge height in metres
16
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1961-2019)
Min (1961-2019)
Average (1961-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020


Water Level at 7am of Mekong at Stung Treng
Gauge height in metres
14
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1961-2019)
Min (1961-2019)
Average (1961-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

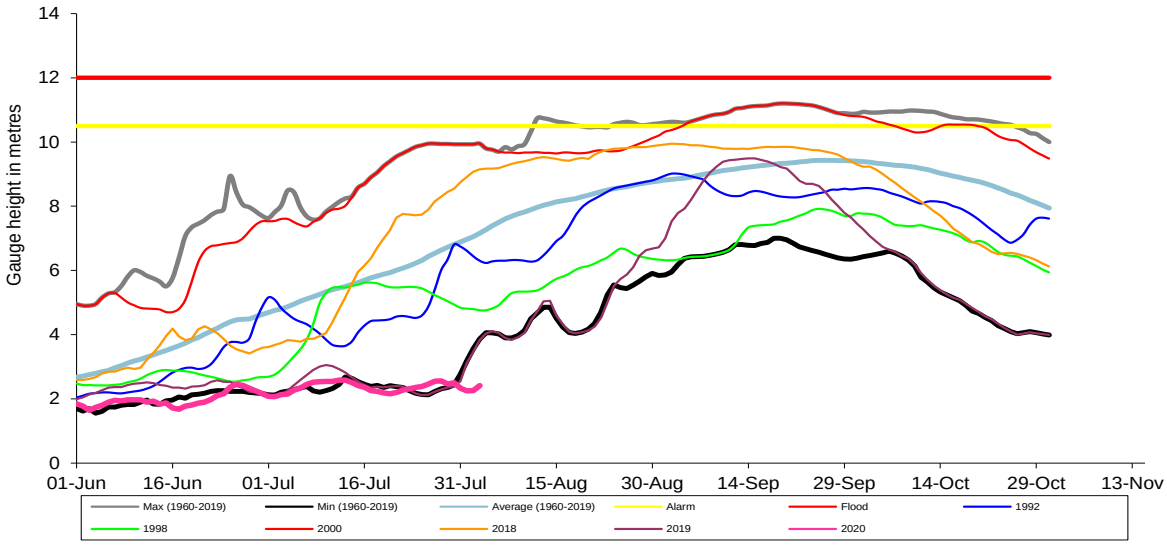
Water Level at 7am of Mekong at Kratie

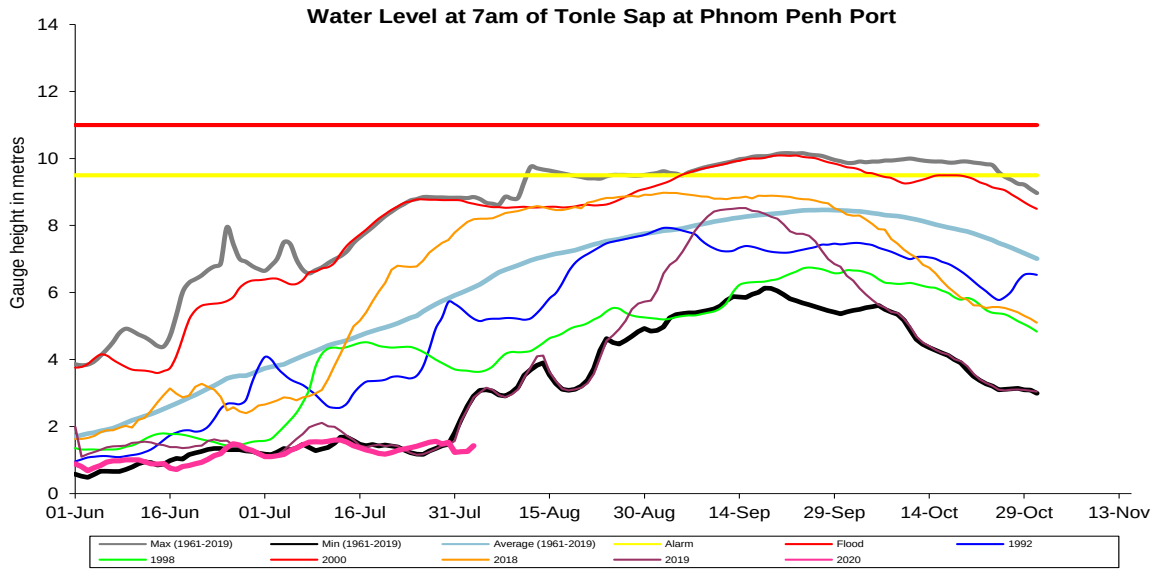


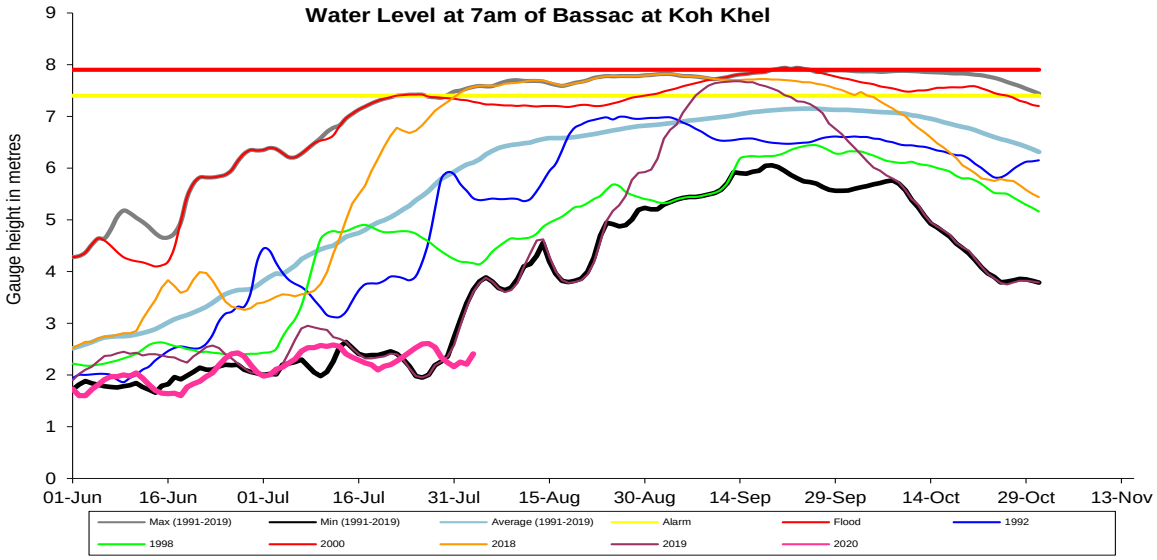
Water Level at 7am of Mekong at Kampong Cham

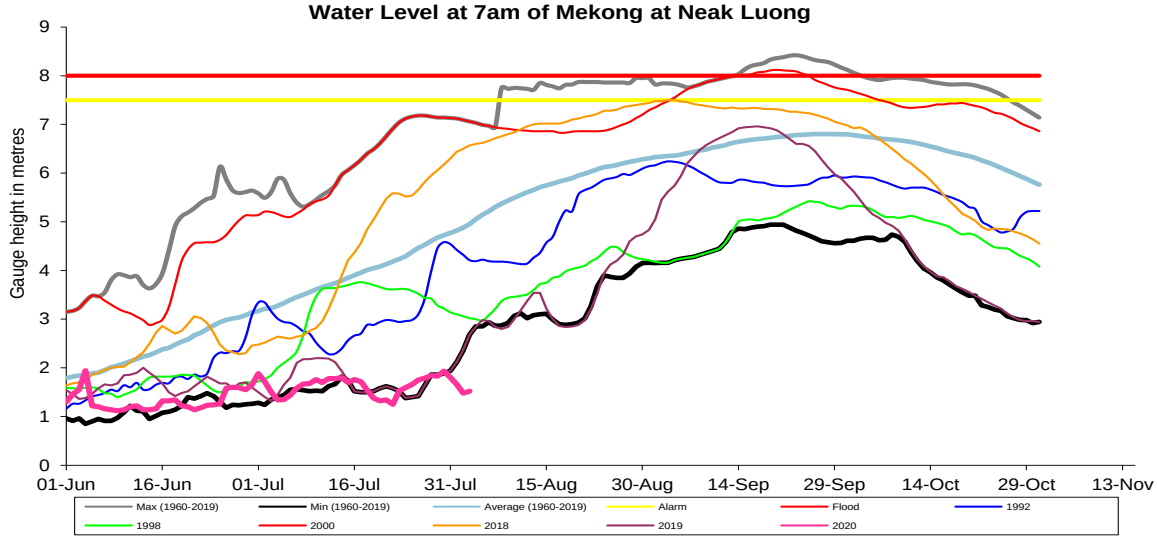


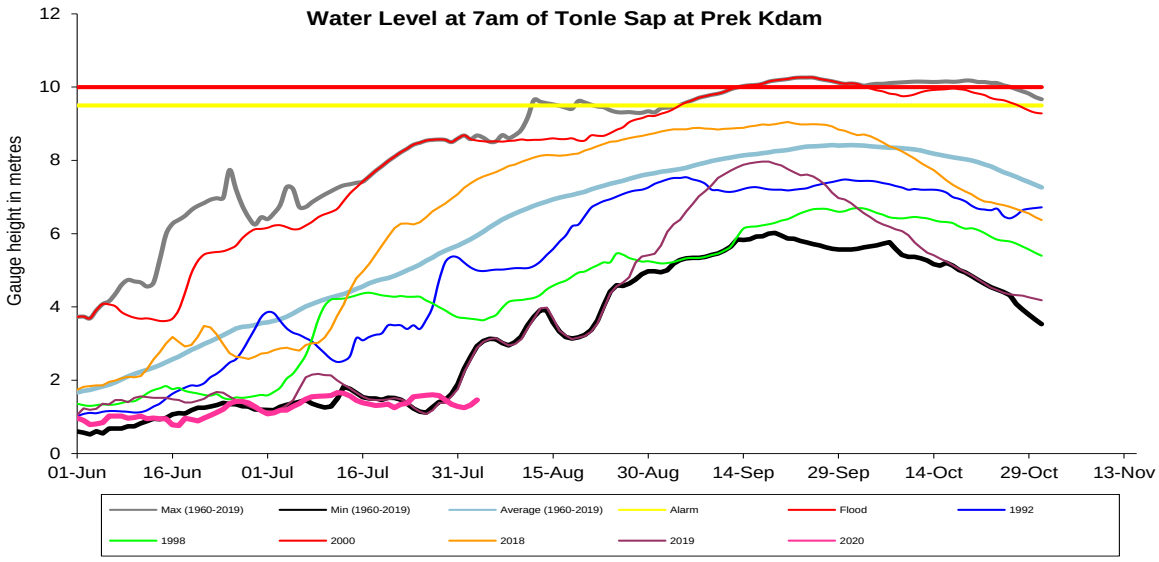
Water Level at 7am of Mekong at Phnom Penh Chaktomuk

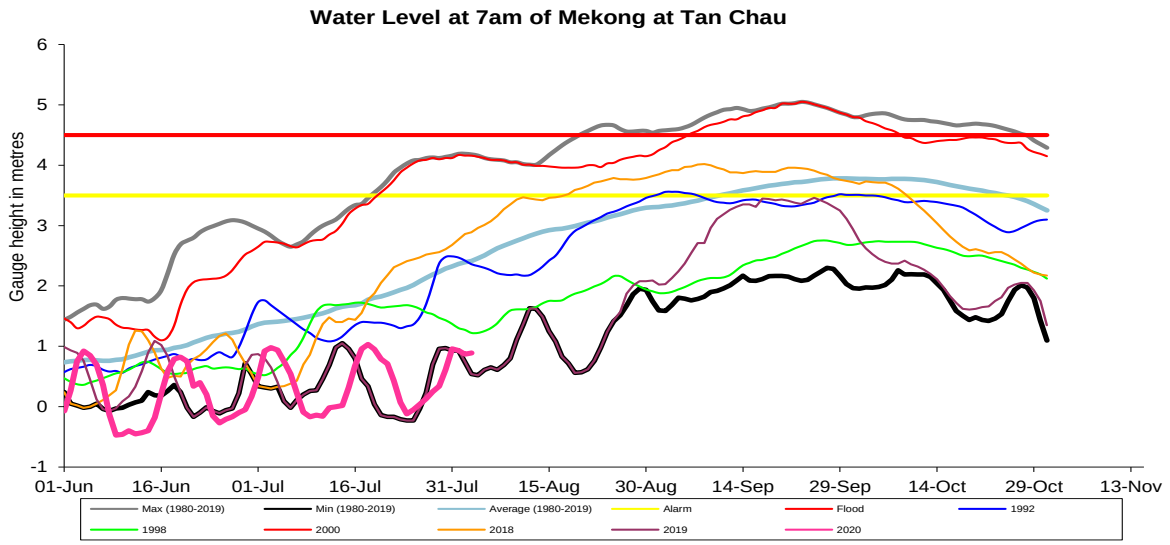


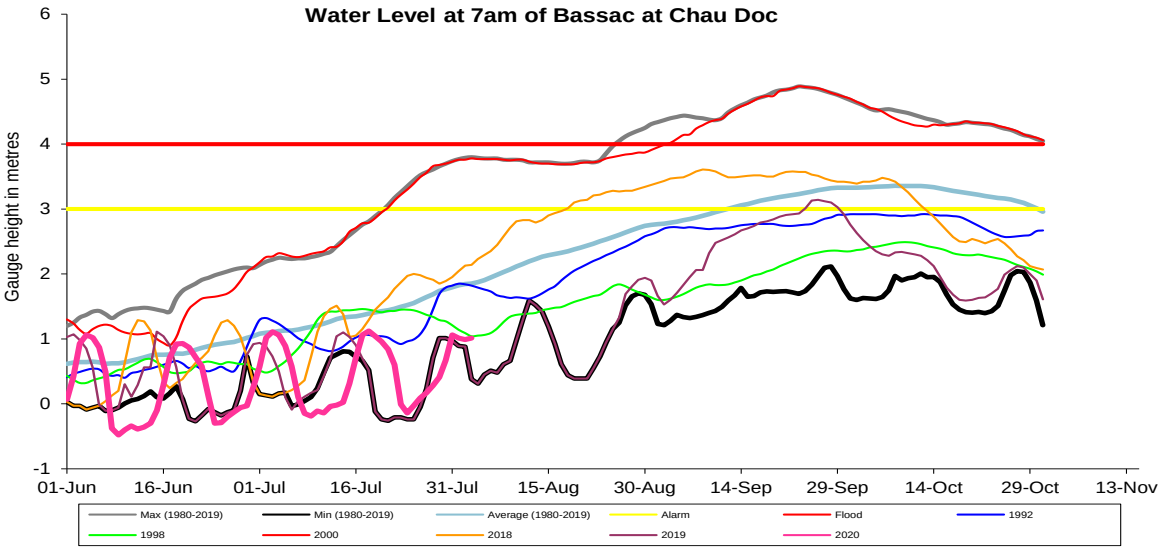

Water Level at 7am of Tonle Sap at Phnom Penh Port
Gauge height in metres
0
2
4
6
8
10
12
14
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1961-2019)
Min (1961-2019)
Average (1961-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020


Water Level at 7am of Bassac at Koh Khel
Gauge height in metres
0
1
2
3
4
5
6
7
8
9
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1991-2019)
Min (1991-2019)
Average (1991-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020


Water Level at 7am of Mekong at Neak Luong
Gauge height in metres
0
1
2
3
4
5
6
7
8
9
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1960-2019)
Min (1960-2019)
Average (1960-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020


Water Level at 7am of Tonle Sap at Prek Kdam
Gauge height in metres
12
10
8
6
4
2
0
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1960-2019)
Min (1960-2019)
Average (1960-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020


Water Level at 7am of Mekong at Tan Chau
Gauge height in metres
6
5
4
3
2
1
0
-1
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1980-2019)
Min (1980-2019)
Average (1980-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

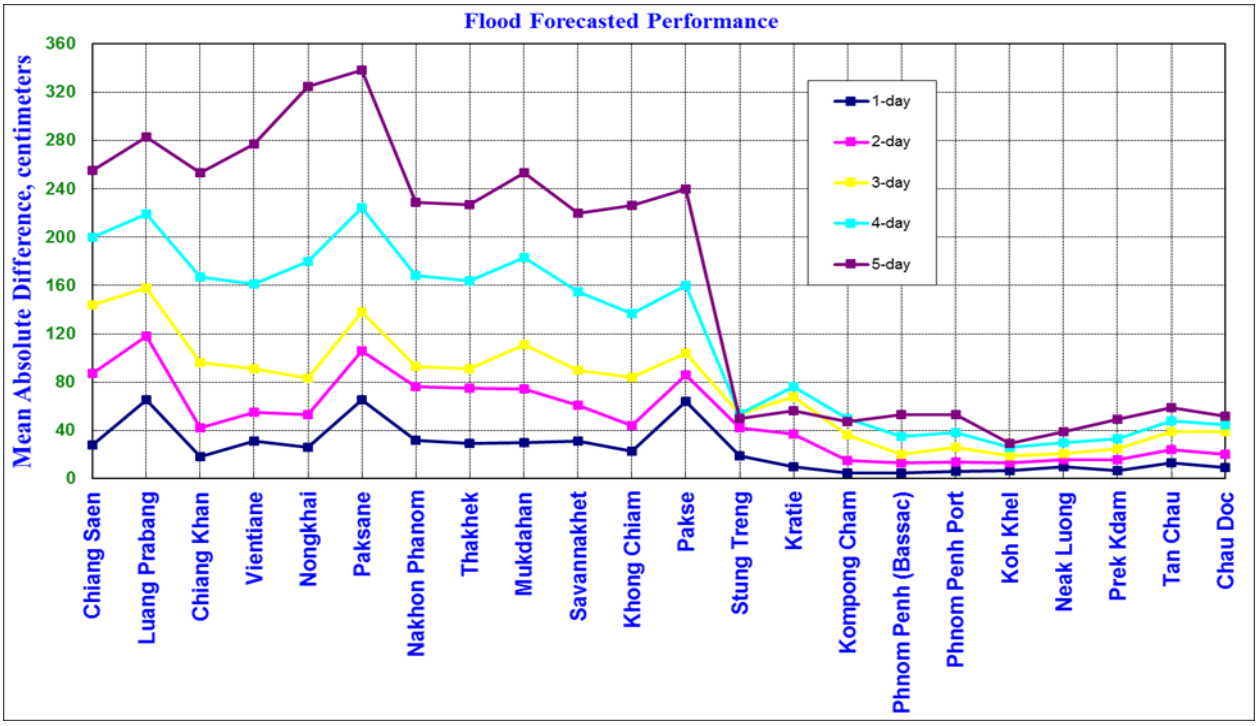

Water Level at 7am of Bassac at Chau Doc
Gauge height in metres
6
5
4
3
2
1
0
-1
01-Jun
16-Jun
01-Jul
16-Jul
31-Jul
15-Aug
30-Aug
14-Sep
29-Sep
14-Oct
29-Oct
13-Nov
Max (1980-2019)
Min (1980-2019)
Average (1980-2019)
Alarm
Flood
1992
1998
2000
2018
2019
2020

Annex B: Accuracy and Performance of weekly flood forecasting

1. Accuracy

"Accuracy" is referred to the results of the MRC Mekong Flood Forecasting System, after adjusted by forecaster and shared them in public information. The adjustment of flood forecasting outcome from the flood forecasting system, required Flood Forecasters to have strong knowledge in hydrology and statistical modelling for estimating the relationships between stations at upstream to downstream of the Mekong River Basin. The flood forecasting performance presented in a graph below showed the average flood forecasting accuracy at each key station along the Mekong mainstream from 28 July to 03 August 2020.

The forecasting values from 28 July to 03 August 2020 showed in overall accuracy is fair for 1-day to 3-day of forecast lead time at stations in the middle part from Chiang Saen to Pakse of the Mekong River, due to the heavy rainfall, effected this area.



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

1) Missing data and data input are not sufficient to be used as input into the flood forecasting model system.
2) Influence of heavy rainfall and hydropower operations from upstream (Xayaburi) and tributaries inflows.
3) Luang Prabang, Chiang Khan and Paksane station has been effected by hydropower operation of Xayaburi and Nam Nguem (water retention and release) and rainfall always accumulated at this spot that could cause rapid high-water levels.
4) Rapid up and down of water levels at stations of Tan Chau and Chau Doc due to daily tidal effect from the Sea in the Mekong Delta.
5) Rainfall from satellite was not well represented to the actual rainfall at ground stations in some areas of the Mekong region.

Forecast Achievement

The flood forecasting achievement indicated in (%) and (cm) from 1-day to 5-day at each key station, against with New Benchmark for a successful lead-time are presented in **Table B1** and **Table B2**.

Table B1: Evaluation performance forecasting (from 28 July to 03 August 2020) base on Old Benchmark (%).

Unit 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	57.1	42.9	57.1	42.9	57.1	71.4	71.4	71.4	57.1	71.4	71.4	57.1	57.1	57.1	57.1	57.1	85.7	57.1	42.9	71.4	57.1	71.4	***61.0***
2-day	50.0	66.7	66.7	66.7	50.0	66.7	50.0	50.0	50.0	66.7	66.7	66.7	50.0	50.0	50.0	66.7	66.7	50.0	50.0	50.0	66.7	50.0	***57.6***
3-day	60.0	40.0	60.0	60.0	60.0	40.0	40.0	40.0	40.0	60.0	60.0	80.0	60.0	60.0	20.0	40.0	40.0	60.0	60.0	60.0	40.0	40.0	***50.9***
4-day	50.0	50.0	50.0	50.0	50.0	50.0	25.0	25.0	50.0	50.0	50.0	75.0	50.0	50.0	75.0	50.0	50.0	50.0	50.0	50.0	50.0	75.0	***51.1***
5-day	66.7	66.7	66.7	33.3	33.3	33.3	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	33.3	33.3	33.3	33.3	66.7	33.3	66.7	***54.5***

Table B2: Evaluation performance forecasting (from 28 July to 03 August 2020) base on Old Benchmark (cm). Unit 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	28	65	18	31	26	65	32	29	30	31	23	64	19	10	5	5	6	7	10	7	13	9
2-day	87	118	42	55	53	106	76	75	74	61	44	86	42	37	15	13	14	13	16	16	24	20
3-day	144	158	96	91	83	138	93	91	111	90	84	104	54	68	36	20	26	19	21	25	39	39
4-day	200	219	167	161	180	224	168	164	183	155	137	160	54	76	50	35	38	26	30	33	48	45
5-day	255	283	253	277	325	338	229	227	253	220	226	240	50	56	47	53	53	29	39	49	59	52

Note: Red values are not well matched with the actual values in (%) and (cm)

2. Performance based on data collection from Member Countries

Flood forecasting performance is based on hydro-met data received from Member Countries (MCs), evaluating performance indicators, missing data and completed time for flood forecasting are presented in **Table B4** and **Figure B1**, **B2** and **B3**, respectively from 28 July to 03 August 2020.

Table B4: Overview of performance indicators for the past 8 days from 28 July to 03 August 2020

	FF time sent				Arrival time of input data								Missing data (number-mainstream and trib.st.)							
2020	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	*10:46*	*00:00*	-	-	*08:15*	*07:10*	*07:33*	*08:47*	*09:19*	*08:48*	*07:44*	*08:42*	*0*	*0*	*3*	*0*	*90*	*0*	*1*	*54*
month	*10:24*	*00:00*	-	-	*08:15*	*07:10*	*07:38*	*08:11*	*08:39*	*08:26*	*07:14*	*08:47*	*0*	*0*	*37*	*0*	*435*	*0*	*2*	*38*

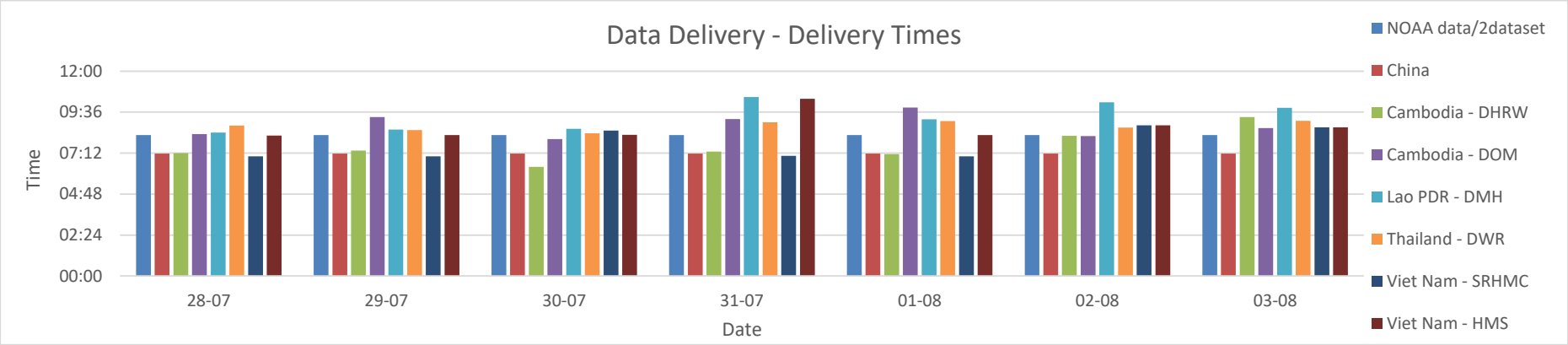


Fig. B1: Data delivery times for the past 8 days from 28 July to 03 August 2020

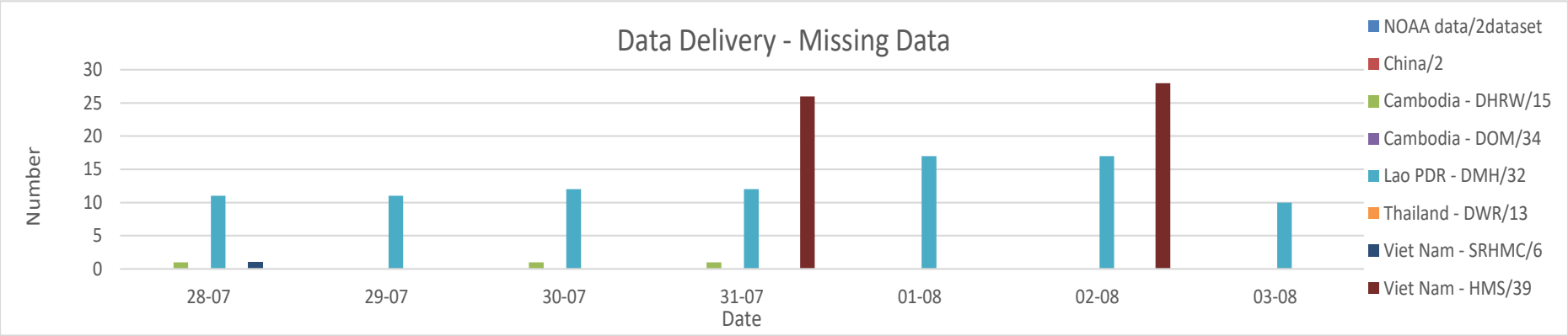


Fig. B2: Missing data for the past 7 days from 28 July to 03 August 2020

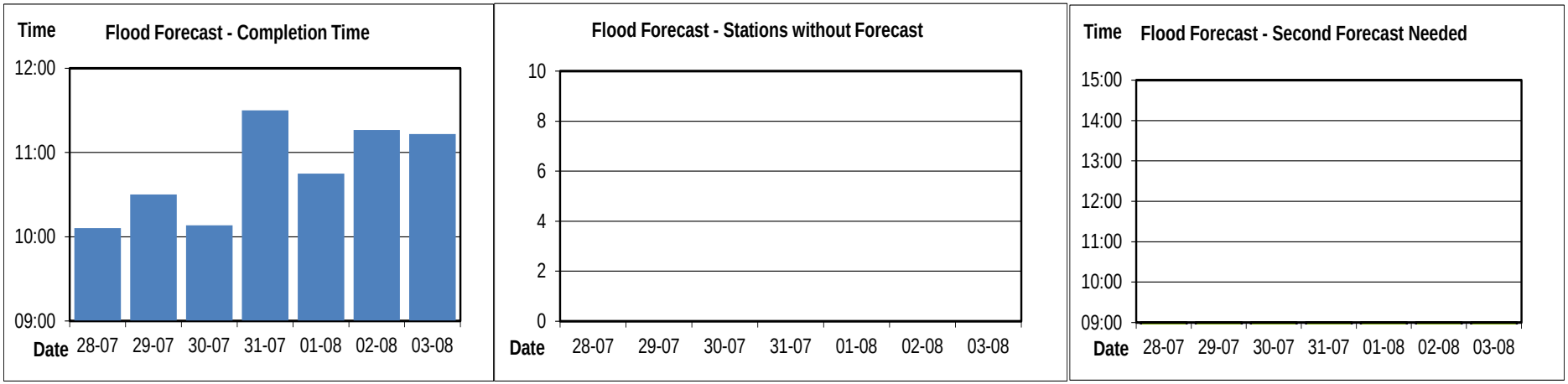


Fig. B3: Flood forecast completion time, stations without forecast and second forecast need from 28 July to 03 August 2020