Mekong River Commission

Regional Flood and Drought Management Centre

Weekly Flood Situation Report for the Mekong River Basin

Prepared at: 23/07/2019, covering the week from 16th to 22th July 2019

Weather Patterns, General Behaviour of the Mekong River and Flood Situation

General weather patterns

During the week of 16th to 22th July 2019, the weather bulletins and maps were issued by the Thailand Meteorology Department (TMD). It was stated that this month, the dry spell may often occur continuously from late June because the low-pressure trough still places on the southern portion of China along with the Southwest Monsoon prevailing over Thailand mostly weakens. As a result, many areas may meet little or no rain continuously for many days, which could draw the low water level in the region. **Figures 1 & 2** presented the weather map for 18nd July and 22th 2019.

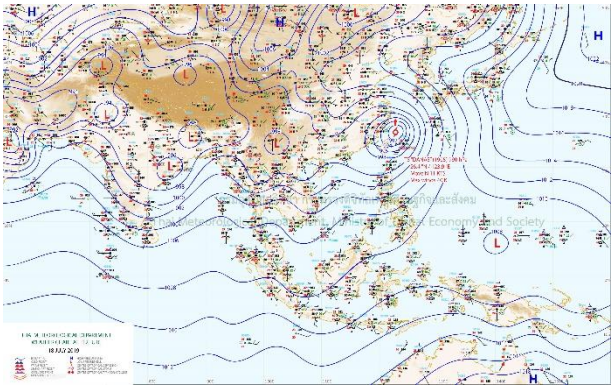

Figure 1: Weather map for 18th July 2019

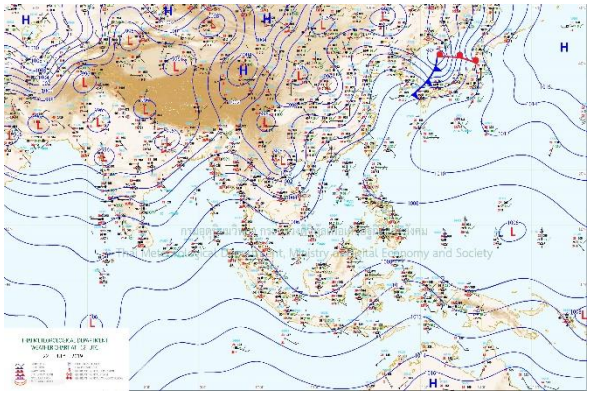

Figure 2: Weather map for 22th July 2019

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

No TD, TS or TY was presented in LMB during this week.

Other weather phenomena that affect the discharge

According to the Asian Specialized Meteorological Center (ASMC), July 2019, drier-than-average conditions are expected over parts of the southern ASEAN region, including the southern parts of Sumatra and Kalimantan, and Java. In the first week of this fortnight, warmer-than-average conditions are predicted over Myanmar and Thailand as well as over Lao PDR. **Figure 2** showed the rainfall outlook over southern Southeast Asia.

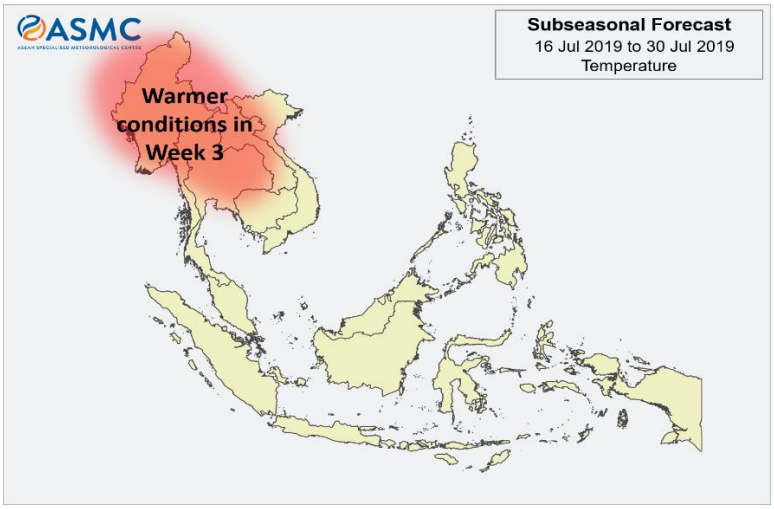

Figure 2: The predicted higher likelihood of below-normal rainfall over southern Southeast Asia

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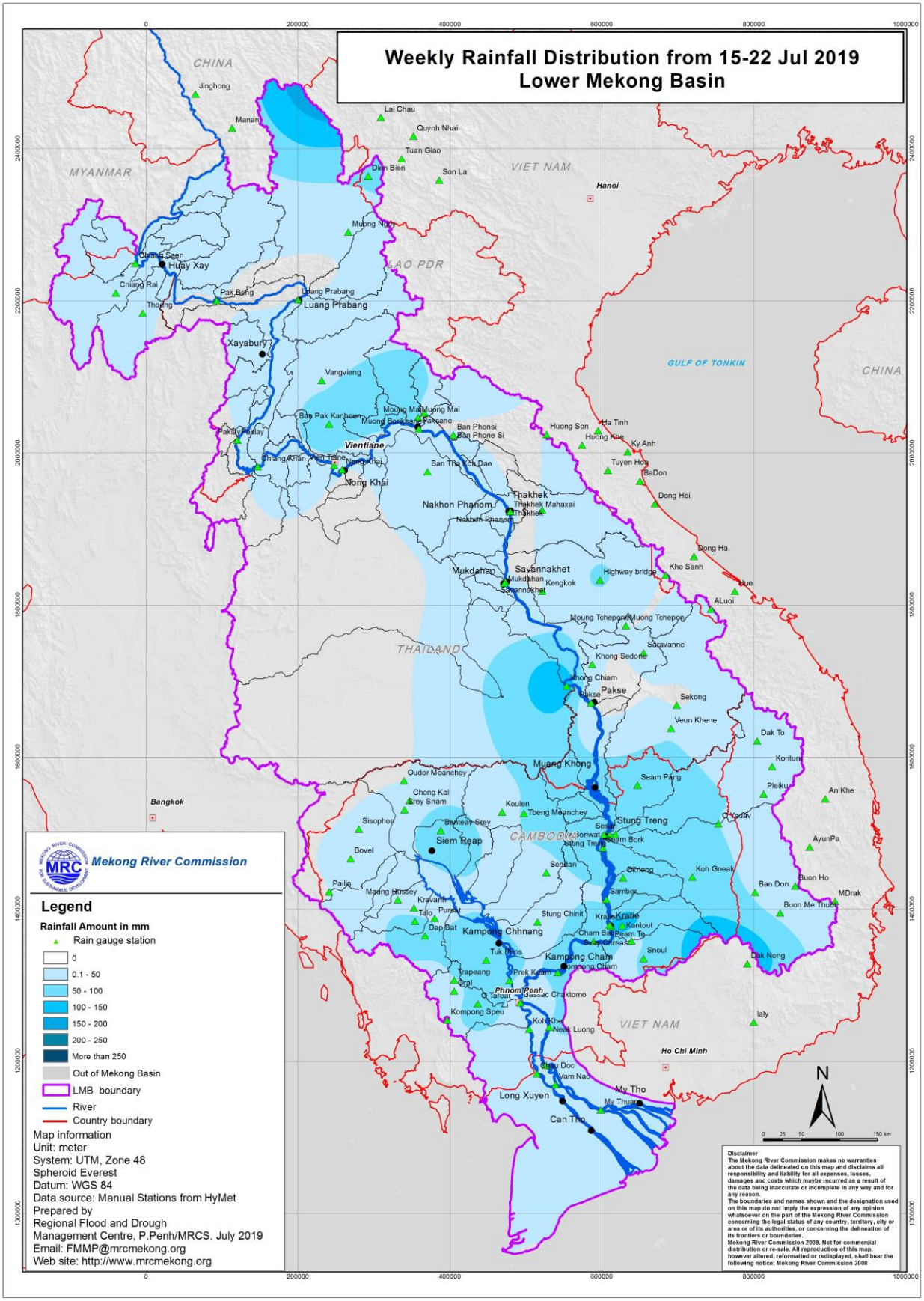

Figure 3: Weekly Rainfall Distribution over the LMB from 15th to 22th July 2019

Over weather situation

The weather of this week was scattered thundershowers with moderate rain of the Southwest monsoon. Consequently, in this week there was moderate rainfall covered from upper part of upper Vientiane and Paksane, varied from 50mm to 100 mm. It was also happened from Pakse down to 3S area in Cambodia, showed varied from 100 to 150 mm. The weekly rainfall distribution from 15th to 22th July 2019 is showed in **Figure 3** and daily rainfall at key stations in the Lower Mekong Basin are shown **Table A2**.

General behaviour of the Mekong River

During the last week, the water levels at stations from upper to middle part of LMB has been decreasing significantly, due to low rainfall and the low inflow caused by hydropower operation upstream parts. China sent the notification of operation information of Jinghong Hydropower Station on Lancang River. The outflow of water from the Jinghong hydropower station in China's Yunnan province will be fluctuating from 5 – 19 July 2019, according to an official notification from China's Ministry of Water Resources was sent to the Mekong River Commission Secretariat on 03rd July 2019. Current water levels at Chiang Saen are gradually increased since 21th July , while at Luang Prabang, Vientiane and down to Cambodia's Neak Luong on the Mekong are stay below those that occurred in the low flow season of 1992, which followed by far the most extreme regional drought year on record in 1992. This tends to suggest a significant reduction in the natural groundwater contribution to these tributaries over the last month. This might arise as a response to what might be described as a hydrological low flow following on from the very deficient rainfall in early Wet Season of 2019. It may be that the ground water contributions tail off exponentially under such conditions

For stations from Chiang Saen and Luang Prabang

Water levels from 16th to 22th July 2019 at Chiang Sean station were gradually increased but still stay below their historical minimum levels (1980-2018). For Luang Prabang station, water levels followed the same trend as upstream which decreased and stay below their their historical minimum levels (1980-2018) since 20th of June this year. The Luang Prabang stations is likely nominated by hydro power dam operation upstream (tributaries) and downstream (Xayaburi) in which water levels stay above their LTAs, during the impounding reservoir at Xayaburi from end of October 2018 to May 2019.

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

Water levels from 16th to 22th July 2019 at these stations were also followed the same trend of upstream inflowed from Luang Prabang. It was observed that at Chiang Khan, Vientiane, Nong Khai and Paksane stations, water levels decreased drastically staying below their historical minimum levels (1980-2018). The water level hydrographs at each key station are showed in **Annex C**.

For stations from Nakhon Phanom/Thakhet to Mukdaha/Sovannakhet

Water levels from 16th to 22th July 2019 at Nakhon Phanom/Thakhet to Mukdahan/Sovannakhet stations were also followed the same trend as upstream stations, in which water levels were significantly decreased and stay below their historical minimum levels (1980-2018).

For stations from Khong Chiam to Pakse

The same as upstream trend, water levels from 16th to 22th July 2019 at Khong Chiam to Pakse stations were significantly decreased and stayed also below historical minimum levels (1980-2018).

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

Water levels from 16th to 22th July 2019 at Stung Treng, Kratie, Kompong Cham and Phnom Penh stations on the Mekong, Bassac and Tonle Sap were followed the same trends as upstream stations. It was found

that water levels at these stations were also significantly decreased and stayed below their historical minimum levels (1980-2018) conditions.

Tan Chau and Chau Doc

Water levels from 16th to 22th July 2019 at these 2 tidal stations were still maintaining fluctuated over their LTAs but did not follow the same trend as previous years as indicated in **Annex C**. This might affect by the El Nino process in the South China Sea.

According to the Japan Meteorological Agency (JMA), Sea surface temperature (SST) variability in the tropics can significantly impact on the global climate through atmospheric circulation. El Niño event, which are identified by SST fluctuations from the central to the eastern equatorial Pacific (NINO.3), are widely known examples of this. The NINO3 index is one of several El Niño/Southern Oscillation (ENSO) indicators based on sea surface temperatures. The five-month running mean of the SST deviation for NINO.3 predicted by JMA's El Niño prediction model is presented in **Figure 4**.

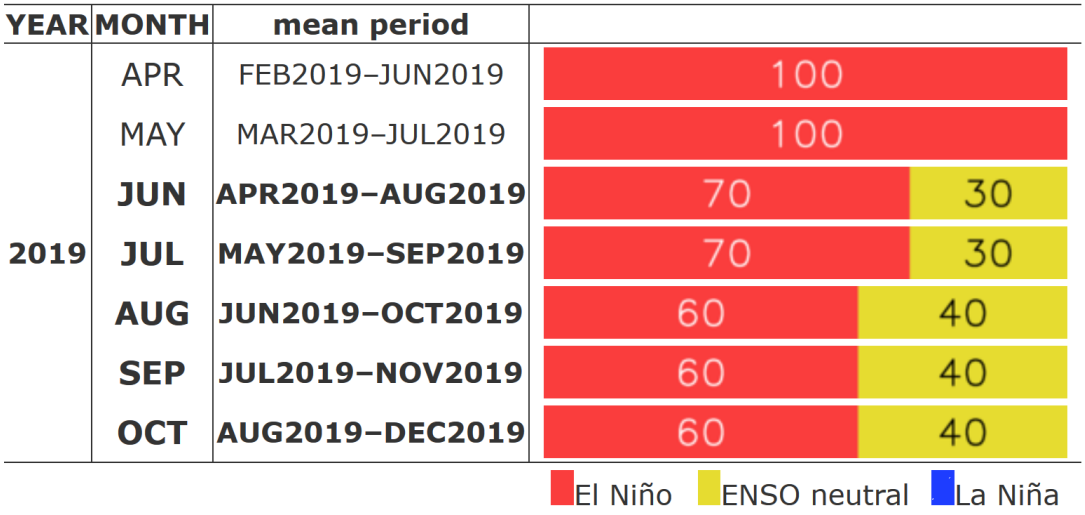

Figure 4 Five-month running mean of the SST deviation for NINO.3 predicted by JMA's El Niño prediction model (JMA/MRI-CGCM2)

Note: For more detail the flood situation from upstream to downstream during the last week, the hydrograph of water level at each key station is showed in **Annex C**.

Conclusion

From 16th to 22th July 2019, the trend of water levels at Chiang Sean was decreased and dropped significantly below their historical low level (1992) due to the low rainfall in early Wet Season and the hydropower dams operation on the Lancang River in Yunnan, China (as China sent a notification of operation information of Jinghong Hydropower Station on Lancang River to MRCS on 3rd July 2019). The impact could obviously see the decreasing water level to downstream of Chaing Sean to Vientiane.

Based on a hydrological phenomenon, the inflow contribution of water from the upstream of Lancang-Mekong in China to the Mekong mainstream is about 11% in total during the Wet season from June to October. The whole inflow of water into the lower Mekong basin is influenced more by tributaries and a direct rainfall distribution.

According to the Asian Specialized Meteorological Center (ASMC), July 2019, drier-than-average conditions are expected over parts of the southern ASEAN region, including the southern parts of Sumatra and Kalimantan, and Java. In the week 3 of this month July, warmer-than-average conditions are predicted over Myanmar and Thailand as well as over Lao PDR.

The initial conclusion (for discussion) is that the regional tail off in water levels is a combined response to regional low rainfall conditions and dam operation. The rapidity of the decrease seems associated with reduced turbined flows from the Upper Mekong reservoirs which in turn are no doubt a reflection of the hydrological 'low-flow' and consequent low levels of reservoir storage.

On the other hand, the hydrological conditions (rainfall and flows) of the Mekong River during early Wet Season 2019 (June-July) is characterized as low flow and low rainfall, compared to the long-term average. This caused a low-water level in the mainstream and many tributaries in rainfed watershed areas of the Lower Mekong Basin. This low-flow condition is likely caused by the low rainfall and the impact of hydropower operation at upstream parts.
Further work to clarify the issues, with specific attention being paid to conditions on the large northern Lao tributaries, need to be clarified

For more detail information of flood forecasting outcomes and its system, please see the following annexes:

- Tables and graphs for water level and rainfall for the last week in **Annex A**
- A graph for accuracy in **Annex B**
- A table of forecast achievement in **Annex B**
- Tables and graphs for performance in **Annex B**
- Water level hydrographs showing weekly observed water level for the Wet Season in **Annex C**

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Annex A: Graphs and Tables

Table A1: observed water levels (16th to 22th July 2019) Unit in m

2019	Jinghong	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
16/07/2019	535.42	1.88	6.86	3.68	0.96	1.34	3.72	2.59	3.84	2.88	1.81	3.24	2.18	3.60	9.20	4.60	2.43	1.43	2.40	1.52	1.55	0.80	0.90
17/07/2019	535.30	1.92	7.09	3.70	0.75	0.80	3.59	2.55	3.81	2.83	1.71	3.29	2.10	3.54	9.34	4.45	2.35	1.39	2.32	1.50	1.48	0.46	0.70
18/07/2019	535.49	2.10	6.88	3.69	0.70	0.84	3.38	2.28	3.57	2.78	1.78	3.20	2.14	3.52	9.31	4.44	2.38	1.43	2.32	1.50	1.46	0.34	0.52
19/07/2019	535.49	2.21	6.68	4.04	0.70	0.85	3.26	1.79	3.25	2.59	1.86	3.15	2.15	3.64	9.27	4.35	2.36	1.46	2.34	1.52	1.46	0.04	-0.12
20/07/2019	536.12	2.18	6.42	4.28	0.84	0.94	3.22	1.65	3.00	2.32	1.65	3.00	1.92	3.43	9.47	4.42	2.38	1.42	2.36	1.58	1.48	-0.14	-0.24
21/07/2019	536.30	2.21	6.22	4.41	0.98	1.30	2.97	1.48	2.80	2.11	1.35	2.79	1.72	3.23	9.17	4.44	2.40	1.45	2.41	1.62	1.51	-0.17	-0.26
22/07/2019	536.36	2.48	6.00	4.39	1.20	1.48	3.15	1.47	2.78	1.98	1.10	2.61	1.70	3.06	8.67	4.13	2.38	1.42	2.40	1.58	1.48	-0.17	-0.21

Table A2: observed rainfall (16th to 22th July 2019) Unit in mm

2019	Jinghong	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
16/07/2019	0	0.6	0	0	0	0	0	0	1.9	0	0	8.5	0	33	0	0	7.3		0	0	0	0	0
17/07/2019	4.5	0	0	3	2.6	0	0	0	0	0	0	56.4	0	36	33.6	0	0.3		6.5	24.2	0	12.9	0.9
18/07/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35.3	14		0	17.8	17.4	1	9.5
19/07/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1		0	0	0	0	0
20/07/2019	0	0	0	0	0	0	0	0	0	4.9	0	0	0	0	2.8	24.2	0		0	0	14.3	0	0.3
21/07/2019	0	0	0	2.4	0	0	3.3	0	0.5	0	0	0	0	3	53.6	0	0		0	0	0	0	0
22/07/2019	5.5	18.8	0	0	32.6	0	0.3	1	2.7	5.7	0	53.1	0	5	28.6	0	0		0	0	6.2	0	0

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Figure A1: Observed water level and rainfall for Jinghong, Chiang Saen, and Luang Prabang

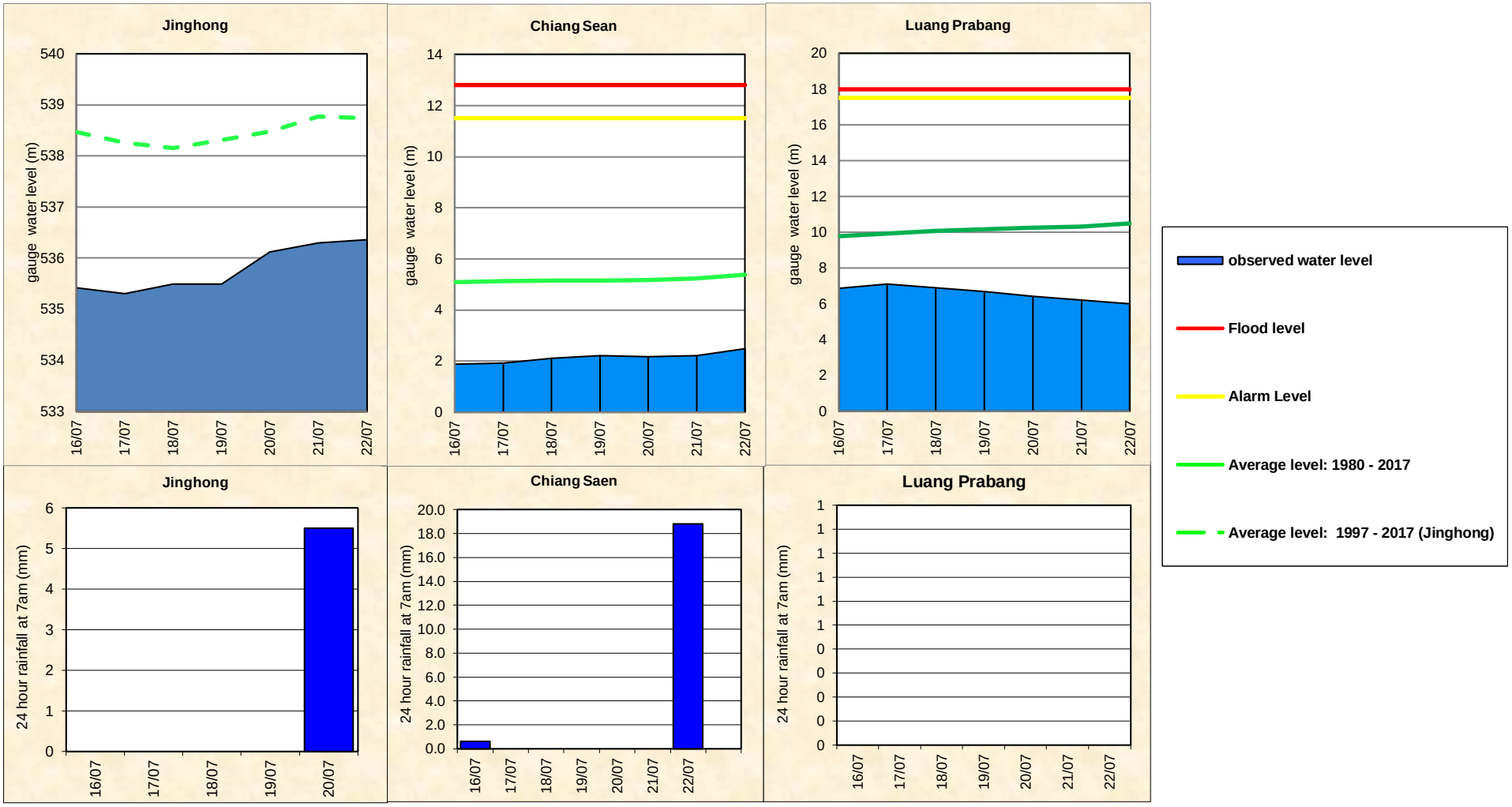

Figure A2: Observed water level and rainfall for Chiang Khan, Vientiane, Nongkhai, and Paksane

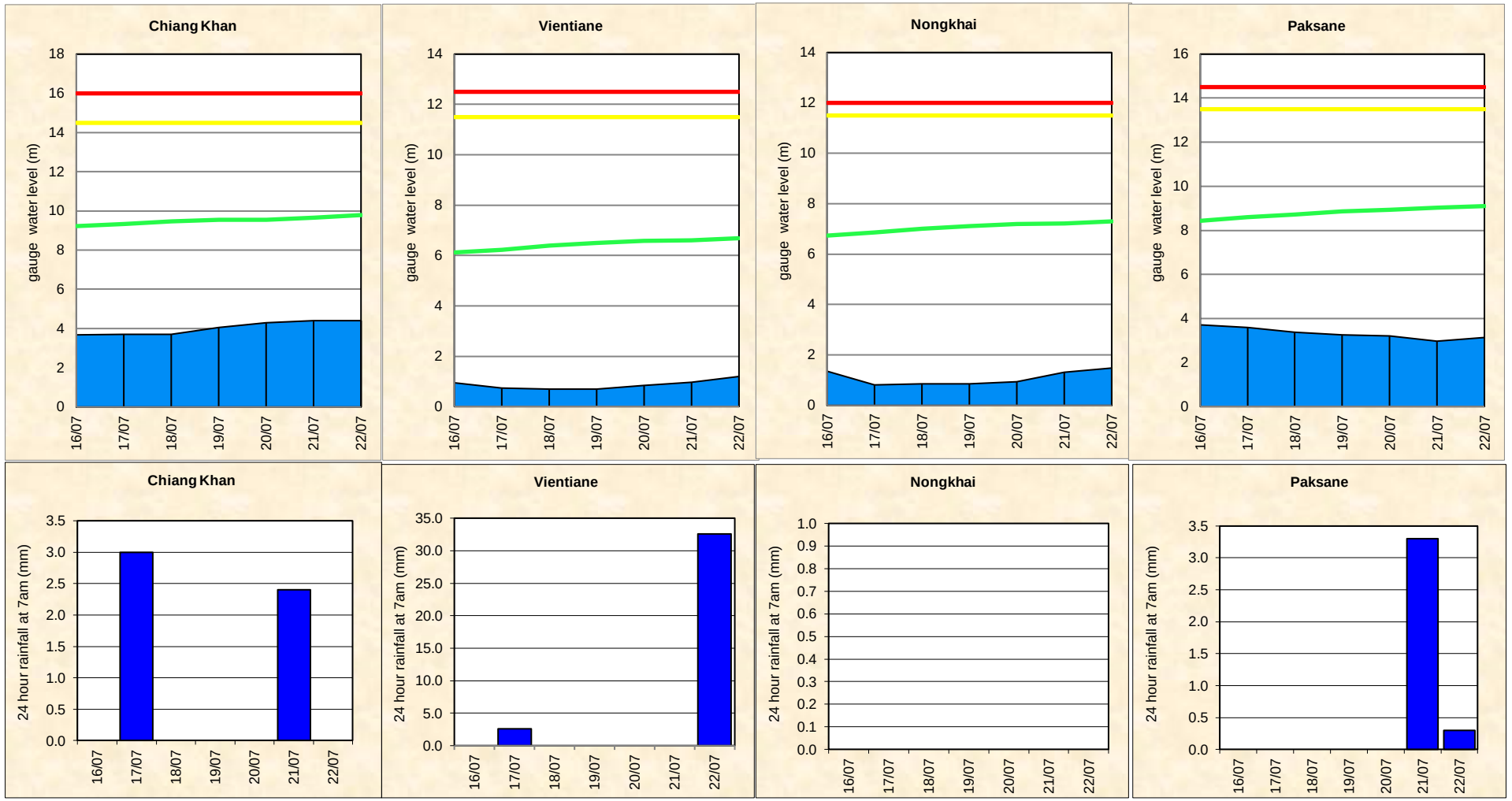

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Figure A3: Observed water level and rainfall for Nakhon Phanom, Thakhek, Mukdahan and Savannakhet

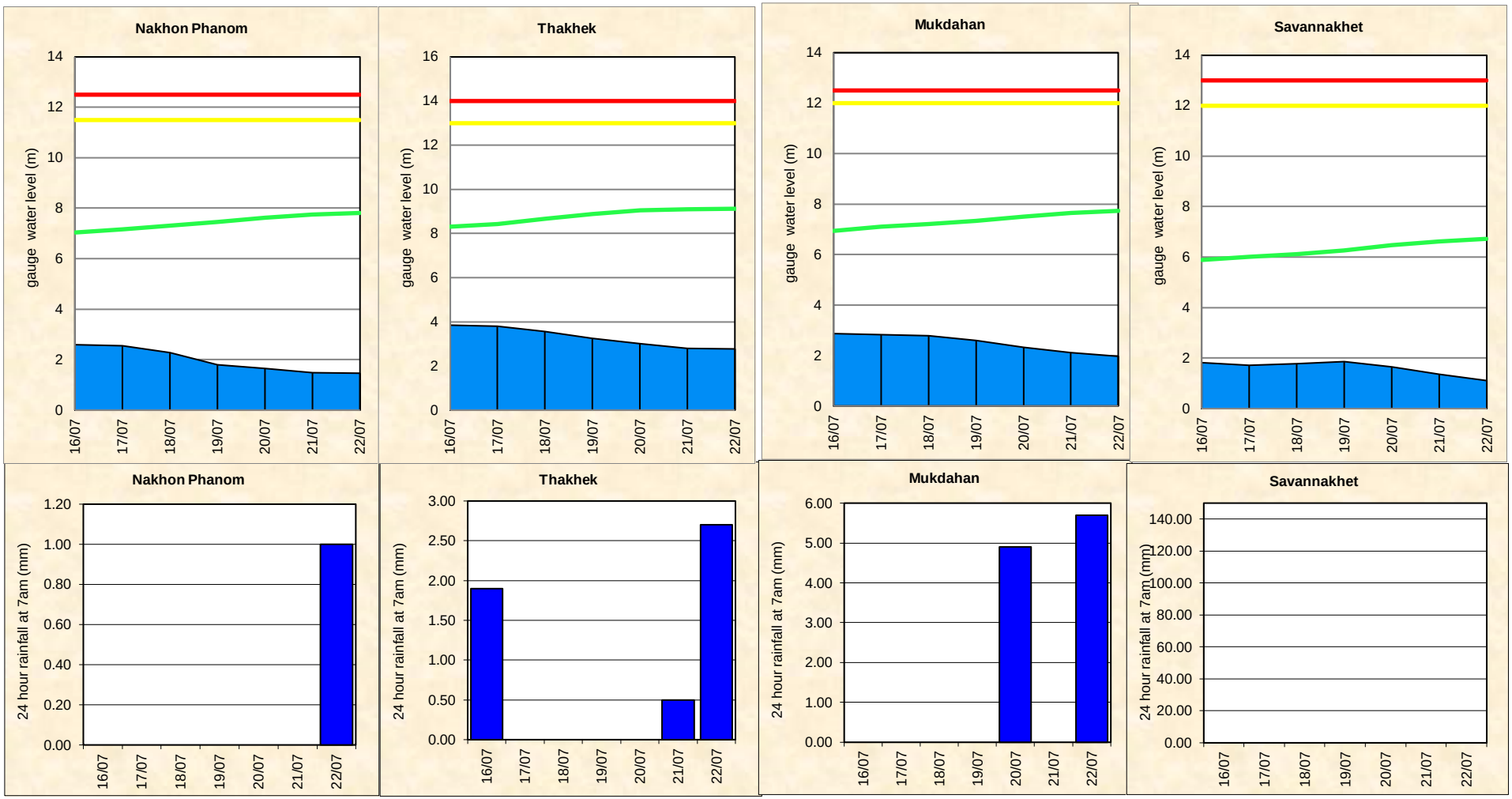

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Figure A4: Observed water level and rainfall for Khong Chiam, Pakse, Stung Treng, and Kratie

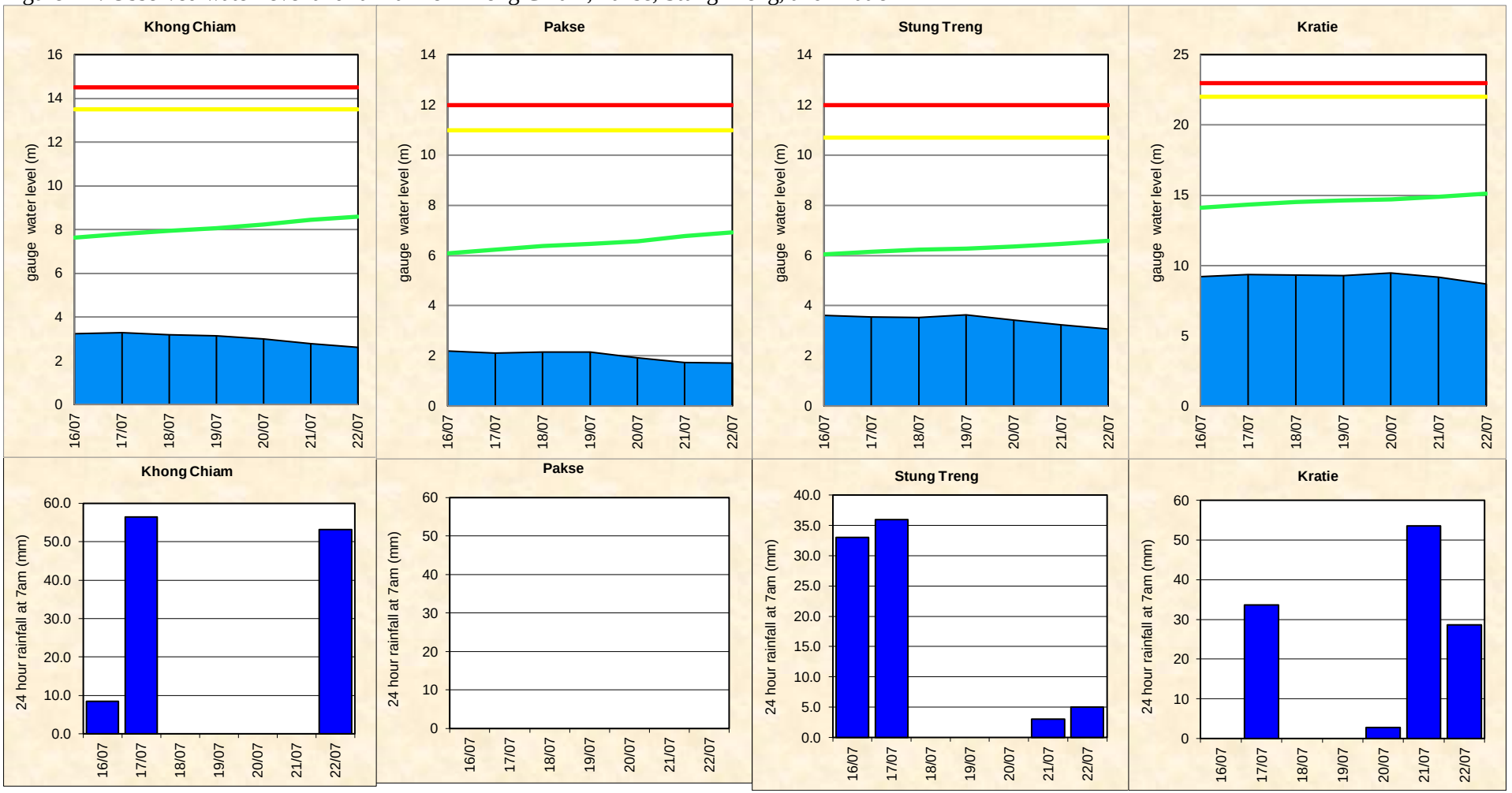

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Figure A5: Water level and rainfall for Kompong Cham, Phnom Penh (Bassac and Port), and Koh Khel

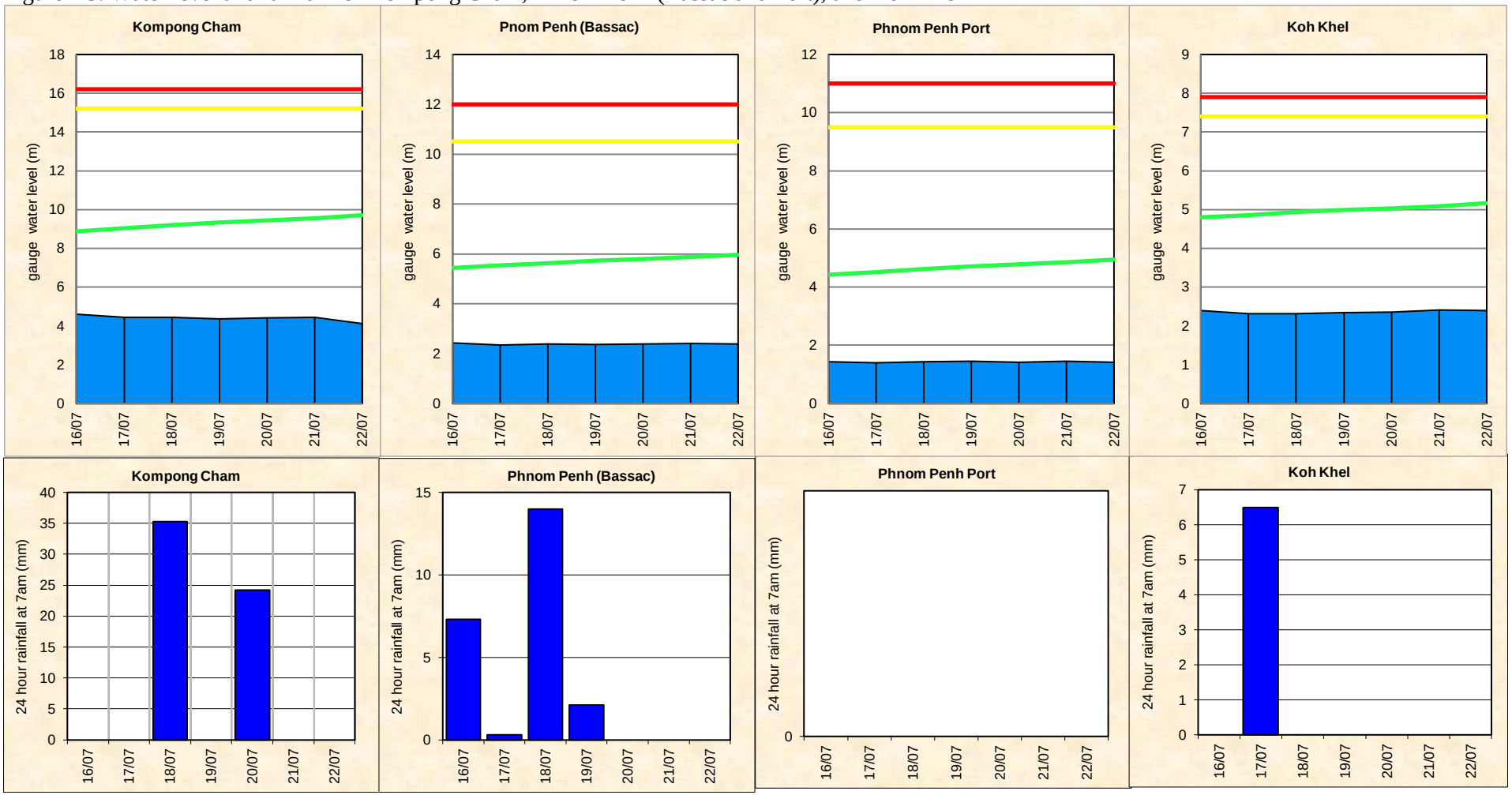

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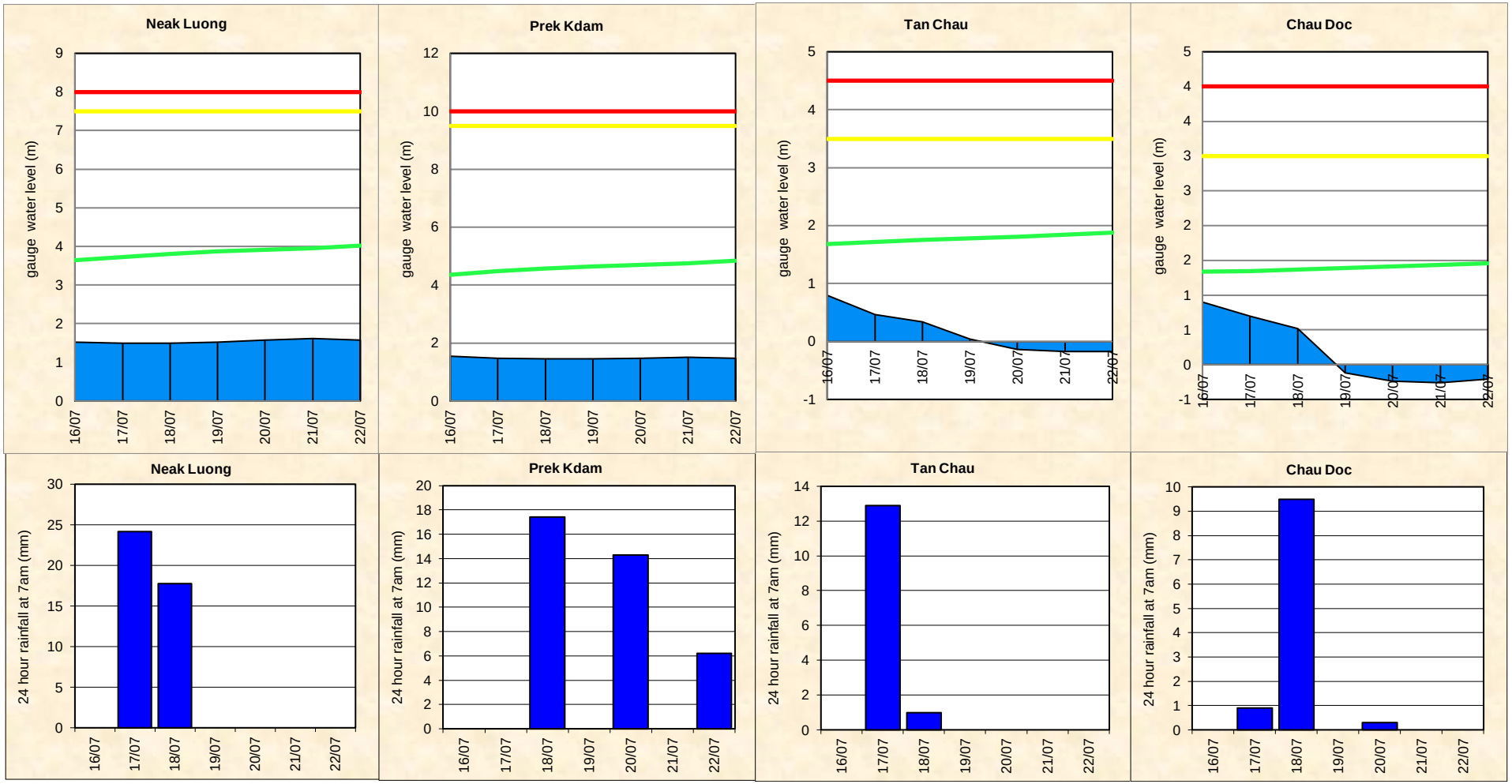
Figure A6: Water level and rainfall for Neak Luong, Prek Kdam, Tan Chau and Chau Doc



Annex B: Accuracy and performance

Accuracy

"Accuracy" describes the accuracy of the adjusted and published forecast, based on the results of the MRC Mekong Flood Forecasting System, which are then adjusted by the Flood Forecaster in Charge taking into consideration known biases in input data and his/her knowledge of the response of the model system and the hydrology of the Mekong River Basin. The information is presented as a graph below, showing the average flood forecasting accuracy along the Mekong mainstream.

In general, the overall accuracy is fair for 1-day to 5-day forecast lead time at stations in the upper and lower parts of the LMB. However, the accuracies at downstream reaches of the LMB stations between Chiang Khan and Kompong Cham, including Tan Chau and Chau Doc for 4-day to 5-day forecast were considered large. This could be affected by the impounding reservoir upstream on the tributaries inflow into the Mekong (Mekong tributaries), rainfall distribution, the travel time of flows and the abnormal tidal on the Mekong and Bassac rivers.

The above differences due to three main factors: (1) internal model functionality in forecasting; for which the parameter adjustment in the model is not possible especially at stations in the upper part and in the Mekong delta where are affected by tidal; (2) the adjustment by utilizing the practical knowledge and experience of flood forecaster-in-charge; and (3) the forecasted accumulated rainfall was not well represented and abnormal tidal trends.

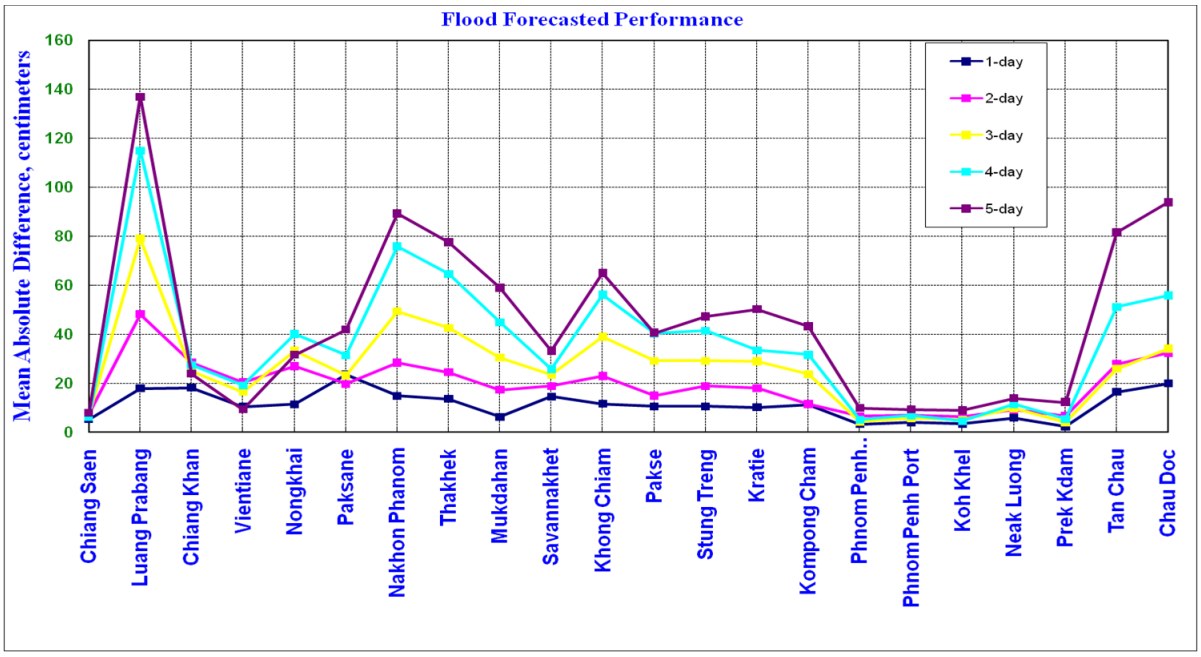


Figure B1: Average flood forecast accuracy along the Mekong mainstream

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Forecast Achievement

The forecast achievement indicates the % of days that the forecast at a particular station for a lead-time is successful against a respective benchmark (Table B2).

Table B1: Evaluation performance forecasting (from 16th to 22th July 2019) base on New Benchmark (%).

Unit in %

Lead time Forecast	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	100.00	85.71	71.43	100.00	71.43	71.43	57.14	85.71	100.00	85.71	85.71	85.71	71.43	85.71	100.00	100.00	100.00	100.00	57.14	100.00	28.57	14.29	79.87
2-day	100.00	50.00	83.33	100.00	83.33	83.33	66.67	83.33	100.00	83.33	100.00	83.33	83.33	100.00	100.00	100.00	100.00	100.00	66.67	100.00	33.33	33.33	83.33
3-day	100.00	40.00	100.00	100.00	80.00	100.00	40.00	60.00	100.00	80.00	80.00	100.00	80.00	80.00	100.00	100.00	100.00	100.00	100.00	100.00	80.00	40.00	84.55
4-day	100.00	25.00	100.00	100.00	100.00	100.00	25.00	50.00	75.00	100.00	75.00	100.00	75.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	25.00	25.00	80.68
5-day	100.00	33.33	100.00	100.00	100.00	100.00	33.33	33.33	100.00	100.00	66.67	100.00	66.67	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00	78.79

Unit in cm

Lead time Forecast	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	22	31	22	23	23	23	20	20	20	20	24	22	18	28	20	9	9	6	7	9	6	6
2-day	39	55	41	42	43	42	38	39	39	38	46	41	33	52	38	18	18	12	14	17	11	11
3-day	51	76	57	59	59	58	54	54	55	54	65	58	46	73	54	26	26	18	20	24	16	16
4-day	60	93	70	72	74	72	68	68	70	68	82	73	57	92	69	34	34	22	26	31	20	21
5-day	66	107	81	84	86	85	81	81	83	80	98	87	67	109	82	41	41	27	31	38	24	24

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Table B2: Evaluation performance forecasting (from 16th to 22th July 2019) base on Old Benchmark (%).

Unit in %

Lead time Forecast	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	100.00	71.43	85.71	57.14	71.43	42.86	42.86	28.57	85.71	57.14	57.14	71.43	42.86	71.43	28.57	100.00	100.00	100.00	100.00	100.00	57.14	42.86	***68.83***
2-day	100.00	50.00	83.33	83.33	50.00	83.33	66.67	50.00	66.67	66.67	50.00	66.67	83.33	66.67	83.33	83.33	83.33	83.33	50.00	66.67	33.33	33.33	***67.42***
3-day	100.00	20.00	80.00	60.00	40.00	60.00	20.00	20.00	40.00	60.00	40.00	40.00	40.00	60.00	60.00	100.00	80.00	100.00	60.00	100.00	40.00	20.00	***56.36***
4-day	100.00	25.00	100.00	100.00	75.00	75.00	0.00	25.00	50.00	75.00	50.00	50.00	50.00	75.00	100.00	75.00	100.00	75.00	100.00	100.00	25.00	0.00	***64.77***
5-day	100.00	0.00	100.00	100.00	100.00	66.67	0.00	33.33	33.33	66.67	33.33	33.33	33.33	66.67	66.67	100.00	100.00	100.00	66.67	100.00	0.00	0.00	***59.09***

Unit in cm

Lead time Forecast	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	25	25	25	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
2-day	50	50	50	25	25	25	25	25	25	25	25	25	25	25	25	10	10	10	10	10	10	10
3-day	50	50	50	25	25	25	25	25	25	25	25	25	25	25	25	10	10	10	10	10	10	10
4-day	75	75	50	50	50	50	50	50	50	50	50	50	50	50	50	10	25	10	25	25	10	10
5-day	75	75	50	50	50	50	50	50	50	50	50	50	50	50	50	25	25	25	25	25	25	25

Note: *An indication of the accuracy given in the Table B2 is based on the performance of the forecast made in 2008 from the new flood forecasting system and the configuration for the 2009 flood season and is published on the website of MRC (http://ffw.mrcmekong.org/accuracy.htm).*

A new set of performance indicators that is established by combining international standards and the specific circumstances in the Mekong River Basin, is applied officially for the flood season of 2011 onward.

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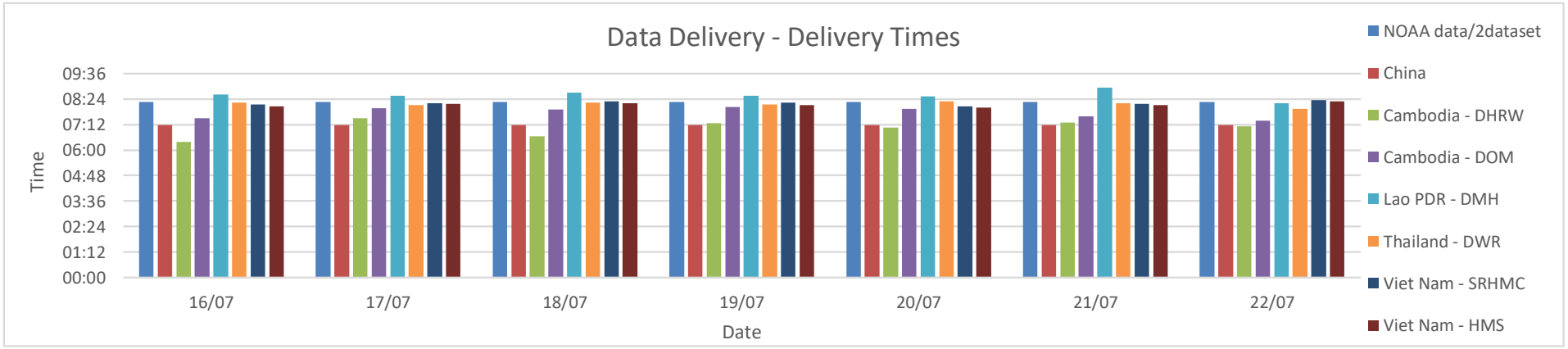
Performance

Performance is assessed by evaluating a number of performance indicators, see table and graphs below:

	FF time sent				Arrival time of input data								Missing data (number-mainstream and trib.st.)							
2019	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	*10:23*	*00:00*	*-*	*-*	*08:15*	*07:10*	*07:01*	*07:45*	*08:35*	*08:09*	*08:12*	*08:07*	*0*	*0*	*3*	*0*	*70*	*2*	*1*	*0*
month	*10:24*	*00:00*	*-*	*-*	*08:15*	*07:14*	*07:24*	*07:55*	*08:34*	*08:09*	*07:26*	*08:12*	*0*	*0*	*7*	*1*	*253*	*4*	*1*	*0*

Table B3: Overview of performance indicators for the past 7 days including the current report date



Week is the week for which this report is made; *Month* is actually the last 30 days (or less if the flood season has just begun); *Season* is the current flood season up to the date of this report.

Figure B2: Data delivery times for the past 8 days including the current report date

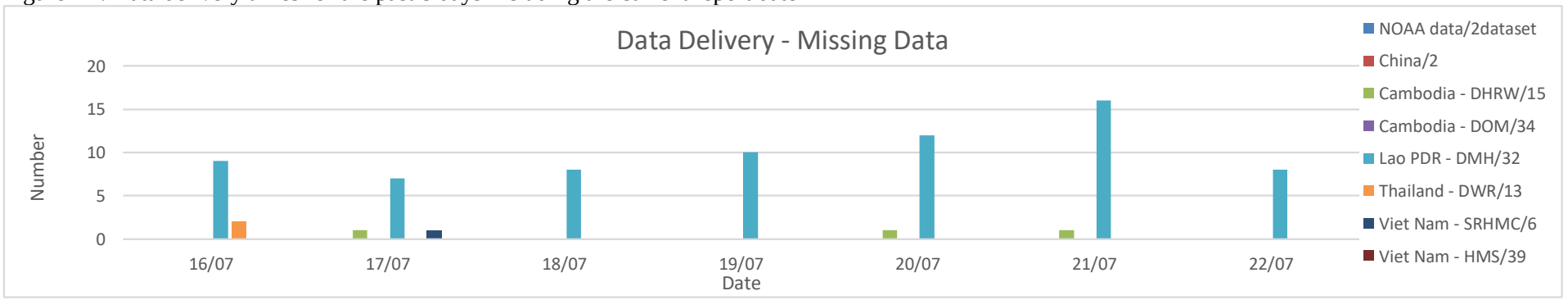


Figure B3: Missing data for the past 8 days including the current report date

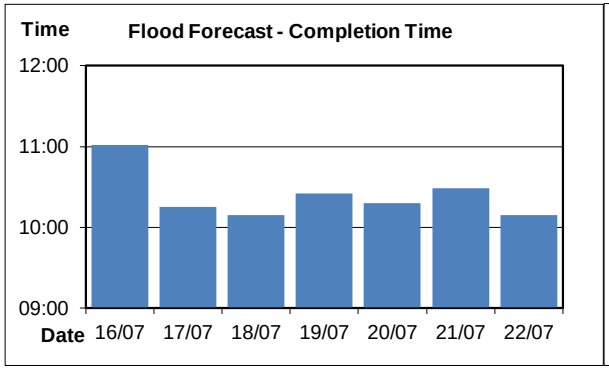


Figure B4: Flood forecast completion time

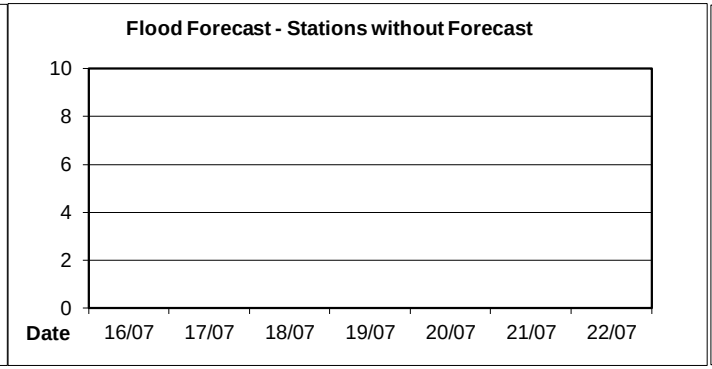


Figure B5: Flood forecast stations without forecast

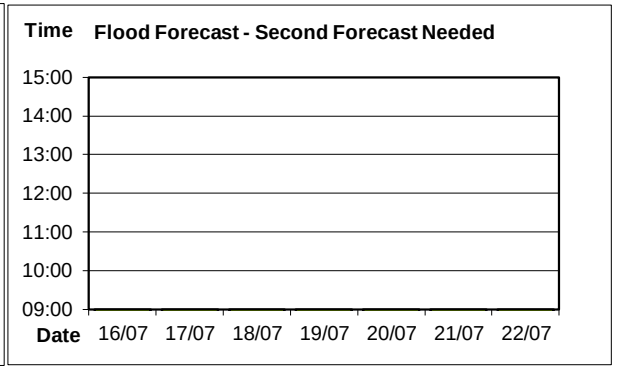


Figure B6: Second forecast needed

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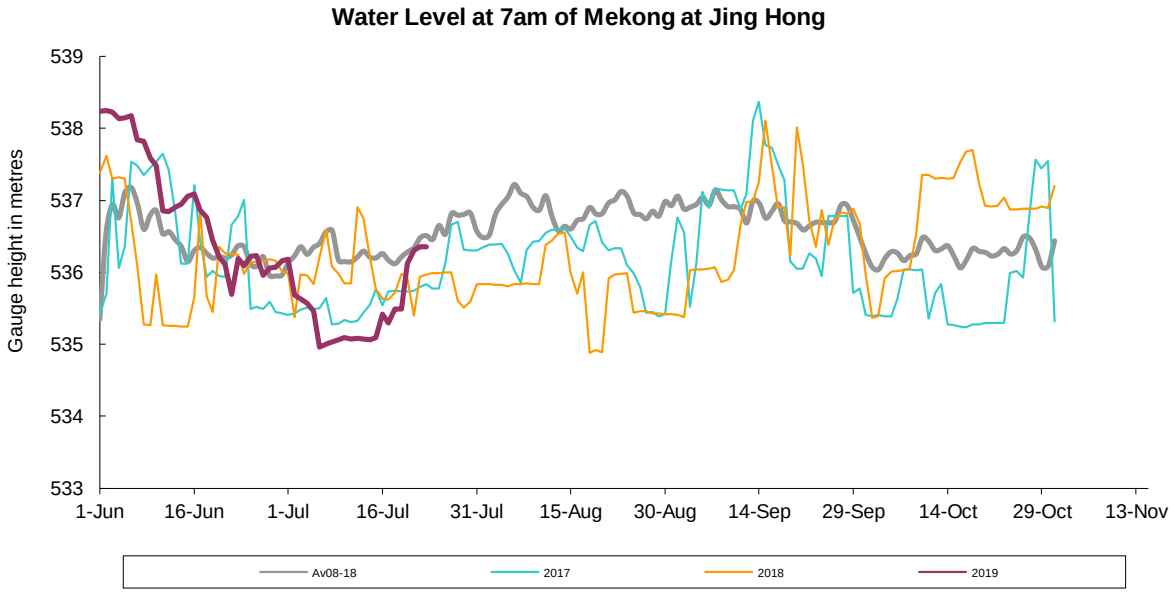
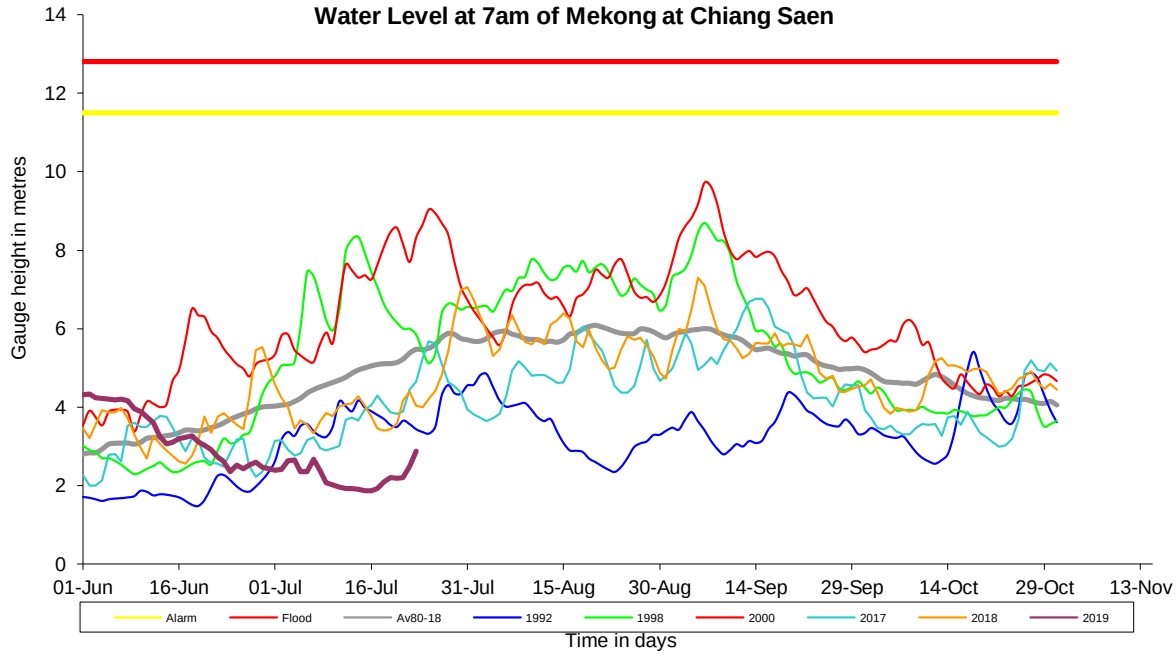
Annex C: Season Water Level Graphs

This Annex has the water level graphs of the report date. These graphs are distributed daily by email together with the Flood Bulletins.

HYDROGRAPHS OF THE MEKONG AT MAINSTREAM STATIONS

IN FLOOD SEASON FROM 1 JUNE TO 23 JULY 2019





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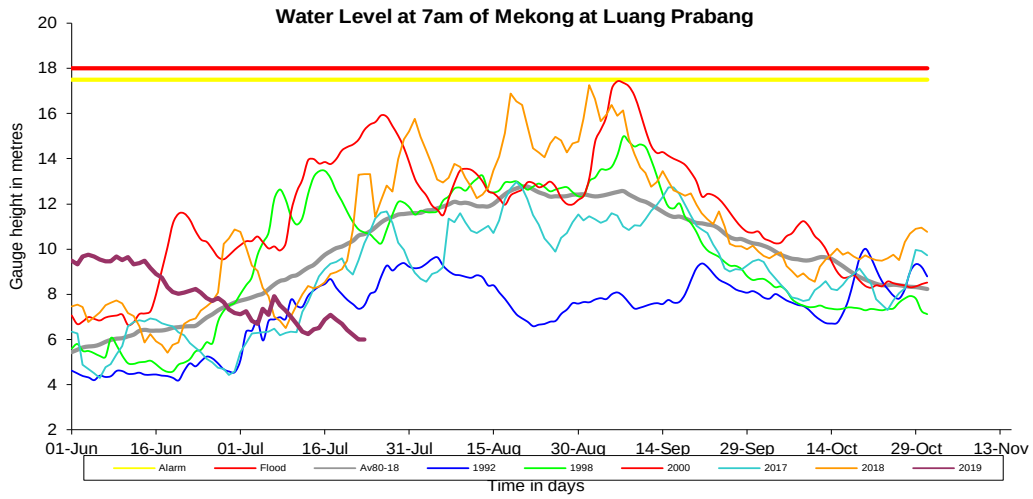

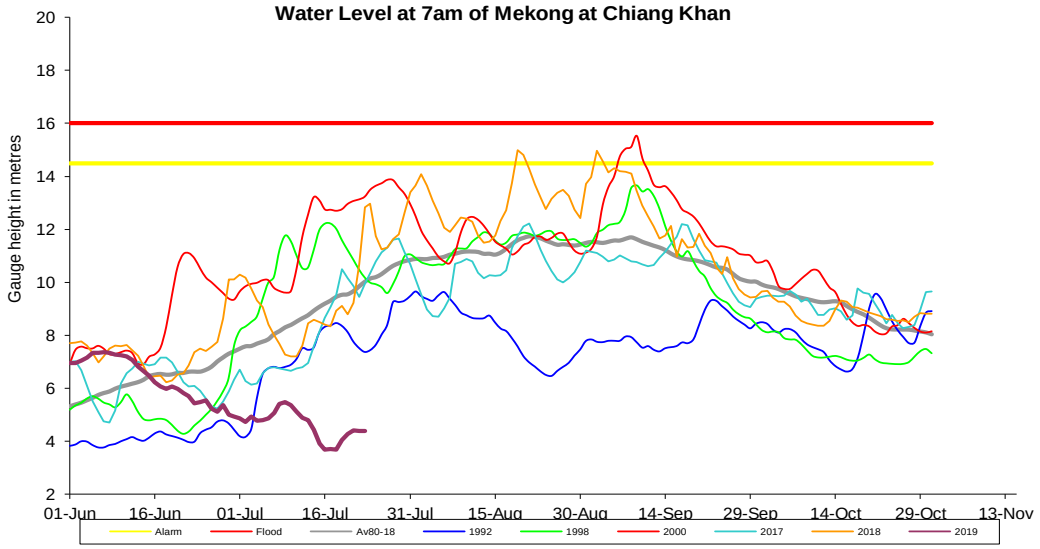

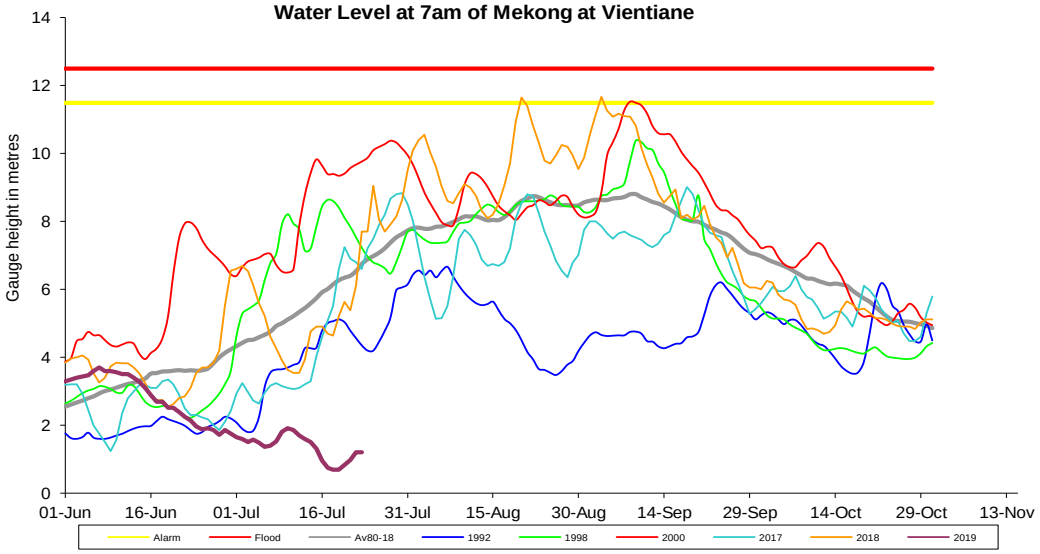

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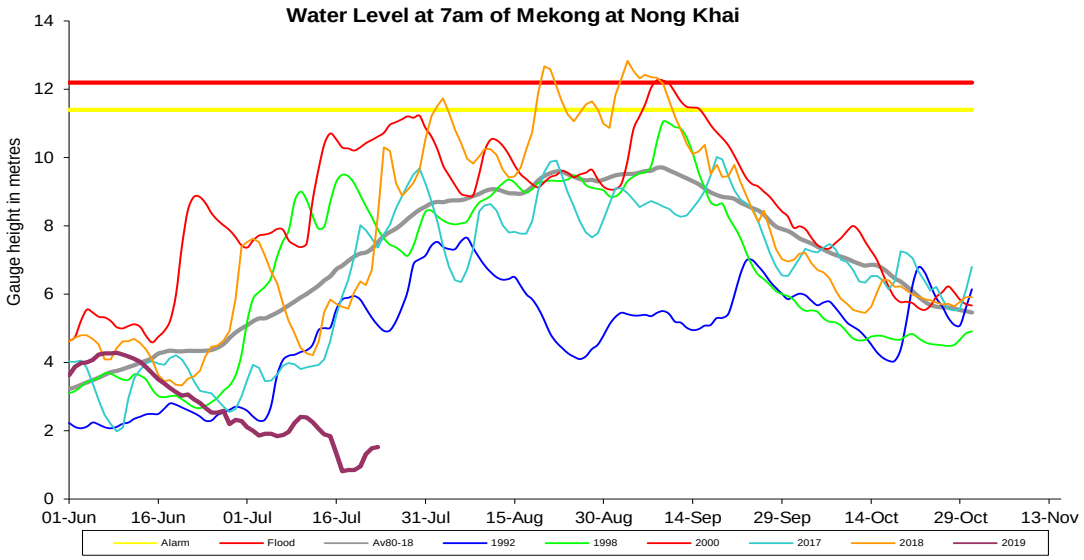

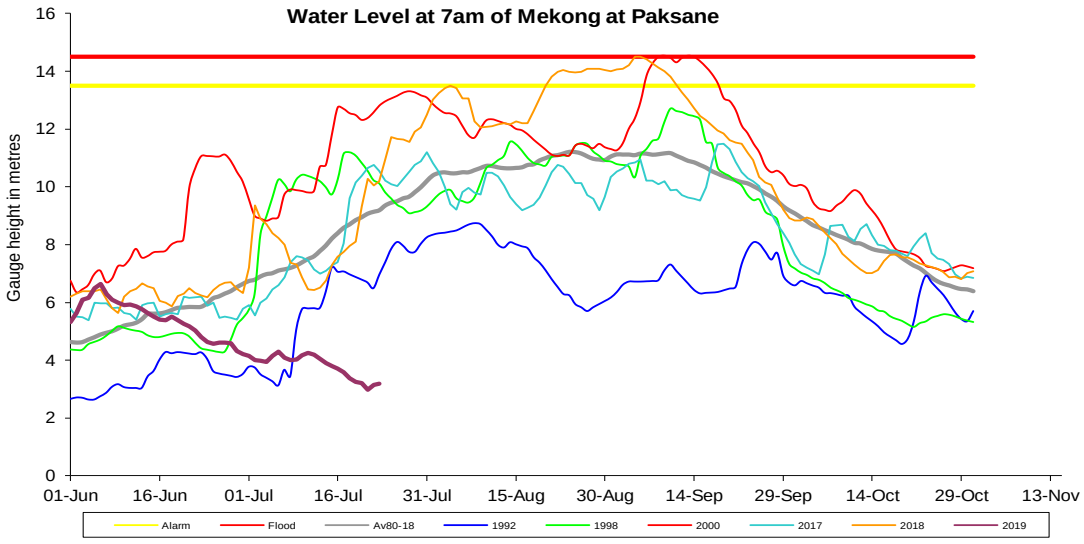

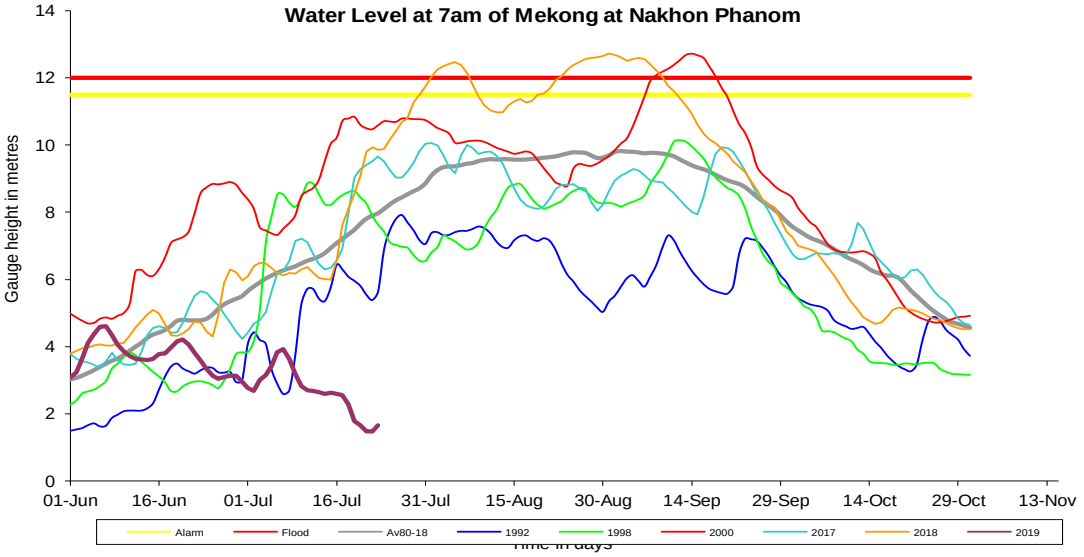

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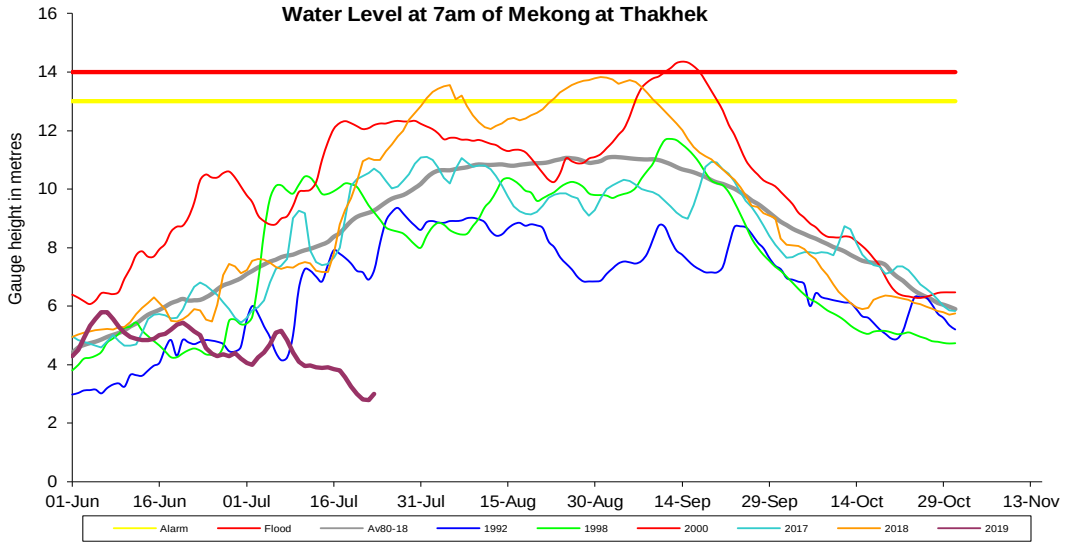

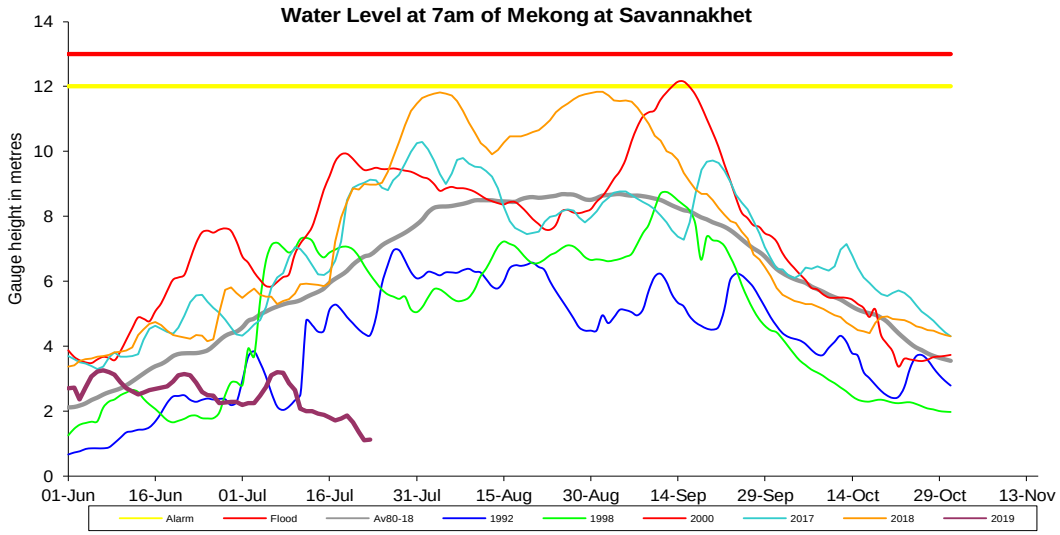

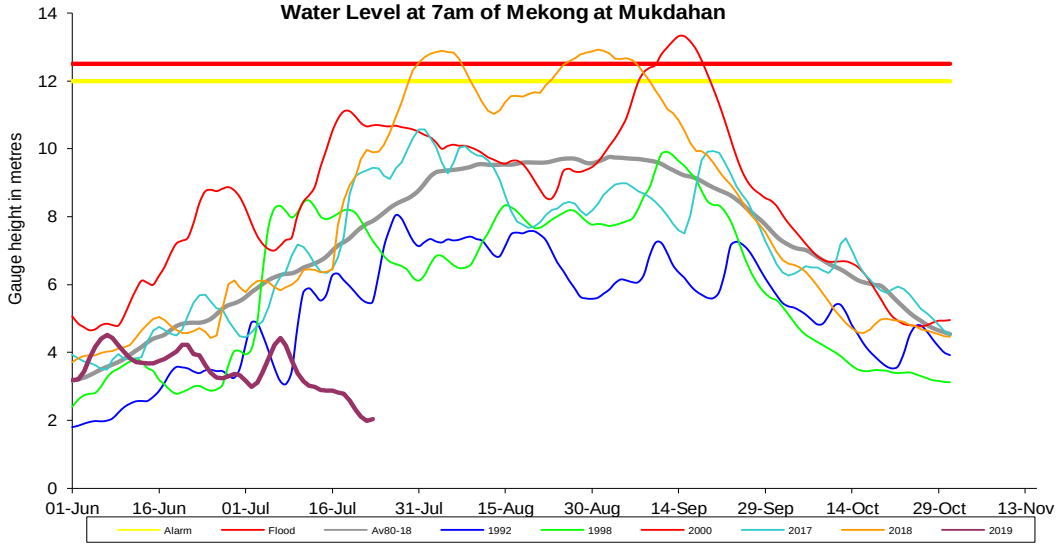

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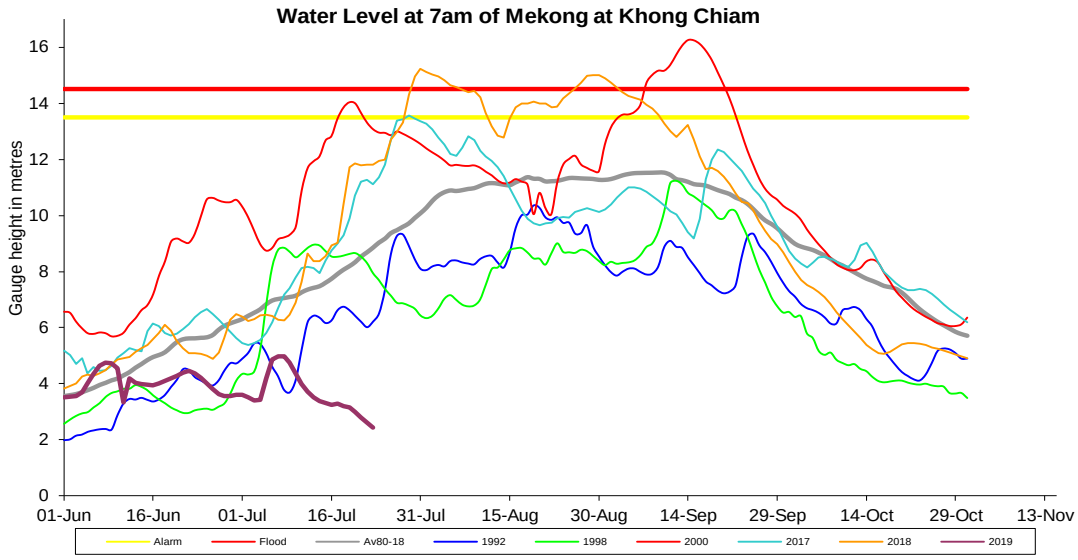

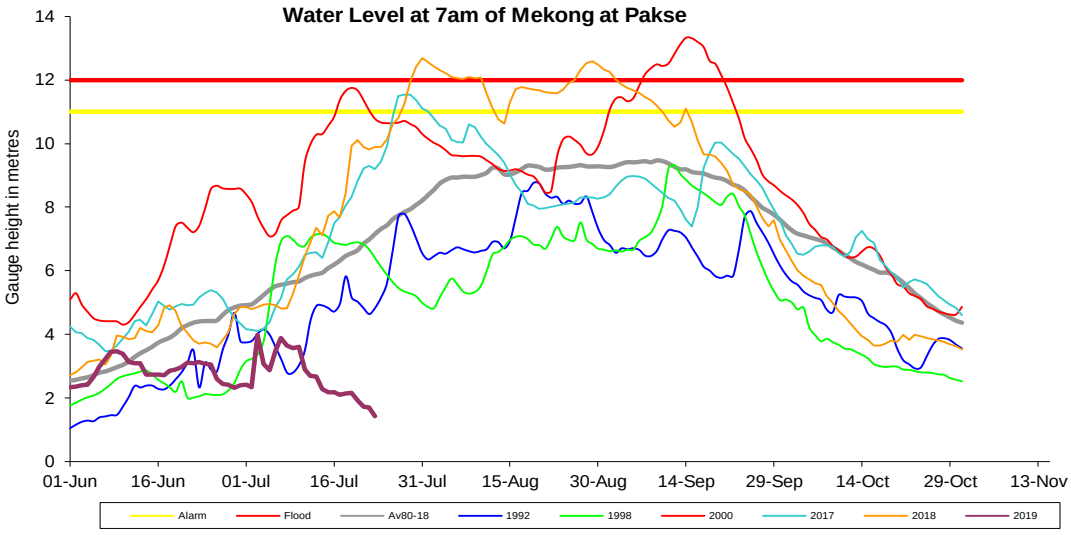

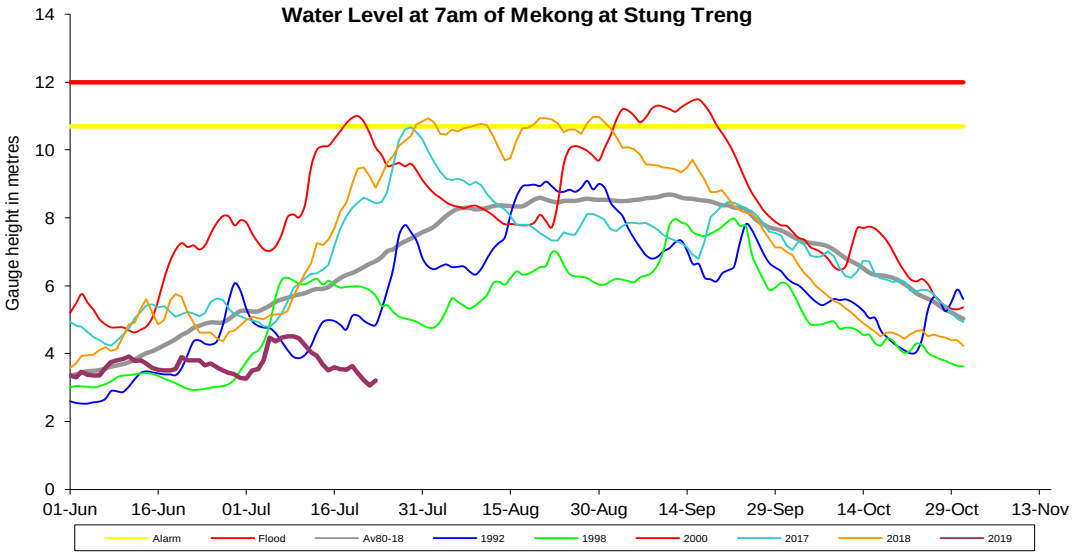

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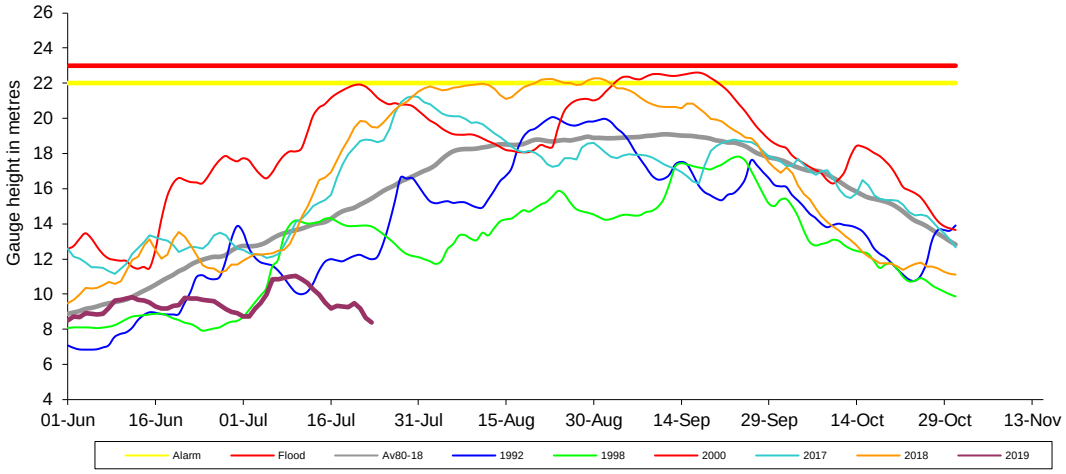
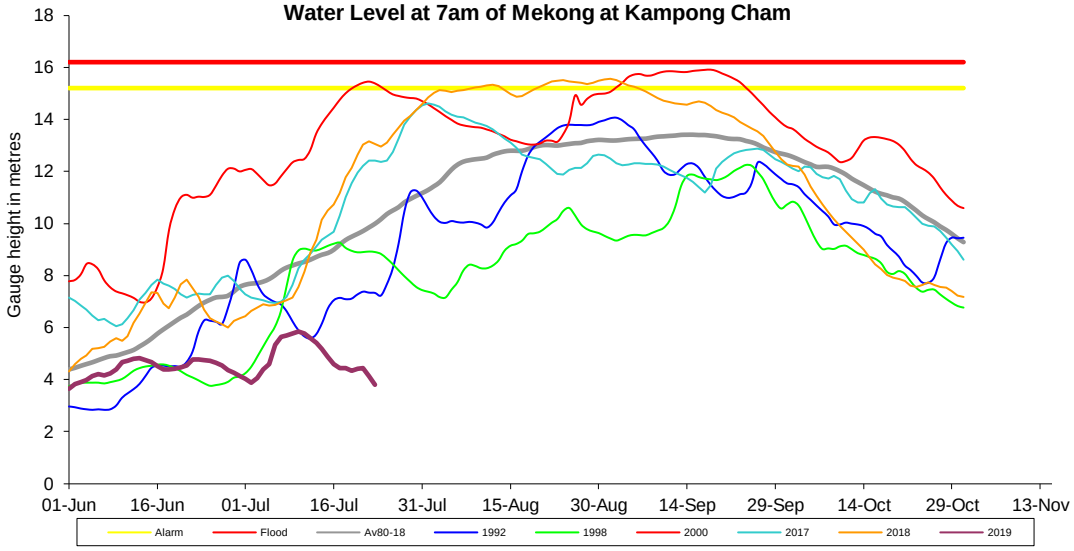
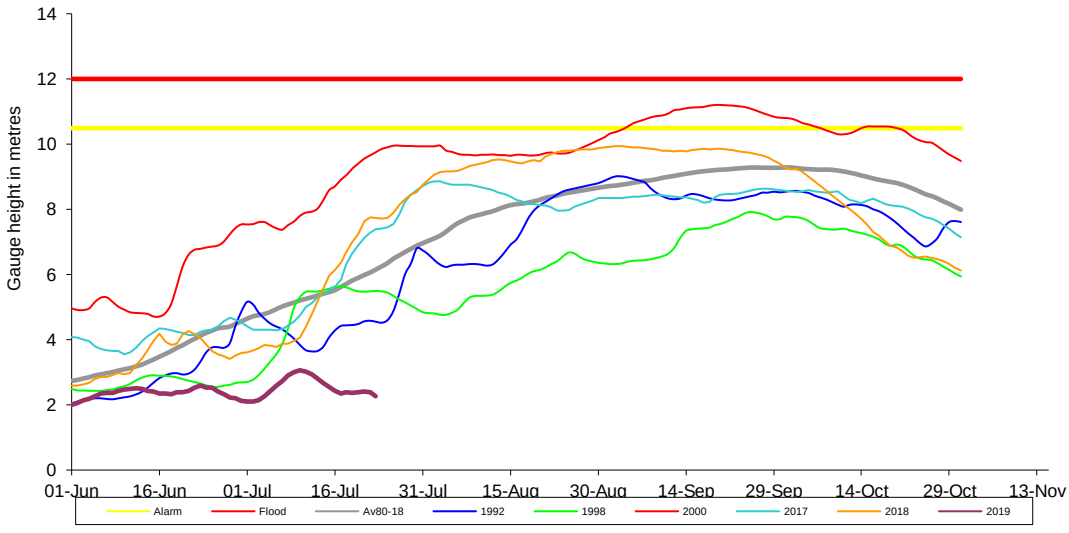
Water Level at 7am of Mekong at Kratie



Water Level at 7am of Mekong at Kampong Cham



Water Level at 7am of Mekong at Phnom Penh Chaktomuk



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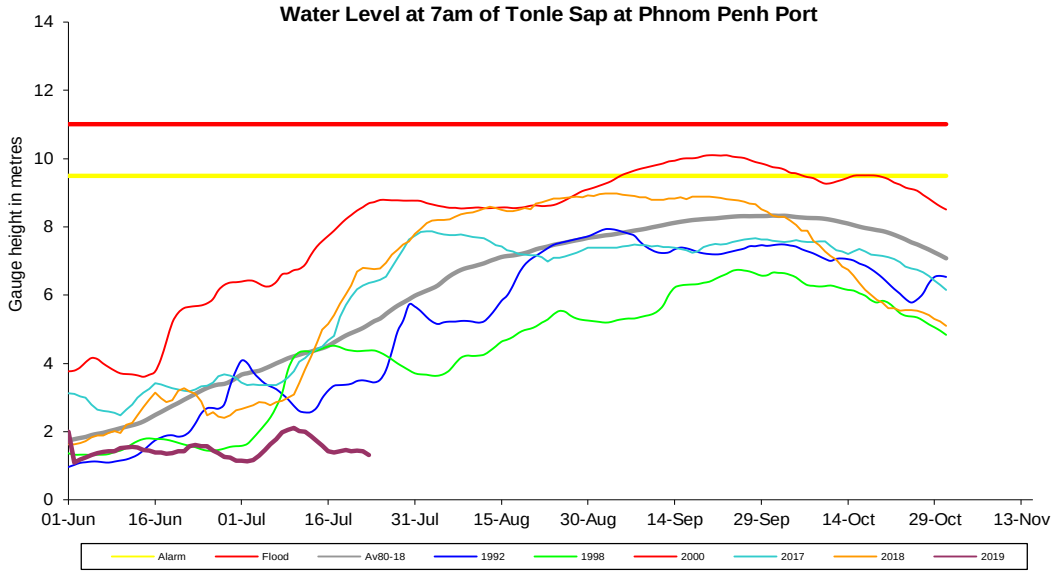

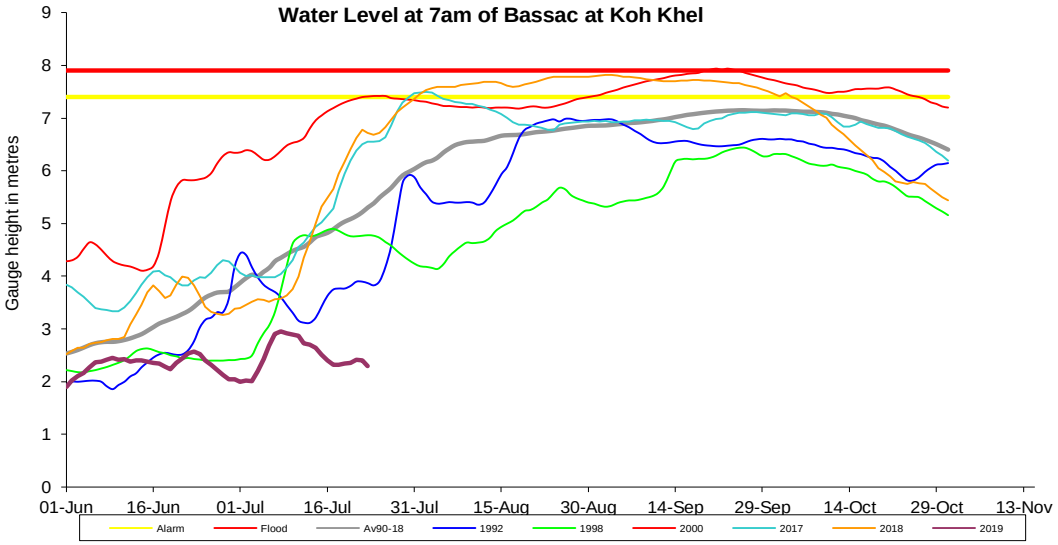

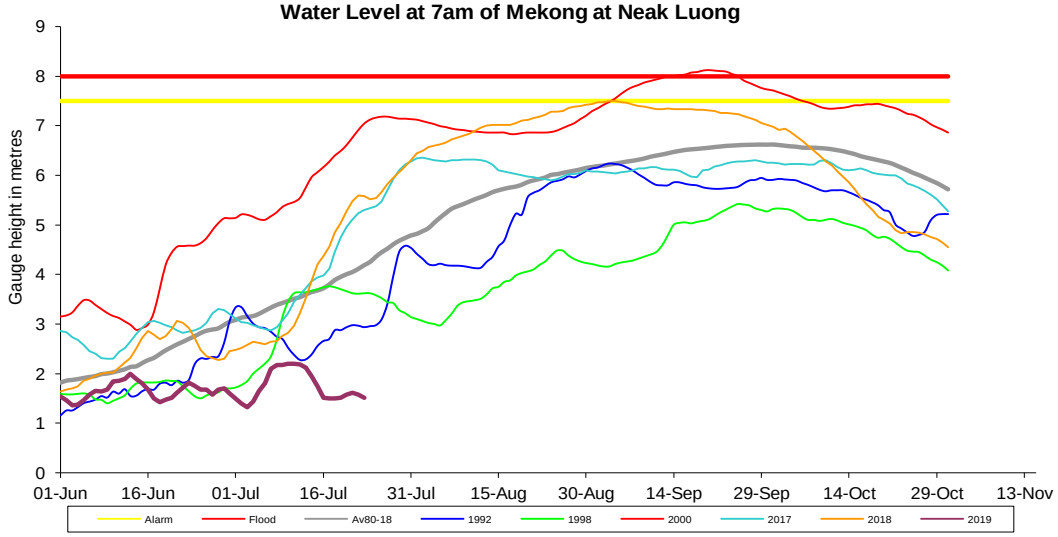

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