

### Weekly Flood Situation Report for the Mekong River Basin

Prepared at: 12/09/2016, covering the week from the 05<sup>th</sup> Sep – 12<sup>th</sup> Sep 2016

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

##### General weather patterns

During the week of 05<sup>th</sup> Sep – 12<sup>th</sup> Sep 2016, four weather bulletins were issued by the Department of Meteorology (DOM) of Cambodia. The weather charts of the 06<sup>th</sup> Sep and 10<sup>th</sup> Sep are presented in the Figures 1 & 2 below:

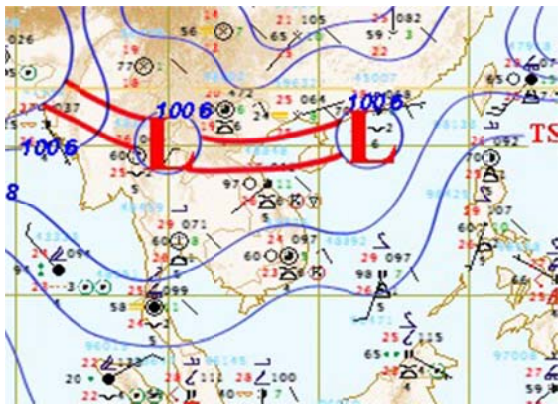


Figure 1: Weather map for 06<sup>th</sup> Sep 2016

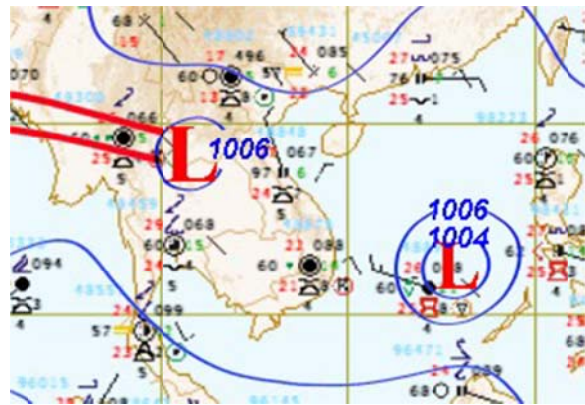


Figure 2: Weather map for 10<sup>th</sup> Sep 2016

##### South-West (SW) Monsoon

During the last week, the moderate Southwest monsoon prevail over Myanmar, Thailand and Indochina Peninsular. (Figure 1 and Figure 2).

##### Inter Tropical Convergence Zone (ITCZ)

The Inter Tropical Convergence Zone (ITCZ) laid across Myanmar, the North of Thailand, the lower North of Lao PDR and Viet Nam.

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

No Tropical Depression (TD), tropical storms (TS) or typhoons (TY) was observed during last week.

##### Other weather phenomena that affect the discharge

The Southwesterly winds prevail over Thailand and Indochina Peninsular at the height of 1.5km (850 hPa).

##### Over weather situation

During the last week, the weather was influenced by Southwest monsoon, ITCZ and Southwesterly winds. As a result, heavy rain occurred mostly in the upper and middle reaches of Lower Mekong Basin. The first three maximum accumulated rainfalls were at Paksane (266.4 mm.), Nakhon Phanom (177 mm.) and Savannakhet (211.9 mm.), see Figure 3 and Table A2 for more details.

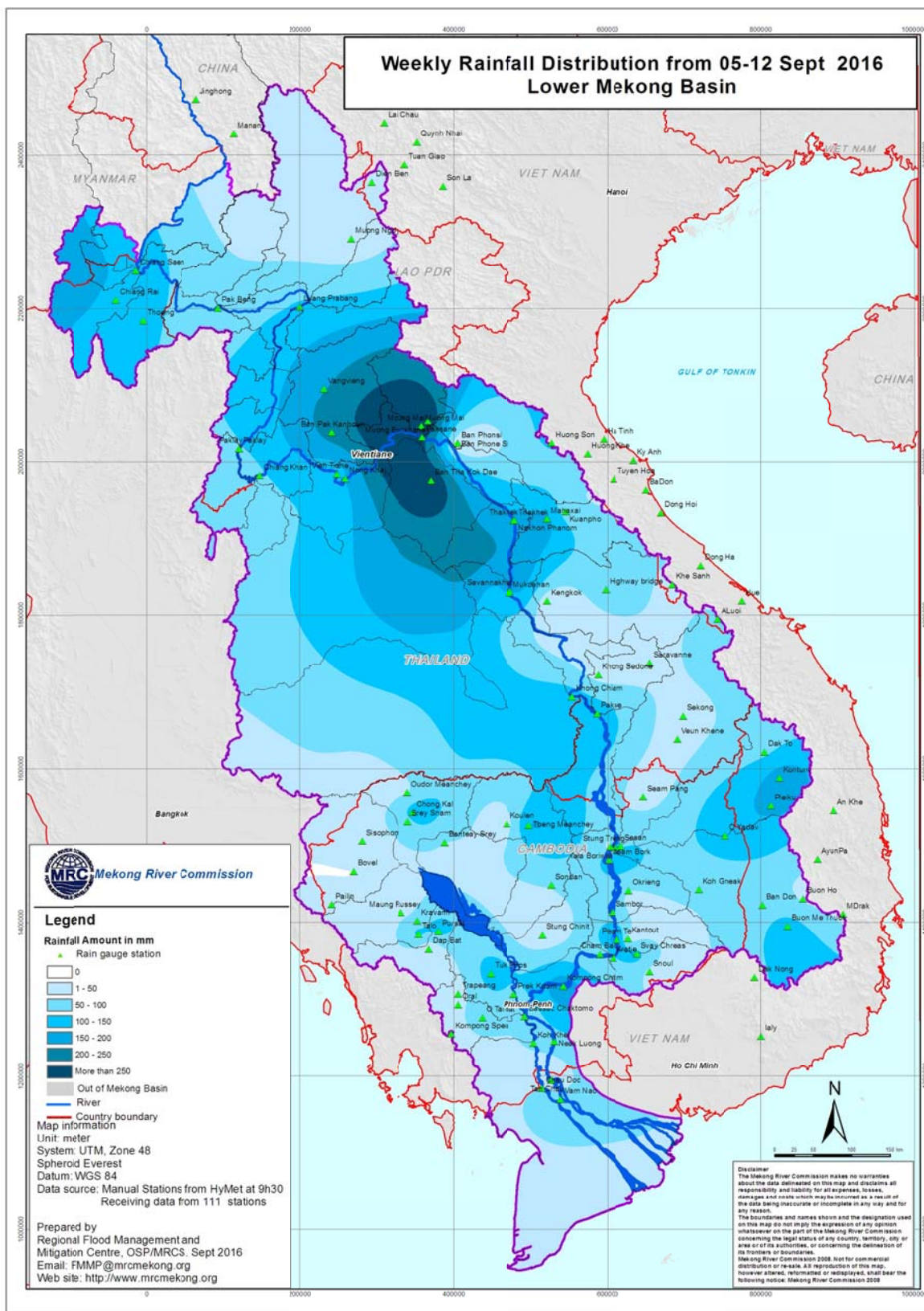


Figure 3: Weekly Rainfall Distribution over the LMB from 05<sup>th</sup> Sep – 12<sup>th</sup> Sep, 2016

### **General behaviour of the Mekong River**

Compared the Long Term Average (LTA), during the last week, the water levels at most stations of LMB were fluctuated below the LTA, except Luang Prabang, Paksane, Nakhon Phanom, Savannakhek and Khong Chiam that were above the LTA.

#### ***For stations from Chiang Saen and Luang Prabang***

During the last week, the water levels at these stations were fluctuated below the LTA except Luang Prabang that was above the LTA.

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

During the last week, the water levels at these stations were fluctuated below the LTA, except Paksane that was above the LTA.

#### ***For stations from Thakhet/Nakhon Phanom to Pakse***

During the last week, the water levels at these stations were fluctuated about or below the LTA, except Nakhon Phanom, Savannakhek and Khong Chiam that were above the LTA.

#### ***For stations from Stung Treng to Kampong Cham***

During the last week, the water levels at these stations were fluctuated below the LTA.

#### ***For stations from Phnom Penh to Koh Khel/Neak Luong***

During the last week, the water levels at these stations were fluctuated below the LTA.

#### ***Tan Chau and Chau Doc***

During the last week, the water levels at these stations were fluctuated below the LTA.

**Note:** For areas between forecast stations, please refer to the nearest forecast station.

### **Flood Situation**

#### ▪ Flood stage or alarm stage:

No alarm stage (where the forecast is expected to reach flood level within three days) was reported anywhere on the mainstream of the Mekong River during the last week. Water levels were still significantly below flood levels (as defined by the national agency) at all forecast stations.

#### ▪ Damage or victims:

No damage or loss of life due to river flooding was recorded anywhere along the Mekong River during the last week.

For more details 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
- the water level graphs showing the observed water level for the season in Annex C

**Annex A: Graphs and Tables****Table A1: observed water levels**

Unit in m

| 2016  | 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 |
|-------|----------|-------------|---------------|-------------|-----------|----------|---------|---------------|---------|----------|-------------|-------------|-------|-------------|--------|--------------|---------------------|-----------------|----------|------------|-----------|----------|----------|
| 05/09 | 536.82   | 4.56        | 10.06         | 9.69        | 6.45      | 7.57     | 9.17    | 9.06          | 10.10   | 8.77     | 8.40        | 9.70        | 7.86  | 6.95        | 16.09  | 10.52        | 6.47                | 5.49            | 5.71     | 4.64       | 5.51      | 1.77     | 1.31     |
| 06/09 | 536.90   | 4.41        | 11.60         | 9.81        | 6.28      | 7.32     | 9.14    | 8.94          | 10.00   | 8.75     | 8.39        | 9.84        | 8.18  | 7.03        | 16.07  | 10.47        | 6.45                | 5.47            | 5.69     | 4.64       | 5.52      | 1.75     | 1.31     |
| 07/09 | 536.88   | 4.65        | 11.80         | 10.60       | 6.58      | 7.56     | 9.09    | 8.89          | 9.95    | 8.78     | 8.41        | 10.14       | 8.33  | 7.64        | 16.43  | 10.55        | 6.47                | 5.48            | 5.69     | 4.62       | 5.51      | 1.77     | 1.33     |
| 08/09 | 536.84   | 4.66        | 11.08         | 11.43       | 7.73      | 8.63     | 9.50    | 8.85          | 9.88    | 8.70     | 8.33        | 10.20       | 8.38  | 7.82        | 17.22  | 11.09        | 6.64                | 5.66            | 5.80     | 4.72       | 5.65      | 1.81     | 1.37     |
| 09/09 | 536.83   | 4.79        | 10.94         | 11.20       | 8.33      | 9.38     | 10.10   | 9.08          | 10.08   | 8.74     | 8.38        | 9.95        | 8.16  | 7.68        | 17.47  | 11.44        | 6.83                | 5.87            | 5.97     | 4.88       | 5.81      | 1.91     | 1.43     |
| 10/09 | 536.71   | 4.90        | 11.00         | 10.87       | 8.17      | 9.22     | 11.34   | 9.34          | 10.37   | 8.91     | 8.55        | 9.86        | 7.99  | 7.43        | 17.25  | 11.41        | 6.92                | 5.93            | 6.02     | 4.91       | 5.86      | 1.95     | 1.48     |
| 11/09 | 536.51   | 4.97        | 11.66         | 10.73       | 7.70      | 8.93     | 11.38   | 9.41          | 10.45   | 9.07     | 8.71        | 10.09       | 8.10  | 7.22        | 16.90  | 11.22        | 6.85                | 5.87            | 5.99     | 4.92       | 5.84      | 2.01     | 1.56     |
| 12/09 | 536.93   | 4.95        | 13.00         | 11.15       | 7.70      | 8.80     | 11.40   | 9.57          | 10.60   | 9.32     | 8.97        | 10.49       | 8.52  | 7.40        | 16.73  | 11.03        | 6.79                | 5.81            | 5.95     | 4.84       | 5.83      | 2.10     | 1.74     |

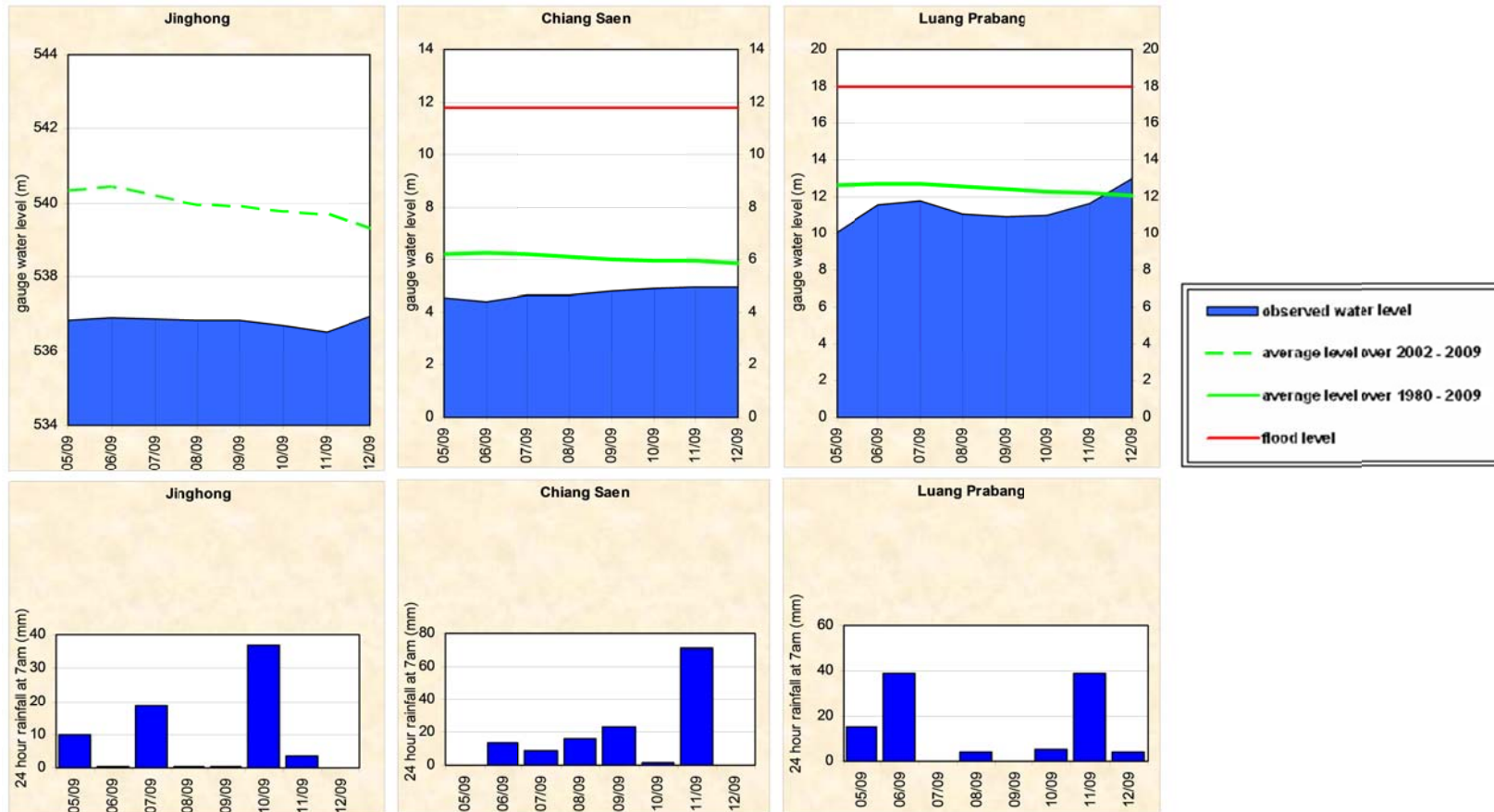
**Table A2: observed rainfall**

Unit in mm

| 2016  | 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 |
|-------|----------|-------------|---------------|-------------|-----------|----------|---------|---------------|---------|----------|-------------|-------------|-------|-------------|--------|--------------|---------------------|-----------------|----------|------------|-----------|----------|----------|
| 05/09 | 10.00    | 0.00        | 15.40         | 0.00        | 5.60      | 3.90     | 85.40   | 4.90          | 4.60    | 2.50     | 4.70        | 1.40        | nr    | nr          | nr     | nr           | 11.40               | -               | 0.50     | 8.40       | 6.30      | 8.50     | 8.00     |
| 06/09 | 0.50     | 13.30       | 39.00         | 8.90        | 68.80     | 26.80    | 17.00   | 20.50         | 16.00   | 19.20    | 70.80       | 28.20       | 70.80 | 26.00       | nr     | 1.40         | nr                  | -               | 0.00     | nr         | nr        | nr       | -        |
| 07/09 | 18.50    | 9.00        | nr            | 12.50       | 36.50     | 10.80    | 1.20    | 49.00         | 35.30   | 9.80     | 36.80       | 2.60        | 2.60  | 10.00       | -      | 5.50         | -                   | -               | -        | -          | -         | nr       | -        |
| 08/09 | 0.50     | 16.40       | 4.00          | 0.00        | 3.60      | 38.90    | 82.00   | 16.10         | 28.30   | 0.00     | nr          | 0.80        | 13.20 | 27.00       | 35.00  | 49.20        | 1.60                | -               | 18.90    | 6.20       | 13.40     | 7.00     | 12.00    |
| 09/09 | 0.50     | 23.50       | nr            | 29.80       | nr        | 0.00     | 6.80    | 23.50         | 0.80    | 0.70     | 3.70        | 0.00        | 1.00  | 19.00       | nr     | 17.00        | nr                  | -               | nr       | 14.20      | nr        | 0.00     | 0.00     |
| 10/09 | 37.00    | 1.50        | 5.40          | 5.30        | 0.00      | 14.20    | 9.40    | 31.40         | 20.80   | 0.00     | nr          | 0.00        | nr    | nr          | 27.00  | 65.80        | 8.50                | -               | nr       | 0.00       | nr        | nr       | -        |
| 11/09 | 3.50     | 71.50       | 39.00         | 38.60       | 4.00      | 54.00    | 64.60   | 1.40          | 7.10    | 17.30    | 61.70       | 55.50       | 38.00 | nr          | 4.50   | 2.70         | 32.70               | -               | 19.30    | 16.40      | 12.30     | 0.00     | 0.20     |
| 12/09 | 0.00     | 0.00        | 4.20          | 0.00        | nr        | 1.30     | nr      | 30.20         | 42.10   | 39.90    | 34.20       | 31.90       | 7.00  | 45.50       | 26.80  | 31.20        | 8.50                | -               | 23.90    | 34.20      | 55.40     | 5.70     | 34.00    |
| Sum R | 70.5     | 135.2       | 107.0         | 95.1        | 118.5     | 149.9    | 266.4   | 177.0         | 155.0   | 89.4     | 211.9       | 120.4       | 132.6 | 127.5       | 93.3   | 172.8        | 62.7                | 0.0             | 62.6     | 79.4       | 87.4      | 21.2     | 54.2     |

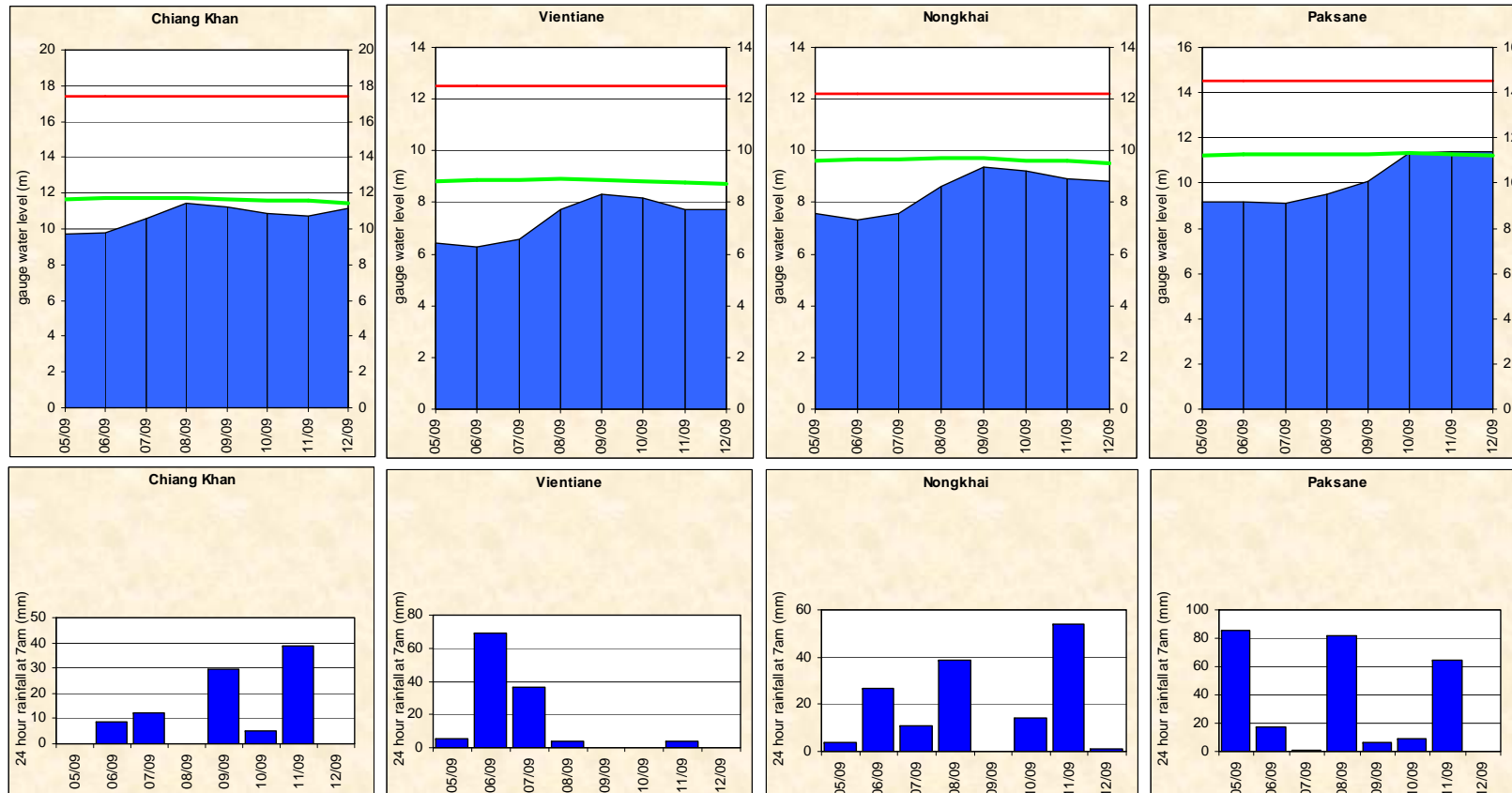
Monday, 12<sup>th</sup> Sep 2016

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



Monday, 12<sup>th</sup> Sep 2016

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



Monday, 12<sup>th</sup> Sep 2016

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

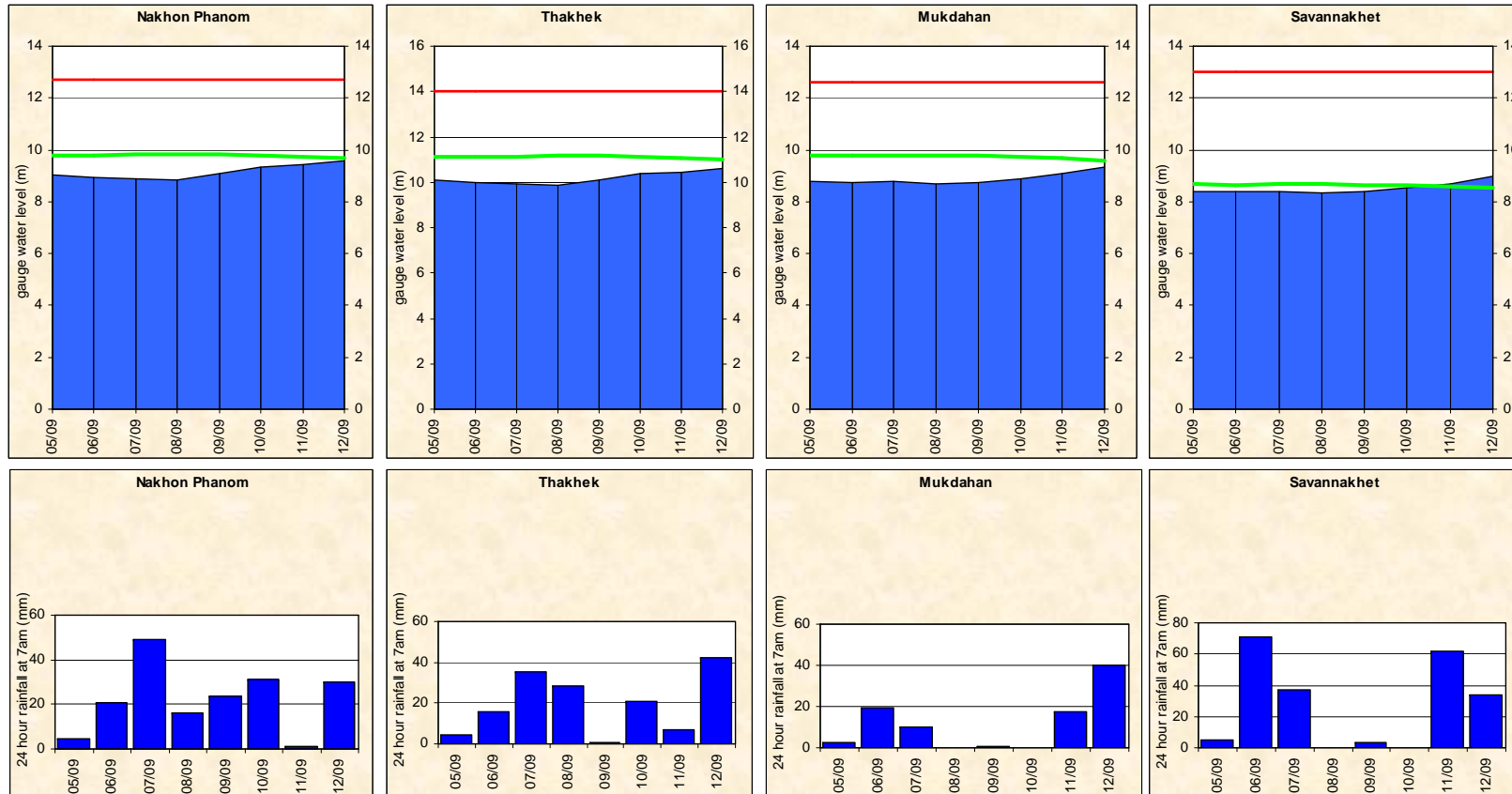
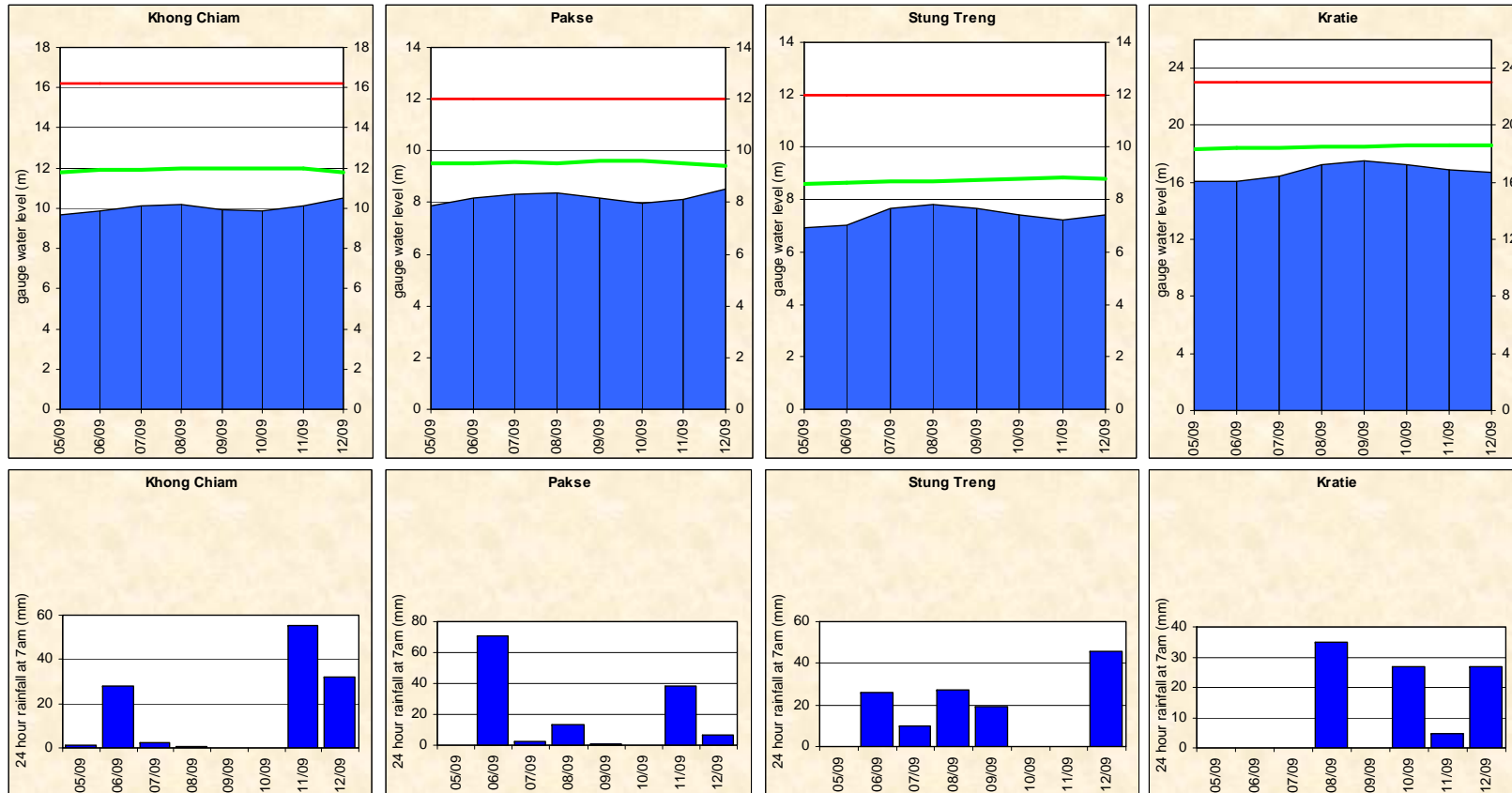


Figure A4: Observed water level and rainfall for Khong Chiam, Pakse, Stung Treng, and Kratie





Monday, 12<sup>th</sup> Sep 2016

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

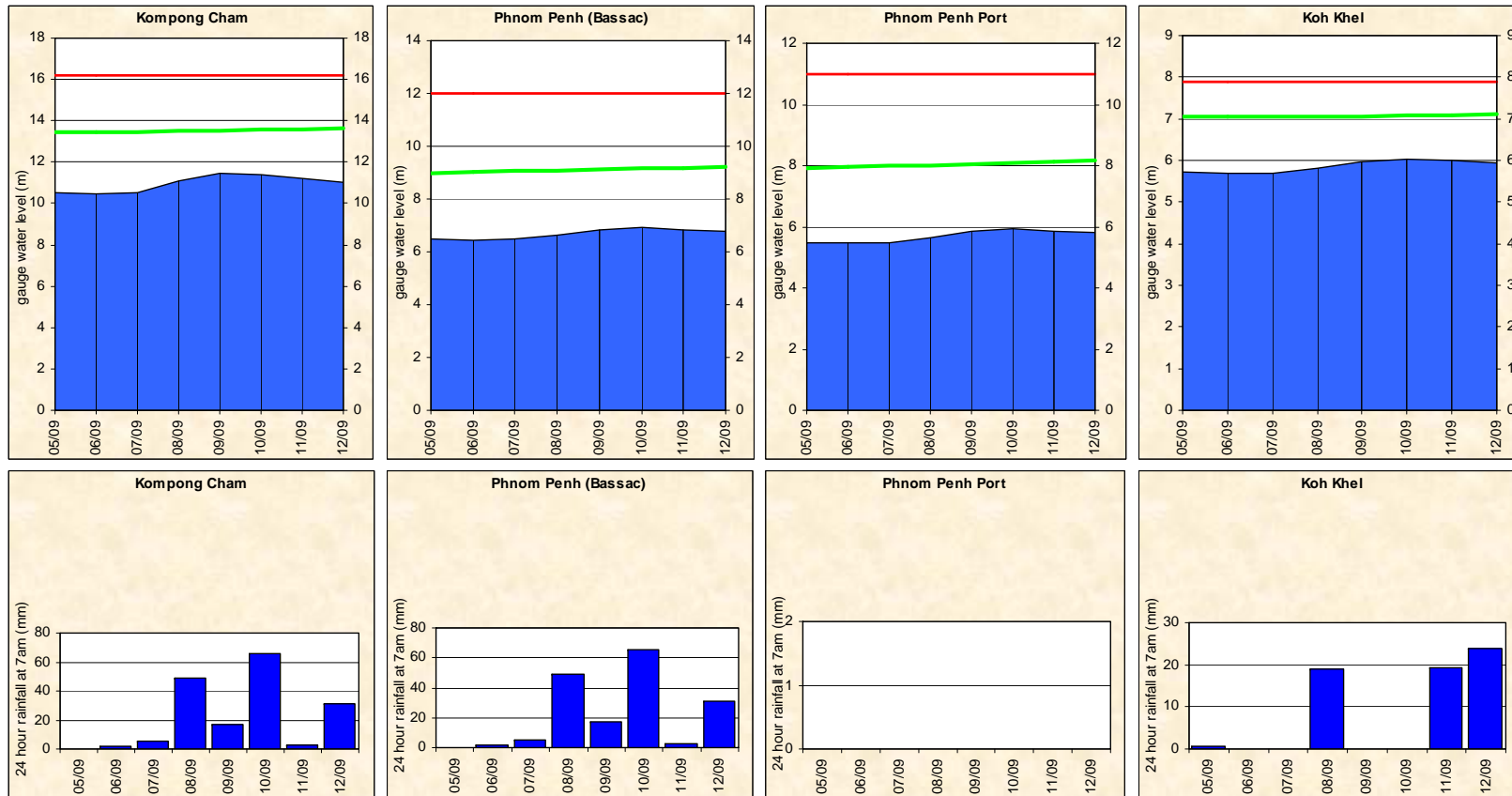
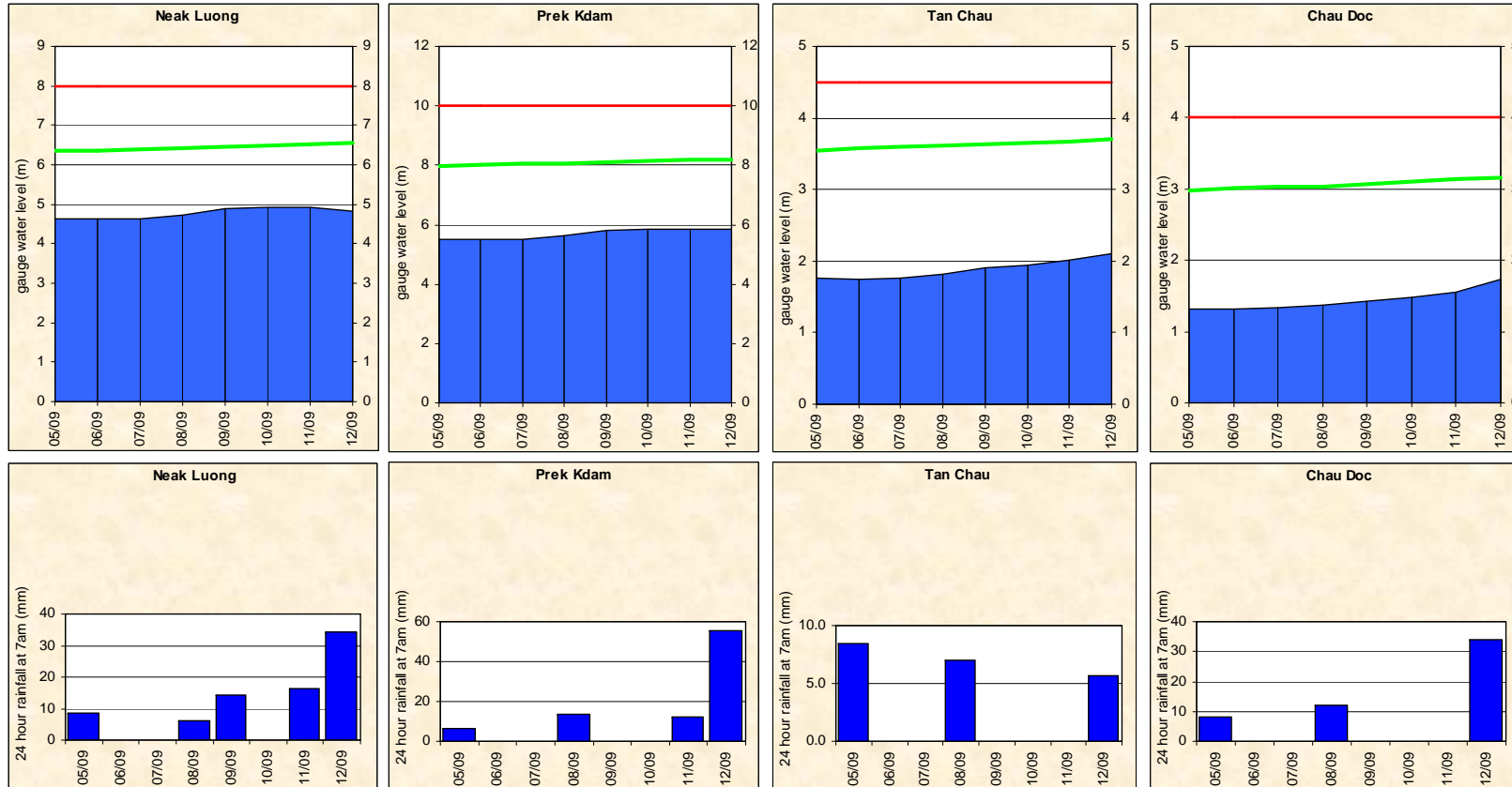


Figure A6: Water level and rainfall for Neak Luong, Prek Kdam, Tan Chau and Chau Doc



## 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 all stations in the LMB. However, the accuracies at upper

reaches at Luang Prabang to Paksane for 1-day to 5-day forecast were less than expected.

The above differences due to two 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; (3) the heavy rainfall happened in many tributaries inside the LMB. See the Figure B1 and table B1 for more detail.

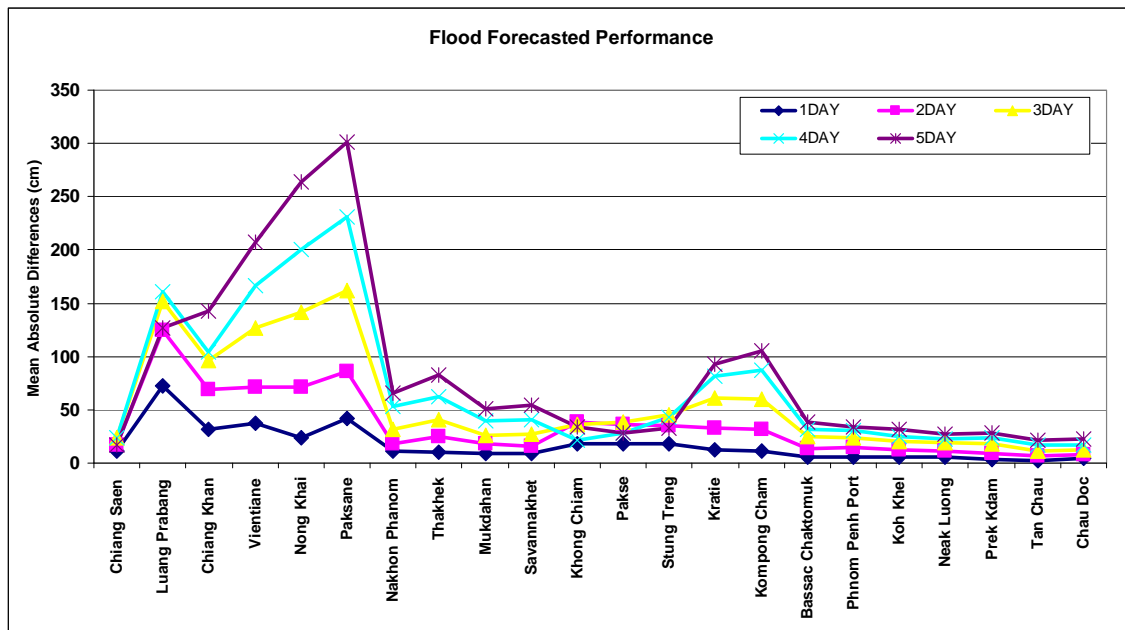


Figure B1: Average flood forecast accuracy along the Mekong mainstream (from 15<sup>th</sup> Aug – 22<sup>nd</sup> Aug 2016)

**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: Achievement of daily forecast against benchmarks

Unit in %

|       | 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 | 100.0       | 0.0           | 57.1        | 0.0       | 28.6     | 28.6    | 71.4          | 57.1    | 71.4     | 57.1        | 14.3        | 28.6  | 28.6        | 42.9   | 57.1         | 71.4                | 71.4            | 85.7     | 85.7       | 85.7      | 100.0    | 85.7     | 55.8    |      |
| 2-day | 100.0       | 16.7          | 33.3        | 33.3      | 33.3     | 16.7    | 83.3          | 50.0    | 66.7     | 50.0        | 16.7        | 50.0  | 50.0        | 66.7   | 50.0         | 33.3                | 33.3            | 33.3     | 50.0       | 66.7      | 83.3     | 83.3     | 50.0    |      |
| 3-day | 100.0       | 20.0          | 20.0        | 20.0      | 20.0     | 0.0     | 40.0          | 40.0    | 60.0     | 60.0        | 40.0        | 40.0  | 40.0        | 40.0   | 20.0         | 0.0                 | 20.0            | 20.0     | 20.0       | 40.0      | 60.0     | 60.0     | 80.0    | 36.4 |
| 4-day | 100.0       | 25.0          | 25.0        | 25.0      | 25.0     | 0.0     | 50.0          | 50.0    | 75.0     | 50.0        | 75.0        | 100.0 | 50.0        | 50.0   | 25.0         | 25.0                | 25.0            | 25.0     | 50.0       | 50.0      | 0.0      | 0.0      | 40.9    |      |
| 5-day | 100.0       | 33.3          | 0.0         | 0.0       | 0.0      | 0.0     | 33.3          | 0.0     | 66.7     | 66.7        | 66.7        | 66.7  | 66.7        | 33.3   | 0.0          | 0.0                 | 33.3            | 33.3     | 33.3       | 33.3      | 100.0    | 66.7     | 37.9    |      |

Table B2: Benchmarks of success (Indicator of accuracy in mean absolute error)

Unit in cm

|       | 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       | 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       | 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       | 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       | 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       | 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.

**Performance**

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

Table B3: Overview of performance indicators for the past 5 days including the current report date

| <b>2016</b>   | FF completed and sent (time) | stations without forecast | FF2 completed and sent (time) | Weather information available (number) | NOAA data | China | Cambodia - DHRW | Cambodia - DOM | Lao PDR - DMH | Thailand - DWR | Viet Nam - NCHMF | NOAA data | China | Cambodia - DHRW | Cambodia - DOM | Lao PDR - DMH | Thailand - DWR | Viet Nam - NCHMF |
|---------------|------------------------------|---------------------------|-------------------------------|--|-----------|-------|-----------------|----------------|---------------|----------------|------------------|-----------|-------|-----------------|----------------|---------------|----------------|------------------|
| <i>week</i>   | 10:08                        | 0                         | -                             | 0                                      | 08:15     | 07:10 | 07:21           | 08:09          | 08:43         | 08:05          | 07:58            | 0         | 0     | 10              | 25             | 385           | 0              | 3                |
| <i>month</i>  | 10:06                        | 0                         | -                             | -                                      | 08:15     | 07:10 | 07:24           | 08:09          | 08:59         | 07:51          | 07:59            | 0         | 0     | 31              | 25             | 1096          | 8              | 14               |
| <i>season</i> | 10:08                        | 0                         | -                             | 0                                      | 08:14     | 07:10 | 07:37           | 07:54          | 08:53         | 07:51          | 07:50            | 0         | 0     | 74              | 144            | 3458          | 32             | 14               |

*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.

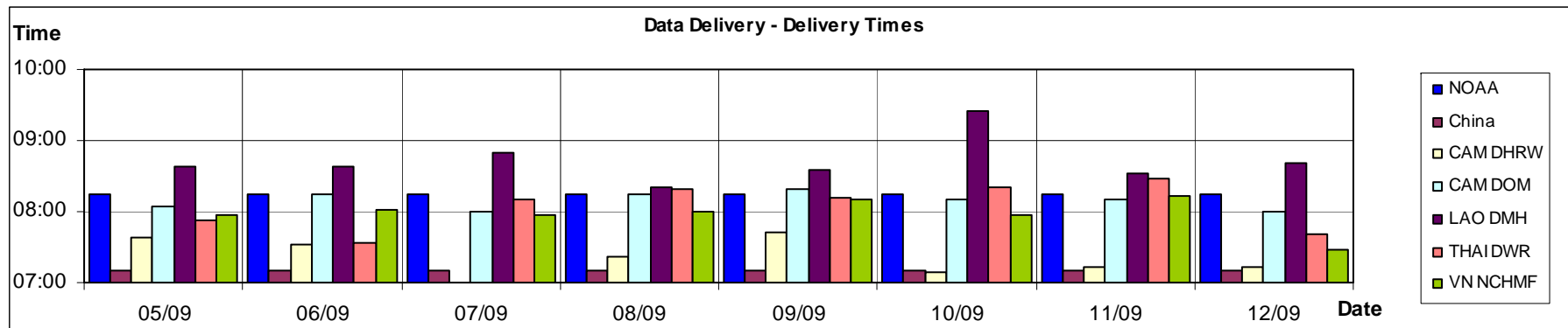


Figure B2: Data delivery times for the past 8 days including the current report date

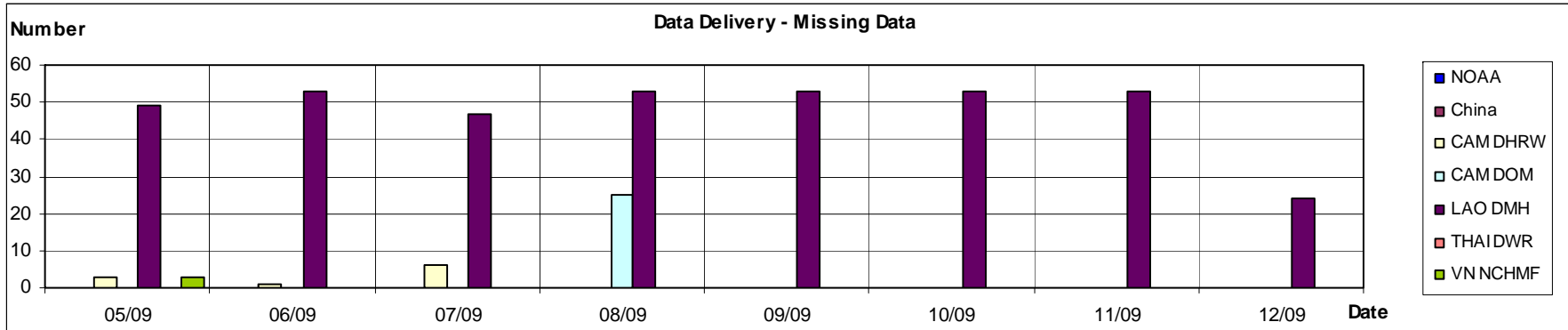


Figure B3: Missing data for the past 8 days including the current report date

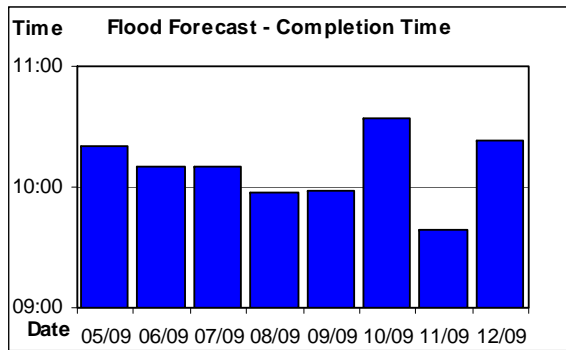


Figure B4: Flood forecast completion time

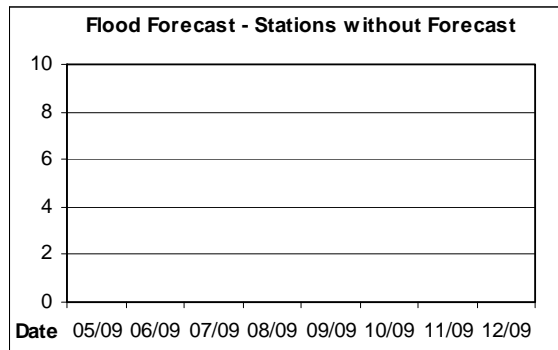


Figure B5: Flood forecast stations without forecast

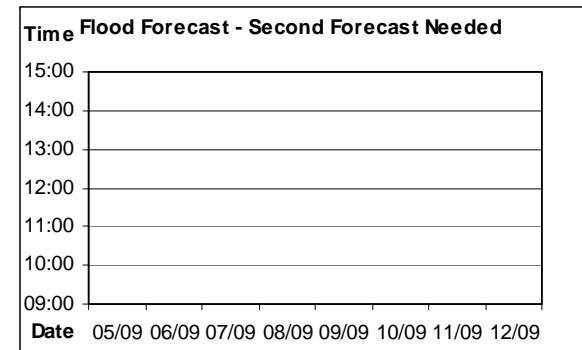


Figure B6: Second forecast needed

## 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 31 OCTOBER

