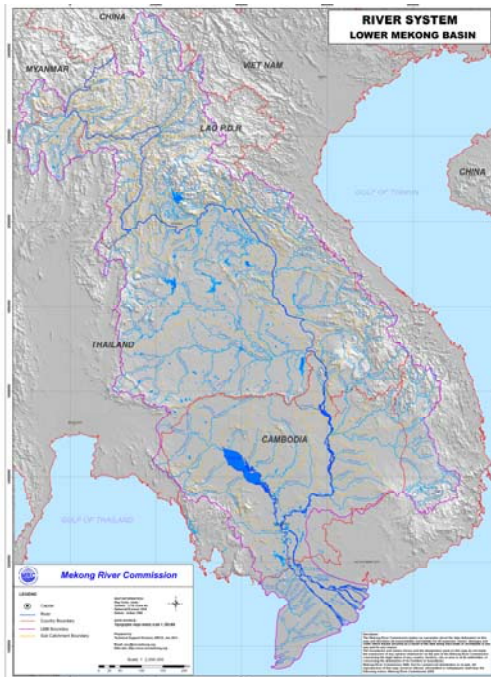




Mekong River Commission Regional Flood Management and Mitigation Programme

Report on data collection and data transfer performance
Evaluation report for the flood season 2015



Prepared by:
Regional Flood Management and Mitigation Center
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**Certification of Approval
of Internal FMMP Technical Document**

Report on data collection and data transfer performance
Evaluation report for the flood season 2015

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List of Abbreviation

CNMC	Cambodia National Mekong Committee
DHM	Department of Hydrology and Meteorology, Lao PDR
DHRW	Department of Hydrology and River Works, Cambodia
DOM	Department of Meteorology, Cambodia
DWR	Department of Water Resources, Thailand
FMMP	Flood Management and Mitigation Programme (MRC)
FTP	File transfer protocol
HMS	Hydro-Meteorological Service (Vietnam)
LNMC	Lao National Mekong Committee
MCs	MRC Members' Countries
MONRE	Ministry of Natural Resources and Environment (Viet Nam)
MOWRAM	Ministry of Water Resources and Meteorology (Cambodia)
MNRE	Ministry of Water Resources and Environment (Thailand)
MOU	Memorandum of Understanding
MRC	Mekong River Commission
MRCs	Mekong River Commission Secretariat
NCHMF Vietnam	National Centre for Hydro-Meteorological Forecasting, Vietnam
SRHMC	Southern Region Hydro-Meteorological Centre, Vietnam
NLAs	National Line Agencies
NMC	National Mekong Committee
RFMMC	Regional Flood Management and Mitigation Centre
TNMC	Thai National Mekong Committee
TOR	Terms of Reference
VNMC	Viet Nam National Mekong Committee

1. Background

1.1 Hydro-meteorological network providing data for flood forecast

Hydro-meteorological data collection is a core activity of the Mekong River Commission (MRC) since the establishment of the Mekong Committee in 1957. Under MRC's Flood Mitigation and Management Programme (FMMP), it serves various purposes such as the flood forecast on the Mekong River which is an important issue that has been the concern of the MRC Secretariat (MRCS) since 1970. Since the establishment of the Regional Flood Management and Mitigation Centre (RFMMC) in Phnom Penh, Cambodia in 2006, the flood forecasts and river monitoring have been performed by this Centre.

Over the past nine years from 2006 to 2015, these tasks have been successfully implemented under the prevailing Memorandum of Understanding (MOU) or Terms of Reference¹ (TOR) between MRCS and MRC Member Countries (MCs) for data collection and transfer from National Line Agencies (NLAs) of the MCs to the RFMMC.

The MOU/TOR was periodically renewable and approved. They provided a formal agreement between MRCS and the MCs for data collection and transfer from the NLAs to RFMMC for flood forecasting and river monitoring. These activities were considered as the routine functions of the RFMMC. Table 1-1 shows the Name of NLAs, the start and end dates of the most recent MOUs/TOR.

This report will only consider data transfer and performance during Flood-Season (June – October 2015) for producing the Flood Forecasting Bulletin.

Table 1-1 Name of National Line Agencies and the start and end dates of renewed MOUs/TOR.

No	Name of National Line Agency, Country	Start and end dates
1	Department of Hydrology and River Works (DHRW), Ministry of Water Resource and Meteorology (MOWRAM) in Cambodia, CNMC	01 January 2014 to 31 December 2015
2	Department of Meteorology (DOM), Ministry of Water Resource and Meteorology (MOWRAM) in Cambodia, CNMC	01 January 2014 to 31 December 2015
3	Department of Meteorology and Hydrology (DMH), Ministry of Natural Resource and Environment (MONRE) in Lao PDR, LNMC	03 April 2014 to 02 April 2016

¹ is required by TNMC as a contract/agreement modality

No	Name of National Line Agency, Country	Start and end dates
4	Department of Water Resources (DWR), Ministry of Water Resources and Environment (MNRE) in Thailand, TNMC	1 June 2015 to 31 May 2016
5	National Centre for Hydro-Meteorological Forecasting (NCHMF), Hydro-Meteorological Service (HMS) / Southern Region Hydro-Meteorological Centre (SRHMC), Ministry of Water Resources and Environment (MONRE) in Viet Nam, VNMC	06 June 2015 to 05 June 2016

According to the MOUs/TOR, the data are collected at the observation stations, sent to the national terminal of the NLAs and then transferred to the RFMMC data terminal through e-mail and the regular update data on the Hydmet database software. This Hydmet-software was installed at every NLA of the MCs who signed the MOUs with MRCS for the data provision for flood forecasting from 01 June to 31 October² and river monitoring from 01 November to 31 May. The data collection from all stations during the wet and dry seasons help to carry out and improve the MRC flood forecasting and river monitoring, as well as to better understand the behavior of rainfall and water levels during the entire hydrologic cycle.

The operational data for the flood forecasting was daily provided to the RFMMC by the NLAs during the flood season, preferably before 8.30am. Between 8.30am-10.00am, the RFMMC collected, compiled and analyzed the data for river flood forecasting activities after which the flood forecasting bulletins were disseminated between 10.00am and 10.30am to all concerned MRC programmes, national government agencies and international organizations which are working in the field of flood relief, emergency management, including for other purposes like research/studies.

The hydro-meteorological data of 146 stations were collected and transferred from NLAs to the RFMMC of which 15, 34, 43, 10 and 44 stations respectively were received from DHRW (Cambodia), DOM (Cambodia); DMH (Lao PDR); DWR (Thailand) and SRHMC (Viet Nam). Table 1-2 shows a list of stations and Figure 1-1 indicates the map of locations of stations.

The objective of this report is to summarize and evaluate the performance of data collection and transfer from the NLAs to the RFMMC's FTP data terminal during the flood season 2015 and conclude which key activities need to be improved for the future.

² Flood forecast period can be extended in according to water level and weather conditions in the LMB

Table 1-2 List of Hydro-meteorological stations to be provided the data to RFMMC during the flood season 2015.

No	Hymos ID	Station Name	Type of Data	Basin /River
DHRW, Cambodia (15 stations)				
1	14501	Stung Treng	WL, Rainfall	Mekong
2	14901	Kratie	WL, Rainfall	Mekong
3	19802	Kampong Cham	WL, Rainfall	Mekong
4	33401	Chaktomuk	WL, Rainfall	Bassac
5	20101	Phnom Penh Port	WL	Tonle Sap
6	20102	Prek Kdam	WL, Rainfall	Tonle Sap
7	19806	Neak Luong	WL, Rainfall	Mekong
8	33402	Koh Khel	WL, Rainfall	Bassac
9	20103	Kampong Chhnang	WL	Tonle Sap
10	620101	Kampong Tmar	WL	Tributary Tonle Sap
11	570101	Kampong Kdey	WL	Tributary Tonle Sap
12	600101	Kampong Chen	WL	Tributary Tonle Sap
13	20106	Kampong Loung	WL	Tonle Sap
14	450101	Lumphat	WL	Sre Pok
15	440102	Veun Sai	WL	Se San
DOM, Cambodia (34 stations)				
1	130322	Banteay Srey	Rainfall	Stung Seam Reap
2	130505	Sadan	Rainfall	Stung Sen
3	120505	Sambo	Rainfall	Mekong
4	120606	Snoul	Rainfall	Prek Chlong
5	130326	Srey Snam	Rainfall	Stung Sreng
6	120309	Talo	Rainfall	Stung Pursat
7	130309	Sre Noy	Rainfall	Stung Seam Reap
8	130202	Sisophon	Rainfall	St. Mongkul Borey
9	130200	O Krieng	Rainfall	Prek Krieng
10	134010	O Yadav	Rainfall	Se San
11	130220	Koh Gneak	Rainfall	Sre Pok
12	134910	Koulen	Rainfall	Stung Sen
13	134813	Tbeng Meanchey	Rainfall	Stung Sen
14	141112	Oudor Meanchey	Rainfall	Sung Sreng
15	110404	Kampong Speu	Rainfall	Prek Thnot
16	110433	Oral	Rainfall	Prek Thnot
17	110434	O Taroat	Rainfall	Prek Thnot
18	110445	Trapang Cho	Rainfall	Prek Thnot
19	120202	Pailin	Rainfall	Stung Sanker
20	120302	Pursat	Rainfall	Stung Pursat
21	120303	Moung Russey	Rainfall	Stung Dauntry
22	120304	Dap Bat	Rainfall	Stung Pursat
23	120312	Kravanh	Rainfall	Stung Pursat
24	120420	Tuk Phos	Rainfall	St. Boribo
25	120423	Stung Chinit	Rainfall	Stung Chinit
26	120520	Chambac	Rainfall	Mekong
27	120602	Peam Te	Rainfall	Prek Te
28	120607	Svay Chreas	Rainfall	Prek Chhlong
29	120611	Kantout	Rainfall	Prek Te
30	130506	Seambok	Rainfall	Mekong
31	130507	Tala Boriwat	Rainfall	Mekong
32	140605	Se San	Rainfall	Se San

No	Hymos ID	Station Name	Type of Data	Basin /River
33	140603	Seam Pang	Rainfall	Sekong
34	130208	Bovel	Rainfall	St. Mongkul Borey
DMH, Lao PDR (43 stations)				
1	10402	Xieng Kok	WL	Mekong
2	10901	Pak Beng	WL, Rainfall	Mekong
3	11201	Luang Prabang	WL, Rainfall	Mekong
4	11401	Paklay	WL	Mekong
5	11901	Vientiane	WL, Rainfall	Mekong
6	12703	Paksane	WL, Rainfall	Mekong
7	13102	Thakhek	WL, Rainfall	Mekong
8	13401	Savannakhet	WL, Rainfall	Mekong
9	13901	Pakse	WL, Rainfall	Mekong
10	230101	Bang Pakkanhoung	WL, Rainfall	Nam Ngum
11	250101	Moung Mai	WL, Rainfall	NamNhiep
12	270101	Ban Phonsi	WL, Rainfall	Nam Cadin
13	260101	Moung Keo(Borikan)	WL, Rainfall	Nam Sane
14	320107	Mahaxai	WL, Rainfall	Se Banfai
15	390102	Khong Sedone	WL, Rainfall	Se Done
16	390103	Saravanne	WL, Rainfall	Se Done
17	430106	VeunKhen	WL, Rainfall	Sekong
18	430105	M. May(Attapeu)-Veunken	WL, Rainfall	Sekong
19	100102	Moung Ngoy	WL, Rainfall	Nam Ou
20	120101	Ban Mixay	WL,	Nam Khan
21	190103	Sayaboury	Rainfall	Nam Houng
22	190205	Xieng Ngeun	Rainfall	Nam Khan
23	180207	Vang Vieng	WL, Rainfall	Nam Ngum
24	230113	Phiengluang	WL, Rainfall	Nam Ngum
25	200204	Oudomxay	Rainfall	Nam Ou
26	210201	Phonsaly	Rainfall	Nam Ou
27	200101	Moung Namtha	Rainfall	Nam Tha
28	270903	Ban Signo	WL, Rainfall	Nam Cadine
29	190302	XiengKhong	Rainfall	Nam Nhiep
30	14301	Ban Chan Noi	WL	Mekong
31	170505	Kuanpho	Rainfall	Se Banfai
32	350101	Ban Keng Don	Rainfall	Se Banhieng
33	350106	Highway Bridge	WL, Rainfall	Se Banhieng
34	160505	Kengkok	Rainfall	Se Banhieng
35	390104	Souvanna Khill	WL	Se Done
36	160506	Phalan	Rainfall	Se Banhieng
37	160605	Moung Phil	Rainfall	Se Banhieng
38	150604	Laongam	Rainfall	Se Done
39	160602	Moung Nong	Rainfall	Se Done
40	150607	Nikum 34	Rainfall	Sekong
41	160601	Moung Tcheraphon	Rainfall	Se Done
42	150609	Sekong	WL, Rainfall	Sekong
43	160504	Ban Donheng	Rainfall	Se Banhieng
DWR, Thailand (10 stations)				
1.	10501	Chiang Saen	WL, Rainfall	Mekong
2.	10801	Chiang Khong	WL,	Mekong
3.	11903	Chiang Khan	WL, Rainfall	Mekong
4.	13801	Khong Chiam	WL, Rainfall	Mekong

No	Hymos ID	Station Name	Type of Data	Basin /River
5.	12001	Nong Khai	WL, Rainfall	Mekong
6.	13101	Nakhon Phanom	WL, Rainfall	Mekong
7.	13402	Mukdahan	WL, Rainfall	Mekong
8.	70103	Thoeng	WL, Rainfall	Nam Mae In
9.	50104	Chiang Rai	WL, Rainfall	Nam Mae Kok
10.	290102	Ban Tha Kok Daen	WL, Rainfall	Nam Songkhram
SRHMC, HMS, Viet Nam (44 stations)				
1	19803	Tan Chau	WL, Rainfall	Mekong
2	19804	My Thuan	WL, Rainfall	Mekong
3	39801	Chau Doc	WL, Rainfall	Bassac
4	39803	Can Tho	WL, Rainfall	Bassac
5	980601	Vam Nao	WL, Rainfall	Vam Nao
6	451305	Ban Don	WL, Rainfall	Srepok
7	440201	Kon Tum	WL, Rainfall	Sesan
8	220201	Moung Te	Rainfall	
9	220303	Tam Duong	Rainfall	
10	220302	Sin Ho	Rainfall	
11	220301	Lai Chau	Rainfall	
12	210305	Tuan Giao	Rainfall	
13	210301	Dien Bien	Rainfall	
14	210303	Quynh Nhai	Rainfall	
15	160611	Khe Sanh	Rainfall	
16	210304	Son La	Rainfall	
17	180505	Houng Khe	Rainfall	
18	180504	Ha Tinh	Rainfall	
19	180601	Ky Anh	Rainfall	
20	170603	Tuyen Hao	Rainfall	
21	170601	Ba Don	Rainfall	
22	170602	Dong Hoi	Rainfall	
23	160706	Dong Ha	Rainfall	
24	160705	A Luoi	Rainfall	Sekong
25	160704	Hue	Rainfall	
26	140715	Dak To	Rainfall	Sesan
27	140703	Pleiku	Rainfall	Sesan
28	130803	An Khe	Rainfall	close to Sesan
29	130804	Ayunpa	Rainfall	Srepok
30	120801	Boun Me Thuoc	Rainfall	Srepok
31	120806	Mdark	Rainfall	Srepok
32	120712	Dak Nong	Rainfall	close to Srepok
33	120805	Buon Ho	Rainfall	Srepok
34	180506	Houng Son	Rainfall	
35	220401	Pha Din	Rainfall	
36	220402	Yen Chau	Rainfall	
37	220403	Mai Chau	Rainfall	
38	220404	Tuong Duong	Rainfall	
39	220405	Con Cuong	Rainfall	
40	220407	Tay Ninh	Rainfall	
41	220406	Phuc Long	Rainfall	
42	220408	Dong Xoai	Rainfall	
43	220409	Ialy	Rainfall	
44	450701	Duc Xuyen	WL, Rainfall	



Figure 1-1 Map of locations of stations using the SMS for data sending for Flood Forecasting in flood season 2015.

Besides the data received from the above mentioned lists of stations, two hydrologic stations name Jinghong and Manan located in China had sent water level and rainfall data to MRC during the period from 1 June until 31 October 2015 via ftp-site. These data were very useful for conducting the river flood forecasting task since they provided more information upstream of Chiang Saen station.

1.2 Arrival time and number of Missing Data

Hydro-meteorological data was collected, carefully checked and recorded the time of data arrival and number of Missing Data of every station in log-sheets after 9.00am daily during the Flood –season and once a week (on Monday) during the Dry - season.

The Data Arrival Time was recorded and the Late Arrival Data was considered arriving after 8.30am, since forecaster needs to carry out the flood forecasting task and disseminates the bulletin before 10.30am. After 9.00am, the number of Missing Data would be counted and recorded in the log-sheets.

Beside the log-sheet, the HYDMET-software was equipped with time-stamp option that will record.

Based primarily on HYDMET-time-stamp and these log-sheets, the data collection and data transfer performance evaluation were derived and conclusions were drawn.

2. Data transfer from stations to the data terminal at National Line Agencies

2.1 Data transfer from stations to the DHRW data terminal

There are 15 hydrological stations of the DHRW station networks that provided data to the DHRW data terminal during flood season 2015 of which 10 stations are located in the mainstream of the Mekong, Bassac and Tonle Sap Rivers and 5 stations in the tributaries of the Mekong River and the Tonle Sap Great Lake. This number remained unchanged since 2012.

During the flood season 2015, there were 153 sending and receiving activities. The percentage of Timely Arrival Data (before 8.30am), the Late Arrival Data and Missing Data were shown in Figure 2-1 and Table 2-1.

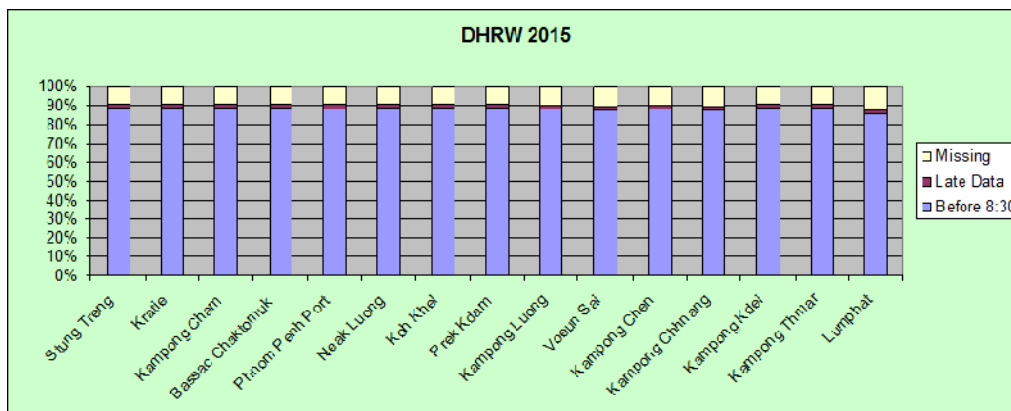


Figure 2-1 The percentage of Timely Arrival Data (before 8.30am), the Late Arrival Data and Missing Data collected on the Hydmet at DHRW data terminal during flood season 2015.

From Figure 2-1 it can be concluded that DHRW has performed very well in sending data to RFMMC. More than 85 percent of data for all stations has arrived at the RFMMC before 8.30am. This is a little less than the year 2014 when 90 percent was scored.

If one considers that data arrived after 8.30am as Late Arrival Data, they varied from 1.96 to 2.61 percent of the total Late Arrival Data, although these numbers were quite low (almost the same as in year 2014).

High Missing Data values of 13.07 and 11.11 percent were at Lumphat, Voeun Sai and Kampong Chhnang stations, respectively. For the whole flood season, Missing

Data varied from 9.80 to 13.07 percent for all stations. If one considers those stations that RFMMC makes forecast (located on main stream), the number of Missing Data is about 9.80 percent and should be improved in the future.

Table 2-1 Summary of Percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data of DHRW.

Station	Before 8:30	Late Data	Missing
Stung Treng	88.24	1.96	9.80
Kratie	88.24	1.96	9.80
Kampong Cham	88.24	1.96	9.80
Bassac Chaktomuk	88.24	1.96	9.80
Phnom Penh Port	87.58	2.61	9.80
Neak Luong	88.24	1.96	9.80
Koh Khel	88.24	1.96	9.80
Prek Kdam	88.24	1.96	9.80
Kampong Luong	87.58	1.96	10.46
Voeun Sai	86.93	1.96	11.11
Kampong Chen	87.58	1.96	10.46
Kampong Chhnang	86.93	1.96	11.11
Kampong Kdei	88.24	1.96	9.80
Kampong Thmar	88.24	1.96	9.80
Lumphat	84.97	1.96	13.07

2.2 Data transfer from stations to DOM data terminal

During the flood season 2015, DOM data terminal collected data from 34 rainfall stations as same number as in the 2013 flood season. The performance was also maintained at the outstanding level. During this period, data transfer from the DOM to RFMMC was very early well before 8.30am as shown in Figure 2-2, although there were a few Missing Data (about 3.27 percent) as well.

Figure 2-2 shows the percentage of Timely Arrival Data (before 8.30am), the Late Arrival Data and Missing Data collected on the Hydmet at DOM data terminal during the flood season 2015.

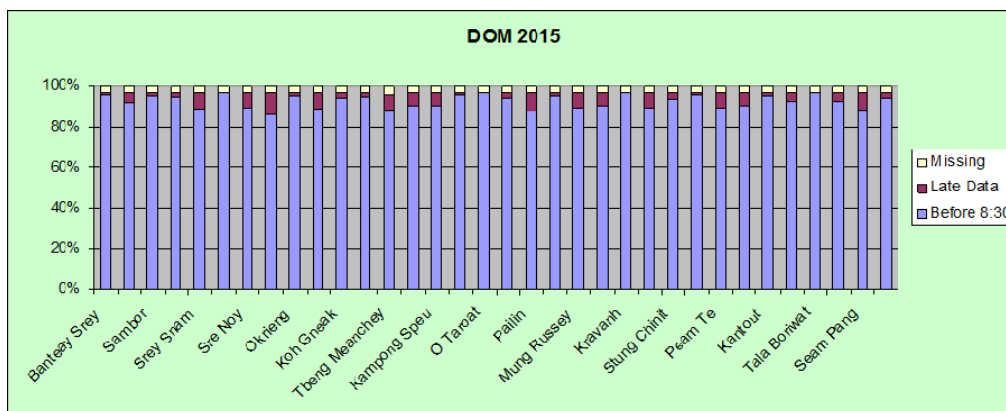


Figure 2-2 The percentage of Timely Arrival Data (before 8.30am), the Late Arrival Data and Missing Data collected on the Hydmet at DOM data terminal during flood season 2015.

From Figure 2-2, DOM had performed very well in sending data to RFMMC. More than 85 percent of data for all stations had arrived RFMMC before 8.30am. As compare to the year 2014, data from Talo and Koh Gneak stations were sent before 8.30am only 96.73 and 94.12 percent, respectively (a little drop from last year).

If one considers that data arrived after 8.30am as Late Arrival Data, they varied from 0 to 10.46 percent of total data that came late, although these numbers were quite low.

There was 3.27 percent Missing Data during flood season from DOM.

Table 2-2 Summary of Percentage of Timely Data Arrival (before 8.30am), Late Arrival Data and Missing Data of DOM.

Station	Before 8:30	Late Data	Missing
Banteay Srey	96.08	0.65	3.27
Sadan	92.16	4.58	3.27
Sambor	95.42	1.31	3.27
Snoul	94.77	1.96	3.27
Srey Snam	88.89	7.84	3.27
Talo	96.73	0.00	3.27
Sre Noy	89.54	7.19	3.27
Sisophon	86.27	10.46	3.27
Okrieng	95.42	1.31	3.27
O Yadav	88.89	7.84	3.27
Koh Gneak	94.12	2.61	3.27
Koulen	94.77	1.96	3.27
Tbeng Meanchey	88.24	7.84	3.92
Oudor Meanchey	90.20	6.54	3.27
Kampong Speu	90.20	6.54	3.27
Oral	96.08	0.65	3.27
O Taroat	96.73	0.00	3.27
Trapeang	94.12	2.61	3.27
Pailin	87.58	9.15	3.27
Pursat	95.42	1.31	3.27
Mung Russey	89.54	7.19	3.27
Dap Bat	90.20	6.54	3.27
Kravanh	96.73	0.00	3.27
Tuk Phos	89.54	7.19	3.27
Stung Chinit	93.46	3.27	3.27
Cham Bac	96.08	0.65	3.27
Peam Te	89.54	7.19	3.27
Svay Chrea	90.20	6.54	3.27
Kantout	95.42	1.31	3.27
Seam Bork	92.81	3.92	3.27
Tala Boriwat	96.73	0.00	3.27
Sesan	92.81	3.92	3.27
Seam Pang	88.24	8.50	3.27
Bovel	94.12	2.61	3.27

2.3 Data transfer from stations to the DMH data terminal

Based on the MOU, DMH should collect the water level and/or rainfall data from 43 stations of which 6 of them were located in the mainstream of the Mekong and 37 stations located in the tributaries of the Mekong River and other main water bodies. However, during the flood season 2015, there were some problems in data collection from either the observations to DMH data terminal and then to the RFMMC terminal.

The percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data of DMH were shown in Figure 2-3 and Table 2-3.

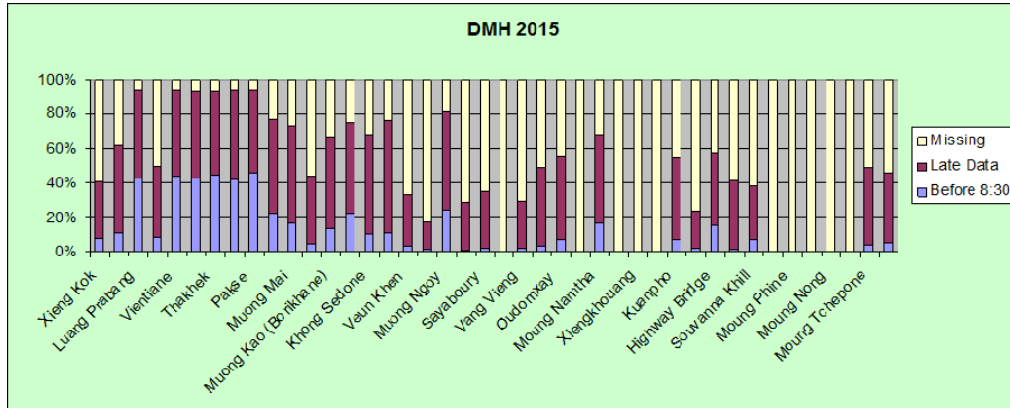


Figure 2-3 The percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data collected on the Hydmet at DMH data terminal during flood season 2015.

From Figure 2-3, DMH had performed poorly in sending data to RFMMC. Of 6 stations located on mainstream (out of 43 stations) only 42.48 to 45.75 percent of data had arrived at the RFMMC before 8.30am; the rest of the Timely Arrival Data (before 8.30am) varied from 0.00 to 24.84 percent.

Of these 6 stations, the number of Late Arrival Data varied from 48.37 to 51.63 percent of total data sent to the RFMMC, while 5.88 to 6.54 percent represents Missing Data. *These Figures need serious improvement in future.*

The rest of the 37 stations, Late Arrival Data varied from 0 to 65.36 percent of total data (zero is because of Missing Data) and Missing Data varied from 18.30 to 100 percent of total data. The number of Missing Data is rather high.

The RFMMC could not identify the problems at the level of DMH and therefore DMH should seriously try to improve and to reduce the number of Missing Data in the future.

In case DMH could share the possible reasons for these shortcomings with the RFMMC, solutions may be worked out in close and mutual cooperation.

Table 2-3 Summary of Percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data of DMH.

Station	Before 8:30	Late Data	Missing
Xieng Kok	7.84	32.68	59.48
Pak Beng	11.11	50.98	37.91
Luang Prabang	43.14	50.98	5.88
Paklay	8.50	41.83	49.67
Vientiane	44.44	49.67	5.88
Paksane	43.14	50.33	6.54
Thakhek	45.10	48.37	6.54
Savannakhet	42.48	51.63	5.88
Pakse	45.75	48.37	5.88
Ban Pak Kanhoung	22.88	54.25	22.88
Muong Mai	16.99	56.21	26.80
Ban Phone Si	5.23	39.22	55.56
Muong Kao (Borikhane)	13.73	52.94	33.33
Mahaxai	22.22	52.94	24.84
Khong Sedone	10.46	58.17	31.37
Saravanne	11.11	65.36	23.53
Veun Khen	3.27	30.07	66.67
Veun Khen	1.31	16.34	82.35
Muong Ngoy	24.84	56.86	18.30
Ban Mixay	0.65	28.10	71.24
Sayaboury	1.96	33.33	64.71
Xieng Ngeun	0.00	0.00	100.00
Vang Vieng	1.96	27.45	70.59
Phiengluang	3.27	45.75	50.98
Oudomxay	7.19	48.37	44.44
Phongsaly	0.00	0.00	100.00
Moung Namtha	16.99	51.63	31.37
Ban Signo	0.00	0.00	100.00
Xiengkhouang	0.00	0.00	100.00
Ban Chan Noi	0.00	0.00	100.00
Kuanpho	7.19	47.71	45.10
Ban Keng Don	1.96	22.22	75.82
Highway Bridge	15.69	41.83	42.48
Kengkok	1.31	40.52	58.17
Souvanna Khill	7.19	31.37	61.44
Phalan	0.00	0.00	100.00
Moung Phine	0.00	0.00	100.00
Laongam	0.00	0.00	100.00
Moung Nong	0.00	0.00	100.00
Nikum 34	0.00	0.00	100.00
Moung Tchepone	4.58	44.44	50.98
Sekong	5.88	39.87	54.25
Ban Donghene	0.00	0.00	100.00
Ban Nape	0.00	0.00	100.00
Se Ban Fai	0.00	0.00	100.00

2.4 Data transfer from stations to the DWR data terminal

For the 2015 flood season, the water level and rainfall data was collected at the DWR data terminal from 10 stations of which 7 of them were located along the Mekong mainstream and 3 located in tributaries. *However, the DWR contributed more stations than indicated in the agreement (MOU).*

The percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data of DWR were shown in Figure 2-4 and Table 2-4.

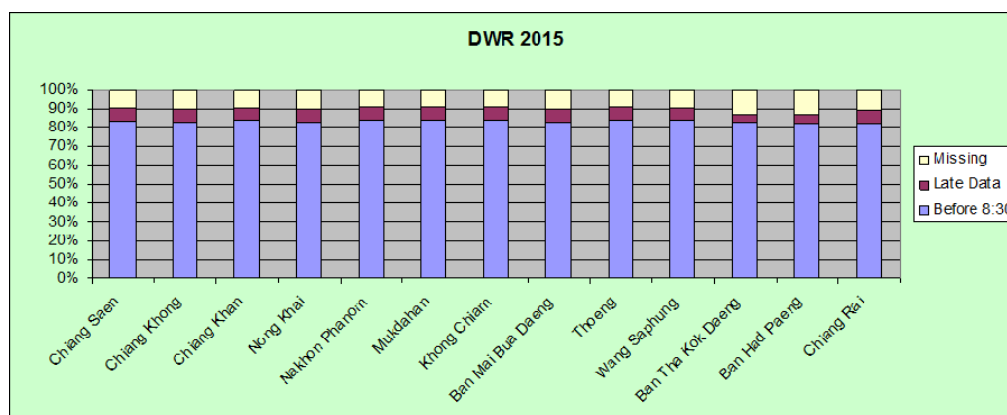


Figure 2-4 The percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data collected on the Hydmet at DWR data terminal during flood season 2015.

From Figure 2-4, DWR had performed reasonably well in sending data to the RFMMC. More than 82 percent of data for all stations had arrived RFMMC before 8.30am.

Table 2-4 Summary of Percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data of DWR.

Station	Before 8:30	Late Data	Missing
Chiang Saen	83.66	6.54	9.80
Chiang Khong	83.01	6.54	10.46
Chiang Khan	84.31	5.88	9.80
Nong Khai	83.01	6.54	10.46
Nakhon Phanom	84.31	6.54	9.15
Mukdahan	84.31	6.54	9.15
Khong Chiam	84.31	6.54	9.15
Ban Mai Bua Daeng	83.01	6.54	10.46
Thoeng	84.31	6.54	9.15
Wang Saphung	84.31	5.88	9.80
Ban Tha Kok Daeng	83.01	3.92	13.07
Ban Had Paeng	82.35	4.58	13.07
Chiang Rai	82.35	6.54	11.11
Ubon	0.00	0.00	100.00

If one considers that data arrived after 8.30am as Late Arrival Data, they varied from 3.92 to 6.54 percent of total data that came late. These numbers are quite low. *For those stations that the RFMMC makes forecast, DWR should try to improve the Late Arrival Data in the future as well.*

Missing Data varied from 9.15 to 13.0 percent as shown in Table 2-4. This was somewhat higher than last year. *Among these, Ban Tha Kok Daeng and Ban Had Paeng stations need to be improved in the future.*

2.5 Data transfer from stations to the SRHMC data terminal

For the 2015 flood season the Southern Region Hydro-Meteorological Centre (SRHMC) in Viet Nam through the northern and southern parts, including the central highlands, collected and transferred water level and/or rainfall data from 5 stations to the SRHMC data terminal. Four (4) stations are located in the Mekong mainstream and 1 in Vam Nao River. The SRHMC had supplied daily one extra station at Vam Kenh. The SRHMC has improved its performance compared to last year's results. Less than 10 percent of data was missing during flood period (See Figure 2-5).

The percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data of SRHMC are shown in Figure 2-5 and Table 2-5.

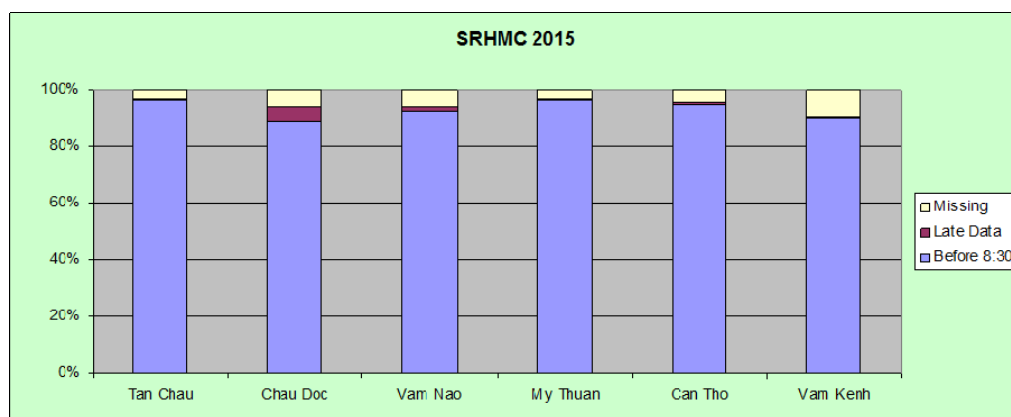


Figure 2-5 The percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data collected on the Hydmet at SRHMC data terminal during flood season 2015.

It can be concluded from the result presented in Figure 2-5 that the SRHMC has performed reasonably well in sending data to the RFMMC. More than 88 percent of data for all stations had arrived RFMMC before 8.30am.

One point that needs to be addressed is that for the two stations that RFMMC makes forecast, Chau Doc performed worse than Tan Chau in term of Missing Data (5.88 percent). *This result needs to be improved in the future.*

If one considers that data arrived after 8.30am as Late Arrival Data, they varied from 0.65 to 5.23 percent of total data that came late, although these numbers were quite low. Missing Data varied from 3.27 to 9.15 percent as shown in Table 2-5.

Table 2-5 Summary of Percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data of SRHMC.

Station	Before 8:30	Late Data	Missing
Tan Chau	96.08	0.65	3.27
Chau Doc	88.89	5.23	5.88
Vam Nao	92.16	1.96	5.88
My Thuan	96.08	0.65	3.27
Can Tho	94.77	0.65	4.58
Vam Kenh	90.20	0.65	9.15

2.6 Data transfer from stations to the HMS data terminal

For the 2015 flood season the Hydro-Meteorological Service (HMS) in Viet Nam through the northern and southern parts, including the central highlands, collected and transferred water level and/or rainfall data from 39 stations to the HMS data terminal.

The percentage of Timely Arrival Data (before 8.30am), the Late Arrival Data and Missing Data of HMS were shown in Figure 2-6 and Table 2-6.

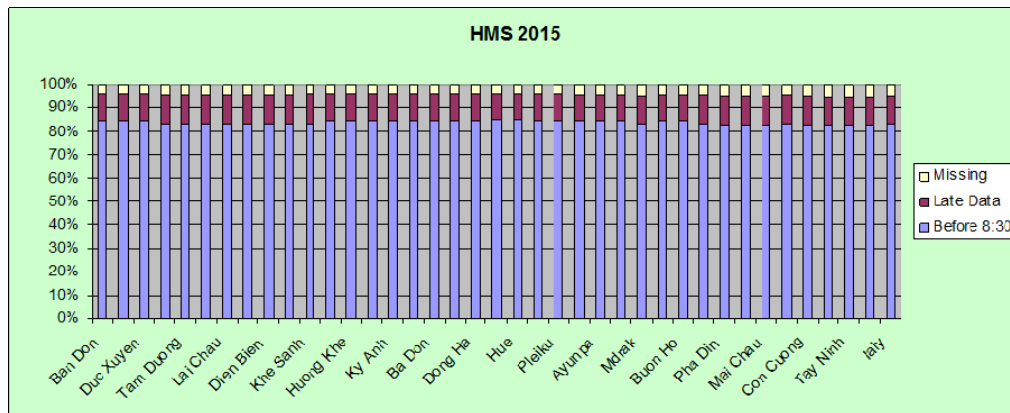


Figure 2-6 The percentage of Timely Arrival Data (before 8.30am), the Late Arrival Data and Missing Data collected on the Hydmet at HMS data terminal during flood season 2015.

From Figure 2-6 it can be concluded that HMS had performed reasonably well in sending data to RFMMC. More than 83 percent of data for all stations had arrived RFMMC before 8.30am (a little less than last year of 85 percent).

But if one considers that data arrived after 8.30am as Late Arrival Data, these varied from 11.11 to 12.42 percent of total data that came late (a little higher than last year of 9.2 to 10.5 percent), *although these numbers were low and almost constant for all stations, still there is a need for improvement in the future.*

Similar to last year, Missing Data varied from 3.92 to 5.88 percent as shown in Table 2-6, and it seemed to be the same for all stations. HMS is invited to reduce the *Missing Data in the future.*

Table 2-6 Summary of Percentage of Timely Arrival Data (before 8.30am), Late Arrival Data and Missing Data of HMS.

Station	Before 8:30	Late Data	Missing
Ban Don	84.31	11.76	3.92
Kon Tum	84.31	11.76	3.92
Duc Xuyen	84.31	11.76	3.92
Muong Te	83.66	11.76	4.58
Tam Duong	83.66	11.76	4.58
Sin Ho	83.66	11.76	4.58
Lai Chau	83.66	11.76	4.58
Tuan Giao	83.66	11.76	4.58
Dien Bien	83.66	11.76	4.58
Quynh Nhai	83.66	11.76	4.58
Khe Sanh	83.66	12.42	3.92
Son La	84.31	11.76	3.92
Huong Khe	84.31	11.76	3.92
Ha Tinh	84.31	11.76	3.92
Ky Anh	84.31	11.76	3.92
Tuyen Hoa	84.31	11.76	3.92
Ba Don	84.31	11.76	3.92
Dong Hoi	84.31	11.76	3.92
Dong Ha	84.31	11.76	3.92
A Luoi	84.97	11.11	3.92
Hue	84.97	11.11	3.92
Dak To	84.31	11.76	3.92
Pleiku	84.31	11.76	3.92
An Khe	84.31	11.11	4.58
Ayunpa	84.31	11.11	4.58
Buon Me Thuoc	84.31	11.11	4.58
Mdrak	83.66	11.11	5.23
Dak Nong	84.31	11.11	4.58
Buon Ho	84.31	11.11	4.58
Huong Son	83.66	11.76	4.58
Pha Din	83.01	11.76	5.23
Yen Chau	83.01	11.76	5.23
Mai Chau	83.01	11.76	5.23
Tuong Duong	83.66	11.76	4.58
Con Cuong	83.01	11.76	5.23
Phuoc Long	83.01	11.11	5.88
Tay Ninh	83.01	11.11	5.88
Dong Xoai	83.01	11.11	5.88
Ialy	83.66	11.11	5.23

2.7 Data transfer from Jinghong and Manan stations

For the 2015 flood season, the Hydro-Meteorological data from these two stations were sent to RFMMC via ftp-site everyday around 8.00am (Phnom Penh time). The RFMMC did receive all data very well in time. The only difficulty faced during flood season 2015 was when internet connection had some problems and could not connect to ftp-site.

3. Summary and conclusion for flood season 2015

3.1 Summary

During the flood season 2015, China had sent hydro-meteorological data of the two locations namely Jinghong and Manan to the RFMMC every morning via ftp-site around 8.00am-8.10am. The only problem that may happen is that the internet fails to connect to ftp-site. In those cases the RFMMC may not have data from China, but so far this has only sporadically occurred (almost like last year 2014).

The National Line Agencies of the 4 MRC Member Countries provided the hydro-meteorological data to the RFMMC through HYDMET-software and as well as through email with the daily morning excel-data file as attachment.

DOM provided during the flood season to RFMMC not only rainfall data but also 'weather situation notices' via FTP. These weather situation notices represents very important information for the forecaster in order to produce the flood forecasting bulletin.

In general, the transfer of water level data along Mekong mainstream to the RFMMC was positive and more than 80% of the data was sent. However this was not the case for data of stations located in tributaries. The percentage of data sent varied dramatically from 0 to 100%, and also the percentage of Missing Data was high; the average was around 21%.

The number of Missing Data of those stations located in tributaries should be reduced in the future.

Late Arrival Data was one big issue that needs improvement in the future since it will put a lot pressure on forecaster to finish his/her task in time, or causes delays in issuing the flood forecasting bulletin.

3.2 Conclusion

There were some improvements in sending data to RFMMC from line agencies in terms of sending data in time and less number of late and Missing Data. But still some agency faced difficulty to improve the data transfer to RFMMC as compared to last year.

There were many factors affected data collection and sending to RFMMC from each member country perhaps different from last year, it would be better if each country lets RFMMC known these factors/problems so we can solve the problems together to improve data collection and sending data in time.

Some countries can learn from other country how to manage data collection, sending data, etc. in order to improve the future performance.

RFMMC hopes that number of Late Arrival Data, Missing Data will be less and less in the future.

4. References

MRCs, 2013: Signed MOU and TOR for the hydro-meteorological data collection and transfer from MRC MCs NLAs to RFMMC for 2013-2015/16

NLAs, MCs, 2014: Progress reports on data transfer and O&M during the flood season 2015

RFMMC, Nov 2015: Log sheet excel files for the flood season 2015.