MEMBER REPORT
Lao PDR

ESCAP/WMO Typhoon Committee

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CONTENTS

I. Overview of tropical cyclones which have affected/impacted Member's area since the last Committee Session

1. Meteorological Assessment (highlighting forecasting issues/impacts)

From early June 2018 through May 2019, near to above average SSTs were present across most of the Pacific Ocean. During February 2019, positive SST anomalies strengthened across most of the equatorial Pacific From July -September 2019, below average SSTs expanded westward into the east - central Pacific. Since mid - September, above average SSTs expanded from the Date Line into the east - central Pacific, while remaining below average in the eastern Pacific. (source: https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf)

As a result of changes in sea surface temperature in the Pacific Ocean, the impact of climate in the Lao PDR in 2019 is as follows.

1.1. Temperature

From January to February 2019, high pressure extended from China to all part of Lao PDR and associated with northeasterly winds, resulted, cold weather over Lao PDR and very cold weather at the mountainous areas, hills, valleys and Bolaven Plateau. The lowest temperature is late January to early February 2019. During late March to May 2019 hot to hottest in each region, particularly in the north-western down to the middle and southern parts. During May to mid-July weather was hot in some local northwestern down to the middle and Southern parts. Then from late July to October 2019, the temperature decreased generally especially in northern part but some areas remained hot weather, particularly in central and southern parts whereas the maximum temperature reached to 35 degree Celsius or higher. Table 1 can be observed that the extreme minimum temperature observed in January and February while the extreme maximum temperature observed mostly in April and May in each station over Lao PDR from the period January to October 2019.

Table 1: the extreme minimum and maximum temperature

Met Station	Extreme minimum and maximum Temperatures (°C)			
	Minimum	Date	Maximum	Date
Phongsaly	07.7	03 Jan 2019	36.5	23 Feb 2019
Viengxay	08.2	01 Jan 2019	35.8	19,20 May 2019
Somnua	05.5	08 Jan 2019	35.7	19 May 2019
Xiengkhuang	06.0	09 Feb 2019	35.0	20 Apr 2019
Luangnamtha	09.0	11 Mar 2019	40.7	20 May 2019
Muang Sing	05.5	06 Feb 2019	39.8	20 May 2019
Viengphoukha	06.2	06 Feb 2019	36.6	21 Apr 2019

Oudomxay	07.0	10 Feb 2019	40.0	20 May 2019
Bokeo	12.0	06 Feb 2019	41.6	20 May 2019
Luangprabang	12.5	08 Feb 2019	42.0	19,20 May 2019
Xaiyabouly	11.2	09 Feb 2019	40.8	20 May 2019
Vientiane Cap	16.0	02 Jan 2019	40.8	20 Apr 2019
Xaysomboun	05.0	09 Feb 2019	33.0	21 Apr 2019
Phonhong	14.2	09 Feb 2019	40.6	20 Apr 2019
Paksan	13.5	01 Jan 2019	40.6	21 Apr 2019
Lak 20	09.4	23 Jan 2019	40.5	21 Apr 2019
Viengthong	09.5	02 Jan 2019	39.9	21 Apr 2019
Thakhek	13.8	01 Jan 2019	40.5	25 Apr 2019
Savanakhet	14.0	02 Jan 2019	40.0	24,25 Apr 2019
Seno	13.5	23 Jan 2019	41.3	25 Apr 2019
Salavanh	15.2	25 Jan 2019	40.0	24 Apr 2019
Pakse	17.2	25 Jan 2019	41.5	25 Apr 2019
Paksong	05.0	25 Jan 2019	30.0	02 May 2019
Nikhom 34	04.0	28 Jan 2019	34.5	24 Apr 2019
Sekong	13.0	24 Jan 2019	41.5	24 Apr 2019
Thateng	10.0	25 Jan 2019	37.0	22 Mar 2019
Dakjung	09.5	25 Jan 2019	34.0	26 Apr 2019
Attapeu	16.5	25 Jan 2019	41.6	24 Apr 2019

1.2. Rainfall

During January, there was moderate to heavy rainfall in the northern part, while the middle to the southern parts had less rain. From February to mid-May 2019, there were heavy rain, thunderstorms and hail, with strong winds in some areas. At the end of May there was a steady increase in rainfall in each region, which is the beginning of the monsoon season in 2019, with rainfall continuing until mid-June. Then, from late June to mid-July, the rains decreased and some localities had little or no rainfall in some parts of the country especially in northern part which affected to agriculture sectors caused of dry spell. By the end of July, the southwest monsoon was intensifying in conjunction with tropical storms across the Lao PDR, leading to heavy rainfall in each region, with the end of August to early September 2019 having tropical storms passing through the Central of the Lao PDR and further southern part.

The cumulative rainfall from January to October, 2019 can be summarized as a percentage of rainfall in each of the following regions: Northeastern: 80 percent, Northwestern: 56.1 percent, Central: 89.7 percent and Southern: 102.7 percent, with a national average of 82.1 percent.

Table 2: The accumulated rainfall from January to October 2019 for each province/district by comparing to normal data.

Met Station	Rainfall in millimeter (mm) from Jan – Oct 2019			
	Maximum rainfall in 24 hours	Date	cumulative rainfall from Jan-Oct 2019	Annual Normal
Phongsaly	68.8	04 Jul 2019	992.2	1,589.6
Viengxay	102.4	03 Aug 2019	1,290.0	1,556.6
Somnua	112.0	03 Aug 2019	1,137.0	1,282.3
Xiengkhuang	142.5	03 Aug 2019	1,234.3	1,437.6
Luangnamtha	74.2	08 Jan 2019	641.7	1,518.6
Muang Sing	60.8	08 Jan 2019	461.9	N/A
Viengphoukha	73.3	31 May 2019	1,209.7	N/A
Oudomxay	89.6	30 Jul 2019	692.9	1,430.4
Bokeo	96.7	08 Jan 2019	741.1	1,873.4
Luangprabang	118.7	03 Aug 2019	988.9	1,309.9
Xaiyabouly	64.1	01 Sep 2019	967.2	1,312.5
Vientiane Cap	137.0	20 Aug 2019	1,412.6	1,671.1
Xaysomboun	62.7	16 Aug 2019	1,539.8	N/A
Phonhong	164.0	29 Jul 2019	1,661.5	2,283.4
Paksan	110.3	31 Jul 2019	1,907.1	3,036.9
Lak 20	102.5	03 Jul 2019	1,622.9	1,620.7
Viengthong	40.4	01 Jun 2019	1,120.7	N/A
Thakhek	113.5	03 Jul 2019	2,230.0	2,187.3
Savanakhet	125.4	29 Aug 2019	1,676.9	1,470.6
Seno	185.0	29 Aug 2019	1,471.5	1,549.8

Salavanh	182.2	02 Sep 2019	2,198.9	2,029.8
Pakse	168.1	03 Sep 2019	2,175.0	1,983.5
Paksong	360.7	03 Sep 2019	4,093.9	3,432.1
Nikhom 34	159.0	03 Sep 2019	2,629.7	N/A
Sekong	145.1	03 Sep 2019	1,375.0	1,487.6
Thateng	139.8	02 Sep 2019	1,812.9	N/A
Dakjung	151.3	02 Sep 2019	1,546.7	N/A
Attapeu	101.7	22 Jun 2019	1,826.2	2,185.6

1.3. Tropical cyclone

As the climate characteristic in Lao PDR is influenced by Southwest Monsoon and associated with direct and/or indirect of Tropical Cyclone from Western North Pacific and from the South China Sea. As a result, in 2019, there were three tropical cyclones direct impacted namely WIPHA, PODUL and KAJIKI, and two tropical cyclones indirect impacted namely MUN and MATMO

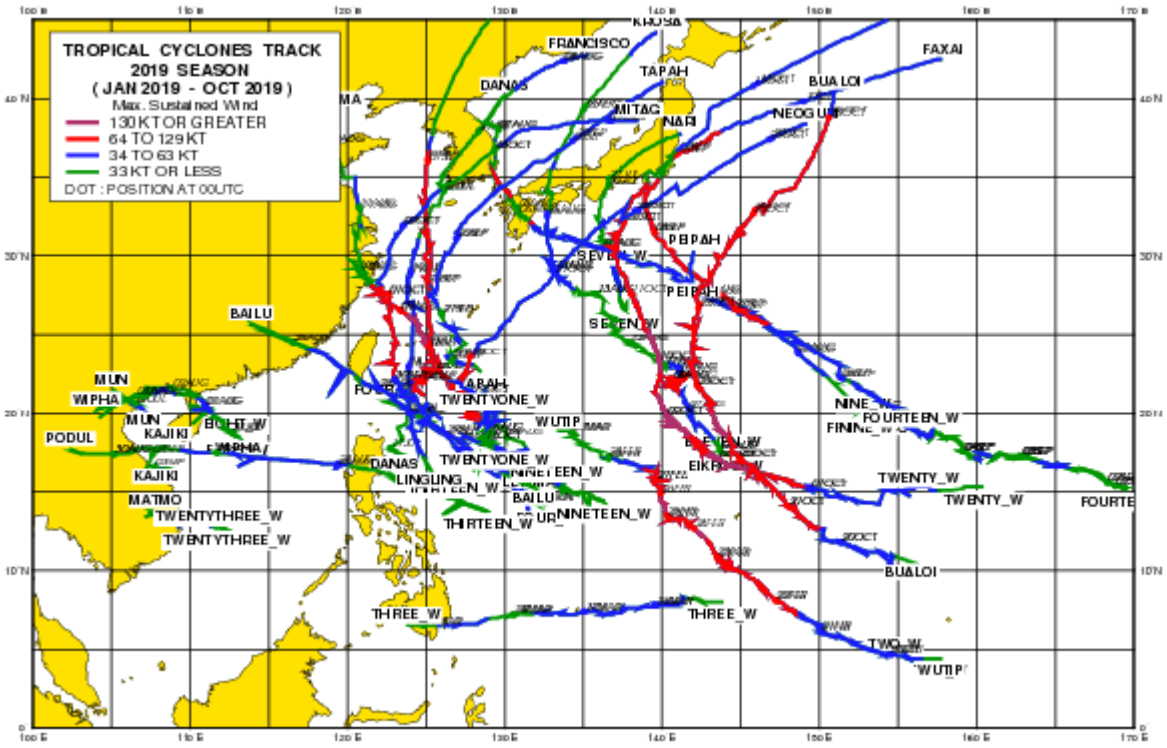


Fig 2: Tropical Cyclones best track in 2019

1.3.1. Indirect impact from Tropical Storm

1.3.1.1. Tropical Storm MUN (1904)

Mun formed as a tropical depression over the northern part of the South China Sea on the afternoon of 2 July 2019 and moved generally westward. After moving across Hainan Island on the

morning of 3 July, Mun was slightly intensified, reaching its peak intensity with an estimated sustained wind of 55 km/h near its centre. Mun made landfall over the northern part of Vietnam on the morning of 4 July and weaken into low pressure afterward. During the passage of MUN, there was heavy rainfall with strong wind in some areas of Lao PDR and caused landslides in northern part and affected to life and properties of the people.

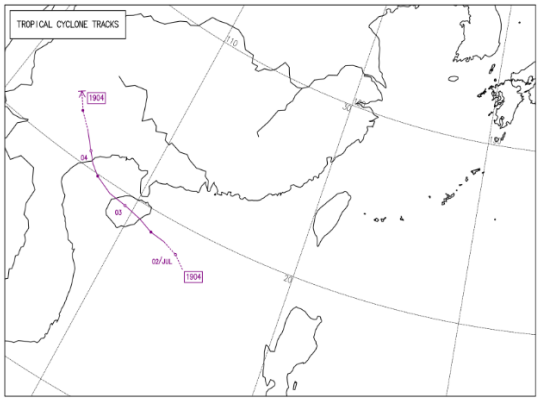
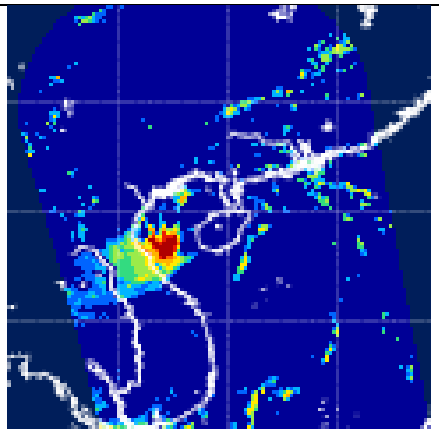


Fig 3: Best track of Tropical Storm MUN (1904)



GPM/TRMM Precipitation

Table 3: Daily rainfall recorded during the passage of MUN over Lao PDR from 1 - 5 July 2019

Station	1-Jul-19	2-Jul-19	3-Jul-19	4-Jul-19	5-Jul-19	Total (mm)
Phongsaly	11.8	6.6	Nill	68.8	6.3	93.5
Viengxay	2.1	0.9	89.5	19.2	Nill	111.7
Xamnua	0.6	0.9	85.6	9.2	Nill	96.3
Xiengkhuang	5.0	13.6	46.6	4.8	Nill	70.0
Luangprabang	5.0	32.5	17.5	15.5	1.2	71.7
Xaysomboun	14.6	11.2	37.1	12.4	6.0	81.3
Phonhong	8.5	5.4	12.8	14.8	2.4	43.9
Paksan	15.4	1.4	29.9	49.2	0.2	96.1
Lak 20	38.3	35.4	102.5	11.8	6.8	194.8
Viengthong	28.0	13.5	24.3	6.0	2.2	74.0
Thakhek	68.4	82.5	113.5	Nill	Nill	264.4
Nakay	4.5	73.4	114.0	11.9	5.0	208.8
Savannakhet	17.0	24.8	30.8	1.0	2.2	75.8
Seno	16.5	36.2	23.4	Nill	7.3	83.4
Salavan	82.3	51.2	9.8	1.8	6.2	151.3
Sekong	47.3	66.8	1.0	Nill	3.2	118.3
Thateng	38.8	64.5	8.0	0.2	2.5	114.0
Pakse	20.7	81.4	7.4	Nill	8.2	117.7
Paksong	84.6	222.3	78.6	31.7	9.4	426.6
Nikhom 34	31.1	60.6	7.4	7.6	2.4	109.1
Dakjung	6.2	59.7	11.3	10.0	1.2	88.4
Attapeu	14.6	76.8	3.8	2.7	13.9	111.8

13.1.2. Tropical Storm MATMO (1922)

MATMO was the second tropical storm has indirect impacted to Lao Lao PDR in 2019. MATMO formed as a tropical depression over the central part of the South China Sea on the afternoon of 29 Oct 2019 and drifted westward in movement speed of 15 km/h. MATMO intensified into tropical storm on 30 Oct and keep moving westward which covered southern part of Lao PDR. During the passage of MATMO, there was moderate to heavy rainfall with strong wind in some areas of southern part of Lao PDR.

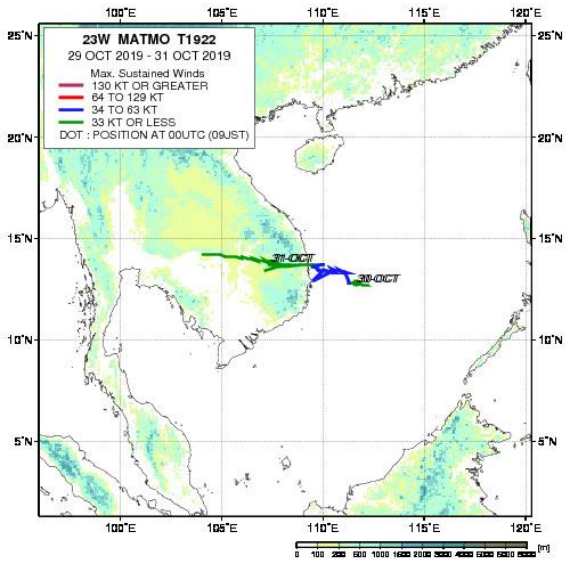


Fig 3: Best track of Tropical Storm MATMO (1922)	GPM/TRMM Precipitation

1.3.2. Direct Impact from Tropical storm

In the year 2019, there are three tropical storms direct impacted to Lao PDR namely: WIPHA, PODUL and KAJIKI

1.3.2.1. Tropical Storm WIPHA (1907)

WIPHA was the first tropical storm entering and affecting Lao PDR in 2019, Although tropical storm Wipha weakened gradually after passing northern part of Vietnam and degenerated into an area of low pressure moved forward to northern part of Lao PDR and making heavy rainfall associated with strong wind in some areas of northern and central parts of Lao PDR. More than 100 millimetres of rainfall per day were generally recorded over the northern and central parts caused landslides and flash flood in some areas.

Wipha formed as a tropical depression over the northern part of the South China Sea on the afternoon of 30 July 2019. It drifted northwards slowly during that night and next morning. Wipha intensified into a tropical storm on the morning of 31 July 2019, later reaching its peak intensity with an estimated maximum sustained wind of 85 km/h near its centre. It started to pick up speed to move west-northwest towards Hainan Island in the afternoon. Wipha slowed down on the early morning of

1 August, making an anti-clockwise loop around the northeastern coast of Hainan Island. It picked up its speed to move northward again in the morning and then moved westward across the Leizhou Peninsula that night. Wipha moved across the coast of Guangxi and the vicinity of Beibu Wan on 2 August and weakened gradually. It degenerated into an area of low pressure over the northern part of Vietnam the next night and moved forward to northern part of Lao PDR on 3rd and 4th August 2019.

Under influence of WIPHA, there were heavy rain with gust in central and northern parts and some areas of southern part. Resulted, flash flood and landslides were occurred in central and northern parts.

Table 4: Daily rainfall recorded during the passage of WIPHA over Lao PDR from 1 - 5 Aug 2019

Station	1-Aug-19	2-Aug-19	3-Aug-19	4-Aug-19	5-Aug-19	Total (mm)
Phongsaly	4.6	10.6	37.3	7.4	16.1	76.0
Viengxay	30.8	29.7	102.4	6.1	NT	169.0
Xamnua	27.7	11.9	112.0	6.2	0.3	158.1
Xiengkhuang	3.5	17.7	142.5	12.3	8.2	184.2
Luangprabang	1.0	2.4	118.7	42.5	NT	164.6
Xaysomboun	8.7	8.7	36.4	7.2	2.1	63.1
Phonhong	23.7	NT	14.2	12.5	23.5	73.9
Paksong	112.8	79.3	56.3	24.9	11.3	284.6

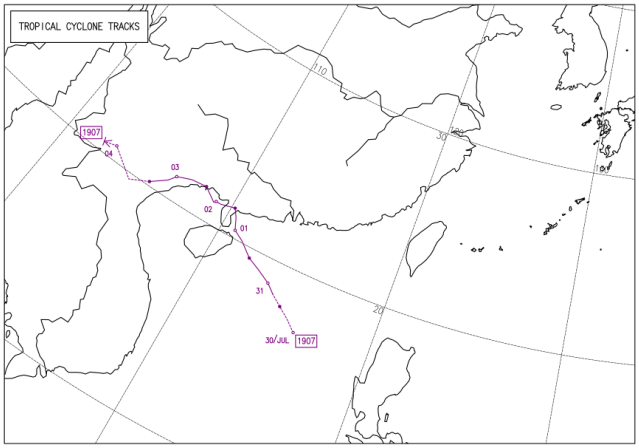
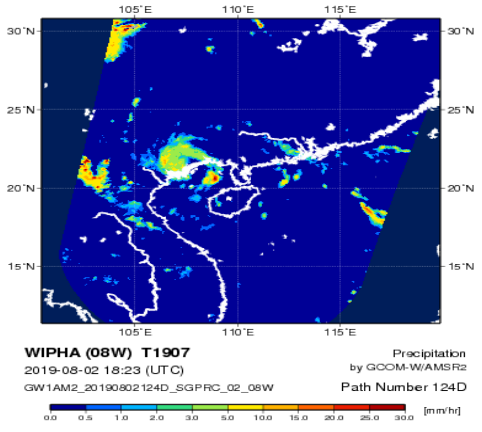


Fig 4: Best track of Tropical Storm WIPHA (1907)



GPM/TRMM Precipitation

1.3.2.2. Tropical Storm PODUL (1912)

Podul was the second tropical cyclone entering and affecting Lao PDR in 2019. Podul formed as a tropical depression over the western North Pacific about 590 km east of Manila on the morning of 27 August 2019. Travelling west-northwestwards quickly, it moved across Luzon that night. Podul continued to move westwards quickly across the central part of the South China Sea and intensified into a tropical storm on 28 August. Podul reached its peak intensity on the small hours of 29 August with an estimated maximum sustained wind of 85 km/h near its centre. Podul made landfall over the central part of Vietnam then kept moving to central part of Lao PDR, on the small hours of 30 August and finally weakened into an area of low pressure over the Indo-China during the day.

Tropical Storm (TS) Podul made landfall in Lao People's Democratic Republic (PDR), bringing heavy rainfall and winds until 3 September 2019, which has caused flooding in six provinces in the central and southern parts of the country. The affected provinces include Khammouan, Savannakhet, Attapeu, Champasak, Khammouane, Salavan and Sekong.

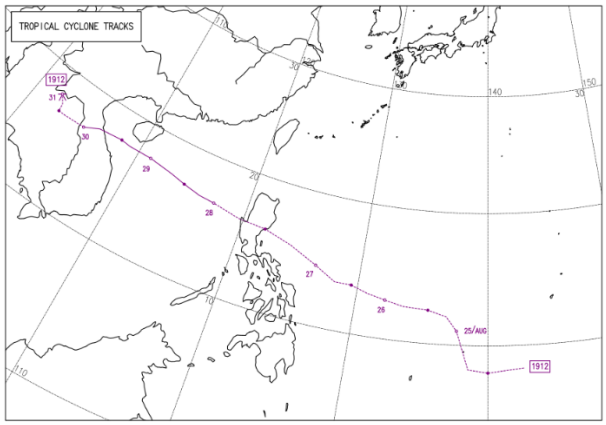
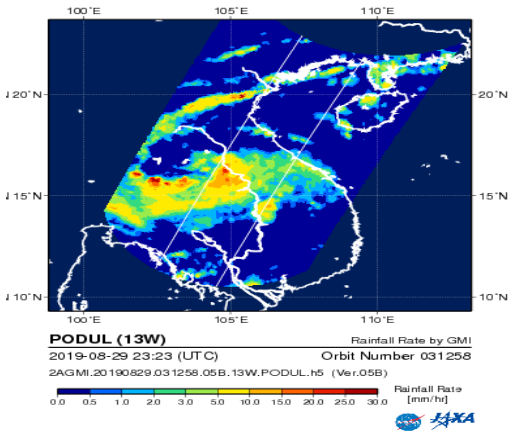


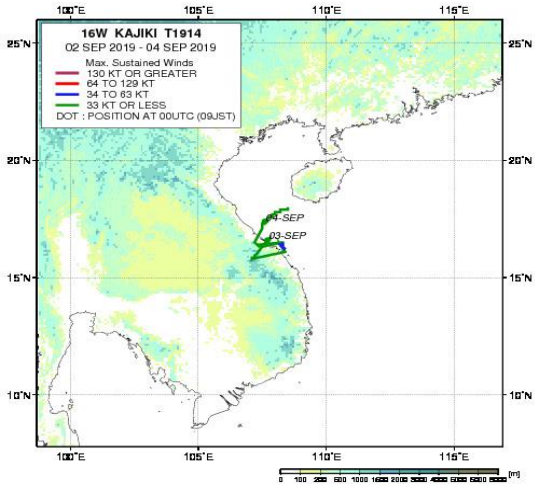
Fig 5: Best track of Tropical Storm PODUL (1912)



GPM/TRMM Precipitation

1.3.2.3. Tropical Storm KAJIKI (1914)

Kajiki formed as a tropical depression over the northern part of the South China Sea on the morning of 1 September and moved westwards across the northern part of the South China Sea. Kajiki intensified slightly during the day with an estimated maximum sustained wind of 55 km/h near its centre. It turned to track southwestwards after moving across the southeastern part of Hainan Island on the morning of 2 September. Kajiki lingered over the vicinity of the coast of central Vietnam and moving to central part of Lao PDR on 3 September and finally degenerated into an area of low pressure over the coastal waters of central Vietnam the next day.



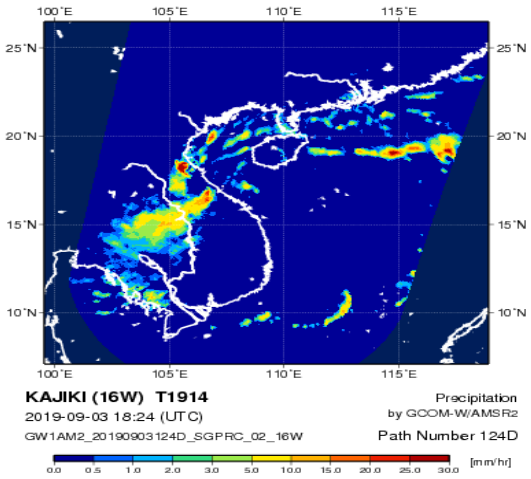


Fig 6: Best track of Tropical Storm KAJIKI (1914) | GPM/TRMM Precipitation

Table 4: Daily rainfall recorded during the passage of PODUL and KAJIKI over Lao PDR from 28 August - 5 September 2019

Station	28-Aug-19	29-Aug-19	30-Aug-19	31-Aug-19	1-Sep-19	2-Sep-19	3-Sep-19	4-Sep-19	5-Sep-19	Total (mm)
Thakhek	0.2	39.5	41.3	16.0	2.4	52.9	46.8	57.5	24.7	281.3
Nakia	1.6	28.0	31.4	32.1	10.5	73.4	44.9	85.3	43.7	350.9
Savannkhet	NT	125.4	109.8	19.5	5.8	88.1	55.7	44.8	2.6	451.7
Seno	NT	185.0	44.5	25.6	13.6	33.7	56.5	46	7.6	412.5
M. Nong		46.8	98.6	21.8	18.2	177.8	353	106.5	36.4	859.1
M. Phin		61.6	16.4	27.2	36.4	114.4	160.8	82.8	23.6	523.2
Phalanxay		58.9	27.0	11.2	5.3	40.2	119.6	86.3		348.5
Chonbouly		132.3	23.4	74.8	15.7	45.0	186.6	66	10.5	554.3
Salavan	0.7	113.2	69.6	7.3	45.2	182.2	15.4	142.4	19.9	595.9
Sekong	10.4	67.6	38.1	3.2	42.9	96.8	145.1	27.4	2.6	434.1
Thateng	2.7	61.1	42.0	3.0	44.8	139.8	112.9	88	6.9	501.2
Dakjung	31.3	48.7	58.0	4.5	7.7	151.3	95.3	18.7	6.5	422.0
Paksong	2.6	96.9	87.9	15.4	96.3	288.1	360.7	203.5	84	1235.4
Nikhom 34	4.5	74	116.8	11.6	34.5	111.4	159	28.7	3.9	544.4
Pakse	33.8	100.8	90.7	NT	90.4	154	168.1	30.6	5.2	673.6
Attapeu	0.3	2.6	31.8	6.7	28.5	23.1	2.7	6.1	11.5	113.3

2. Hydrological Assessment (highlighting water-related issues/impact)

2.1. The Weather condition in 2019

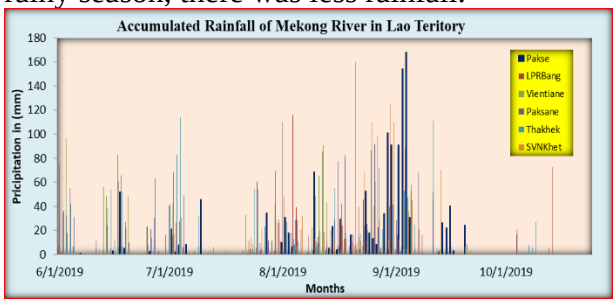
In this year, the rainy season started latter than normal in the whole part of the country (started from the end of August to beginning of September and finished by the medium of September). The monsoon rain were very active from early to medium September. During the rainy season, the Mekong River and its tributaries are unusually dry, starting from the early of June to the present. However, the some central and southern regions are flood affected by the storms during the early August to mid-September period, usually not more than 10 days, but after the beginning of October, the floods are as dry as other stations.

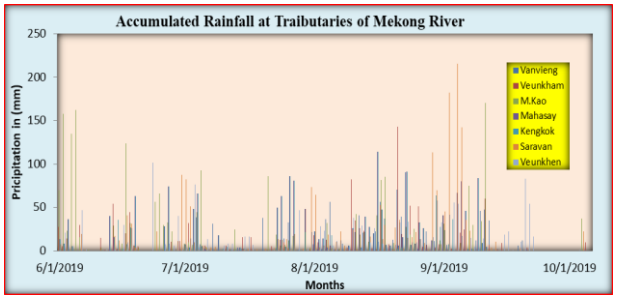
The annual precipitation of the year 2019 was near mostly Fewer normal in each part of the country. From 31 July – 05 Aug 2019 the WIPA Storm and From 28 August to 06 September 2019 the PODUL and Kajiki storms Passed over central and southern parts of Lao PDR. There was a moderate to heavy rainfall. Over the past six days, there were some areas with a total of 9 days ranging from 240-800 millimeters. The Central and southeast monsoon to dominate with moderate to heavy rainfall and very heavy rainfall in some areas.

From August 28 to September 6, 2019, in some areas heavy rainfall was estimated and compare to range of rainfall from June to October was covered from 20% to 51%, with more rainfall in Pakse than Another station. More clearly see table below:

DD/RV/ST	Mekong River						N.Song	N.Ngum	N.San	XBFai	XCPhon	Xedone	Xekong
	Luang prabang	Vien tiane	Paksane	Thakhek	Savan nakhet	Pakse	Vang vieng	Veun kham	M. Kao	Mahasay	Kengkok	Saravan	Veun khen
8/29/2019	3.4	2.5	0	0.2	0	33.8	0.0	0.0	5.2	12.3	0.0	113.2	16.0
8/30/2019	12.2	1.8	4.3	39.5	125.4	100.8	11.5	3.7	2.0	63.8	91.9	69.6	57.9
8/31/2019	4.5	4.5	11.6	41.2	109.8	90.7	0.5	7.4	12.0	27.7	3.9	7.3	32.7
9/1/2019	4.6	0	28.4	16	0	0	41.0	40.6	31.6	23.7	2.6	45.2	0.0
9/2/2019	12.6	0	2.2	2.6	5.8	90.7	6.9	0.3	0.0	7.4	5.6	182.2	41.3
9/3/2019	0	4.2	0	52.9	88.1	154	0.0	2.3	0.0	36.7	36.5	0.0	55.5
9/4/2019	0	4.6	1.7	46.8	35.7	168.1	0.0	0.0	0.0	67.1	62.3	215.4	54.5
9/5/2019	0	52.5	1.5	57.5	44.8	30.6	0.0	21.2	8.8	80.3	36.4	142.4	17.5
9/6/2019	0	5.2	0.7	24.7	2.6	0	0.0	24.3	0.0	46.1	0.0	35.4	0.8
Total	37.3	75.3	50.4	281.4	412.2	668.7	59.9	99.8	59.6	365.1	239.2	810.7	276.2
% compare with Rainy Season year 2019	6.1	5.4	2.7	15.7	37.5	51.2	5.9	8.1	2.7	19.9	33.5	45.0	19.6

The graph below shows that this year's rainy season, from early July to mid-August, is less rainy. And after heavy flooding in central and southern regions from mid-September until the end of he rainy season, there was less rainfall.



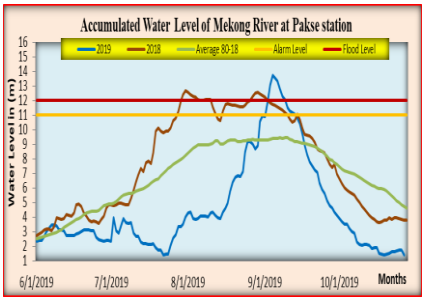


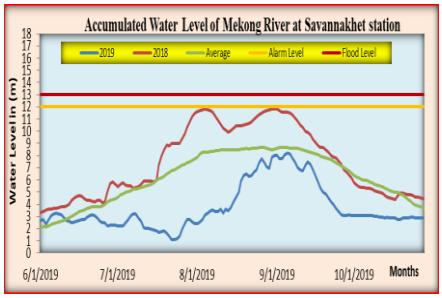
2.2. **Water Level Condition in 2019**

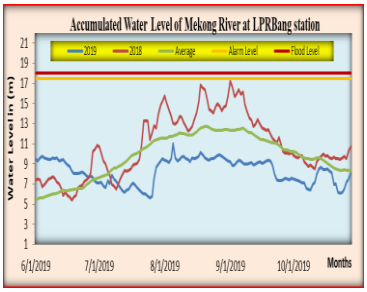
From 28 August to 6 September of continuous rainfall, the levels of the Mekong River at Pakse station and the tributaries of Central and the South continued to increase, especially in Khammouane, Savannakhet, Champasack, Saravan, Sekong and Attapeu provinces extensive inundation caused great damage to people's property and transportation

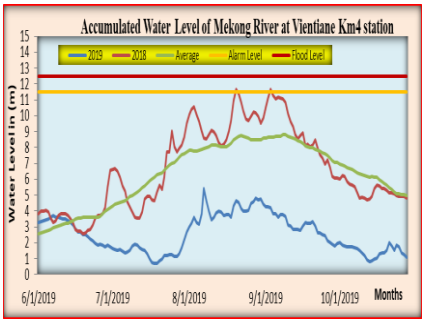
At the tributaries level, there was also increase in water levels, especially in Xebangfai, Xedone, Xebanghieng and Xekong Rivers. Until September 17, 2019, the level of the Mekong River and its tributaries has been down but slowly, more detail sees table and figure below:

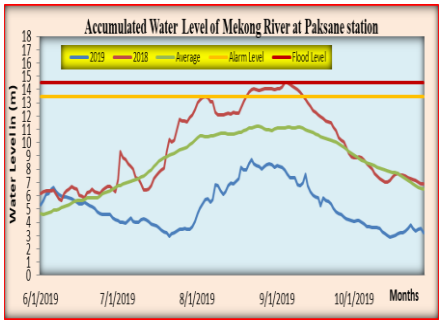
D	12.00	17.00	15.00	8.50	13.30	11.50	16.00
W	11.00	16.00	14.00	7.50	12.30	10.50	15.00
River	Mekong	Sebanghier	Sebangfai	Xechamphone	Se Done	Se Done	Sekong
Date/Station	Pakse	Sepon	Mahasay	Kengkok	Khongse done	Saravan	Veunkhen
1			14.10				
2			14.46				
3	11.94		14.64		12.68		
4	13.06	18.00	15.00		16.22	12.15	16.30
5	13.75	19.25	15.36	9.42	15.50	11.19	17.77
6	13.60	18.89	15.76	10.36	15.29		17.10
7	13.34		16.14		13.91		
8	12.80		16.51				
9	12.32		16.76				
10	12.04		16.74				
11			16.64				
12			16.52	10.86			
13			16.20	10.38			
14			15.66	8.86			
15			14.92				
16			14.08				
17			14.92				

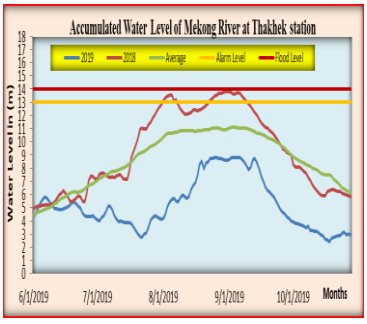












3. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)

- Socio Economic loss by Local storm:

From 17-18 Mar 2019, local storm occurred in Xaythani, district, Vientiane capital central parts of Lao PDR, causing the strong wind and many houses damages , trees and electricity poles broken down.On 24 April 2019, Local Storm occurred in Xanasomboun district, Champasack Province, southern parts of Lao PDR, causing the strong wind and many houses damages , trees and electricity poles broken down

- Socio Economic loss by hail storm.

On 20 April 2019, severe hail storm occurred in Tomran district , Saravanh Province, southern parts of Lao PDR, and affected to agricultural product. On 13 Mar 2019, hail storm occurred in Vientiane capital and effected many houses.

- Socio Economic loss by lightning.

On 04 0ctober 2019, lightning strike killed 8 cows in Feung district, Vientiane Province

- Socio Economic loss by flash floods.

From 8 to 10 January 2019 there were heavy rain the flash flood occurred in some villages, especially at Hatsa and other surrounding villages affected by flash flood, Phongsaly, Province which is impacted to properties of people, rice stocks and house washed away

On 30 July 2019, there were heavy rain over 8 villages namely Sibounheung, Simongkhoun, Phonhin, Palai, Nalao, Nafay, Nakeun, and thad. Nan district, Luangprabang Province. This flash food affected to the house, irrigation scheme and agricultural of people. The damage cost is approximately 70.000 US Dollars.

- Socio Economic loss by landslides.

On 02 June 2019, strong southwest monsoon and associated with heavy rain causing landslides in Ban Nakang Mai district, Phongsaly Province,04 people were killed.


- Socio Economic loss by floods.

On 29 August to 04 September, Tropical Storm PODUL (1912) caused heavy rains and flooding in 47 districts of 6 provinces across Lao PDR. According to the Government, over 150.146 families are affected by these floods thus far. With the water levels in the Mekong River and its tributaries due to rise over the coming weeks, the situation is likely to deteriorate and flooding may spread farther.






Disaster impacts to Lao PDR in 2019

NO	Province	District	Village	Household	People	Female	Missing	Death
1	Phongsaly	1	2	77	350	181		1
2	Oudomxay	1	3	125	710	353		4
3	Houphan	2	3	5	28	15	6	1
4	Luangprabang	2	13	400	2.391	1.204		
5	Xiengkhouang	1	1	2	9	4		
6	Xaiyabouly	1	1	1	4	1		1

7	Khammoune	5	178	11.48	43	24.002		1
8	Savannakhet	15	452	42.509	38.053	18.473		3
9	Saravanh	7	375	35.905	138.881	N/A		3
10	Champasack	10	483	48.614	267.249	N/A	1	8
11	Xekong	4	197	24.019	121.754	N/A		
12	Attapeu	5	89	15.104	52.493	N/A		4

4. Regional Cooperation Assessment (highlighting regional cooperation success and challenges.

The Department of Meteorology and Hydrology of Lao PDR has collaborated with International Organizations and donors to improve the hydrological and meteorological services in Lao PDR such as:

- By collaboration with Mekong River Commission (MRC) to upgrade the hydrological networks along the Mekong River as well as its tributaries, and also to share the water level and flood forecasts among the MRC member countries.
- With JICA: 18 meteorological stations has been upgraded to Automatic Weather Stations, 8 hydrological stations upgraded to Automatic Water Level Stations, and well as facilities for weather monitoring and forecasting have been upgraded.
- Under support from World Bank to upgrading hydro-meteorological networks stations over the country and construct national early warning center, and providing the facilities for national early warning center.
- Under support from Asian Development Bank to upgrade the hydro-meteorological networks over central part.
- Under support from Food and Agriculture Organization (FAO) to establish the 15 agro- meteorological stations.
- Under Typhoon Committee frameworks, National Disaster Management Institute (NDMI) support for establish Flash Flood Alert System in Lao PDR.
- With support from World Bank to Strengthen Resilience to Natural Disaster (DRM project)
- With support from CMA, DMH has completed to set up the weather TV's studio
- Under supporting from Chinses Government to establish the water resources center which located in DMH's headquarter.

II. Summary of Progress in Priorities supporting Key Result Areas

1. Establishment of Flash Flood Alert System in Lao PDR

Main text:

NDMI of Republic of Korea and DMH of Lao PDR have signed the agreement to install the Flash Flood Alert System in Lao PDR. Main purpose of this project is to build resilience and strengthen the capacity on disaster risk reduction in Lao PDR. In this project, NDMI and DMH cooperate to install: the Automatic Rainfall Warning System (ARWS) and Flash Flood Alert System (FFAS) in Lao PDR. In the Year 2016, the installation completed in one district namely Vang Vieng District of Vientiane Province, and for the year 2017 completed installation system in Muang Houn of Oudomxay Province. In 2018, completed installation system in Muang Xay, Oudomxay Province. And in 2019, completed installation of Flood Warning System in Bolikhan District of Bolikhamxay Province

Identified opportunities/challenges, if any, for further development or collaboration:

NDMI will expend the project to another province for 2020.

Priority Areas Addressed:

- ✓ 3 automatic water level stations installed in Nam San River of Bolikhan and Thahom Districts
- ✓ 3 automatic rain gauges installed in Nam San River of Bolikhan and Thahom Districts
- ✓ 3 warning posts installed Bolikhan District of Bolikhamxay Province
- ✓ Upgraded the server in Department of Meteorology and Hydrology

PakGnong Bridge (Xan River):
Ban PakGnong, Thathom District, Saysomboun Province

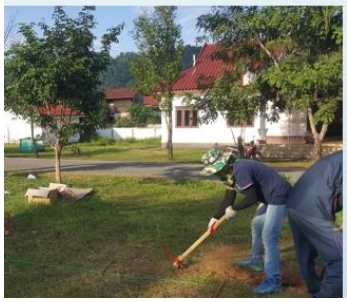
KhenYong Bridge (Xan River):
Ban KhenYong, Bolikhan District, Bolikhamxay Province

Nam Xan Bridge (Xan River):
Ban NaHene, Bolikhan District, Bolikhamxay Province





Warning Post
Bolikhan District Administration



Contact Information:

Member: Lao PDR

Name of contact for this item: Mr. Bounteum Sysouphanthavong

Telephone: +856-20-56505997

Email: s.bounteum@hotmail.com, dmhvte@gmail.com, dmhlao@gmail.com