MEMBER REPORT
Lao PDR

ESCAP/WMO Typhoon Committee

16th Integrated Workshop

Video Conference

2-3 December 2021

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)

In 2021, there were four (4) tropical cyclones direct impacted to Lao PDR, namely KOGUMA, CONSON, DIANMU, KOMPASU, and one (1) tropical cyclone indirect impacted namely CEMPAKA

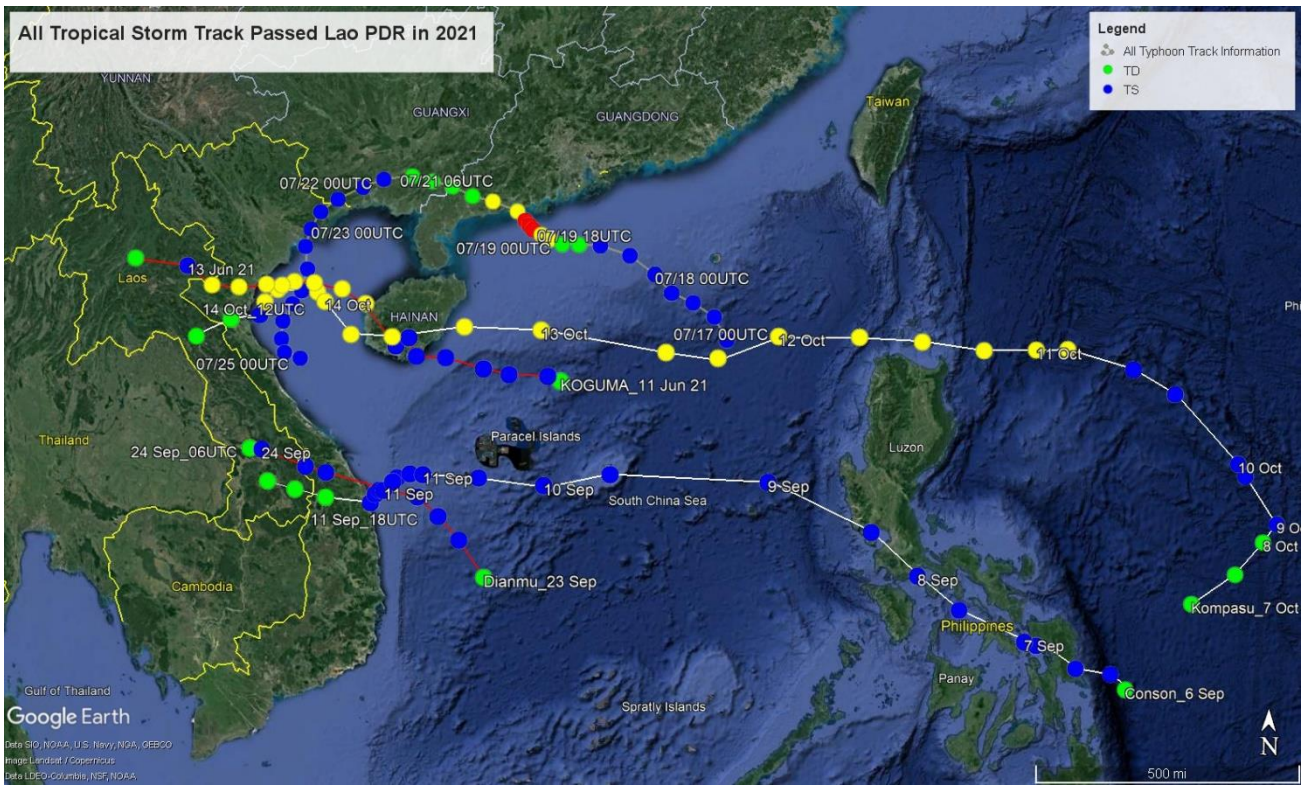


Fig 1: Tropical Cyclones best track passed over Lao PDR in 2021

1.1. Direct impact from Tropical Storm

1.1.1. Tropical Storm KOGUMA (TS2104)

Koguma was the first tropical cyclone affecting Lao PDR in 2021. A monsoon depression developed into a tropical depression over the northern part of the South China Sea on the afternoon of 11 June. It generally tracked west-northwestward towards Hainan Island. The tropical depression moved across Hainan Island on the morning of 12 June and was named Koguma in the afternoon. Koguma intensified into a tropical storm over Beibu Wan in that evening and reached its peak intensity with an estimated maximum sustained wind of 65 km/h near its centre. It made landfall over the northern part of Vietnam on the morning of 13 June and downgraded into Tropical Depression moved over Northeastern part of Lao PDR in the afternoon of the same day and then degenerated into an area of low pressure over Northwestern part of Lao PDR in the morning of 14 June 2021. During the passage of KOGUMA, there was heavy rainfall with strong wind in some areas of Central and Northern part of Lao PDR and caused landslides flash flood in central and northern parts, and affected to life and properties of the people.

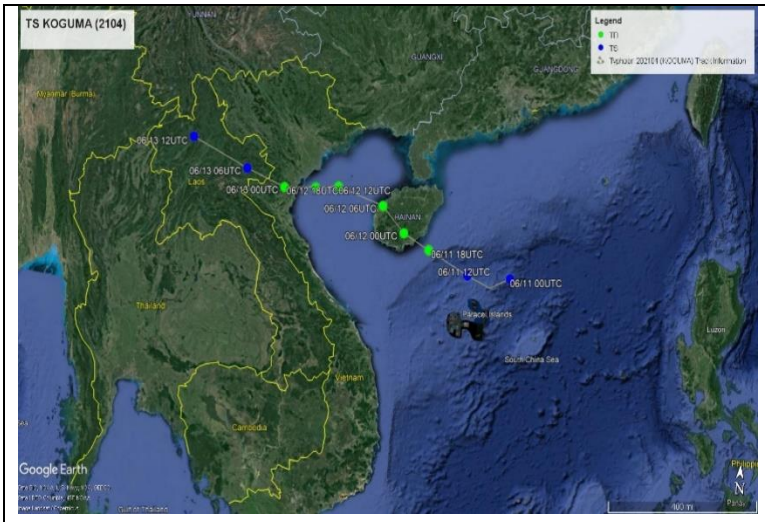
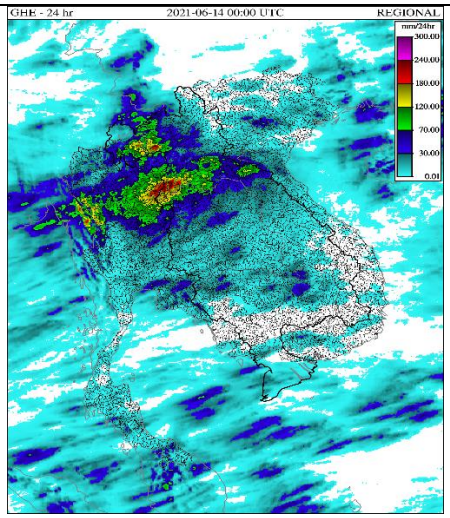


Fig 2: Best track of Tropical Storm KOGUMA (TS2104)



GHE – 24 hrs

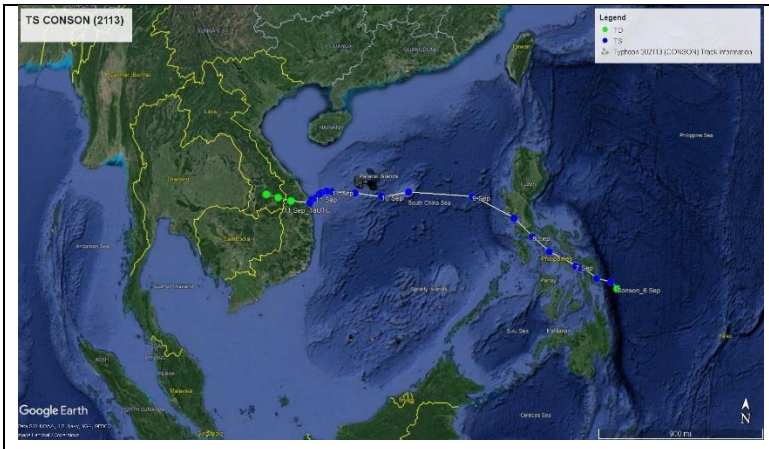
Table 1: Daily rainfall recorded during the passage of KOGUMA over Lao PDR from 11 – 15 June 2021

Station		11-Jun-21	12-Jun-21	13-Jun-21	14-Jun-21	15-Jun-21	Total
Northeastern	Phongsaly	17.6	1.3	4.7	6.7	1.1	31.4
	Samnua	22.0	23.3	21.0	NT	NT	66.3
	Viengxay	14.3	17.0	15.6	NT	NT	46.9
	Xiengkhuang	7.7	38.1	146.0	0.9	1.2	193.9
Northwestern	Luangnamtha	2.6	27.1	9.7	2.1	0.5	42.0
	M. Sing	29.6	1.4	14.5	NT	2.5	48.0
	Viengphoukha	0.0	NT	35.7	10.3	2.4	48.4
	Oudomxay	3.7	9.8	9.7	2.3	0.4	25.9
	Bokeo	4.2	NT	68.6	86.5	0.2	159.5
	Luangprabang	10.2	29.4	86.9	13.2	1.4	141.1
	Sayabouli	NT	2.9	219.1	13.1	5.6	240.7
Central	Vientiane	NT	12.3	44.8	4.8	NT	61.9
	Phonhong	4.6	10.8	107.6	1.4	NT	124.4
	Saysomboun	17.1	23.3	165.8	14.2	9.3	229.7
	Paksanh	0.4	54.4	8.0	1.1	4.2	68.1
	Lak 20	21.0	119.3	54.9	2.0	3.0	200.2
	Viengthong	19.8	25.7	28.0	NT	4.0	77.5
	Thakhek	10.0	57.0	5.2	1.1	0.1	73.4
	Nakay	20.6	104.5	20.0	9.4	2.3	156.8
	Savannakhet	59.3	23.1	NT	NT	NT	82.4
	SENO	46.6	21.7	4.3	NT	NT	72.6
Southern	Salavanh	14.5	62.8	21.4	1.2	6.1	106.0
	Sekong	23.2	57.2	3.2	1.9	NT	85.5
	Thateang	6.2	30.9	2.2	2.5	4.5	46.3
	Pakse	36.6	16.6	27.7	0.2	NT	81.1
	Paksong	53.8	97.3	8.2	14.5	2.2	176.0

	Nikhom 34	50.4	46.8	10.1	20.6	9.5	137.4
	Dakchung	4.5	20.5	3.7	NT	NT	28.7
	Attapeu	6.3	37.8	34.6	0.6	39.5	118.8

1.1.2. Tropical Storm CONSON (TS2113)

CONSON was the second tropical storm has direct impacted to Lao PDR in 2021. CONSON formed as a tropical depression on 06 UTC of 6 September 2021 at latitude 10.8º North and longitude 126.8º East. It moved northwestward and intensified gradually. CONSON developed into a tropical storm on 7 September and made landfall east coast of Central part of Philippines and continued moving northwestward during 7 – 8 September. It further moved over South China Sea from 9 – 10 September. CONSON made landfall at Danang City of Vietnam on 11 September then downgraded into Tropical Depression (TD) moved across the southern and central parts of Lao PDR on 12 September 2021, and then it finally degenerated into an area of low pressure over the Thailand of the next day.



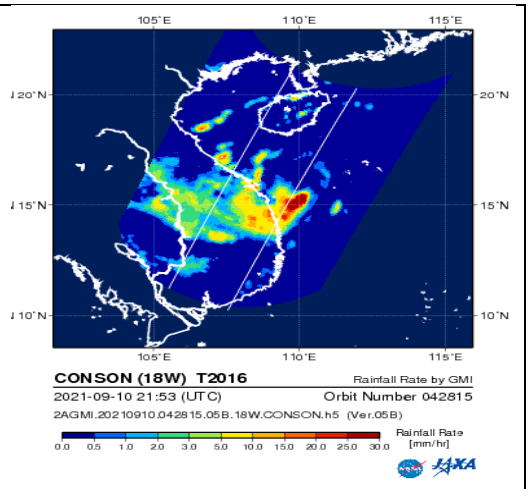


Fig 3: Best track of Tropical Storm CONSON (TS2113) | GPM/TRMM Precipitation

During the passage of CONSON, there was moderate to heavy rainfall with strong wind in some areas of central and southern parts of Lao PDR, the summary of rainfall as table 2.

Table 2: Daily rainfall recorded during the passage of CONSONL over Lao PDR from 10 - 12 Sep 2021

Station		8-Sep-21	9-Sep-21	10-Sep-21	11-Sep-21	12-Sep-21	Total
Northeastern	Phongsaly	1.4	NT	NT	NT	NT	1.4
	Samnua	16.1	1.1	NT	NT	NT	17.2
	Viengxay	17.2	1.8	NT	NT	NT	19.0
	Xiengkhuang	10.0	5.3	NT	0.2	NT	15.5
Northwestern	Luangnamtha	1.7	NT	NT	NT	NT	1.7
	M. Sing	15.1	0.9	NT	0.0	0.0	16.0
	Viengphoukha	NT	0.0	NT	NT	NT	0.0
	Oudomxay	NT	NT	NT	NT	NT	0.0
	Bokeo	NT	93.1	NT	NT	NT	93.1

	Luangprabang	4.9	0.5	NT	NT	NT	5.4
	Sayabouli	NT	5.5	NT	NT	NT	5.5
Central	Vientiane	35.9	13.1	10.5	NT	NT	59.5
	Phonhong	9.2	19.6	NT	NT	NT	28.8
	Saysomboun	13.2	12.2	NT	NT	2.8	28.2
	Paksanh	14.3	15.0	NT	NT	6.4	35.7
	Lak 20	30.7	NT	NT	NT	2.1	32.8
	Viengthong	23.0	NT	NT	NT	NT	23.0
	Thakhek	45.5	25.4	0.8	NT	3.1	74.8
	Nakay	15.3	6.9	NT	NT	5.5	27.7
	Savannakhet	8.0	24.4	NT	2.2	8.4	43.0
	SENO	18.8	5.2	0.2	2.6	12.6	39.4
Southern	Salavanh	0.6	N	18.4	156.2	62.4	237.6
	Sekong	0.3	NT	6.5	61.0	33.7	101.5
	Thateang	0.5	29.7	4.2	82.3	54.8	171.5
	Pakse	40.7	27.4	15.6	141.3	43.6	268.6
	Paksong	8.6	8.6	15.8	124.2	104.8	262.0
	Nikhom 34	2.2	13.3	4.9	56.7	20.3	97.4
	Dakchung	7.7	6.7	9.0	101.5	31.0	155.9
	Attapeu	1.1	1.0	5.0	28.9	10.1	46.1

1.1.3. Tropical Storm DIANMU (TS2115)

DIANMU was the third tropical storm has direct impacted to Lao PDR in 2021. DIANMU formed as tropical depression over the South China Sea on morning of 23 September 2021 at the position 13.5^{o} North and 111.7^{o} East. DIANMU intensified into tropical storm on 06 UTC of 23 September at position 14.8^{o} North and 110.6^{o} East and kept moving northwestward, DIANMU made landfall in Danang City of Vietnam in 12 hours later and moving over southern part to central part of Lao PDR on 24 September then finally weakened into tropical depression and an area of low pressure respectively during the night of 24 - 25 September 2021 respectively.

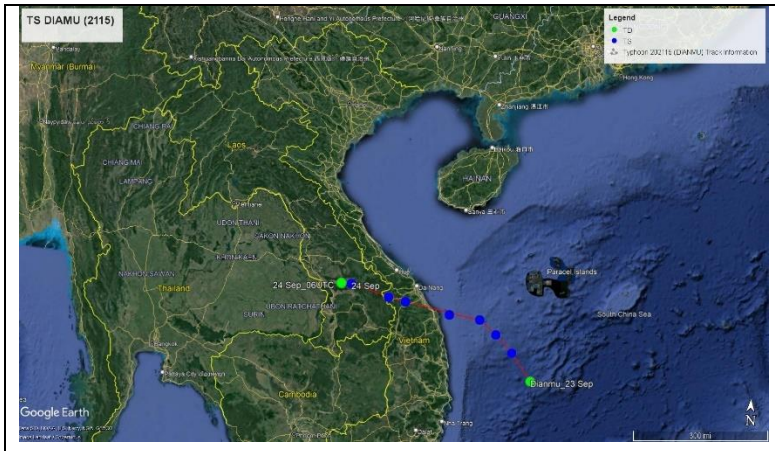
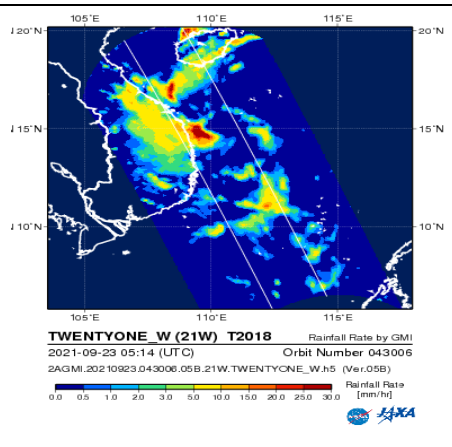


Fig 4: Best track of Tropical Storm DIANMU (TS2115)



GPM/TRMM Precipitation

During the passage of DIANMU, there was moderate to heavy rainfall with strong wind in some areas of central and southern part of Lao PDR, the summary of rainfall as table 3.

Table 3: Daily rainfall recorded during the passage of DIANMU over Lao PDR from 23 - 25 September 2021

Station		22-Sep-21	23-Sep-21	24-Sep-21	25-Sep-21	26-Sep-21	Total
Northeastern	Phongsaly	NT	NT	NT	NT	NT	0.0
	Samnua	NT	2.2	15.7	38.7	6.4	63.0
	Viengxay	NT	3.5	16.3	2.8	7.9	30.5
	Xiengkhuang	NT	2.7	2.2	1.0	NT	5.9
Northwestern	Luangnamtha	NT	NT	NT	NT	4.0	4.0
	M. Sing	NT	NT	NT	NT	NT	0.0
	Viengphoukha	NT	NT	NT	NT	NT	0.0
	Oudomxay	NT	NT	0.1	0.1	NT	0.2
	Bokeo	7.0	NT	NT	0.4	18.2	25.6
	Luangprabang	NT	6.7	0.9	NT	3.7	11.3
	Sayabouli	10.8	2.5	NT	2.3	9.2	24.8
Central	Vientiane	16.7	20.8	1.5	14.5	5.2	58.7
	Phonhong	4.3	15.6	1.5	9.6	6.5	37.5
	Saysomboun	0.2	NT	1.0	4.3	9.1	14.6
	Paksanh	NT	17.2	3.4	1.6	1.8	24.0
	Lak 20	2.6	10.8	26.6	NT	NT	40.0
	Viengthong	25.2	1.0	2.6	NT	NT	28.8
	Thakhek	14.3	12.9	5.6	16.5	35.3	84.6
	Nakay	12.3	37.9	34.6	NT	9.1	93.9
	Savannakhet	8.6	15.6	24.6	30.6	4.0	83.4
	SENO	9.3	16.0	32.3	49.6	3.8	111.0
Southern	Salavanh	12.6	41.4	28.0	11.4	2.0	95.4
	Sekong	NT	103.6	15.8	1.2	3.6	124.2
	Thateang	12.0	119.0	54.3	5.2	8.7	199.2
	Pakse	NT	59.5	130.8	6.0	NT	196.3
	Paksong	3.6	93.4	118.7	25.8	NT	241.5
	Nikhom 34	28.6	90.3	37.3	9.2	26.5	191.9
	Dakchung	11.5	58.7	9.5	7.5	0.3	87.5
	Attapeu	12.7	66.4	12.5	21.3	39.1	152.0

1.1.4. Tropical Storm KOMPASU (TS2118)

KOMPASU was the fourth tropical storm has direct impacted to Lao PDR in 2021. KOMPASU formed as tropical depression on 07 October 2021 near the eastern part of Philippines at the position 12.7^{o} North and 128.5^{o} East and moved northeastward. KOMPASU intensified into tropical storm on 08 October at the position 13.8^{o} North and 121.5^{o} East, KOMPASU continued intensifying into Severe Tropical Storm (STS) on 8 October and then kept moving west-northwestward and passed over Hainan island on 9 October then kept moving westward, KOMPASU made landfall to northern part of Vietnam on 14 October then weakened into tropical depression passing Bolikhamxay Province of Lao PDR in the evening of 14 - 15 October 2021.

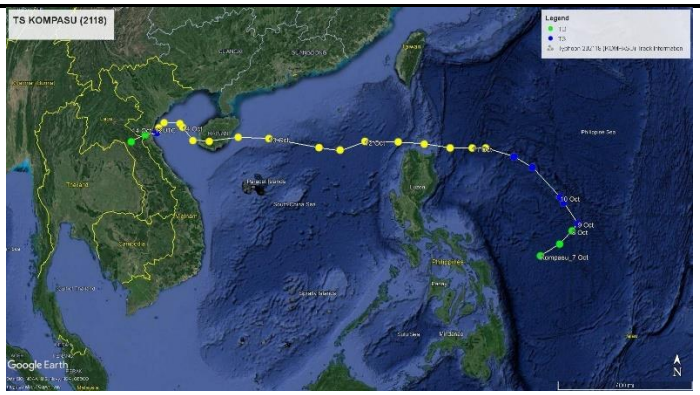
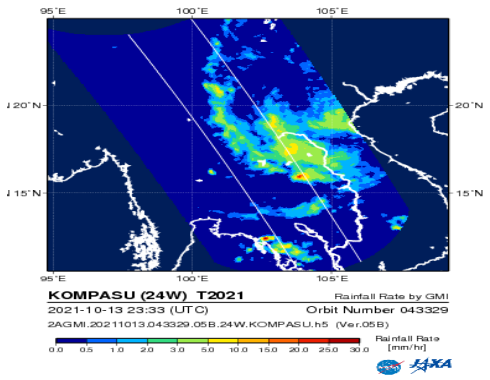


Fig 5: Best track of Tropical Storm KOMPASU (TS2118)



GPM/TRMM Precipitation

During the passage of KOMPASU, there was light to moderate rainfall with strong wind in some areas of central and northern part of Lao PDR, the summary of rainfall as table 4.

Table 6: Daily rainfall recorded during the passage of KOMPASU over Lao PDR from 12 - 16 Oct 2021

Station		12-Oct-21	13-Oct-21	14-Oct-21	15-Oct-21	16-Oct-21	Total
Northeastern	Phongsaly	NT	1.3	1.4	4.1	4.1	10.9
	Samnua	NT	23.6	24.6	19.6	8.3	76.1
	Viengxay	NT	20.2	16.8	29.7	12.2	78.9
	Xiengkhuang	NT	4.8	5.7	1.8	0.4	12.7
Northwestern	Luangnamtha	NT	1.6	0.5	12.9	0.6	15.6
	M. Sing	NT	1.6	0	15.2	0.4	17.2
	Viengphoukha	NT	1.4	0	0	1.4	2.8
	Oudomxay	NT	0.1	2.7	0.9	NT	3.7
	Bokeo	NT	NT	3.3	3.7	1.1	8.1
	Luangprabang	NT	2	7.5	NT	NT	9.5
	Sayabouli	NT	6.8	1.8	1.9	NT	10.5
Central	Vientiane	7.2	7.8	21.2	4.3	NT	40.5
	Phonhong	NT	8.8	3	2.9	NT	14.7
	Saysomboun	NT	5.1	6.7	1.1	NT	12.9
	Paksanh	NT	12.6	0	0.4	NT	13.0
	Lak 20	NT	57.3	3	2.8	8.8	71.9
	Viengthong	0.9	24.3	5.2	1	0.6	32.0
	Thakhek	NT	42.3	4.5	2.6	3.5	52.9
	Nakay	NT	27.3	11.9	9.3	2.4	50.9
	Savannakhet	NT	27.8	4.5	52.6	21	105.9
	SENO	NT	30.4	2.9	4.2	17.3	54.8
Southern	Salavanh	NT	5.8	6.2	2.8	44.2	59.0
	Sekong	0.4	0.7	9.9	17.8	39	67.8

	Thateang	1.5	2.3	32.3	17.4	65.7	119.2
	Pakse	NT	NT	22.3	121.8	36.9	181.0
	Paksong	NT	0.6	15.3	8.6	37.8	62.3
	Nikhom 34	0.3	0.7	56.3	24.2	36.2	117.7
	Dakchung	0.5	1	8.3	25	73.8	108.6
	Attapeu	NT	0.5	18.6	38.4	57.5	115.0

1.2. Indirect impact from Tropical Storm

1.2.1. Typhoon CEMPAKA (TS2107)

Cempaka was the first tropical storm has indirect impacted to Lao PDR in 2021. Cempaka formed as a tropical depression over the northern part of the South China Sea on the night of 18 July. It moved generally northwestwards to west-northwestwards slowly towards the coast of western Guangdong and intensified rapidly. Cempaka intensified into a typhoon in the small hours on 20 July and reached its peak intensity with an estimated maximum sustained wind of 120 km/h near its centre. It started to weaken at night and made landfall near Yangjiang. Cempaka moved across western Guangdong and inland Guangxi, and weakened into a tropical depression progressively on 21 July. It turned to move south-southwestwards the next day and entered Beibu Wan on 23 July. Cempaka finally degenerated into an area of low pressure over Beibu Wan on 24 July. (Source: Report on Typhoon Cempaka (2107) | Hong Kong Observatory(HKO) | Tropical Cyclone Reports and Publications).

Under the influence of Cempaka, a maximum sea level (above chart datum) of 2.60 m and a maximum storm surge of 0.41 m (above astronomical tide) were recorded at Tsim Bei Tsui and Tai Po Kau respectively. At the Observatory Headquarters, the lowest instantaneous mean sea-level pressure of 1001.2 hPa was recorded at 4:09 p.m. on 19 July. The outer rainbands associated with Cempaka brought heavy showers and thunderstorms to Lao PDR on 22 - 25 July 2021.

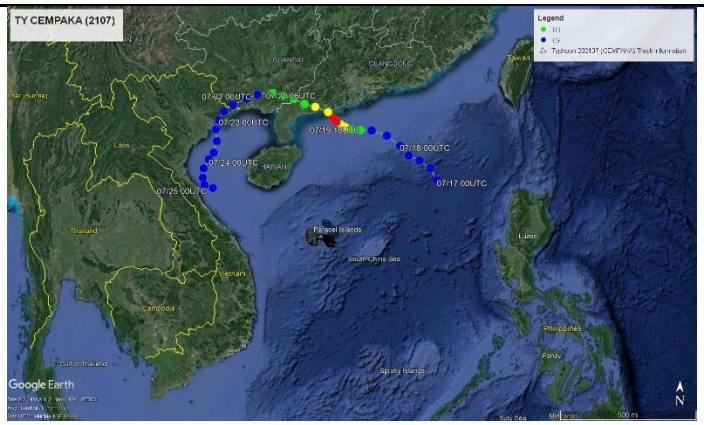
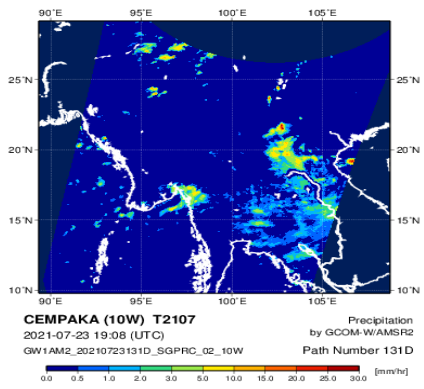


Fig 9: Best track of Tropical Storm CEMPAKA (TS2107)



GPM/TRMM Precipitation

Table 7: Daily rainfall recorded over Lao PDR during the passage of CEMPAKA over South China Sea from 21 – 25 July 2021

Station		21-Jul-21	22-Jul-21	23-Jul-21	24-Jul-21	25-Jul-21	Total
Northeastern	Phongsaly	123.7	8.2	5.4	51.0	45.7	234.0
	Samnua	4.5	0.2	104.9	5.7	6.4	121.7
	Viengxay	7.9	3.3	144.0	12.1	12.6	179.9
	Xiengkhuang	6.0	6.6	19.9	13.4	1.5	47.4
Northwestern	Luangnamtha	56.9	0.2	0.3	3.5	108.4	169.3
	M. Sing	18.8	NT	3.5	0.5	45.6	68.4
	Viengphoukha	4.8	0.4	27.6	0.0	57.2	90.0
	Oudomxay	NT	0.3	3.5	23.8	9.7	37.3
	Bokeo	1.0	5.7	2.3	NT	26.8	35.8
	Luangprabang	0.5	6.5	26.2	0.2	61.0	94.4
	Sayabouli	NT	NT	9.5	2.3	21.2	33.0
Central	Vientiane	NT	18.8	10.8	12.8	0.0	42.4
	Phonhong	NT	1.0	6.1	4.8	0.4	12.3
	Saysomboun	7.3	5.5	28.9	4.4	27.5	73.6
	Paksanh	12.6	3.2	22.2	17.5	96.7	152.2
	Lak 20	18.9	14.2	62.4	77.8	68.2	241.5
	Viengthong	11.0	1.1	40.5	47.0	10.3	109.9
	Thakhek	49.0	81.1	23.8	87.7	1.2	242.8
	Nakay	37.7	27.3	75.3	46.2	56.4	242.9
	Savannakhet	NT	6.0	36.2	89.8	NT	132.0
	SENO	0.4	6.9	33.4	62.3	NT	103.0
Southern	Salavanh	13.2	32.8	48.3	41.2	13.0	148.5
	Sekong	1.6	14.6	21.9	12.7	10.6	61.4
	Thateang	1.1	13.3	42.3	58.0	16.4	131.1
	Pakse	41.5	7.2	31.0	58.0	11.5	149.2
	Paksong	18.2	84.6	121.5	230.6	134.4	589.3
	Nikhom 34	10.0	14.5	18.7	30.2	5.7	79.1
	Dakchung	3.3	16.7	15.0	26.7	29.7	91.4
	Attapeu	29.7	5.8	32.6	32.3	0.6	101.0

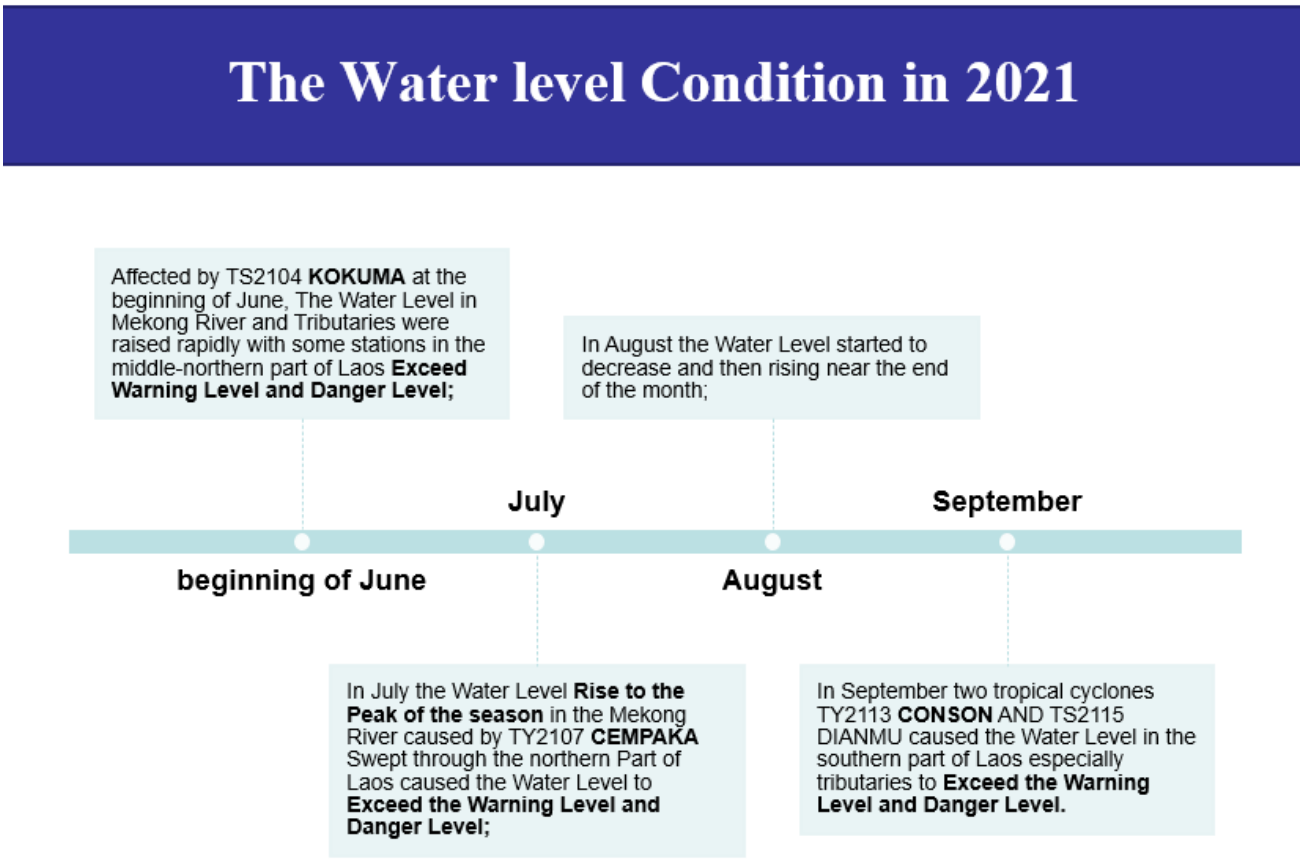
1.3. TC prediction in Lao PDR

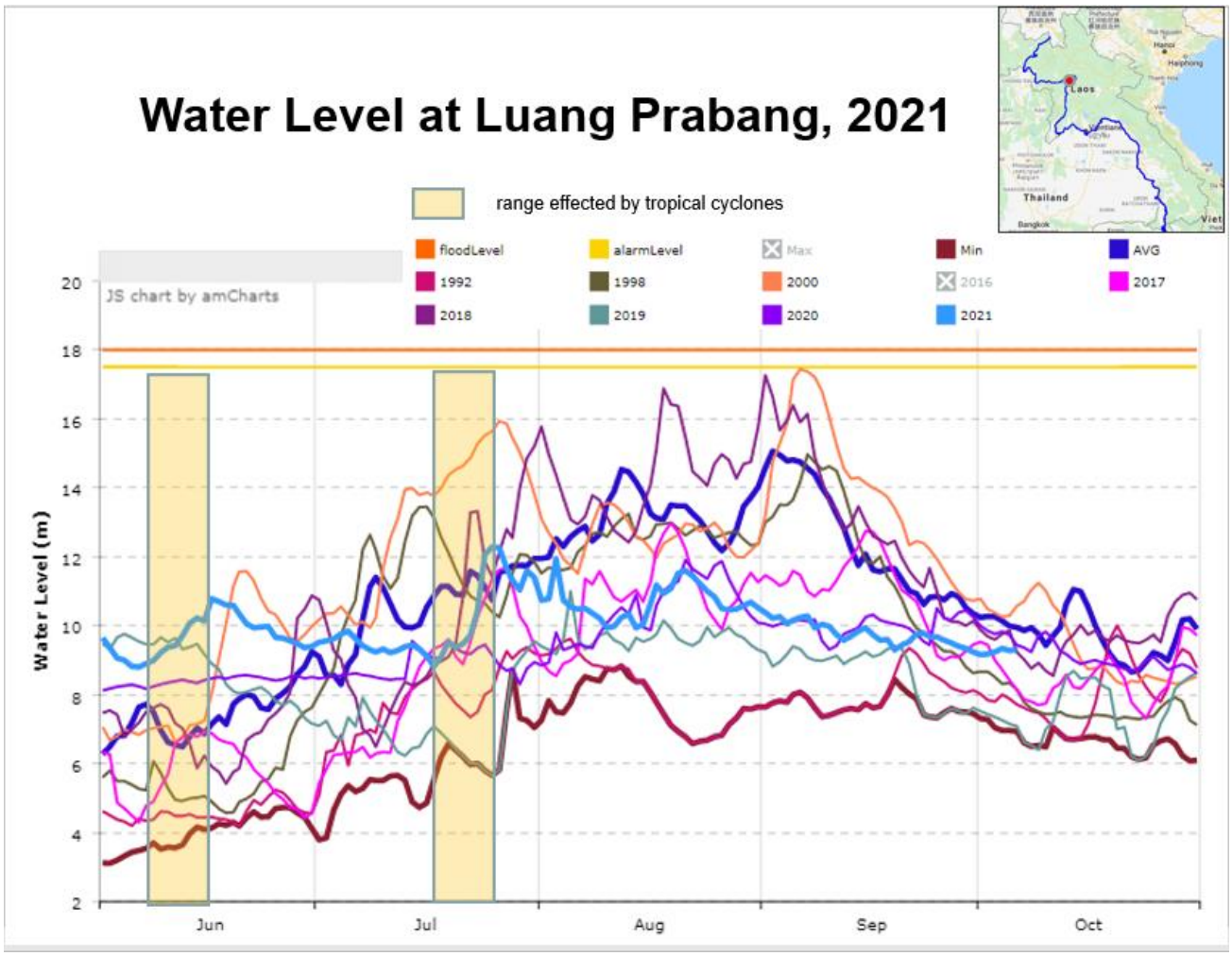
Based on the Guidance, Numerical Weather Prediction (NWP) and Typhoon Forecast from different centers such as RSMC-Tokyo, KMA, JMA, CMA, SWFDP-SeA, FFGs-SeA, ECMWF, etc., DMH has improved the accuracy of tropical storm warnings, reliable and timely.

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

In term of rainfall, tropical storm KOGUMA was the wettest tropical storm affecting Lao PDR in June 2021, it brought more than 100 millimeters of rainfall per day in central northern parts of Lao PDR.

About 150 – 300 millimeters of rainfall (5 days accumulate rainfall) was generally recorded over Lao PDR during the passage of KOGUMA. From July to October 2021, the tropical storms made landfall to central part of Vietnam and passed mostly central and southern part of Lao PDR, which brought lot of rainfall in these areas, resulted some Mekong's tributaries reached over danger level (flood level) and lasted more than one or two weeks.




Water Level at Luang Prabang, 2021
range effected by tropical cyclones
floodLevel
alarmLevel
Max
Min
AVG
1992
1998
2000
2016
2017
2018
2019
2020
2021
JS chart by amCharts
Water Level (m)
20
18
16
14
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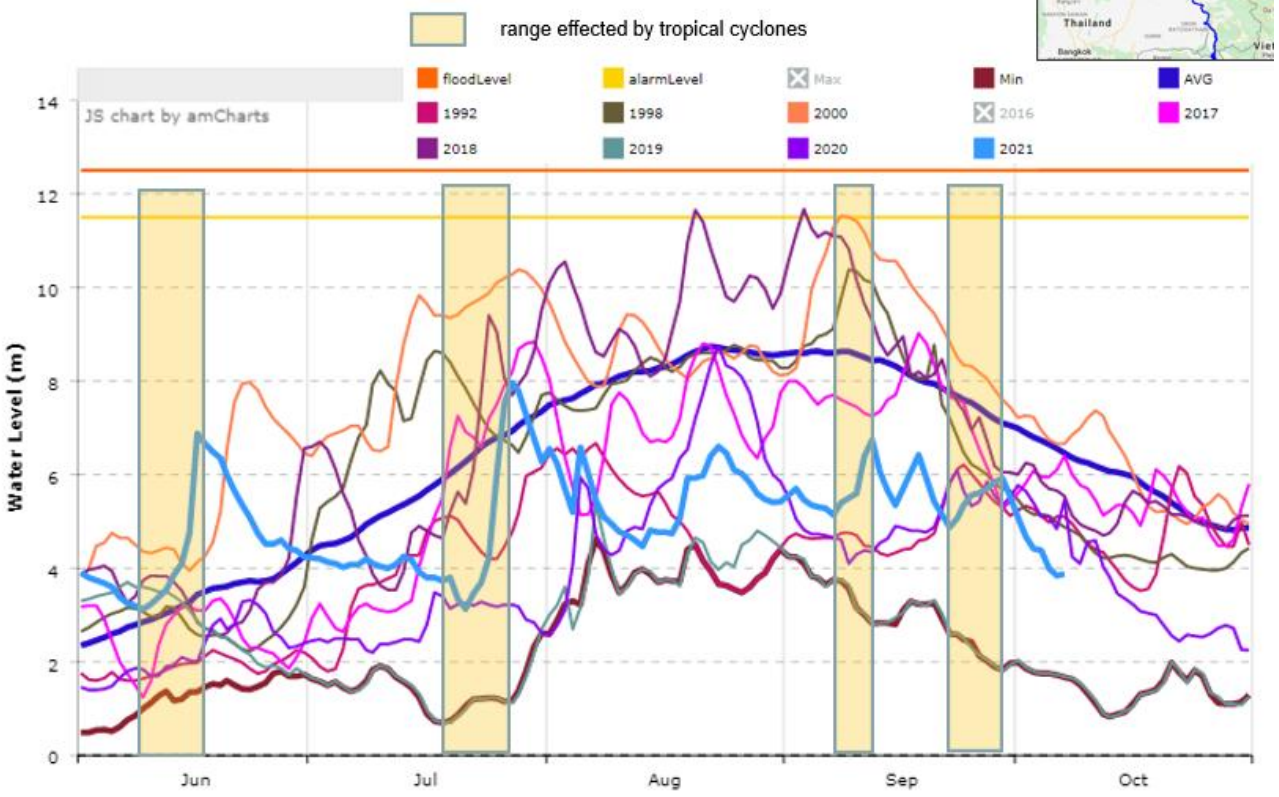
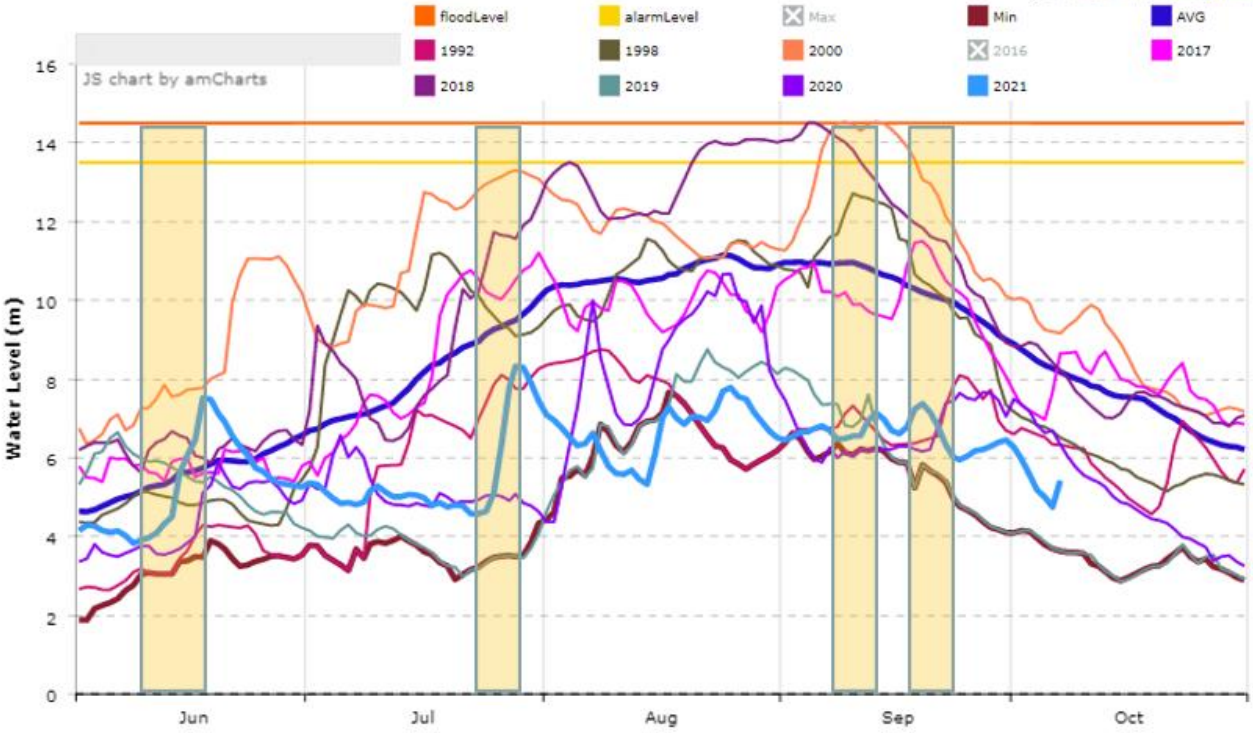
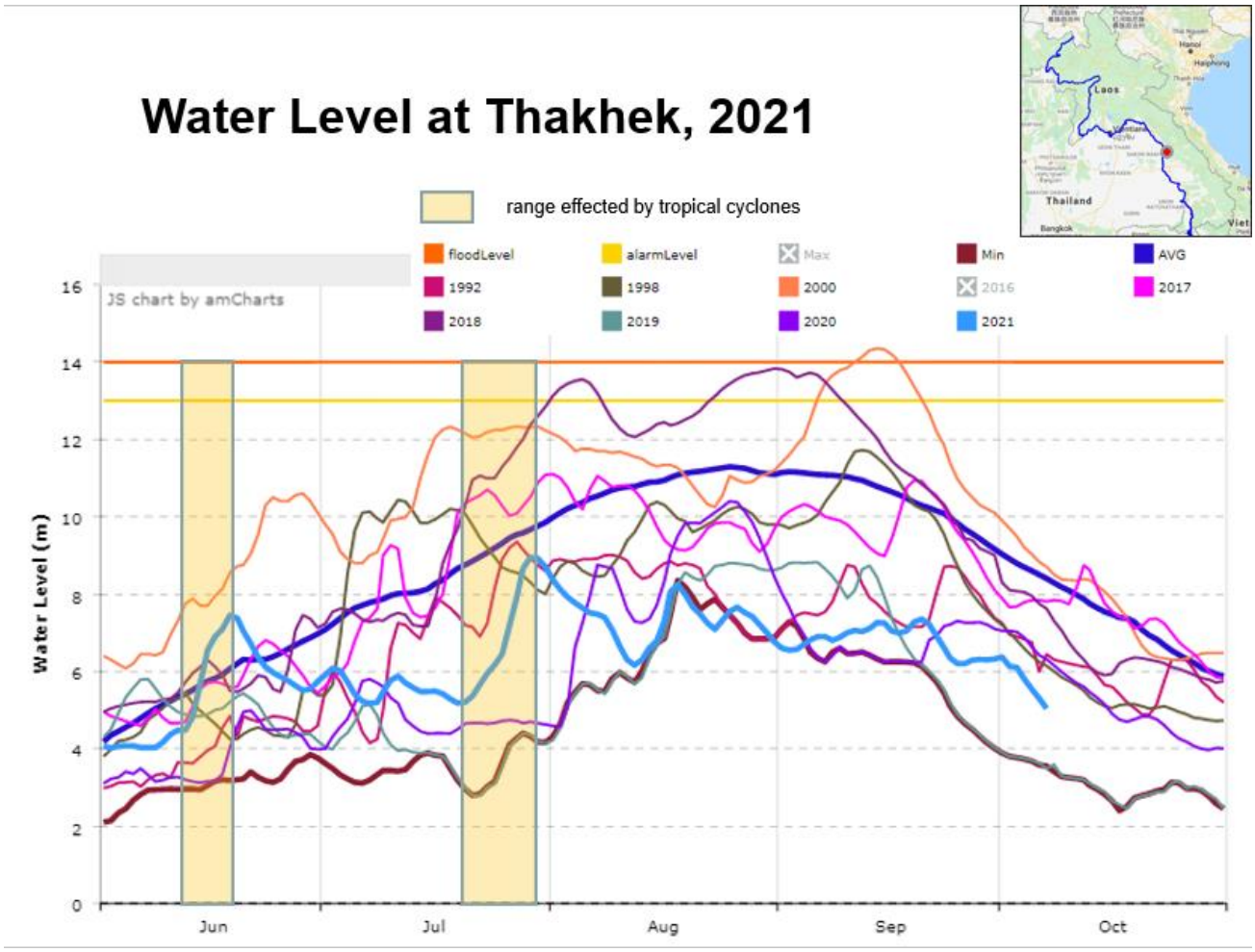
Jul
Aug
Sep
Oct
Laos
Thailand
Bangkok
Hanoi
Haiphong

Water Level at Vientiane, 2021

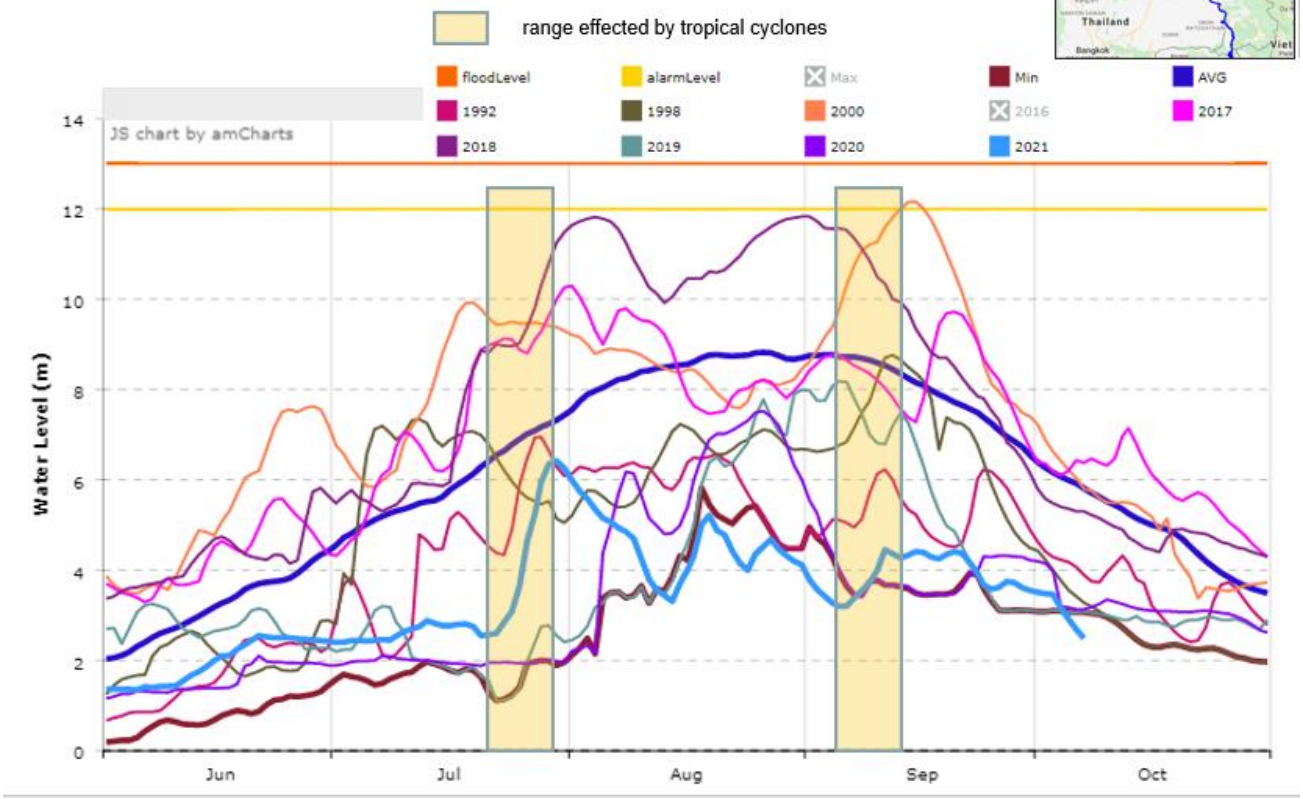


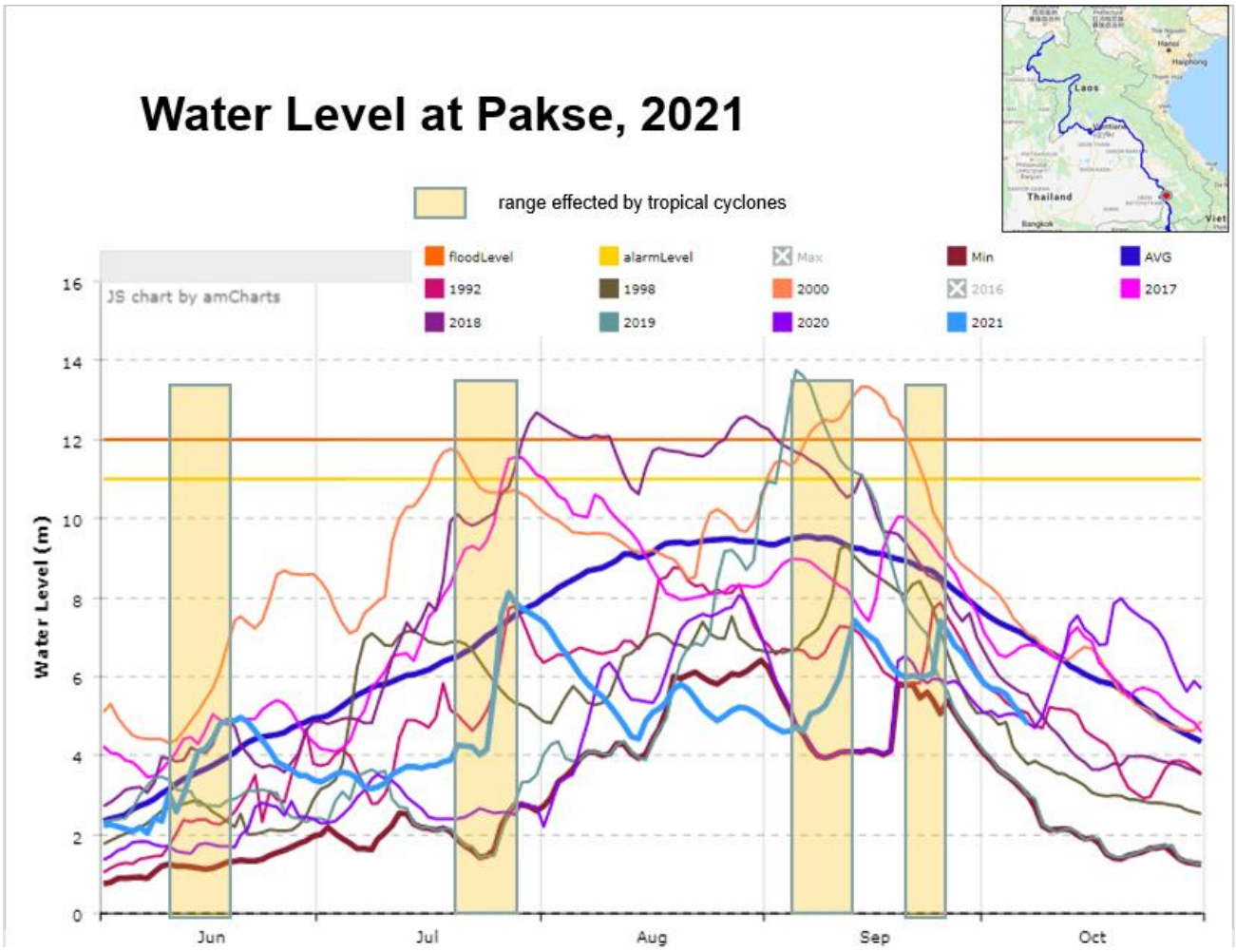
Water Level at Paksane, 2021




Water Level at Thakhek, 2021
range effected by tropical cyclones
floodLevel
alarmLevel
Max
Min
AVG
1992
1998
2000
2016
2017
2018
2019
2020
2021
JS chart by amCharts
Water Level (m)
16
14
12
10
8
6
4
2
0
Jun
Jul
Aug
Sep
Oct
Laos
Thailand
Bangkok
Hanoi
Haiphong

Water Level at Savannakhet, 2021




Water Level at Pakse, 2021
range effected by tropical cyclones
floodLevel
alarmLevel
Max
Min
AVG
1992
1998
2000
2016
2017
2018
2019
2020
2021
JS chart by amCharts
Water Level (m)
16
14
12
10
8
6
4
2
0
Jun
Jul
Aug
Sep
Oct
Laos
Thailand
Bangkok

The peak water level of the Mekong's Main Tributaries in 2021

No	Name of station	Peak of water level 2021 (m)	Warning level (m)	Danger level (m)
1	LuangNamTha (NamTha)	8.32 (21July)	6.50	7.50
2	Xaiyabouli (Namhoung)	6.80 (14June)	6.50	7.50
3	Vangvieng (Nam Song)	6.02 (14June)	3.50	4.50
4	Muang Kao (Nam Sane)	8.24 (15 Sep)	7.00	8.00
5	Mahaxai (Sebangfai)	14.06 (28July)	14.00	15.00
6	Sebangfai Bridge	18.90 (29July)	17.50	18.50
7	TonHen (Sebangfai)	12.74 (29July)	12.00	13.00
8	Kengkok (Sechamphone)	8.06 (27July)	7.50	8.50
9	Souvannakili (Sedone)	11.08 (13 Sep)	10.00	11.00

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

In The Beginning-mid of May, strong wind and thunderstorms caused damage to houses, buildings, and domestic livestock in the middle-southern part of Laos at Borikhamxay, Sekong, Champasak province, and East-Northern part at Xiangkhouang Province

During 7-14 June, KOGUMA brought heavy rainfall on a large scale in the north and middle part of Laos cause flood at Xaiyabouly and Vientiane province; Flash Flood also occurred in Bokeo Province.

In early July, a tropical depression (TD) passed through the northern part of Laos caused high rainfall and thunder in a large-scale area in the whole country. Flash Flood occurred on 08th July Xaiyabouly Province. 09th July The two deaths caused by Thunder was reported in BoKeo Province

19-21 July, effected by TY2107 CEMPAKA caused heavy rainfall in middle-northern part of Laos, Flood and Flash Flood occurred in Luangnamtha Province

In September affected by Typhoon CONSON caused Strong Wind and high Rainfall in the southern part of Laos caused damage to houses and buildings. On 24th of September tropical storm DIANMU also causing heavy rainfall in the southern part of Laos causing a Flash Flood at Sekong and Saravan Province.

3.1. Disaster Response

Throughout the period of disasters such as during and after disasters, the National Committee for Disaster Management (NDMC), headed by the Vice Prime Minister, has approached and directed the timely assistance to the affected people, as well as mobilized funds from the private sector and international organizations to provide assistance.

Disaster Response from line Agencies and Development Partner

Labor and socio welfare sector (Shelter, Cams

Army sector

Disaster Response from line Agencies and Development Partner

Health sector and Lao Red Cross: **WATER, SANITATION AND HYGIENE, health service**

Education sector: Children corner and learning facilities and material.

Disaster Response from line Agencies and Development Partner

Public Works and Transport sector: **Repaired road and pre-assessment**

Agriculture and Forestry sector: pre-assessment

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

- Strengthen the cooperation with development partners under programs WB, JICA, FAO, ADB, NDMI working to Upgrading manual stations to the automatic station (at present Laos has more than 127 automatic Mete-Hydrology stations);
- Improve the cooperation for data sharing between Center-Provincial and different sectors for effectiveness procedure from data collecting to issue an early warning;
- In the Priority areas which Flash Flood and Flood have a high frequency of occurring. Modern technology for automatic alert and warning was installed (NamSan Vangvieng, Nam Song M. Mai) which contribute largely to the reduction of loss of properties and lives of people in the affected area in Flood Season year 2021.