

MEMBER REPORT

ESCAP/WMO Typhoon Committee
13th IWS

SOCIALIST REPUBLIC OF VIET NAM

October 2018

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

1. Meteorological assessment

In 2018, there were 6 tropical cyclones and 4 tropical depressions in Bien Dong sea. They are TS. No. 1 (Bolaven) in early 2018, TS. No. 2 (Ewiniar) in June, TD in June (17-18 June 2018) and two tropical depressions July (16-17 July 2018 and 21-24 July), TS. No. 3 (Sontinh) in July, TS. No. 4 (Bebinca) in August, TS. No. 5 (Barijat) and No. 6 (Mangkut) in September 2018. Three of those tropical cyclone and tropical depressions has made landfall and caused strong wind of minimum force 6 in coastal area and/or islands of Vietnam.

The track and summary for those TS/TD that has not made landfall or not directly affected to Vietnam (i.e caused strong wind of minimum force 6 in Beaufort scale) was listed and summary in the table below.

Table 1: Brief summary of tropical storms and tropical depression in Bien Dong sea in 2018

No	Name/Time	Genesis location	Landfall area	Affected area
1	TS. No 1 (Bolaven) 21/12/2017- 04/01/2018	East Philippines	Weaken in coastal area of Phú Yên-Ninh Thuận.	North and central Bien Dong sea
2	TS. No. 2 01-09/6	South East of Bien Dong sea	Guangdong, China	North and central Bien Dong sea
3	TD in June (17-18/6)	North Bien Dong sea	Phuc Kien, China	Northern part of North Bien Dong sea
4	TD in July (16-17/7)	South Bac Bo gulf	Downgraded to tropical disturbance in coastal area of Nghệ An-Quảng Bình	South Bac Bo gulf
5	TS. No. 3 - SONTINH (16-18/7)	Northeast of North Bien Dong	Thanh Hóa-Nghệ An	North Bien Dong and Bac Bo gulf
6	TD in July (20-21/7)	North Bien Dong sea	Moved eastward and exited Bien Dong sea, did not make landfall	North Bien Dong sea
7	TD in July (21-24/7)	Coastal area of Bac Bo	South west of Hainan island (China)	Bac Bo gulf
8	TS. No. 4 (BEBINCA)	South of Guangdong (China)	Weaken to tropical depression before making landfall in	Northwest of Bien Dong sea and Bac Bo gulf

No	Name/Time	Genesis location	Landfall area	Affected area
	13-17/8		Thanh Hóa	
9	TS. No. 5 (BARIJAT) (10-13/9)	North Bien Dong sea	Loi Chau peninsula (China)	Bac Bo gulf
10	TS. No. 6 (MANGKHUT) (14-17/9)	Western Pacific	Guangdong (China)	Bac Bo gulf

The following paragraphs describe more in detail for those tropical storms and/or tropical depressions that made landfall in Vietnam.

1.1. Evolution and Impact of TS No.3 (SONTINH)

On July 16th, 2018 a tropical depression was formed in the ocean, northeast of Luzon island (Philippines), moved westward fast at about 35-40 km/h. The tropical depression passed Luzon island in early 17th July and intensified to tropical storm, named Sontinh and kept its pace at 35-40km/h westward. This is the 3rd storm active in Bien Dong sea in 2018. In the morning of July 18th, Sontinh crossed Hainan and entered Bac Bo gulf, intensified to maximum intensity of force 9, gust 11 in Bac Bo gulf and slow down at speed of 20-30 km/h. At about 16.30 UTC of 18 July 2018, Sontinh made landfall in Thanh Hoa, Nghe An with maximum observed windspeed is force 8 at Bach Long Vi island (in Bac Bo gulf) (Figure 1).

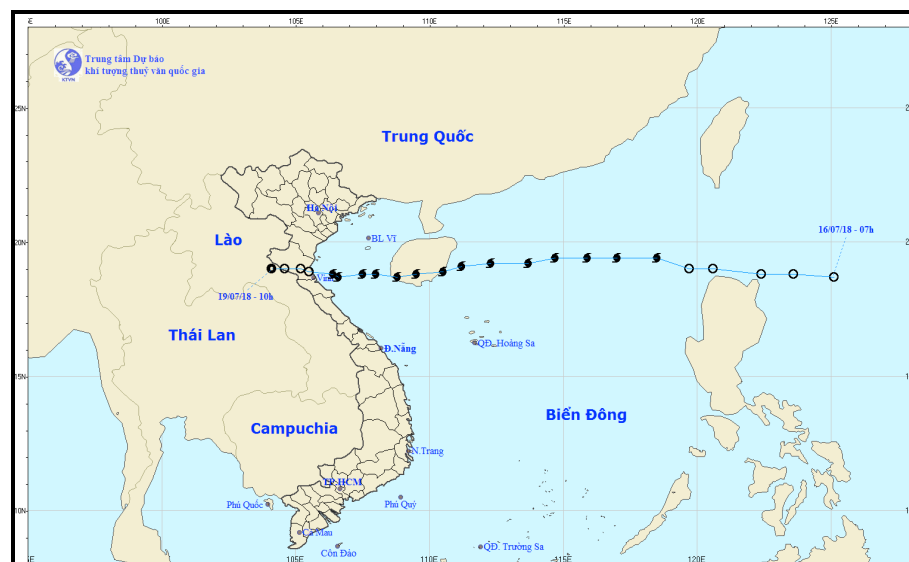


Figure 1.1. Best track of TS No.3 (Sontinh) (source: VNMHA).

Table 2: Observed maximum windspeed and gust during TS. No. 3 (Sontinh)

No	Station	Max Wind	Time (Hour, Minute, Date)	Gust
1	Bạch Long Vĩ	18m/s (force 8)	11h22' - 18/7	23m/s (force 9)

2	Cô Tô	13m/s (force 6)	22h07' - 18/7	19m/s (force 8)
3	Nho Quan	7m/s (force 4)	21h36' - 18/7	11m/s (force 6)
4	Ninh Bình	9m/s (force 5)	20h43' - 18/7	13m/s (force 6)
5	Cúc Phương	7m/s (force 4)	02h25' - 19/7	11m/s (force 6)
6	Thái Bình	12m/s (force 6)	20h41' - 18/7	17m/s (force 7)
7	Như Tân	14m/s (force 7)	01h53' - 19/7	18m/s (force 8)
8	Văn Lý	12m/s (force 6)	01h00' - 19/7	19m/s (force 8)
9	Sầm Sơn	12m/s (force 6)	23h36' - 18/7	18m/s (force 8)
10	Thanh Hóa	12m/s (force 6)	00h06' - 19/7	17m/s (force 7)
11	Như Xuân	10m/s (force 5)	02h20' - 19/7	13m/s (force 6)
12	Tĩnh Gia	12m/s (force 6)	03h00' - 19/7	22m/s (force 9)
13	Nga Sơn	10m/s (force 5)	02h29' - 19/7	14m/s (force 7)
14	Ngọc Trà	11m/s (force 6)	00h00' - 19/7	22m/s (force 9)
15	Quỳ Hợp	12m/s (force 6)	04h20' - 19/7	18m/s (force 8)
16	Tây Hiếu	10m/s (force 5)	02h20' - 19/7	14m/s (force 7)
17	Quỳnh Lưu	14m/s (force 7)	03h14' - 19/7	20m/s (force 8)
18	Vinh	8m/s (force 5)	05h33' - 19/7	13m/s (force 6)
19	Hòn Ngư	18m/s (force 8)	02h57' - 19/7	23m/s (force 9)
20	Cửa Hội	8m/s (force 5)	03h44' - 19/7	13m/s (force 6)
21	Kỳ Anh	9m/s (force 5)	18h58' - 18/7	11m/s (force 6)
22	Hoành Sơn	12m/s (force 6)	18h35' - 18/7	17m/s (force 7)
23	Cầm Nhượng	9m/s (force 5)	01h51' - 19/7	12m/s (force 6)
24	Cồn Cỏ	10m/s (force 5)	20h14' - 18/7	12m/s (force 6)

Rainfall impact: TS. No. 3 caused heavy rain in North Vietnam and extreme heavy rain in Thanh Hoa – Nghe An – Ha Tinh with popular total rainfall of 100-200mm, especially in Do Luong (Nghe An) observed 245mm, Yen Thuong (Nghe An) 211mm. This heavy rain event caused a flood in Thao river (Yen Bai), Hoang Long river (at Ben De station) with highest water level exceed level 3 warning, particularly in Bua river (at Thanh Son) recored a historial flood of 29.58m at 9.00am (local time) 21 July, higher than the previous historical level (in 1975): 1.35m.

1.2. Evolution and Impact of TS No.4 (BEBINCA)

In the afternoon of August 08th, a low pressure was formed in north Bien Dong sea, southeast of Paracel Islands and moved northwest slowly. By 10th August afternoon, the low pressure intensified to tropical depression and moved to ocean region off-coast of Guangdong province (China). From 10 to 12 August, the tropical depression is almost stationary. In 13th August morning, the tropical depression intensified to tropical storm No.4 in Bien Dong in 2018, named Bebinca. After forming, TS. No. 4 move slowly to the North before move westward and kept moving west-south-west slowly since 16th August. In 17th August early morning, TS. No. 4 weakened when move to the coastal region of Nam Dinh – Thanh Hoa provinces. TS. No. 4 made landfall at about 5.00 AM local time of 17th August in Thanh Hoa (Figure 3).

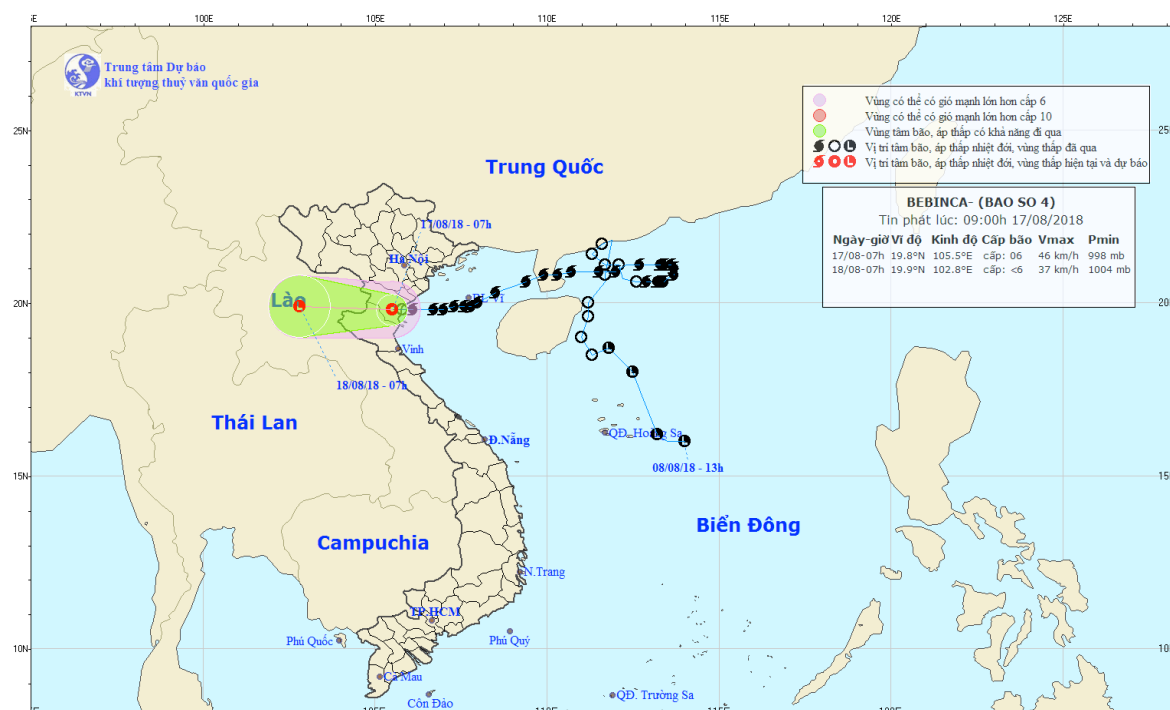


Figure 1.2. Best track of TS No. 4 (Bebinca).

Gale was observed at Bach Long Vi island (Bac Bo gulf) in the 16th August afternoon and strong wind of force 6-7 observed in the coastal area of Bac Bo, Thanh Hoa and Nghe An.

Table 3: Observed maximum windspeed and gust during TS. No. 4 (Bebinca)

No	Station	Max Wind	Time (Hour, Minute, Date)	Gust
1	Bạch Long Vĩ	26m/s (force 10)	14h17' - 16/8	33m/s (force 12)
2	Cô Tô	12m/s (force 6)	11h06' - 16/8	18m/s (force 8)
3	Hòn Dấu	11m/s (force 6)	06h42' - 17/8	14m/s (force 7)
4	Bãi Cháy	12m/s (force 6)	19h10' - 16/8	15m/s (force 7)
5	Văn Lý	15m/s (force 7)	02h15' - 17/8	19m/s (force 8)

6	Phủ Lễ	12m/s (force 6)	22h53' - 16/8	16m/s (force 7)
7	Như Tân	13m/s (force 6)	01h36' - 17/8	16m/s (force 7)
8	Ba Lạt	14m/s (force 7)	23h20' - 16/8	15m/s (force 7)
9	Sầm Sơn	13m/s (force 6)	03h44' - 17/8	19m/s (force 8)
10	Quỳnh Lưu	13m/s (force 6)	04h38' - 17/8	19m/s (force 8)
11	Hòn Ngư	11m/s (force 6)	23h58' - 16/8	16m/s (force 7)
12	Ngọc Trà	12m/s (force 6)	02h58' - 17/8	20m/s (force 8)
13	Yên Định	12m/s (force 6)	03h25' - 17/8	13m/s (force 6)

TS. No. 4 caused a widespread heavy rain period from 15/8 to 18/8 in Bac Bo and Bac Trung Bo with total rainfall ranging from 100 to 200mm, particularly higher than 250mm in some stations such as: Km46 (Son La) 378mm, Ban Chieng (Hoa Binh) 375mm, Tam Dao (Vinh Phuc) 393mm, Mau San (Lang Son) 402mm, Bat Mot (Thanh Haa) 262mm, Quynh Luu (Nghe An) 320mm.

2. Hydrological Assessment

2.1. Hydrological Assessment in the North of Viet Nam

An abnormal flood had appeared on the upper parts of Lo, Thao rivers with flood amplitude of 1.5 – 2.9m in the mid of January, 2018. During the time of dry season, flooding on the main rivers provided precious water resource for agriculture and hydro-power generation.

In 2018, flood season concentrated in 3.5 months from the end of June to the first half of September. The number of major flood events during flood season 2018 is 06 events, much less than that of flood season 2017 up to 11 events. However, flood peaks in several locations were recorded over historical statistic and over alert level 3 (AL3).

From the end of May to the mid of June, small flood events mostly appeared on the mountainous rivers and the upstream of the Red river systems as a result of the appearance of low pressure trough with axis through Northern part. In general, water level situation in Northern part river system were low and were recorded the peak at the most location that are below AL 1.

From the end of June to the August, as results of tropical depression, tropical storm (TS), inter tropical convergence zone (ITCZ) and low pressure trough appearances, historical floods were recorded on upper part of the Da as inflow to the Lai Chau and Ban Chat reservoirs, on Bua river at Thanh Son, on Nam Pan at Hat Lot; big flood with the peak over or approximate AL3 were recorded on the Thao river at Yen Bai and Phu Tho, on Boi river at Lam Son and Yen Dinh, on Hoang Long river at Ben De.

During the 18th and 25th July, a severe flooding on the Bui river was occurred as a result of heavy rain and upper reach's flood. An Ha Noi outskirt's district named Chuong My was deeply inundation during one week and a part of dyke was broken.

Table 1 summarized information of flood characteristics on the river systems in the North of Viet Nam during flood season 2018, the figure 1 and figure 2 illustrated the flood on the Thao river at Yen Bai where the flood peak was over AL 3 leading to serious flooding in the Yen Bai city and historical inflow to the Lai Chau reservoir which is over flood flow in 1971.

Table 1. The characteristics of flood events for main stations and reservoirs on rivers in the North of Viet Nam from June to September, 2018

No	Duration	Weather patterns	Stations	Rivers	Flood peaks m ³ /s	Time of flood peaks	Flood amplitudes	Compared with AL
1	24-26/6	Low pressure developed from ground surface to the height of 5000m	Inflow to Lai Chau reservoir	Da	9360 m ³ /s	1h/25/6	7000 m ³ /s	>Historical flood (HF) 1971: 960 m ³ /s
			Inflow to Ban Chat reservoir		6690 m ³ /s	14h/24/6	6300 m ³ /s	> HF 2013: 1600 m ³ /s
			Ha Giang	Lo	102.91 m	22h/24/6	8.4 m	~ AL 3
			Yen Bai	Thao	30.66 m	15h/25/6	3.60 m	<AL2: 0.34m
2	19-22 /7	SONTINH TS circulation and Low pressure trough line with the axis over Northern of Central and Red river delta areas	Inflow to Hoa Binh reservoir	Da	11820 m ³ /s	7h/21/7	4430 m ³ /s	<AL3: 180m ³ /s
			Yen Bai	Thao	33.12 m	18h/20/7	5.6 m	>AL3: 1.12 m
			Phu Tho		18.98 m	16h/21/7	4.02 m	~ AL3
			Ben De	Hoang Long	4.14 m	14h/22/7	1.94 m	>AL3: 0.14 m
			Hung Thi	Boi	14.88 m	22h/19/7	3.92 m	>AL3: 2.88 m
			Lam Son	Bui	24.61 m	15h/21/7	4.2 m	>AL3: 1.61 m

No	Duration	Weather patterns	Stations	Rivers	Flood peaks m/m ³ /s	Time of flood peaks	Flood amplitudes	Compared with AL
			Yen Duet		7.36 m	7h/24/7		>AL3: 0.36 m
			Phu Ly	Day	4.48 m	3h/23/7	2.0 m	>AL3: 0.38 m
			Ba Tha		6.25 m	15h/23/7	2.25 m	>AL2: 0.25 m
			Luc Nam	Luc Nam	4.39 m	7h/20/7	2.5 m	>AL1: 0.09 m
3	25-30 /7	Low pressure trough with the axis over Northern of Central and Southern of the Red river delta areas	Lam Son	Bui	22.53 m	1h/30/7		>AL2: 0.53 m
			Yen Duet		7.44 m	7h/30/7		>AL3: 0.44 m
			Hung Thi	Boi	11.69 m	9h/30/7	2.34 m	<AL3: 0.31 m
			Ben De	Hoang Long	3.53 m	16h/30/7	1.0 m	>AL2: 0.03 m
			Phu Ly	Day	4.02 m	10h/30/7		<AL3: 0.08 m
			Ba Tha		6.09 m	14h/30/7		>AL2: 0.09 m
4	3 - 8/8	Low pressure trough with axis over Northern part	Bao Yen	Chay	72.65 m	7h/5/8	3.01 m	<AL2: 0.35 m
			Ha Giang	Lo	99.98 m	13h/8/8	2.01 m	>AL1: 0.98 m
5	16-19/8	TS No. 4 (BEBIN CA) circulation	Yen Bai	Thao	31.10 m	2h/18/8	3.16 m	>AL2: 0.1 m
			Lang Son	Ky Cung	253.42 m	22h/17/8	5.75 m	>AL1: 1.42 m
			Phu Lang Thuong	Thuong	4.98 m	7h/19/8	2.42 m	<AL2: 0.32 m
			Lam Son	Bui	21.25 m	13h/17/8		>AL1: 0.25 m
6	28/8 - 4/9	Low pressure trough with the	Inflow to Hoa Binh reservoir	Da	10550 m ³ /s	23h/30/8	7500 m ³ /s	>AL2: 550 m ³ /s

No	Duration	Weather patterns	Stations	Rivers	Flood peaks m/m ³ /s	Time of flood peaks	Flood amplitu des	Compared with AL
		axis over Northern part + tropical depressio n	r					
			Bao Yen	Chay	73.17 m	3/9	3.53 m	>AL2: 0.17 m
			Ha Giang	Lo	100.79 m	13h/2/9	5.63 m	<AL2: 0.21 m
			Lam Son	Bui	23.09 m	15h30 /30/8	1.96 m	>AL3: 0.09 m
			Hat Lot	Nam Pan	517.28 m	16h40 /30/8		>AL3: 3.78 m; > HF 2008: 0.51 m
			Yen Bai	Thao	32.36 m 31.10 m	20h/31/ 8 9h/4/9	3.85 m 1.60 m	>AL3: 0.36 m >AL2: 0.1 m
			Dap Cau	Cau	5.13 m	5h/1/9	3.63 m	<AL2: 0.17 m
			Phu Lang Thuong	Thuong	5.79 m	5h/31/8	4.10 m	>AL2: 0.49 m
			Luc Nam	Luc Nam	5.22 m	9h/30/8	3.98 m	<AL2: 0.08 m

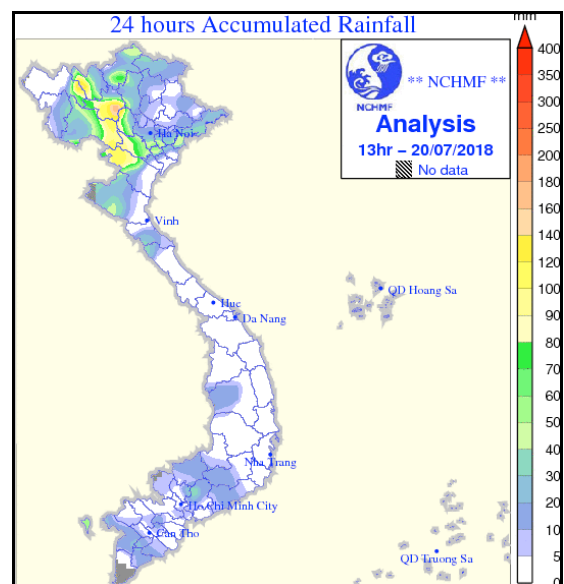
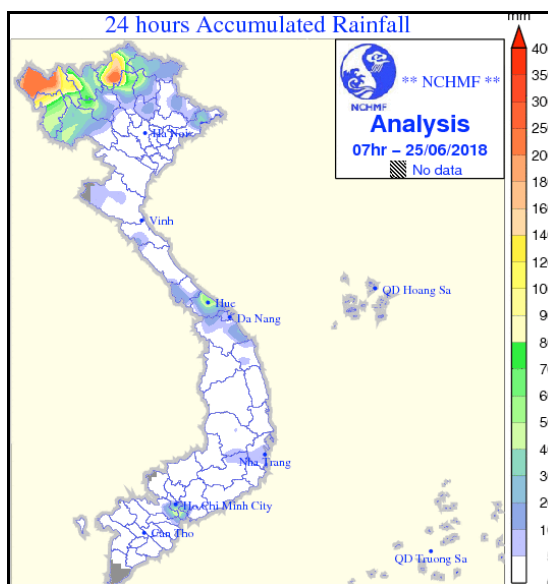


Figure 2.1. The 24h accumulated rainfall in the 25th June and the 20th July as a result of low pressure appearance and TS SON TINH's circulation

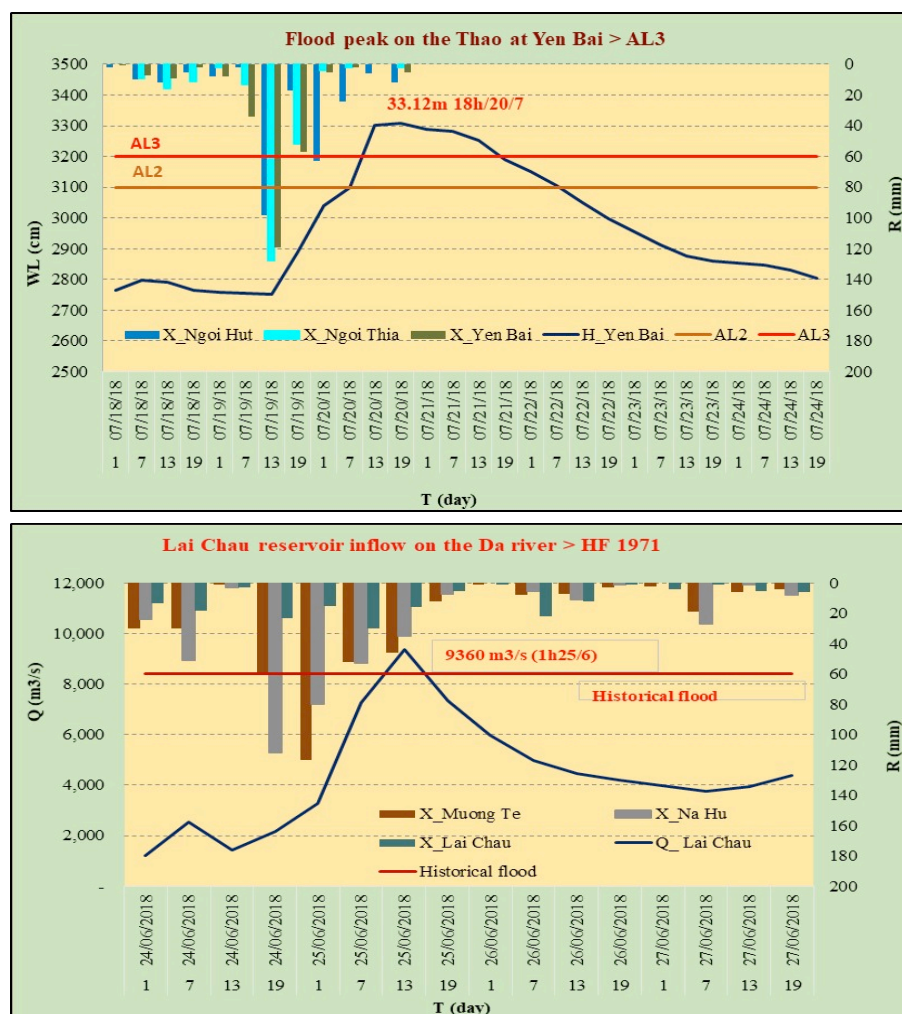


Figure 2.2. Flood peaks on Thao river at Yen Bai and inflow to Lai Chau res. on Da river over AL3 and historical flood.

2.2. Hydrological Assessment in the Central, Highland areas

During the first of 6 months in 2018, hydrological situation was found a slowly changes of water levels on rivers in Central and highland areas. Water levels on several river from Thanh Hoa to Ha Tinh provinces, Phu Yen, Thua Thien Hue were affected by reservoir regulation. Some small flood events were found on the Buoi river (Thanh Hoa), Cam Ly (Lam Dong) during the end of April and the beginning of May and on the Tra Khuc, Ve rivers in the beginning of June.

From 15 to 25 July, a flood event occurred on the river systems from Thanh Hoa to Ha Tinh, in Quang Binh, Kon Tum, Gia Lai provinces with flood amplitudes of 2.0-5.0m in the upper reaches and 1-3m in the downstream locations. Flood peaks on rivers, in general, reached from AL1 to AL2, especially on the Buoi river at Kim Tan, on the Po Ko at Dak Mot where flood peaks were recorded over AL3. The flood characteristics on rivers in the Central and highland areas during the second half of July are summerized in table 2.

Table 2. Flood characteristics on main rivers in the Central and Highland areas during the mid of July

No	River	Station	Time of flood peaks	Flood peaks (m)	Compared with AL
1	Buoi	Kim Tan	24h/22/7	12.10	> AL3: 0.1m
2	Ma	Cam Thuy	01h/22/7	19.83	>AL2: 0.83m
3	Ca	Dua	06h/21/7	22.22	<AL2: 0.28m
4	Ca	Nam Đan	20h/21/7	6.09	>AL1: 0.69m
5	Ngan Pho	Son Diem	15h/17/7	11.39	<AL2: 0.11m
6	Po Ko	Đak Mot	15h/23/7	586.72	> AL3: 0.22m
7	Po Ko	Đak To	16h/23/7	577.81	< AL2: 0.19m

From 13 to 19 August, a medium flood occurred on the rivers in Thanh Hoa, Nghe An and Kon Tum provinces with the amplitudes of 6.0-8.0m in the upper reaches and 4.0-5.0m in the lower reaches. Flood peaks in the most of rivers were recorded from AL2 and over AL2, however, some locations as Dak Mot on the Po Ko river, Cam Thuy on the Ma river where peak floods were over AL3. In this period, water level at Tuong Duong on the Ca river was recorded the flood peak that is over historical flood in 2005.

From 28 August to 2 September, a big flood occurred on the rivers in Thanh Hoa and Nghe An provinces with the amplitudes of 4.0-8.5m. Flood peaks were reached over AL3 on the Buoi river, in the upper and middle reaches of Ma river; over AL2 in the downstream of Ma river. In particular, peak of flood on the Ma river at Hoi Xuan was 66.05m ((24h/30/8), over AL3: 1.05m, equivalent to the historical flood in 2007; and at Cam Thuy was 22.20m (16h/31/8) which reached a new historical value with 0.33m higher than historical flood in 2007.

Table 3. Flood characteristics on main rivers in the Thanh Hoa and Nghe An provinces from 28 August to 2 September

No	River	Station	Time of flood peaks	Flood peaks (m)	Compared with AL
1	Buoi	Kim Tan	10h/01/9	12.62	> AL3: 0.62m
2	Ma	Hoi Xuan	01h/29/8	58.59	
3	Ma	Hoi Xuan	24h/30/8	66.05	>AL3: 1.05m; ~ HF in 2007
4	Ma	Cam Thuy	16h/31/8	22.2	>AL3: 1.7m; > HF in 2007: 0.33m
5	Ma	Ly Nhan	04h/01/9	12.4	>AL3: 0.4m
6	Ma	Giang	05h/01/9	5.53	>AL2: 0.03m

7	Chu	Bai Thuong	23h/30/8	15.2	>AL1: 0.20m
8	Chu	Xuan Khanh	01h/01/9	7.11	<AL1: 1.89m
9	Ca	Dua	23h/31/8	22.84	>AL2: 0.34m
10	Ca	Nam Đan	16h/01/9	5.82	>AL1: 0.42m
11	Buoi	Kim Tan	10h/01/9	12.62	>AL3: 0.62m

In the September and October, there were 2 to 3 small flood events with amplitudes of 1.5m – 4.0m and flood peaks in the range of AL1 – AL2, excepting flood on La Nga river at Ta Pao where the peak of flood was recorded 120.48m (02h/25/9), over AL2.

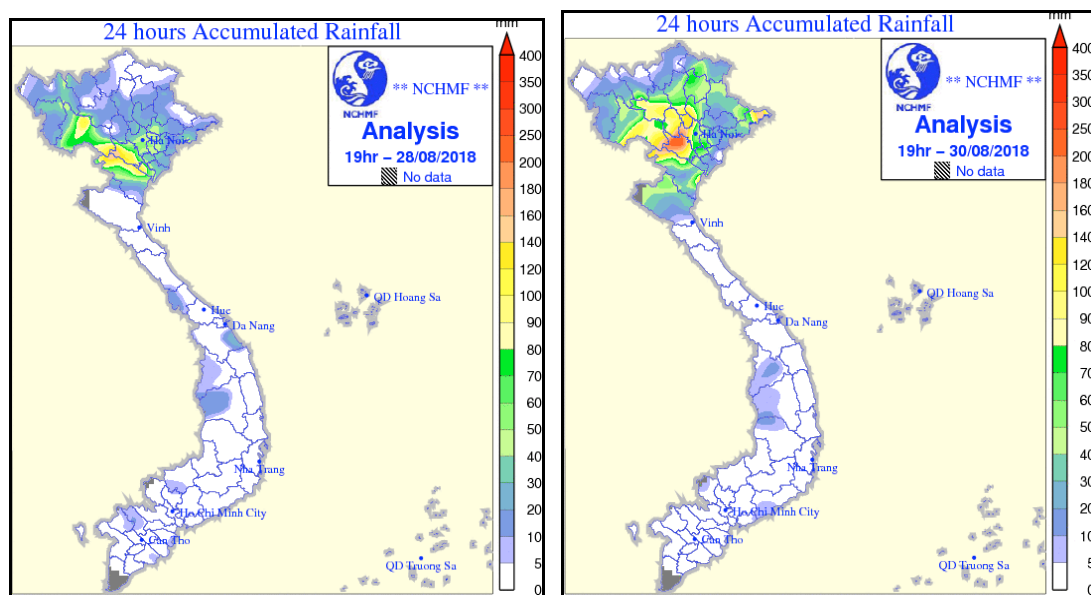
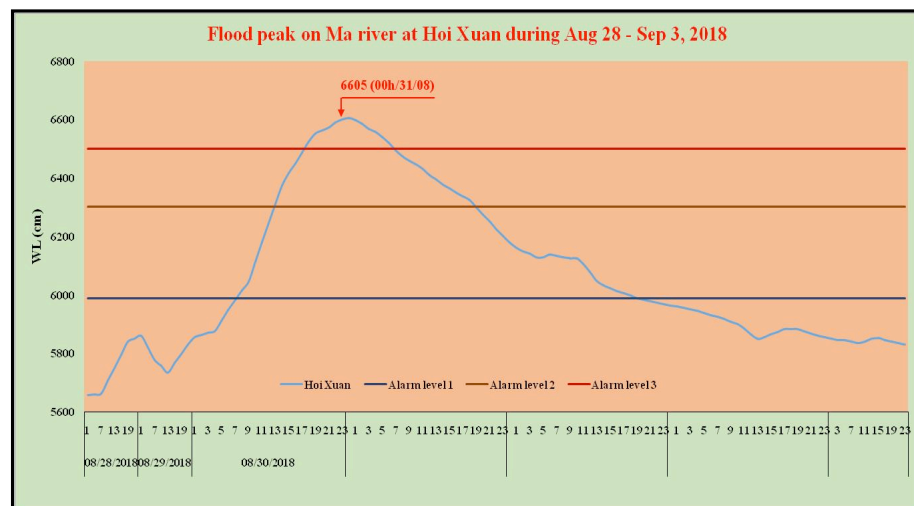


Figure 2.3. The 24h accumulated rainfall in the 28th (left) and 30th August (right)



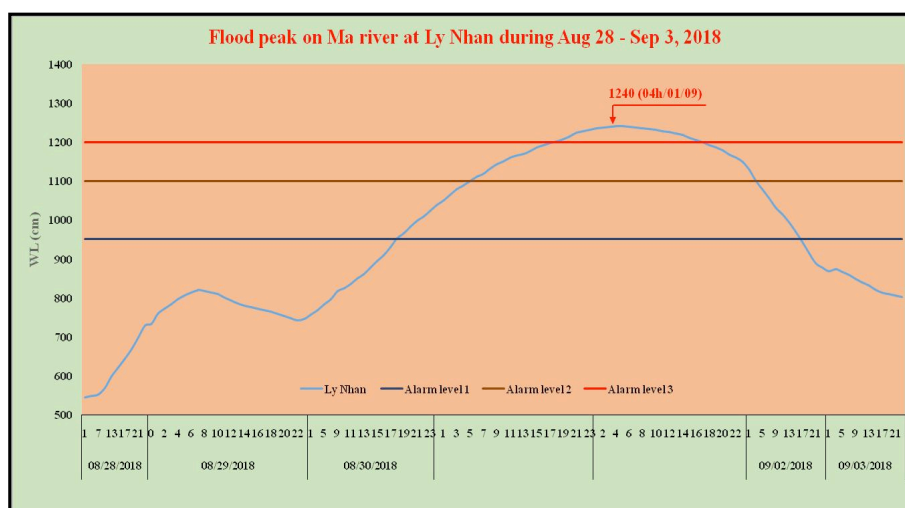


Figure 2.4. Flood peaks on the Ma river at Hoi Xuan and Ly Nhan over AL3 during the 28th and 3rd September

2.3. Hydrological Assessment in the Southern areas

From January to June 2018, the water levels in the upper and middle parts of the Mekong river were always higher from 0.5m to 2.0m than the long-term average at the same period of the year; the upstream water levels of Cuu Long river were higher than the long-term average from 0.2m to 0.6m. During the dry season in 2018, salinization in the Mekong Delta was lower than the long-term average, therefore, it is not be able to affect to the agriculture and human life.

During the second half of July, a big flood event appeared in the upper and middle reaches of the Mekong with flood amplitudes of 5m-6m in upstream stations and 7.0m-9.0m in the middle reach stations as a result of heavy rain. In August, water level in upstream of the Mkong continued rising and maintained in high stage situation as a result of heavy rain of 150mm-300mm/month covering the whole basin.

Regarding to the water volume of Mekong river, total of water flow in main river was higher than that of long-term average 20-40% in July and 20-50% in August. However, water level in the upstream of the Mekong decreased steadily from the mid of September due to the lack of rainfall in 2 months, September and October.

In the Mekong delta area, flood peaks of the year at Tan Chau and Chau Doc stations were recorded over AL2 in the middle of September and higher 0.55m-0.65m than that of long-term average in the same period.

2.4. Flash flood situation

Severe flash flood, landslide occurrences in mountainous areas were major disaster in the North of Viet Nam during flood season 2018 causing huge losses of human, properties, infrastructures and agriculture production as well. The largest flash flood and landslide situation occurred in the ending of June in the Northwestern mountainous areas. Table 4 is summarized flash flood and landslide locations and appearance times as well in 2018.

No	Appearance Time	Flash flood and landslide location
1	24/4	Sop Cop district, Son La province
2	02/6	Nam Quang, Nam Cao, Tan Viet communes, Bao Lam district, Cao Bang province
3	23-24/6	Noong Heo, Sin Ho communes; national highways and provincial ways belong Tam Duong, Than Uyen, Tan Uyen, Muong Te, Sin Ho districts, Lai Chau province
4	23-24/6	National highway No 279 belong Van Ban district, Lao Cai province
5	27/6	Sang Tung village, Ta Ngao commune, Sin Ho district, Lai Chau province
6	19/7	Dong Phong commune, Cao Phong district, Hoa Binh province
7	19/7	National highway No 6, Co Cham village, Long Luong commune, Van Ho, Mai Chau district, Hoa Binh province
8	19-20/7	Van Chan, Van Yen, Mu Cang Chai districts, Yen Bai province
9	19-20/7	Tan Son district, Phu Tho province
10	19/7	Lang Chanh district, Thanh Hoa province – flash flood
11	21/7	Tien Phong commune, Da Bac district, Hoa Binh province
12	26/7	National highway No 6, Km90, Moc Chau district, Son La province
13	29/7	Que Phong district, Nghe An province
14	30/7	Lanslide in Dong Tien commune, Hoa Binh city, Hoa Binh province
15	31/7	National highway No 279, Bao Ha commune, Bao Yen district, Lao Cai province
16	2/8	Ha Quang commune, Tra Linh district, Cao Bang province
17	3/8	Mu Sang & Vang Ma Chai communes, Phong Tho district, Lai Chau province
18	23/8	Thuan Chau district, Son La province
19	24/8	Van Chan district, Yen Bai province
20	23-24/8	Si Ma Cai, Muong Khuong, Bac Ha districts, Lao Cai province

No	Appearance Time	Flash flood and landslide location
21	28/8	Nam Po, Muong Cha, Tuan Giao, Tua Chua districts, Dien Bien province
22	29-30/8	Landslide: Phu Yen, Bac Yen, Mai Son, Muong La, Phu Yen districts, Son La province; Muong Lat, Quan Hoa, Quan Son districts, Thanh Hoa province; Ky Son district, Nghe An province
23	29/8	Landslide: Cho Moi districts, Bac Kan province
24	2/9	Landslide: Phong Tho, Muong Te districts Lai Chau province
25	3/9	Landslide: Bac Yen, Mai Son, Yen Chau districts, Son La province

In flood season 2018, flash flood and landslide are mostly occurred in the North of Viet Nam and several districts in the Northern part of Central provinces as Thanh Hoa and Nghe An.



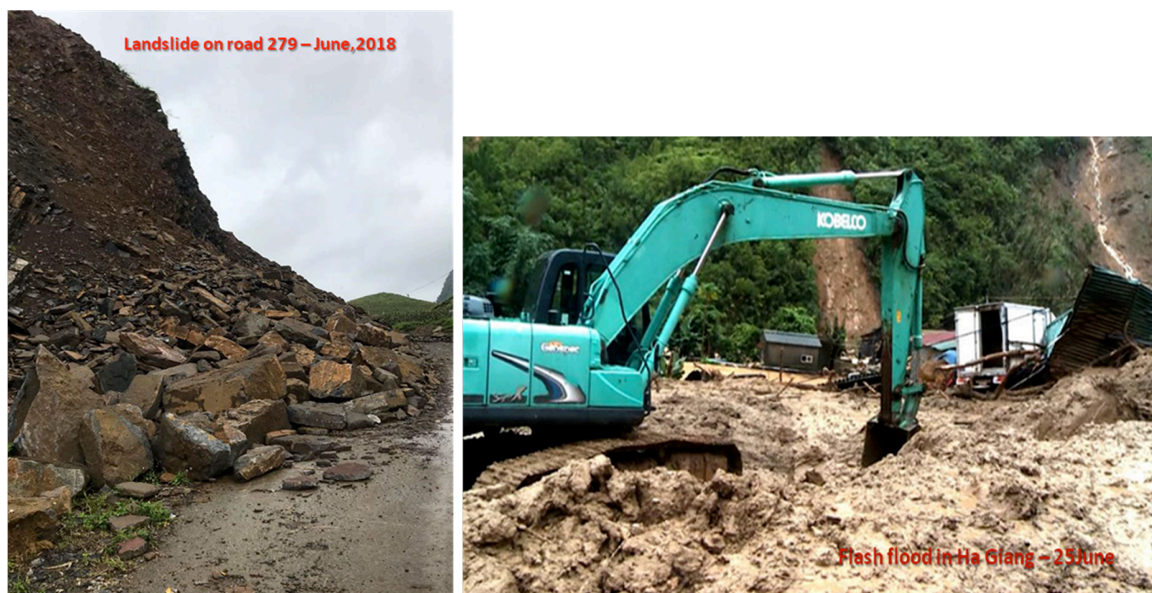


Figure 2.5. Landslide at Nam Nhun district and national road 279, Lai Chau province; severe flash flood in Ha Giang - June, 2018



Figure 2.6. Flash flood in Muong La district - Son La, Tuan Giao district - Dien Bien and Muong Lat district – Thanh Hoa in the end of August, 2018

2.5. *Flooding situation*

During the end of June and August, serious flooding and inundation were appeared in the many cities and low-land areas as a result of extreme heavy rainfall, sharp rising of water level on stream and river. The names of cities and provinces faced inundation, flooding was listed below:

- Flooding in Ha Giang city (Ha Giang province) caused by sharp rising of water level on the Lo river in the end of June (figure 7);
- Severe flooding in Chuong My district –outskirt of Ha Noi capital as a result of big flood in the upstream of Bui river from the 18th to the 25th July (figure 8);
- Flooding in Nghe An province due to severe flood on the La river when the TS No.4 (BEBINCA) appearance in the mid of August (figure 7).
- Flooding in Hoa Binh, Yen Bai, Phu Tho, Thanh Hoa and Nghe An province from the 28th to the 4th September.



Figure 2.7. Flooding in Ha Giang city in June and Nghe An province during TS Bebinca appearance in the mid of August.



Figure 2.8. Serious flooding on Bui river from the 18th to the 25th July

3. Socio-Economic Assessment

Disasters have continually occurred all over the country, causing vast losses in human life, property, socio-economic and cultural infrastructure as well as environmental degradation. There are more than 400 missing and dead people annually on average by disaster and asset damage equivalent to 1.5% of GDP.

Disasters in 2017 caused severe damage to people and property and left consequences for overcoming in many years and reduced the growth of the national economy, as follows:

- Casualty: 386 deaths included of:
 - + Storm: 43 deaths (11%), mainly caused by Storm No 12 in 2017 with 37 deaths;
 - + Flood: 243 deaths (63%);
 - + Landslide: 71 deaths (18%);
 - + Other types of disaster: 29 deaths (8%).

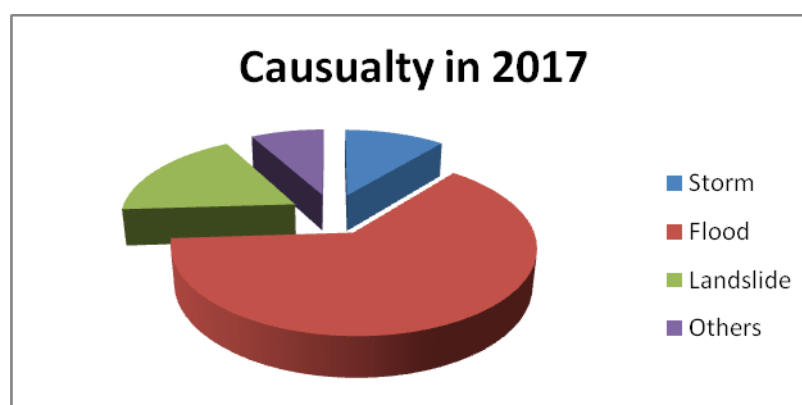


Figure 3.1. Causality in 2017

- Housing: 8.166 fallen and swept away house; 610.000 flooded, damaged and emergency evacuated houses;
- Agricultural production:
 - + 364.000 ha flooded and damaged crop and vegetable, 170.000 ha industrial and fruit trees and 143.440 ha damaged and fallen forest;
 - + 70.000 cattle and 02 million poultry died; 60.400 ha aquaculture farm and 76.500 damaged aquaculture cages
- 277 km of dyke level III, embankment and 868 km of canals, coastal banks were landslide; many dams, irrigation canals were damaged; 7.0 million m³ of transportation roads were landslide.
- 10 big transport ships were sunk in Quy Nhon bay, Binh Dinh province in the storm No. 12.

- Many information problems, grid system from 110KV to 500 KV and most low voltage system caused widespread blackouts in many localities affected by typhoons No. 10 and 12 with more than 3 million customers of power outage;

Total economic losses are about 60,000 billion VND equivalent to 2.5 billion USD (300% increase compared to many years).

Natural disasters have performed irregularity, increased in both intensity and frequency. They occur more frequently in areas where major natural disasters such as storm in the South Central and South regions have been less frequent. Rapid socio-economic development which is increasing scale in all regions and investment in building infrastructure unsustainably raises the risk of natural disasters and more damage to people and property.

II. Summary of progress in Key Result Areas

The Severe Weather Forecasting Demonstration Project (SWFDP) is a WMO Commission of Basic Systems (CBS) initiative, commenced in 2005, to demonstrate how warning services provided by NMHSs in developing countries can be enhanced and linked with disaster management authorities improved through cooperative work among meteorological centers. The WMO GDPFS has been recognizing the role of a new class of Regional Forecasting Support Centre (RFSC) in the context of the SWFDP. The most suitable center to fulfill the functions of a Regional Centre in an SWFDP subproject may not always be a WMO-designated RSMC. In this situation, an SWFDP RFSC may perform similar functions to an

existing RSMC (with geographical specialization) within its Regional Association, but also provide regional severe weather forecasting guidance products for the SWFDP, for a group of meteorological services in the close vicinity of the RSFC, and for the short- to medium-range only (initially up to 5 days ahead).

Following the “*SWFDP Guidebook for planning Regional Subprojects*”, a SWFDP-SeA Implementation Plan was developed for the anticipated meeting of the RSMT, wherein the responsibilities and functions of the Regional Forecasting Support Centre (RFSC) in Hanoi are described, as follows:

- to redirect toward the NMHSs relevant products issued from the global centre (if necessary);
- to provide NMHSs with its own interpretation of the medium-range guidance, including EPS products;
- to provide the NMHSs with the short-range NWP guidance (including products adapted to severe weather events), as frequently as possible;
- to indicate existing satellite/radar imagery and satellite/radar based products that could be used for now casting purposes;
- to issue Daily Severe Weather Forecasting Guidance products summarizing interpretation of NWP products with respect to severe weather over the responsibility area of the NMHSs;
- to provide the other centers with short-range NWP guidance and EPS output including probabilistic products specially adapted to the concerned severe weather events;
- to tailor products to the requirements of the National Centers including the provision of sub-domains and probabilistic products;
- to evaluate its own interpretation of EPS products as well as its NWP guidance;
- to provide global centers with a feedback about the usefulness and efficiency of global products;

The above additional functions of RFSC Hanoi in the context of the SWFDP regional subproject is not intended to affect the existing national responsibilities of National Center of Hydro-Meteorological Forecasting of Vietnam (NCHMF).

Current activities

Currently, all the SWFDP-SeA activities over web portal (NWP products, guidance) are maintained by the numerical weather prediction and remote sensing division of NCHMF. The guidance has been provided by forecasters operationally since January 1, 2016 on 24/7 basis in the third phase or demonstration phase of this project. All products have been sharing on a password-protected website <http://www.swfdp-sea.com.vn/index>. As dedicated in plan, the guidance domain was also expanded to cover Myanmar domain.

Training desk activities in 2018

As recommended by the Regional Subproject Management Team (RSMT) of SWFDP-Southeast Asia in its meeting in 2015 (Ha Noi, Viet Nam, August 2015) and agreed during its meeting in 2017 (Ha Noi, Viet Nam, November 2017), a two-

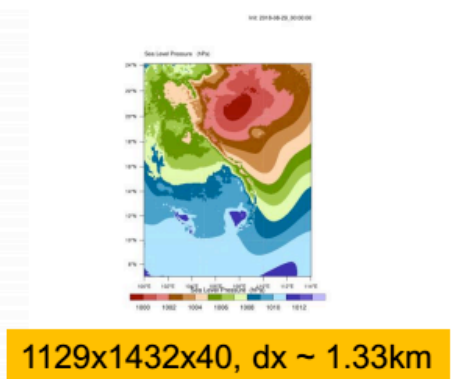
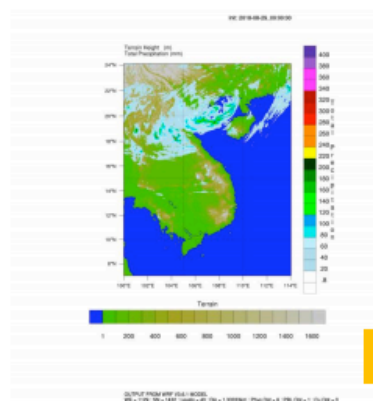
week Training Desk was organized at RFSC Ha Noi from 7 to 18 May 2018 with attachment of two experts from NMHSs of Philippines (which is also RTC for RA V) and Thailand and operational forecasters from Viet Nam Meteorological and Hydrological Administration (VNMHA).

Two expert lecturers from Hong Kong Observatory (HKO), Hong Kong, China contributed to the training desk. HKO is the regional technical training support centre for SWFDP-Southeast Asia. One HKO lecturer attended week-1 of the training desk to cover rainfall nowcasting and forecasting aspects, while the second HKO expert participated in week-2 to provide contribution on tropical cyclone analysis and forecasting.

Future plans

For improving the SWFDP, there are still some future considerations that should be taken into account. The plan of applying the results of WMO fellowship program at ECMWF with the main topic on verification for Vietnam as well as for other countries over SeA (need local data and global/regional NWP archives) need to be taken as soon as possible.

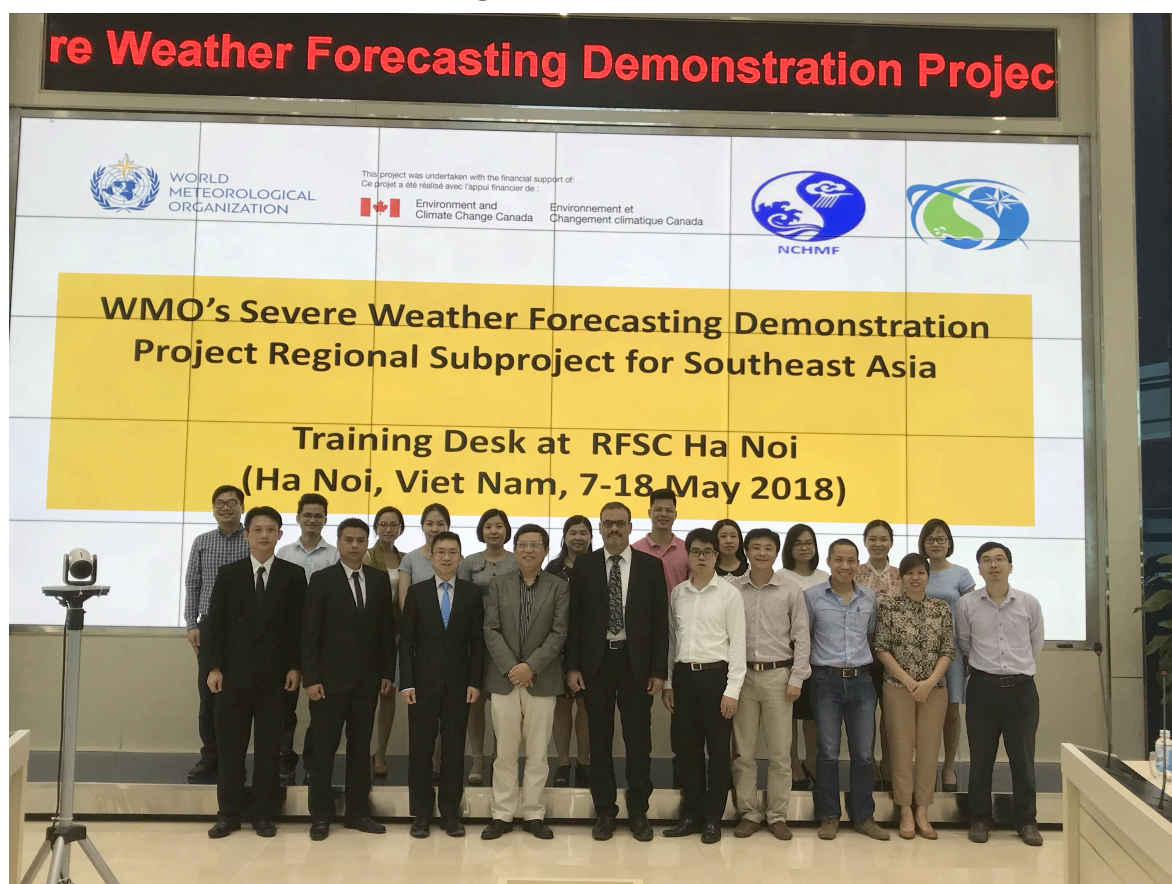
Moreover, the limitation of regional NWP including horizontal resolution, data assimilation of local data such as radar and observation, and verification information of different countries. Therefore, it is essential to update HPC system at NCHMF in 2017-2020 to 80-100Tflops (*the Cray XC40 system at VMHA with more than 2000 physical computing cores, is being tested with WRF system at 1.33 horizontal resolution, picture below*) which would facilitate the downscaling simulation of NWP models ~ 5 kilometers in operation over SeA domain.



1129x1432x40, dx ~ 1.33km

Cray-XC40, 59 nodes, 80- Tflops, ~ 2124 physically available cpus

Photo groups during training desk: opening at VHMA and visiting radar observation station at Hai Phong Province, Vietnam



The 50th Session of the Typhoon Committee and other activities

From 28 February to 3 March 2018, the 50th Session of the Typhoon Committee was held in Ha Noi, Viet Nam. 153 participants from 13 of 14 Members of the

Typhoon Committee attended the Session, namely: Cambodia; China; Hong Kong, China; Japan; Lao People's Democratic Republic (Lao PDR); Macao, China; Malaysia; Philippines; Republic of Korea; Singapore; Thailand; United States of America (USA); and the Socialist Republic of Viet Nam. Representatives of United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), World Meteorological Organization (WMO) and Typhoon Committee Secretariat (TCS) also attended the Session.



(The 50th Session of the Typhoon Committee Group Photo Session, in Ha Noi, Viet Nam, 28th February, 2018)

To celebrate the 50th anniversary of the Typhoon Committee, the first day of the Session (28 February 2018) was set as a “High Level Session” in which the Permanent Representative with WMO of each Member, or his/her designate, or other senior officials were invited to give a welcome remark for the 50th Session and concisely present their country milestones as well as sharing history with the past key persons of the Typhoon Committee.

In addition, a 2-day Technical Conference (TECO) was held on 26 and 27 February 2018 prior to the Session and the main theme was “Embracing new technologies and knowledge to meet the challenges in the new era of tropical cyclone forecasting”. The TECO included both invited Keynote Presentations and submitted Technical Presentations for the three topics under the main theme.

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