# MEMBER REPORT [THAILAND]

ESCAP/WMO Typhoon Committee
14th Integrated Workshop
Tumon, Guam USA
4-7 November 2019

# 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)

### Overview of tropical cyclones which have affected/impacted Thailand from 1 October 2018 to 30 September 2019

During October 2018 to September 2019, there were 4 tropical cyclones originated over the South China Sea and Pacific Ocean and directly affected Thailand and 4 tropical cyclones having some effects on rainfall of Thailand as seen in figure 1-1.

There was significant effect from 4 tropical cyclones originated over the South China Sea and the Northwest Pacific Ocean. They were the tropical depression in middle October 2018, the tropical Storm "PABUK" (1901) in early January 2019, the tropical Storm "WIPHA" (1907) in late July to early August 2019 and the tropical Storm "PODUL" (1912) in late August are shown in figure 1-2.

There were 4 tropical cyclones (TORAJI (1827), USAGI (1829), MUN (1904) and KAJIKI (1914)) having some effects on rainfall of Thailand

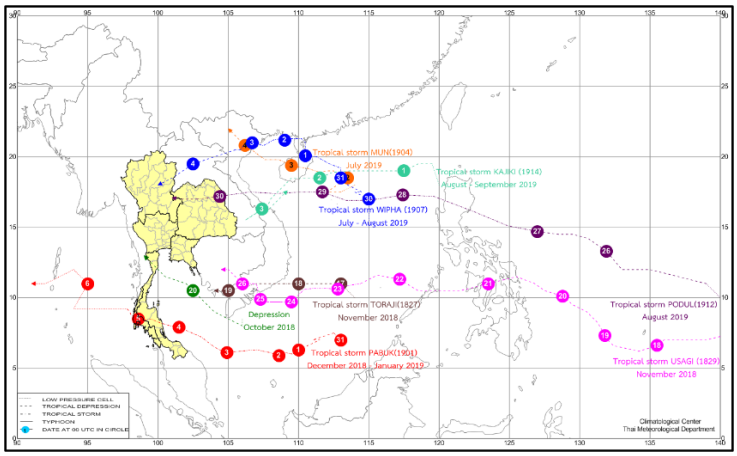


Figure 1-1: Tracks of tropical cyclones that affected on rainfall of Thailand from 1 October 2018 to 30 September 2019

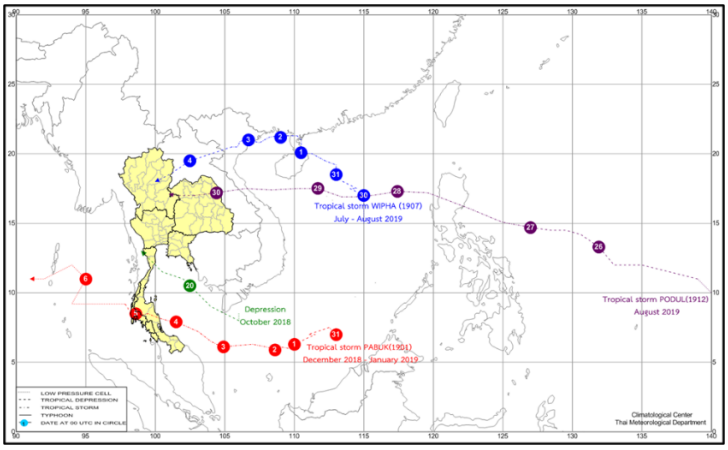


Figure 1-2: Track of the tropical cyclone entering Thailand from 1 October 2018 to 30 September 2019

## 1. Tropical depression during 19-21 October 2018

The tropical depression was the first tropical cyclone entering Thailand in this period. It formed as a tropical depression over the lower South China Sea on October 19 then moved through the Tip of Indochina into the Gulf of Thailand and made landfall in southern part of Thailand at Kui Buri in Prachuap Khiri Khan province on October 20. After that, it downgraded into the low-pressure cell and moved to cover the Gulf of Mataban, Myanmar. Under the influence of the tropical depression, rainfall in southern Thailand was relatively increased with fairly widespread to widespread rain and heavy to very heavy rainfall in some areas during October 19-21.

The heaviest daily rainfall in southern Thailand was 98.6 mm at Hat Chao Samran, Amphoe Mueang in Phetchaburi province on October 20. For the track of the tropical depression and accumulated amount of rainfalls during the affected period are shown in figure 1-3.

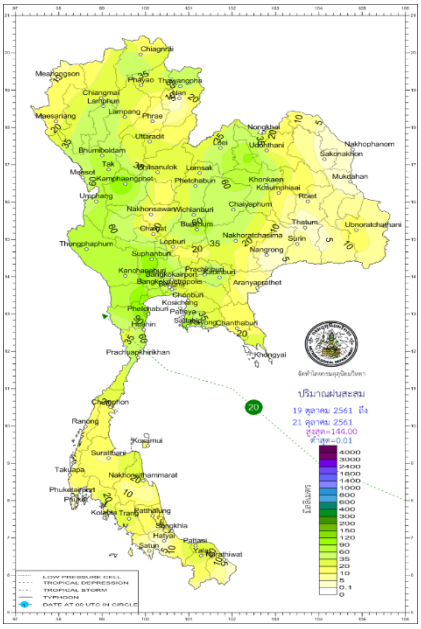

Figure 1-3: Accumulated amount of Rainfalls during 19 - 21 October 2018

## 2. Tropical Storm "PABUK (1901)"

Pabuk was the earliest-forming tropical storm of the northwest Pacific Ocean on record and also the first tropical storm entering Thailand in January. It formed as a tropical depression over the lower South China Sea on December 31 then intensified into the tropical storm "PABUK (1901)" in the afternoon of January 1. It further moved towards the lower Gulf of Thailand and made landfall at Nakhon Si Thammarat province on January 4. After that, it moved through the southern part of Thailand and downgraded into a tropical depression in the morning of January 5. It moved into the Andaman Sea before degenerated into the active low pressure in the afternoon on January 5 then moved into the upper Andaman Sea and later dissipated.

Under the influence of Pabuk, it brought torrential rain and squall to southern Thailand during January 3-5 especially in Surat Thani, Nakhon Si Thammarat, Yala and Pattani provinces on January 3 and at Ranong, Krabi and Trang provinces on January 5.

Gusty wind was reported at Songkhla, Pattani and Narathiwat provinces on January 3 and at Nakhon Si Thammarat and Phatthalung provinces on January 4. Moreover, Pabuk brought storm surge at Songkhla province on January 5.

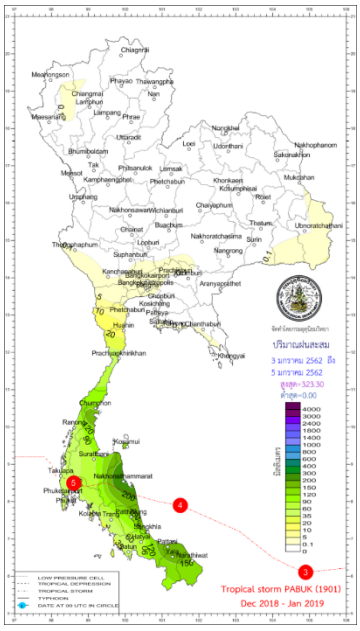


Figure 1-4: Accumulated amount of Rainfalls during 3 – 5 January 2019

The maximum daily rainfall was 303.9 mm at Chawang district in Nakhon Si Thammarat province on January 4. The accumulated amount of rainfalls during the affected period of Pabuk is shown in figure 1-4 and 1-5.

According to Department of Disaster Prevention and Mitigation (DDPM), 883,572 people from 265,132 families in 23 provinces were affected including 5 deaths 405 houses were fully damaged and 53,008 houses were partially damaged.

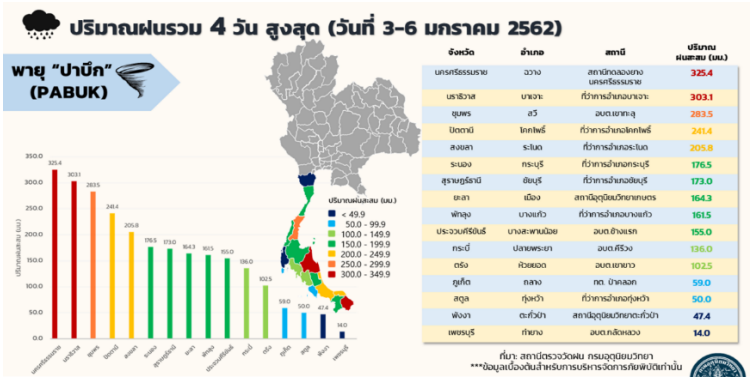


Figure 1-5: Accumulated amount of Rainfalls during 3 – 6 January 2019 which affected by tropical cyclone Pabuk.

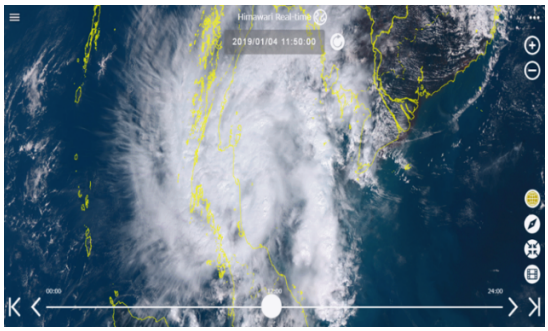


Figure 1-6: Himawari-8 satellite image on 4 January 2019 at 04.50 UTC (11.50 local time)

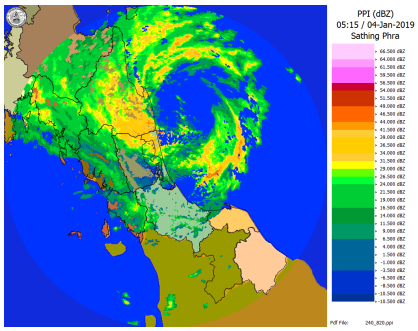


Figure 1-7: Radar echo from Sathing Phra Station on 4 January 2019 at 05.15 UTC

## 3. Tropical Storm "WIPHA (1907)"

Tropical Storm "WIPHA" originated from a low pressure area over the upper South China Sea and intensified into a tropical depression on July 30. It moved in the west-northwest direction and reached tropical storm strength "WIPHA" (1907) on July 31. Then, it moved through Hainan Island entering Guangdong province, China on August 1 and moved through the Gulf of Tokin before made landfall over upper Vietnam in the morning of August 3. After that, it weakened into a tropical depression in the evening of the same day then moving through Laos and entering Thailand in Nan Province at 04:50 UTC on August 4 and then downgraded to an active low pressure cell while moving pass northern part of Thailand in the same day. Under the influence of Wipha, rainfall was increasing both amount and distribution with widespread rain and heavy to very heavy rainfall in upper Thailand especially in the northern part during August 3-5, the maximum daily rainfall in upper Thailand was 136.4 mm at Phu Sang in Phayao province on August 4. Flash flood was reported at Phayao province on August 3-5 and at Tak province on August 4. Gusty wind was reported at Kamphaeng Phet province on August 2 and at Chiang Mai and Loei provinces on August 3.

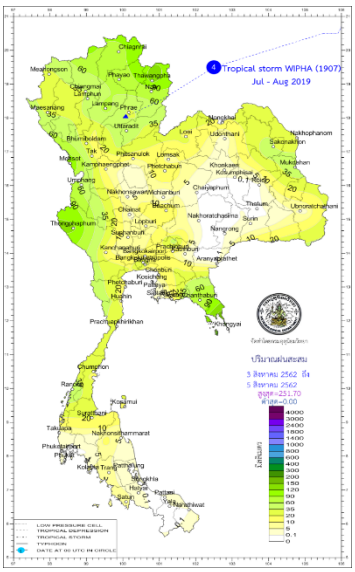


Figure 1-8: Accumulated amount of Rainfalls during 3 – 5 August 2019

Moreover, landslide was reported at Nan province on August 3. For the track of Wipha and accumulated amount of rainfalls during the affected period are shown in figure 1-1 and 1-8 respectively.

## 4. Tropical Storm "Podul (1912)"

Podul formed as a tropical depression over the western North Pacific and intensified into a tropical storm on August 27. Podul continued to intensify after entering the South China Sea and reached its peak intensity with an estimated sustained wind of 80 km/h then accelerated to the west towards Vietnam on August 29. After landfall, Podul quickly moved through Vietnam, and Laos before entered Thailand at Nakhon Phanom province on August 29. Podul gradually weakened into tropical depression at Sakon Nakhon province on August 30 and later traversed the upper northeastern part then degenerated into an area of low pressure over Loei province of the same day.

Under the influence of Podul, torrential rainfall was occurred over upper Thailand especially in the northeastern and northern parts. During August 29-September to October1, the maximum daily rainfall was 459.0 mm at Khao Ko in Phetchabun province on August 30. For the track of Podul and accumulated amount of rainfalls during the affected period are shown in figure 1-1 and 1-9 respectively.

Under the influence of Podul and some effects from Kajiki, according to Department of Disaster Prevention and Mitigation (DDPM) report, flash flood was reported in several areas of northeastern and northern parts of Thailand with land slide and gusty wind in some areas, 419,988 families in 26 provinces were affected including 35 deaths and 22,882 houses were partially damaged.

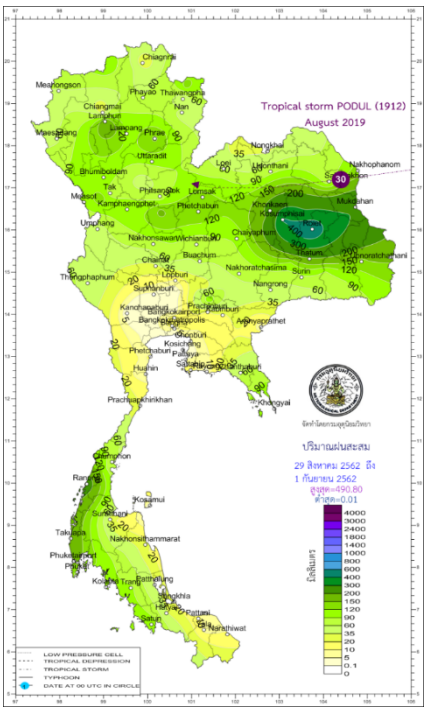


Figure 1-9: Accumulated amount of Rainfalls during 29 August – 1 September 2019

The average rainfall over Thailand from 1 October 2018 to 30 September 2019 was 1482.6 mm or about 6.6 % below normal. Figure 1-10 shows that the monthly rainfall during October 2018 to September 2019 was below the 1981-2010 normal except in December 2018, January and August 2019 which was above normal. Affected by weak El Niño brought below average rainfall or aberration in seasonal rainfall patterns especially in the first half of rainy season (mid-May to July) that monsoon trough moved to cover Myanmar and Laos and most disappeared in the mention period. In 2019, Thailand had faced drought situations until early August. Under the influence of northeast monsoon prevailing over the Gulf of Thailand, intermittent rainfall was observed in December 2018 and January 2019 especially on January 3-5 that experienced widespread rain due to the tropical storm "PABUK (1901)" which was the first tropical storm entering Thailand in 2019. Monthly rainfall of December 2018 and January 2019 were 80.7 and 42.4 mm or 67% and 149% above the normal respectively. In August 2019, rainfall was 304.8 mm or 27% above the normal. Under the influence of 2 tropical cyclones that entering Thailand namely tropical storm "Wipha" in early-August and tropical storm "Podul" in late August brought plentiful rainfall to Thailand and resolved the effect of drought in some areas. Thailand's anomaly rainfall is shown in figure 1-10.

Monthly temperature of Thailand from 1 October 2018 to 30 September 2019 was dominated by the weak El Niño that led to above average temperature. Mean temperature over Thailand was above the 1981-2010 normal throughout the period mainly in December 2018 and February 2019 which the mean temperature rising to 2.2°C and 1.5°C respectively above the normal. Thailand's anomaly monthly temperature is shown in figure 1-11.

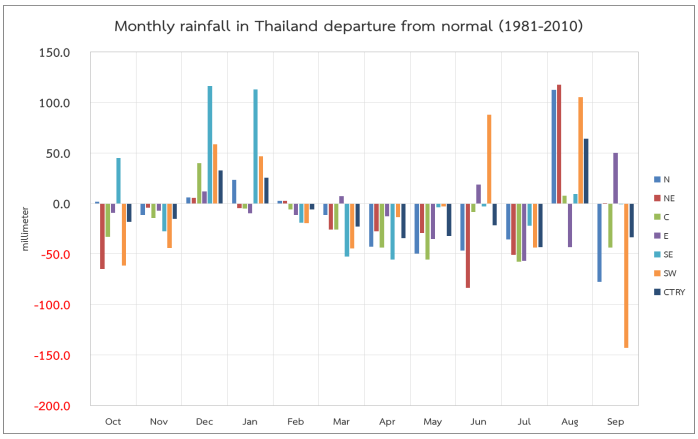


Figure 1-10: Anomaly rainfall during October 2018 - September 2019 in each region of Thailand

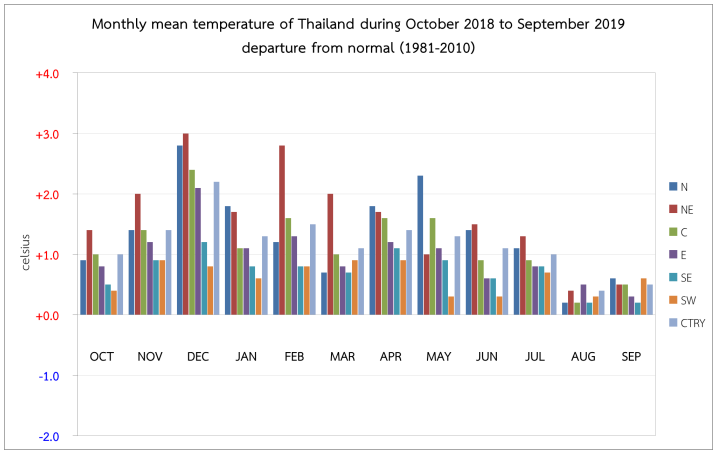


Figure 1-11: Anomaly mean temperature during October 2018 - September 2019 in each region of Thailand

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

In 2019, from January to September, there are 3 tropical storms impacted Thailand. Despite during rainy season, Thailand particularly in lower northeastern (e.g. Nakorn Ratchasima Province), and central regions (e.g. Suphanburi, Uthaithani Provinces) also faced the drought situation for few months in the mid-year.

Royal Irrigation Department of Thailand, by SWOC (Smart Water Operation Center), is in charge of monitoring 24-hour flood situations by integrating meteo-hydrological data as well as hydraulics structures data from related agencies in order to set up operation plans and making warning messages for the expected risky area through the RIO (Regional Irrigation Office) and relate to the local government.

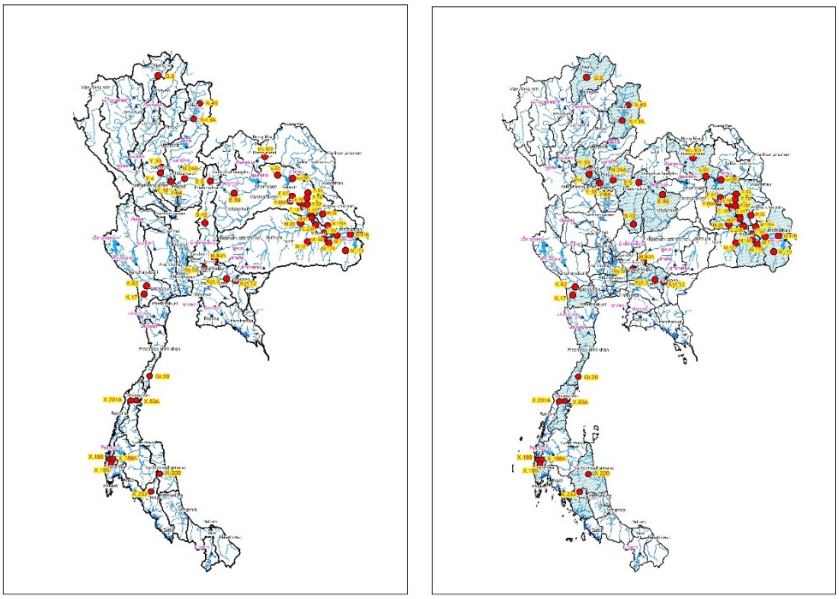

Figure 2-1: The provinces and hydrological observation stations that happened the flood situation in 2019 (total: 48 stations of 20 provinces)

At the beginning, Thailand confronted with the tropical storm 'PABUK'. Thai Meteorological Department (TMD) announced to public on the 1st of January 2019. The PABUK reached the southern east coast peninsula on 3rd January. The precipitation in Nakhon Si Thammarat Province was almost 300 mm. within 2 days. It caused overbank flow and urban flood in many areas in the south of Thailand.


Figure 2-2: Flood in Nakhon Si Thammarat province caused by 'PABUK'

Later from February to mid of July, there were many areas occurred the drought in the North Northeastern, and Central Regions. The amount of precipitation was 10-20% less than the average. Several large-scale dams in Thailand only had water stored around 30% of their capacities. Thailand's water related agencies such as Royal Irrigation Department had to adjust the water management plan to solve the problems.

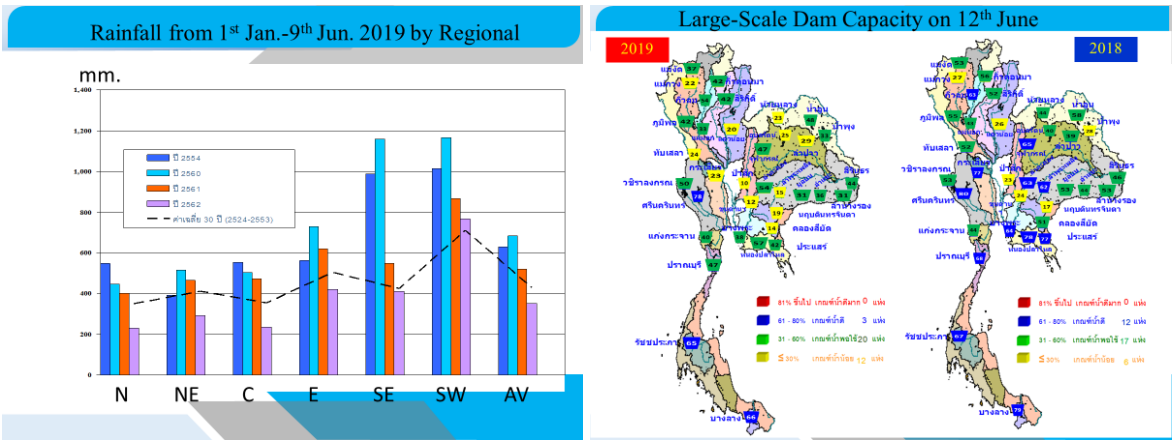


Figure 2-3: Show about rainfall amount that less than average and water storage in large-scale dams in 2019 compared with 2018 was decreased

Furthermore, in the end of July, there was tropical storm 'WIPHA' which was downgrade to the depression storm and attack the Northeastern and the North Regions of Thailand. At the same time, the strong southwest monsoon also affected the Western Region of Thailand. Fortunately, this event gave a benefit for the large-scale dams capacities but also some flash flood happened in the mountainous area e.g. upstream areas of Nan River basin in the North and Takua Pa River basin in the south.

Moreover, for the latest tropical storm 'PODUL', greatly affected Thailand in late August. It caused heavy rainfall in the Northeastern Region of Thailand. Ubon Ratchathani Province was the most impacted area that faced the big floods (about 20-year return periods) for almost a month. The water depth in some areas were more than 4 meters. The situation was recovered to normal condition on 4th October.

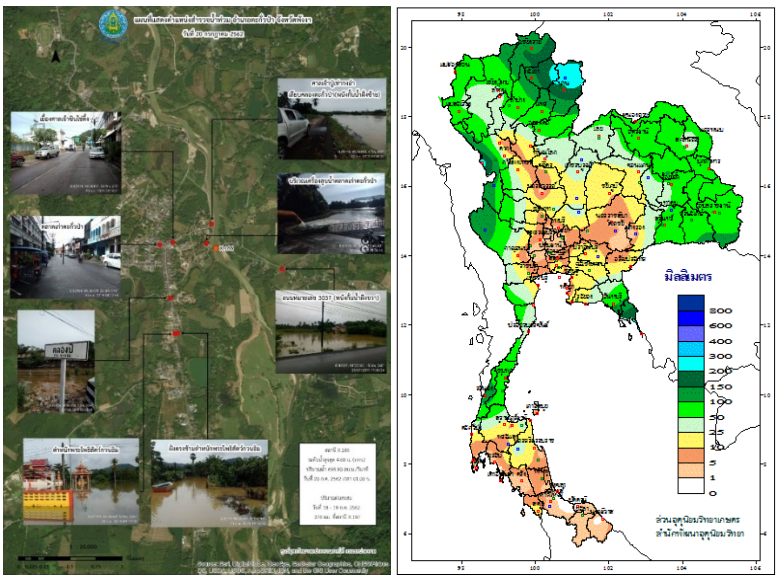

Figure 2-4: Flood map of Takua Pa river and accumulate rainfall 7 days by 'WIPHA'

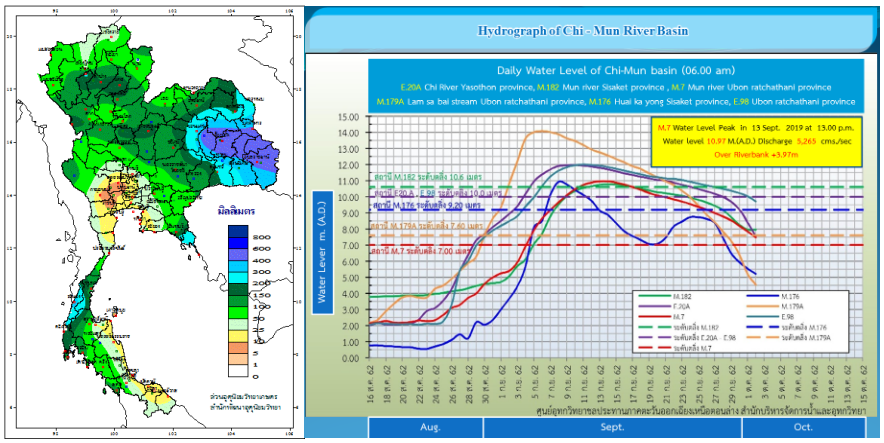


Figure 2-5: Accumulate rainfall 7 days by 'PODUL' and hydrograph of Chi-Mun Basin

Figure 2-6: Flood in Mun River, Ubon Ratchathani province Thailand.

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

The impacts of Tropical Storm Podul and Tropical Depression Kajiki as well as the severity of southwest monsoon which was prevailed over the Andaman sea and the Gulf of Thailand from 29 August to the present caused flashflood and landslide in 32 provinces out of 76 provinces throughout Thailand. 182 districts, 969 sub-districts, 7,115 villages, 5 municipalities, 11 communities, 418,549 people were affected, 3818 houses were reported partially damaged, the death toll was 34 people and 1 person was injured. (As of 18 September, 2019)

Damages by sector are as the follows;

1. Road : Some highways and rural roads in 4 provinces are inaccessible. (Source: Department of Highway and Department of Rural Roads)
2. Education : 346 schools were affected (Source : Ministry of Education)
3. Heath : 18 Public Health Facilities were affected (Ministry of Public Health)
4. Agriculture : Crops : 2,035,858 Rai of farmland were affected

Figure3-1: Flooding in Ubon Ratchathani province Thailand.

Figure 3-2: A photo released by the Royal Thai Government shows an aerial view of the flooded area in Yasothon province, northern Thailand, Sept 9, 2019.

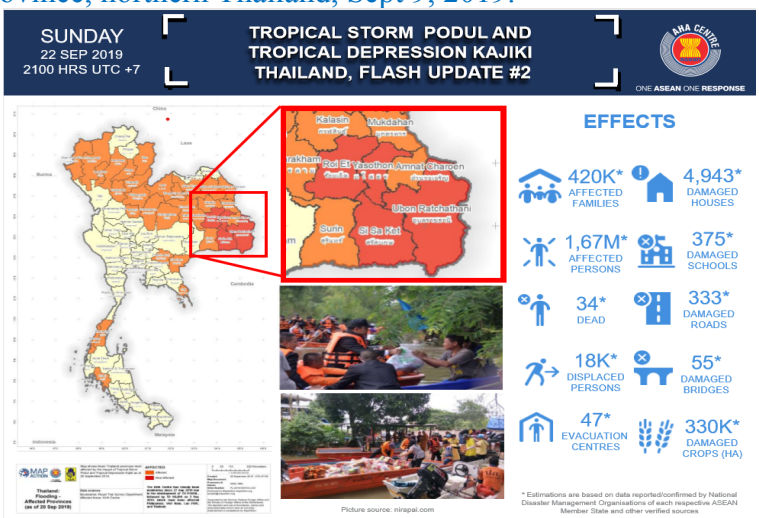


Figure 3-3: The report of AHA Centre Flash Update No. 02 – Tropical Storm PODUL and Tropical Depression KAJIKI, Thailand – 22 September 2019

**Disaster Risk Reduction:**

Thai Meteorological Department forecasted and disseminated warning messages of the above-mentioned tropical storm and tropical Depression. Then, Department of Disaster Prevention and Mitigation by National Disaster Warning Center also disseminated warning messages in advance to the public and local people to prepare for the impacts

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

### 1. SWFDP Regional Subproject in Southeast Asia (SWFDP-SeA)

The fourth Meeting, Severe Weather Forecasting Demonstration Project (SWFDP) – Regional Sub-project Management Team (RSMT) for Southeast Asia (SeA) was held by the Thai Meteorological Department (TMD) in collaboration with World Meteorological Organization in TMD Head Quarter, Bangkok, Thailand during 24-27 September 2019.
The Project has been successfully strengthening capacity of National Meteorological and Hydrological Services (NMHSs) in developing countries including least developed countries (LDCs) and Small Island Developing States (SIDSs) to deliver improved forecasts and warnings of severe weather to save lives and livelihoods, and protect property and infrastructure. Therefore, RSMT is a significant organ and mechanism of the SWFDP-SeA in lading down the implementation plan and push forward the project to achieve the expected outcome and goals as laid down by the WMO

Figure 4-1: The fourth Meeting, Severe Weather Forecasting Demonstration Project (SWFDP) – Regional Sub-project Management Team (RSMT) for Southeast Asia (SeA) during 24-27 September 2019.

### 2. National Workshop on Strengthening Multi-Hazard Early Warning Systems in Thailand

The National Workshop on Strengthening Multi-Hazard Early Warning Systems was held by the Thai Meteorological Department (TMD) in collaboration with World Meteorological Organization in TMD Head Quarter, Bangkok, Thailand during 29-30 October 2019.

The workshop will be led by Thai Meteorological Department (TMD), WMO and RIMES, and aims to;

a. Gather Stakeholders involved in MHEWS, disaster risk reduction and management (DRR/DRM) and climate change adaptation (CCA) in Thailand and collect their feedback and related information for future improvement and in light of international commitments,
b. Present and discuss the CREWS-Canada SeA Project, the assessment sub-project, its purpose and timeline of activities, and validate the outcomes of the desk research in the areas of;
    - The policy and legal basis for MHWES in Thailand,
    - The institutional framework and actors involved,
    - Current products and services and end-users of hydrometeorological data, products and services,
    - Resent and on-going programmes or projects related to MHEWS, DRR/DRM and CCA in Thailand, and;

- Residual gaps and needs and approaches for overcoming these for priority programming.

c. Provide recommendations to the upcoming second SeA Project Steering Committee Meeting (SeA-PSC-2, 4 December 2019), organizes in conjunction with a Regional Workshop on Strengthening Multi-Hazard Early Warning Systems (MHEWS) in Southeast Asia under the same Project (2-4 December 2019 in Bangkok), as well as future MHEWS-related capacity development initiatives in the Region.


Figure 4-2: 2. National Workshop on Strengthening Multi-Hazard Early Warning Systems in Thailand during 29-30 October 2019

# II. Summary of Progress in Priorities supporting Key Result Areas

1. Enhancement of Numerical Weather Prediction Product
2. Improving Radar composite and Meteorological Satellite Data analysis
3. Verification of estimate rainfall by Satellite data and Radar Composite to Observation Station with Bias-Correction Method
4. Improving Standard Operating Procedure (SOPs) among NMC and disaster management and civil protection and other relevant agencies
5. Flood Management and Operation Center, Chi-Mun Basin by RID (Front Part)

## 1. Enhancement of Numerical Weather Prediction Product

**Main text:**

TMD applied product from WRF-TMD model to identify and assess heavy rainfall in district areas. TMD can predict the scatter heavy rainfall from 1 to 10 days ahead. Heavy rainfall prediction and CSV Data are available on this website: http://www.model.tmd.go.th/.

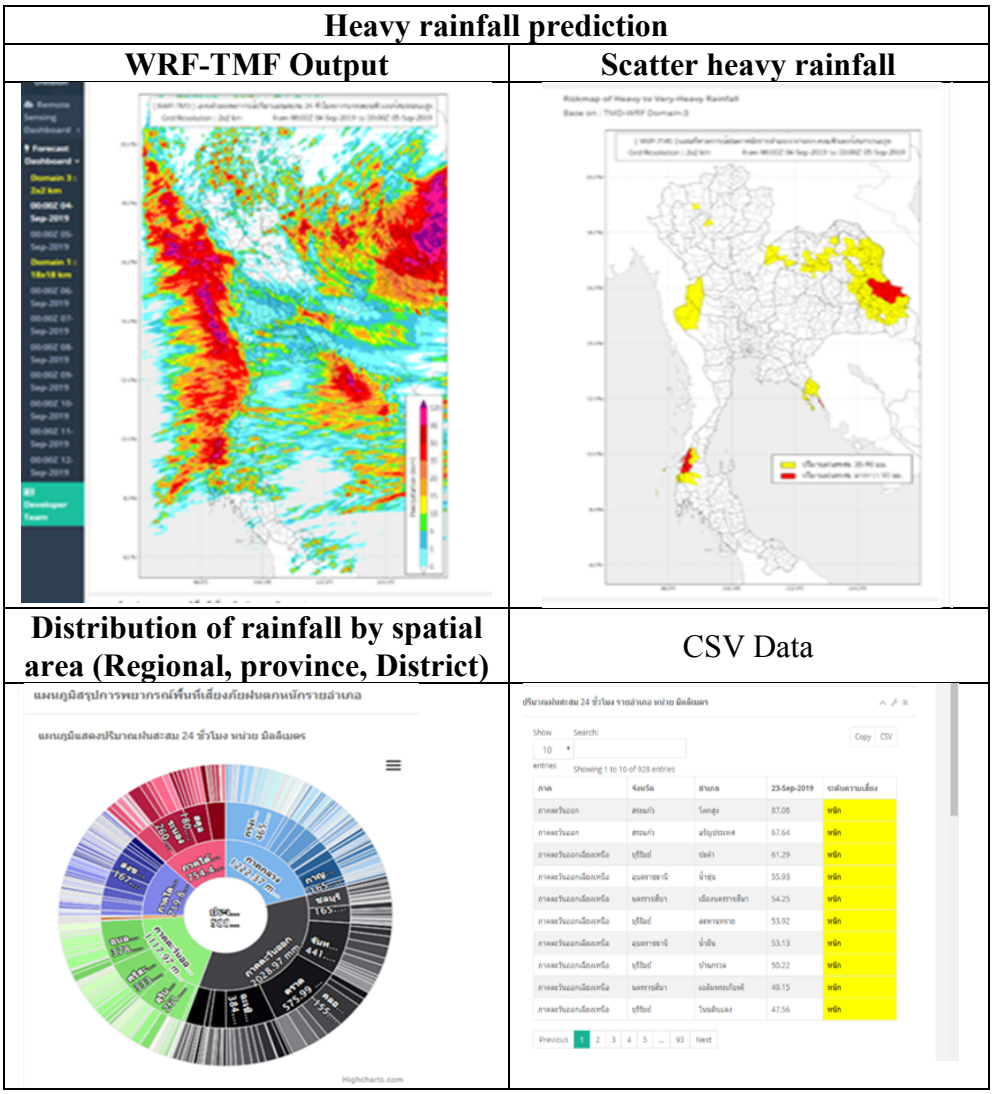


Figure 5: Products of WRF-TMD Heavy rainfall prediction

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

Intend to improving the comparison and verification of the forecast with observations.
Increasing the knowledge and implementations of Data Assimilation.

**Priority Areas Addressed:**

KRA 2: Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings.

KRA 4: Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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## 2. Improving Radar composite and Meteorological Satellite Data analysis

**Main text:**

Meteorological satellites and Radar Observation are very important to monitor heavy rain, estimate rainfall and track the formation of storms, TMD has been successfully overlay radar composite on near real time satellite images with the Himawari-8 satellite from Japan and FY satellite from China.

In 2019, TMD provide FY-4AGI satellite image every 4 minutes and 10 minutes for Himawari-8 on the dashboard of meteorological satellite web portal. However, the Radar composite images show every 15 minutes.

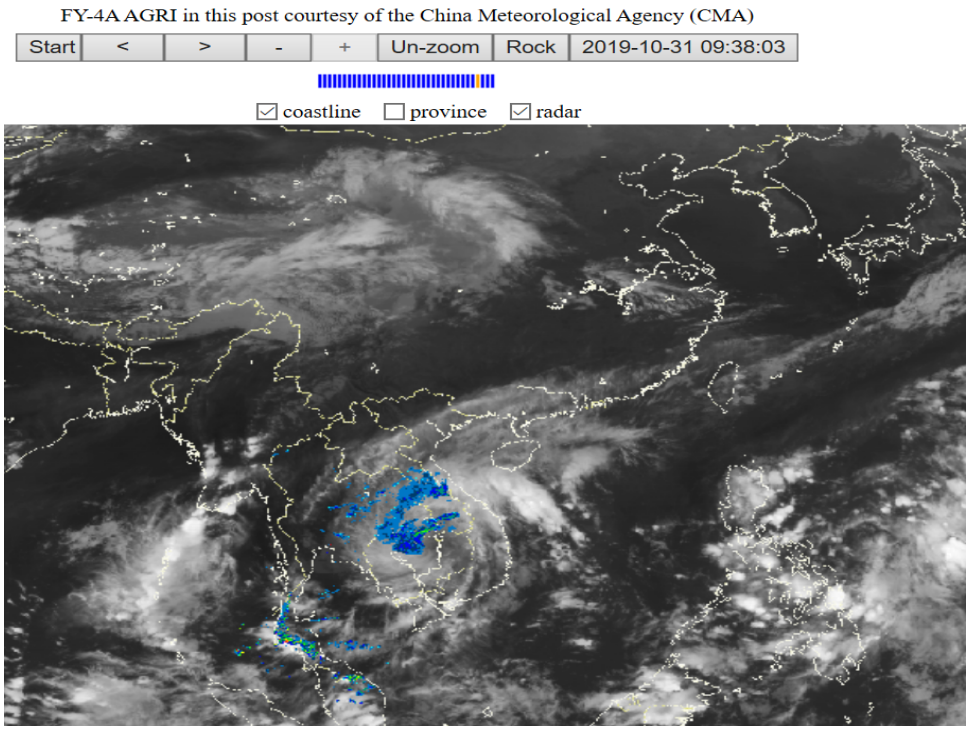


Figure 6: FY-4AGI satellite image at 0938 UTC on 29 October 2019 overlay with Radar composite images

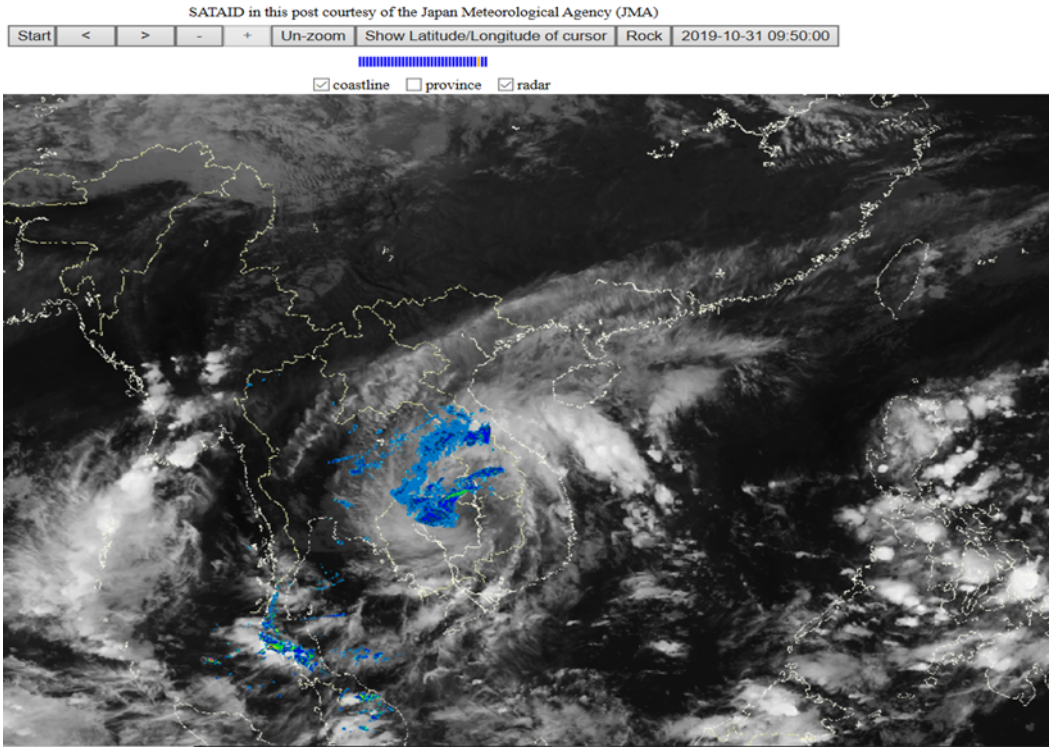


Figure 7: Himawari-8 satellite image at 0950 UTC on 29 October 2019 overlay with Radar composite images

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

Enhance collaborative activities with other regional/international frameworks/ organizations, including TC and PTC cooperation mechanism.

**Priority Areas Addressed:**

KRA 2: Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings.

KRA 4: Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

KRA 5: Enhance Typhoon Committee's Regional and International collaboration mechanism.

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## 3. Verification of estimate rainfall by Satellite data and Radar Composite to Observation Station with Bias-Correction Method

**Main text:**

TMD applied the Precipitation Estimation from Remotely Sensed Imagery using an Artificial Neural Networks Cloud Classification System (PERSIANN-CCS) technique to estimate the rainfall from Himawari-8 satellites images. The hourly estimate rainfall products were available on the PERSIANN Cloud Classification System website (http://www.satda.tmd.go.th/monitoring/). One example the comparison of Accumulate Rainfall from 00 UTC Oct 2 – 00 UTC 3 Oct by Persiann-CCS technique (Satellite), Radar Composite and Observation data are shown in figure 8.

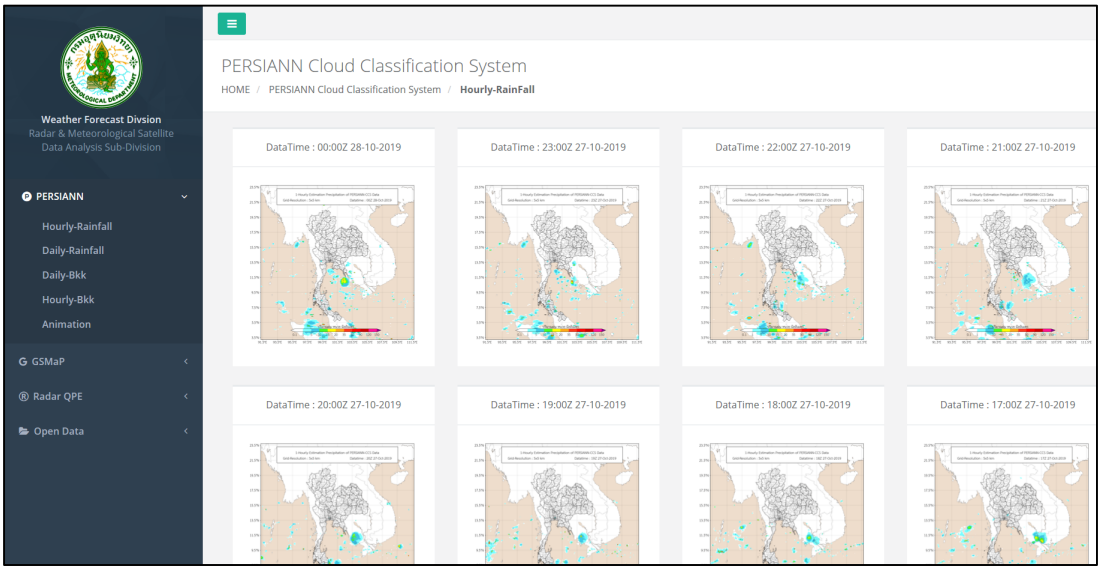


Figure 8: The dashboard of PERSIANN Cloud Classification System show in website: (http://www.satda.tmd.go.th/monitoring/)

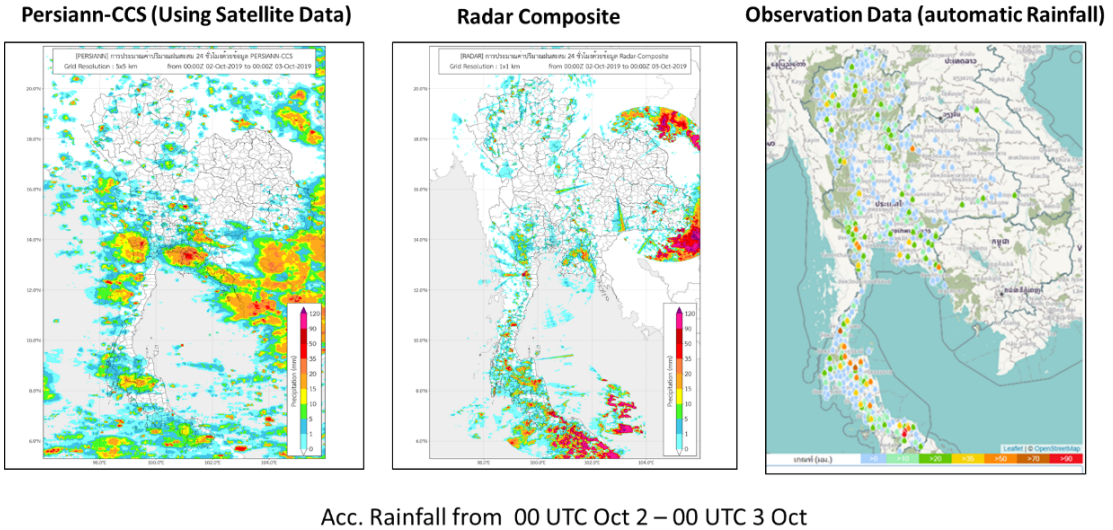


Figure 9: The Comparison of Estimate Accumulate Rainfall between Persiann-CCS technique, Radar Composite and Automatic Rainfall from 00 UTC Oct 2 – 00 UTC Oct 3.

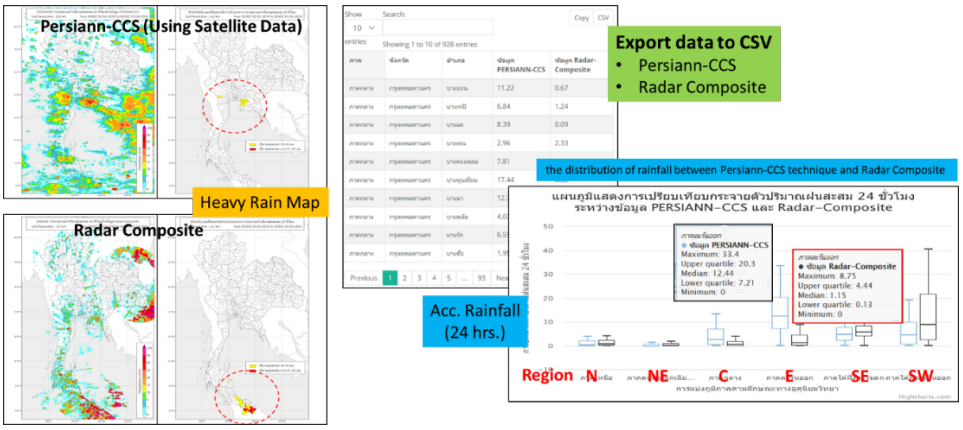


Figure 10: The Comparison of Estimate Accumulate Rainfall using by Persiann-CCS technique and Radar Composite from 00 UTC Oct 2 – 00 UTC Oct 3.

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

To intend to improving the estimate rainfall technique from satellite data and Radar Composite Data.

**Priority Areas Addressed:**

Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change.

KRA 2: Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings.

KRA 4: Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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## 4. Improving Standard Operating Procedure (SOPs) among NMC and disaster management and civil protection and other relevant agencies

**Main text:**

In 2019, Consultation Workshop “Preparing synergized standard operating procedures for multi-hazards early warning systems” was held at the Winsor Suite Hotel, Bangkok, from 8 to 9 July 2019.

In this Workshop, TMD were received an honor and great contribution from Mr. Tom Evans, Deputy Director of the Pacific Region NOAA's National Weather Service, USA who is the SSOP-II Project Manager and Asst. Prof. Dr. Thawida Kamolwech, the Dean of the Faculty of Political Science, of Thailand’s Thammasat University to kindly transfer their useful knowledge, their views and suggestions and guidance for TMD improve SOPs.

The workshop is participated by all 35 participants from 10 agencies involved with the multi-hazards early warning system and disaster risk reduction in Thailand.


Figure 11: Consultation Workshop "Preparing synergized standard operating procedures for multi-hazards early warning systems" was held at the Winsor Suite Hotel, Bangkok, from 8 to 9 July 2019.

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

Enhance collaborative activities with other regional/international frameworks/ organizations, including TC and PTC cooperation mechanism

**Priority Areas Addressed:**

KRA 2: Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings

KRA 5: Enhance Typhoon Committee's Regional and International collaboration mechanism.

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## 5. Flood Management and Operation Center, Chi-Mun Basin by RID (Front Part)

**Main text:**

Due to tropical storm 'PODUL' affected in the Northeastern Region of Thailand that caused the great flood in many areas. RID has set up the Flood Management and Operation Center, Chi-Mun Basin (Front Part) to monitoring, operate, manage and communicate with the local people at the site area.

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

Flood Management and Operation Center, Chi-Mun Basin (Front Part) was set up on 13th September 2019 by Director-General was presided over the open ceremony.


Role of the Flood Management and Operation Center, Chi-Mun Basin (Front Part)

- To monitor and report the flood situation in Chi and Mun Basin in hourly started from 13th Sep. 2019 until recovery state.
- To forecast flood peak of Mun River at M.7 station (Mueang District, Ubon Ratchathani Province) in hourly and also forecasted the period of time for recovery.
- To check and operate the RID machine's installation and transport for support the purpose and assistance.
- To inform public the accuracy information and up-to-date.
- To support The Ministry of Agriculture and Cooperatives (MOAC) team of volunteers to rehabilitate the extensive flooded areas of Ubon Ratchathani, in order to expedite help and rehabilitation in flood affected areas so that people are able to return to their normal lives as soon as possible started from 23rd Sep. 2019.


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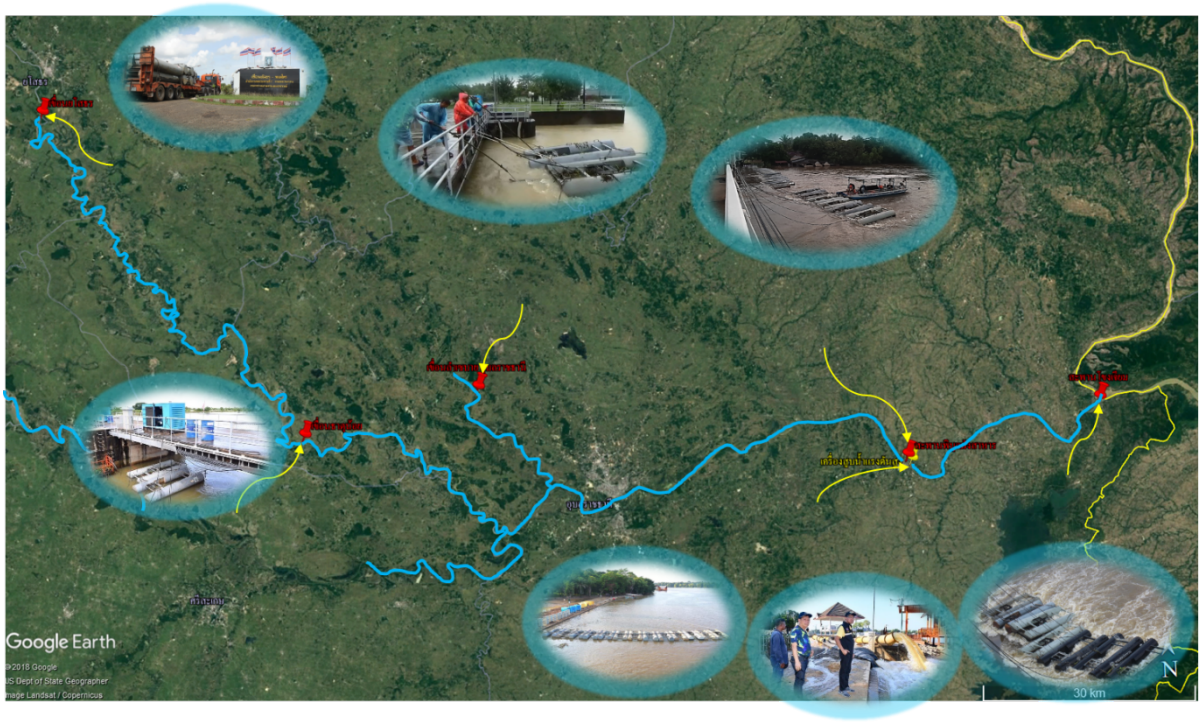
(ส่วนหน้า)
ปฏิบัติการโดยกรมชลประทาน
กระทรวงเกษตรและสหกรณ์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**Priority Areas Addressed:**

KRA 1: Enhance capacity to monitor mortality and direct economic loss caused by typhoon-related disasters

KRA 2: Enhance capacity to generate and provide accurate, timely and understandable information using multi-hazard impact-based forecasts and risk-based warnings

KRA 4: Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

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