

MEMBER REPORT

ESCAP/WMO Typhoon Committee
11th Integrated Workshop

THAILAND

Cebu, Philippines
24-27 October 2016

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I. Overview of tropical cyclones which have affected/impacted Member's area in 2016

1. Meteorological Assessment (highlighting forecasting issues/impacts)

From 1st January to 30th September 2016, there was only one tropical cyclone over the West Pacific and South China Sea namely Tropical storm RAI (1615) directly affected Thailand, which was downgraded into a tropical depression before entering Thailand on 13 September. There also were two occasions in which tropical storms namely "MIRENAE (1603)" and "DIANMU (1608)" indirectly affected the weather in the country. The tracks of those three tropical cyclones were given in Figure 1 and the detailed information is described below.

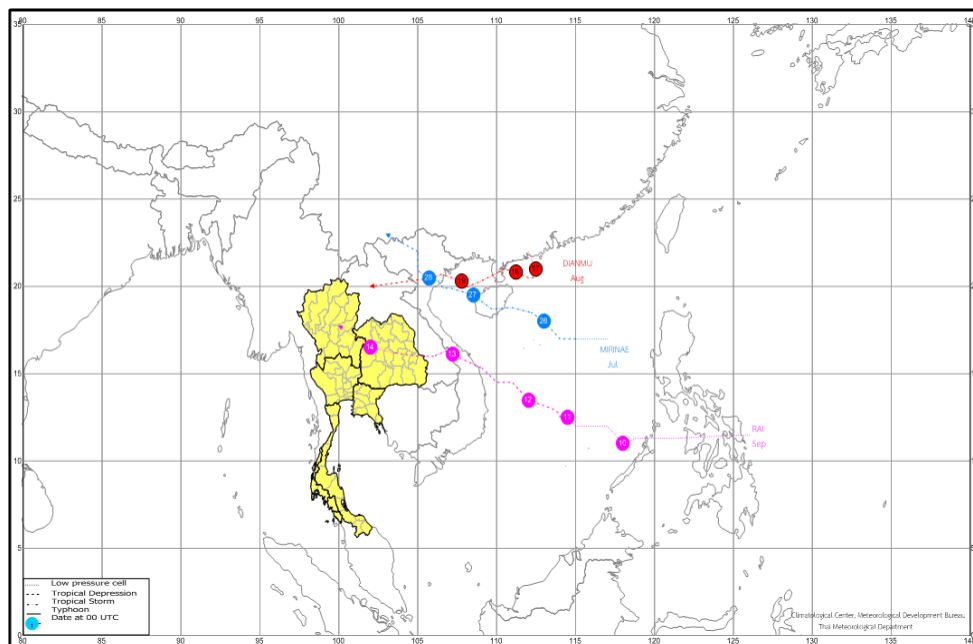


Figure 1 : Tracks of Tropical Storm effecting Thailand during Jan. to Sep. 2016

Tropical storm RAI (1615)

Tropical storm Rai formed from a tropical depression over the middle of the South China Sea (12.5 °N, 114.0 °E) at 0600 UTC on 11 September. This depression generally moved west – northwestwards and the system developed into a tropical storm and reached its peak intensity on 12 September, before made landfall the south of Da Nang, Vietnam as tropical storm early in the morning of 13 September. It continued to move in the same direction towards the central part of Vietnam before entering Laos. After that, it changing to westerly track and downgraded into the tropical depression at 0600 UTC on the same day and moves further into Ubon Ratchathani and Amnat Charoen provinces, Thailand in the afternoon of 13 September and moved pass Yasothon, Roi Et and Kalasin provinces. It later became low pressure cell over the middle portion of northeastern region and moves to cover lower portion of northern region of Thailand on the following day.

Under the influence of tropical storm Rai, abundant rainfall continued to upper Thailand during 12-14 September with the highest daily rainfall was 150.2 mm in Amphoe Chum Phuang, Nakhon Ratchasima Province on 13 September. Flood was reported in Loei province on 13 September. The accumulated amount of rainfalls is show in figure 2. Besides, rainfall in Thailand was increasing by the indirect affected of

the tropical storm “MIRENAE (1603)” and the tropical storm “DIANMU (1608)” in late July and middle August, respectively.

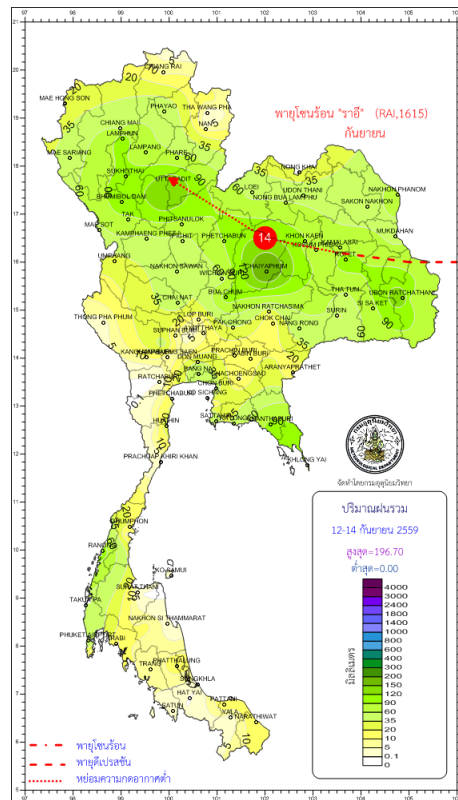


Figure 2 : Accumulated amount of Rainfalls during 12-14 September 2016

Rainfall

The average rainfall over Thailand from 1st January to 30th September 2016 was 30.5 mm or about 2 % above 1981-2010 normal which was wetter than usual. Figure 3 showed that monthly rainfall during January, June, July and September was above the 1981-2010 normal especially during January and June, which was 34.1mm (201%) and 59.2 mm (31 %) above normal over the whole areas, respectively. On the other hand, Thailand was drier than usual during February to May especially in March and April which was below normal rainfall over Thailand.

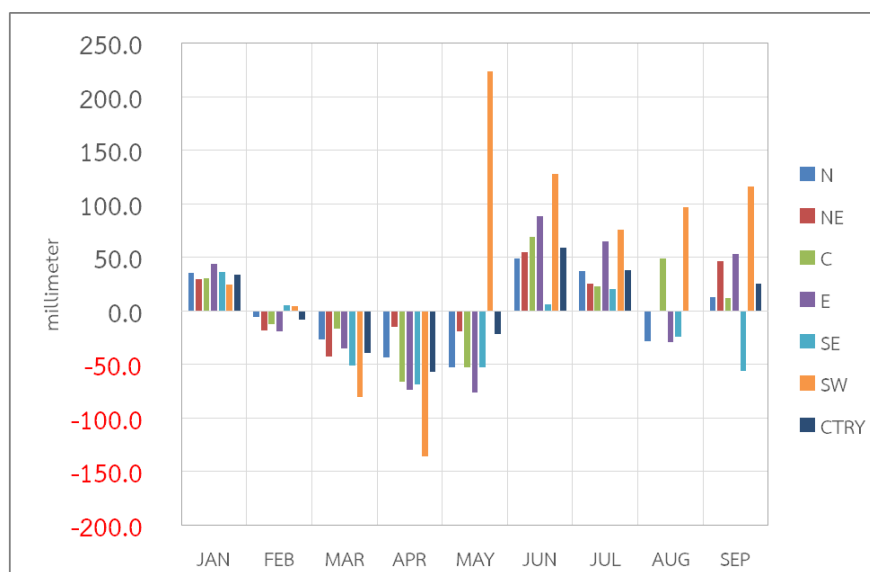


Figure 3 : The monthly rainfall of Thailand departure from normal (1981-2010)

Temperature

Monthly temperatures of Thailand during February 2016 were dominated by cool conditions in most of the regions. Mean temperature over Thailand was 0.6°C below the 1981-2010 normal. These were the resulted from the high pressure area from China occasionally extended its ridge to cover upper Thailand coupled with the northeast monsoon prevailing over Thailand and the Gulf of Thailand. During the rest period in summer and rainy seasons Thailand still experienced warmer conditions in all regions. Thailand's monthly temperatures are shown as Figure 4.

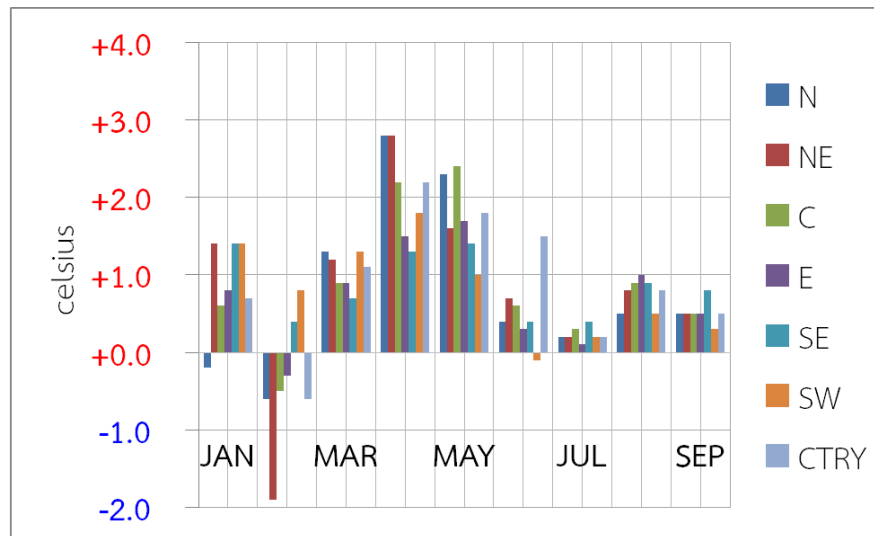


Figure 4 : The monthly mean temperature of Thailand departure from normal (1981-2010)

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

Following the situation from 2015, Thailand was still in drought period till the rainy season that started since the 18th May 2016. However, from January until the end of June, the trend of the precipitation is in average zone compare with the past record but it's more increase in later on.

In early of July, the monsoon started to effect the upstream in the northern part of Thailand. In September, the impact of the tropical storms 'RAI' and the southwest monsoon caused the floods and flash flood in some regions of Thailand. There were flooding in the Northern Part and Central of Thailand in August, September and October.

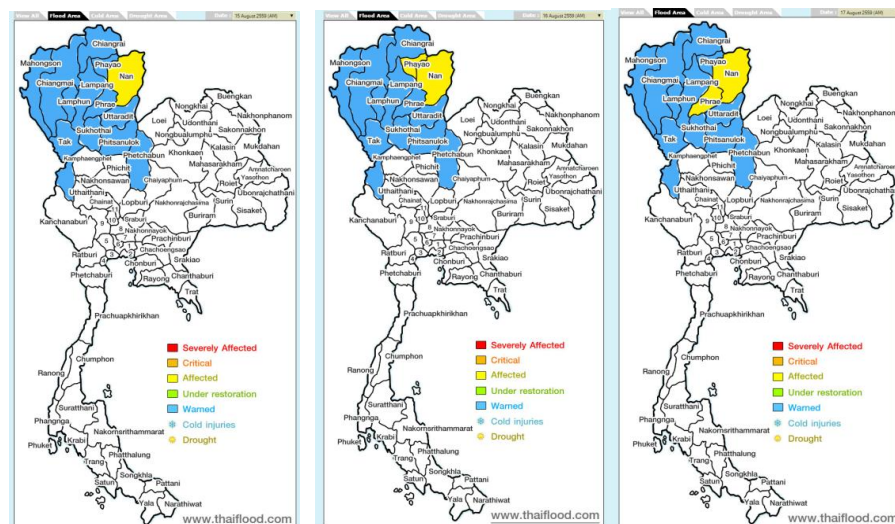


Figure 5 : The warning and the flood provinces in 15-17 September

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

In the beginning of this year, Thailand has not been directly affected by any tropical cyclones. Mainly is seasoning storm that occurs around summer and rainy season. Around January-April 2016 Thailand was hit by seasoning storm in many areas. The areas were affected is described below. Otherwise, in September, there was only one tropical cyclone namely Tropical storm RAI (1615) directly affected Thailand.

In January, the areas were affected in 19 provinces in northeast, northern and southern of Thailand that was hit by seasoning storm. The storms have an effect on 2,899 houses, farmland 120 units, death toll 3, injured 16 people, disappear 3 people and economic damage was estimated at 31,895,300 Baht.

In February, the areas were affected in 16 provinces in northern, southern, eastern, western and central of Thailand that was hit by seasoning storm. The storms have an effect on 82 houses, farmland 3,530 units and economic damage was estimated at 135,000 Baht.

In March, the areas were affected in 16 provinces in northern, southern, eastern, western and northeast of Thailand that was hit by seasoning storm. The storms have an effect on 215 houses, death toll 1, and economic damage was estimated at 175,000 Baht.

In April, the areas were affected in 49 provinces in Thailand including Bangkok that was hit by Tropical storm. The storms have an effect on 21,380 houses and death toll rise to 9 and injured 10 people.

In term of Regional Cooperation, DDPM has the office in all provinces that cooperate with communities and other government organizations to manage disasters including prevention and mitigation, preparedness, response, and recovery.

DDPM also emphasize on Disaster Risk Reduction (DRR) that because it is everyone's business and is a shared responsibility among citizens, the private sector and government. Therefore, it is essential to lay down operational guidelines for all stakeholders in the country at all levels to further carry out their disaster risk management responsibilities cooperatively. The relevant global and regional frameworks for action have been developed and adopted that have provided critical guidance in efforts to reduce disaster risk. These frameworks for action have embraced the following priorities for action: understanding disaster risk; strengthening disaster risk governance to manage disaster risk; investing in disaster risk reduction for resilience and building natural disaster immunity; and enhancing disaster preparedness for effective response and to "Building Back Better" and safer in recovery, rehabilitation and reconstruction.

DDPM implement the Community – Based Disaster Risk Management (CBDRM) project which has put the focus on the role of community in prevention and mitigation, preparedness, response, and recovery. It has provided the opportunity for all community members and other stakeholders in the community to collectively participant in the planning process, play key role in decision – making and to collectively identify the solutions for addressing the challenges related to disaster risk management. CBDRM is a project to boosting community involvement in reducing the current disaster risk.

In this year, DDPM had implemented the project on CBDRM in 11,645 communities across Thailand

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

II. Summary of progress in Key Result Areas

TC Members' Report

Summary of Progress in KRAs

Title of item 1 : Typhoon Warning Issuance and Dissemination in Thailand

Typhoon Warning Issuance and Dissemination in Thailand

TMD issued severe weather bulletins in Thailand as a watch or a warning, depending on severity of the event. The warning issuance and dissemination in the areas affected by typhoon is issued based on the analysis of satellite imageries, numerical weather prediction (NWP) products, ensemble forecast products including tropical cyclone track information from RSMC Tokyo, Hong Kong Observatory etc. are described below.

Areas affected	Tropical Cyclone Warning	Disseminate channels
Tropical cyclone track outside the area of responsibility	Advisory (every 6 hours)	- TMD website, TMD radio, Social media, Mobile App - Traditional Media (Radios, TVs) - Government agencies
Tropical cyclone forms within or enters the area of responsibility (South China Sea and the Gulf of Thailand), which expected to affect the country	Warning (every 3 hours)	- TMD website, TMD radio, Social media, Mobile App, Hotline, SMS - press release - Traditional Media (Radios, TVs) - Government agencies, Local government
Tropical cyclone move over Thailand	Warning (every hour or 30 minutes)	- TMD website, TMD radio, Social media, Mobile App, Hotline, SMS - press release - Traditional Media (Radios, TVs) - Government agencies, Local government

Tropical cyclone track information

TMD has improved website to provide information about the warnings in the awareness reports issued and tropical cyclone information, which background geographical information from Google Maps.



Figure 6 : tropical cyclone information
Source: <http://www.metalarm.tmd.go.th/monitor/typhoon>

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

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology				√		√	
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

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Title of item 2 : Advancement on regional radar network

Nationwide radar composite

TMD successfully applied the lowest level intensity techniques (EIL) to produces Nationwide Radar Composite Map. In this year, it increased a number of TMD radar sites (NAN, SKM), including dual-polarization weather radars (NAN, SNK, KKN, CHN, URT, SRN, SKM, NRT) used for the operational radar composite map.

WMO NO	CODE	NAME	LATITUDE	LONGITUDE	HEIGHT (m)	RANGE (Km)	SCAN TILT	Polarization
48308	CRI*	CHIANGRAI	19 57 41.00N	99 52 52.98E	440.0	240	0.9 1.3	Single
48329	LMP	LAMPHUN	18 33 55.44N	99 02 30.12E	320.0	240	0.8 1.6 2.6 3.5	Single
48331	NAN	NAN	19 07 23.5092N	100 48 47.3976E	264.7	240	0.5 1.5 2.4 3.4	Dual
48356	SNK	SAKON NAKHON	17 09 22.91N	104 07 57.33E	196.0	240	0.5 1.5 2.4 3.4	Dual
48378	PHS	PHITSANULOK	16 46 31.30N	100 13 4.39E	72.0	240	0.5 1.5 2.4 3.4	Single
48379	PHB	PHETCHABUN	15 39 24.98N	101 06 18.98E	97.0	240	0.5 1.5 2.4 3.4	Single
48381	KKN	KHONKAEN	16 27 45.00N	102 47 9.17E	217.0	240	0.5 1.5 2.4 3.4	Dual
48402	CHN	CHAINAT	15 9 28.27N	100 11 28.55E	40.0	240	0.5 1.0 1.5 3.4	Dual
48407	URT	UBON RATCHATHANI	15 14 37.00N	104 52 29.02E	155.0	240	0.6 1.0	Dual
48417	KKW	KHAO KEAW	14 21 44.00N	101 23 35.02E	1261.0	240	0.5 0.9 1.3 2.4 3.4	Single
48429	SVP*	SUARNABHUMI	13 41 11.00N	100 46 03.00E	28.0	240	0.9 1.5	Single
48432	SRN	SURIN	14 52 33.34N	103 29 45.27E	176.0	240	0.5 1.0 2.0 4.0	Dual
48438	SKM	SAMUTSONGKRAM	13 24 26.00N	100 01 55.00E	31.0	240	0.5 1.5 2.4 3.4	Dual
48475	HHN*	HUAHIN	12 35 10.00N	099 57 45.00E	30.0	240	0.8 1.6	Single
48478	RYG	RAYONG	12 38 01N	101 20 26E	34.0	240	0.7 1.3 2.2 4.0	Single
48517	CMP	CHUMPHON	10 29 35.16N	99 11 17.53E	32.0	240	1.0 1.6 2.8 4.0	Single
48551	STN*	SURAT THANI	09 08 8.00N	99 09 07.02E	33.0	240	0.7 0.7 1.1	Single
48563	KRB	KRABI	08 06 5.00N	98 58 41.02E	52.0	240	1.0 1.3 1.7 2.2	Single
48565	PKT	PHUKET AIRPORT	08 08 1.00N	98 19 46.00E	281.0	240	0.0 0.5 1.0 1.5 2.0 2.5	Single
48568	STP	SATHING PHRA	07 26 59.98N	100 27 35.98E	33.0	240	0.5 1.5 2.4 3.4	Single
48583	NRT	NARATHIWAT	06 25 36N	101 49 30.59E	32.0	240	0.5 1.5 2.4 3.4	Dual

(*) not every 15 minutes

Quantitative Precipitation Estimation (QPE)

TMD successfully applied to use an application of radar data calibration techniques for Quantitative Precipitation Estimated (QPE).

Radar composite data exchange

TMD, in collaboration with JMA and MMD, was working on experimental radar data exchange (using GRIB2 format) with the aim of achieving regional radar composite in Southeast Asia in future. Data to be exchanged area in the Southern part of Thailand (every hour on the hour) and the file name format of radar exchange is Z__C_VTBB_yyyymmddHHMMSS_RDR_TMDGPV_Gll0p01deg_Pri60lv_Aper15min_ANAK_grib2.bin when yyyy, mm, dd, HH, MM, SS is: year, month, day, hour, minute and seconds respectively.

TMD is develop a Bourne Again Shell script namely "operations_radarQPE.sh" to control new radar library in java language that developed by JMA for manipulation nationwide radar composite and quantitative precipitation estimated.

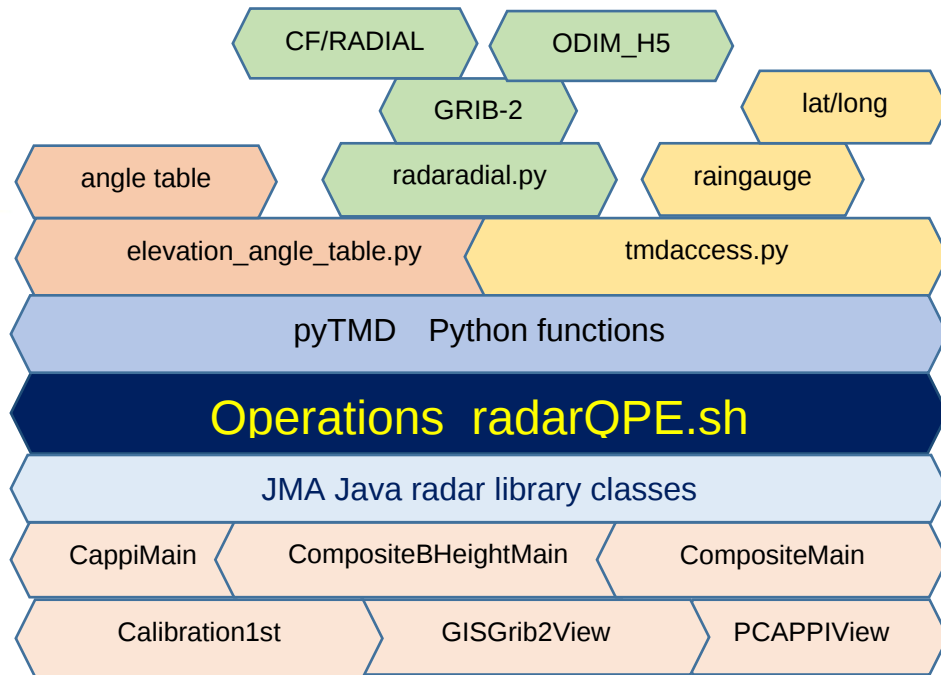


Figure 7 : Composite Beam Height and Blockage

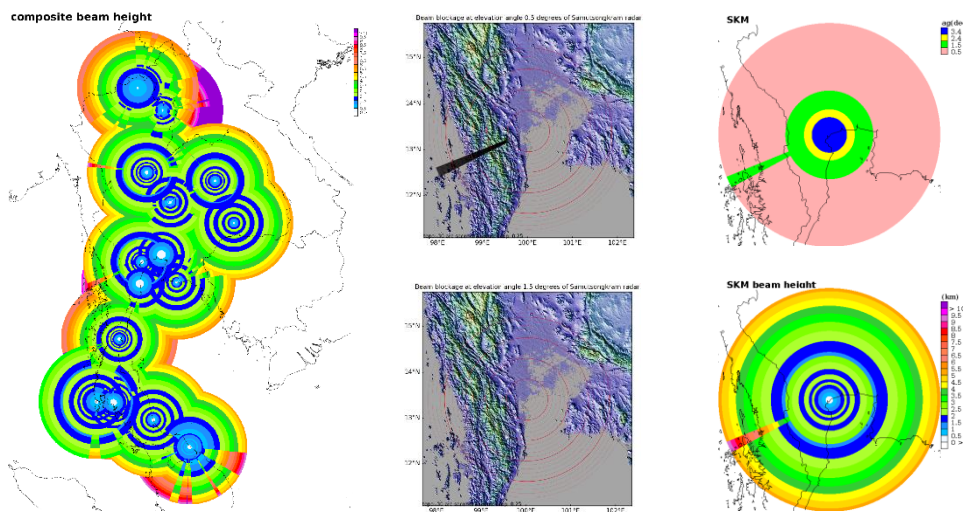


Figure 8 : Composite map at 10;00 UTC on 13 September 2016

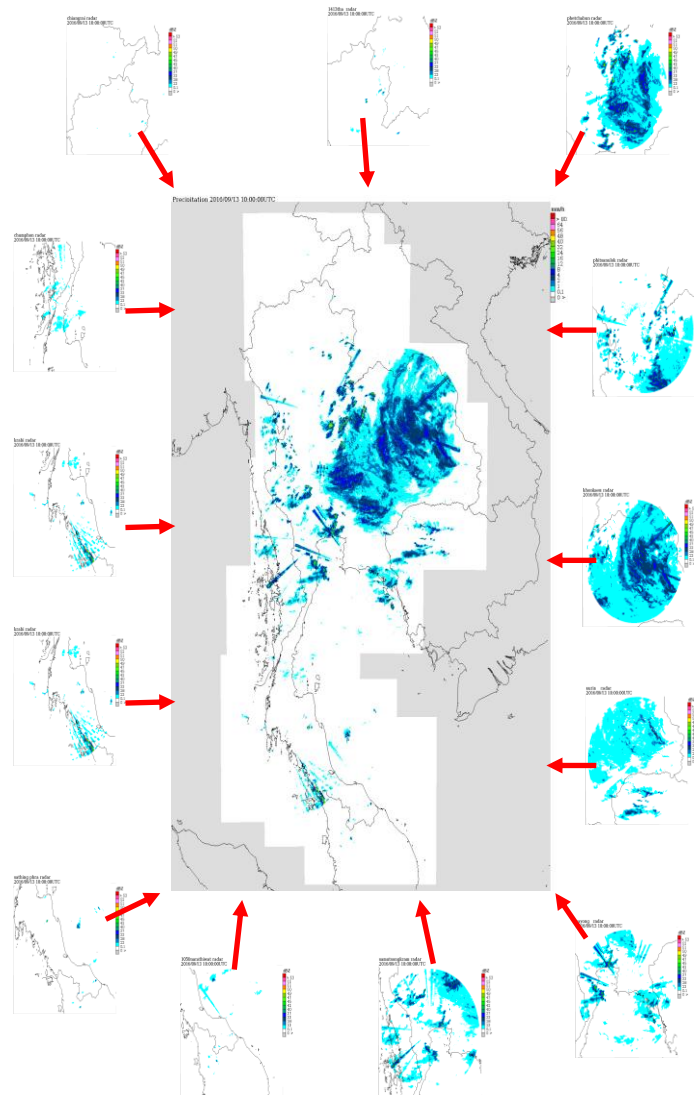


Figure 9 : Composite map at 10:00 UTC on 13 September 2016

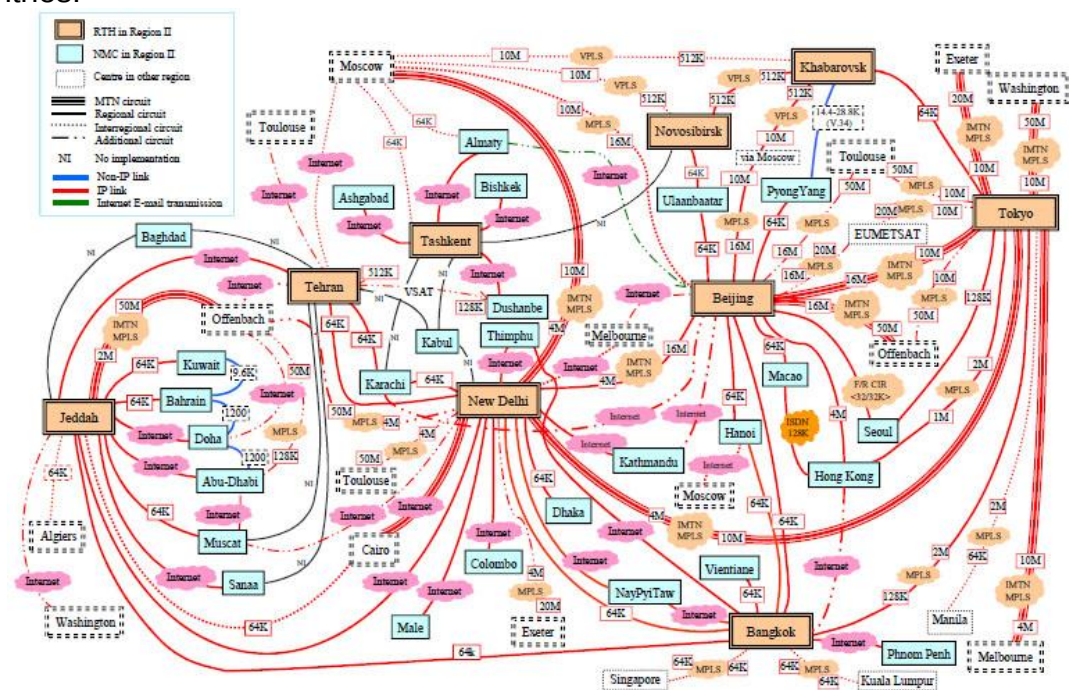
Identified opportunities/challenges, if any, for further development or collaboration:
Nil

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology						√	√
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

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The international network which is called GTS (Global Telecommunications System) network is an implemented essentially through dedicated telecommunication means with a guaranteed quality of service. This GTS network is used for international exchange among meteorological/hydrological organization, satellite data centers and numerical weather prediction centers. Recently, this network has been reinforced by selected backup plans under the bilateral agreements as follows. Lao PDR has been upgraded their system and included an internet backup link operating in parallel with leased line which is similar to New Delhi configuration. Other centers, Beijing and Hanoi, are also having backup internet link ready for operation in case of emergency. In Tokyo case, the FTP link has been included incorporating with the existing Socket link for large file transfer such as radar composite data in the future use. Osaka DR site connecting to Bangkok was also set up and tested successfully in strengthening of smooth operation. We currently have number of data connection to international centers in total of thirteen countries.



Regional Meteorological Telecommunication Network for Region II (Asia)
Current status as of 28 October 2015 (Based on the annual survey produced by RA-II EG-WIS)

Figure 10 :GTS Network for RA II

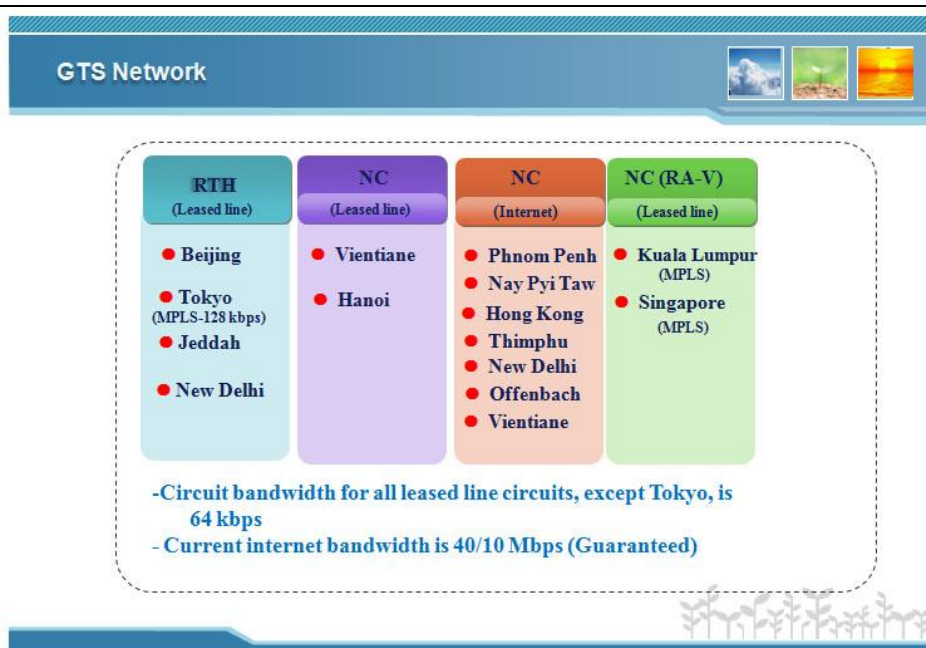


Figure 11 : GTS Network for RTH Bangkok

The DCPC Bangkok WIS Portal has been officially up and running since June 2, 2015. Other than the functioning of RTH in TMD area of responsibility, the additional product which is the URL of Ocean Wave Forecast by TMD was added to its "Product" tab in WIS portal. Other products will be considered and included in the future. To support GTS operation, Offenbach, as a GISC Tokyo backup scheme, has been receiving data from Bangkok area of responsibility through this WIS subscription.

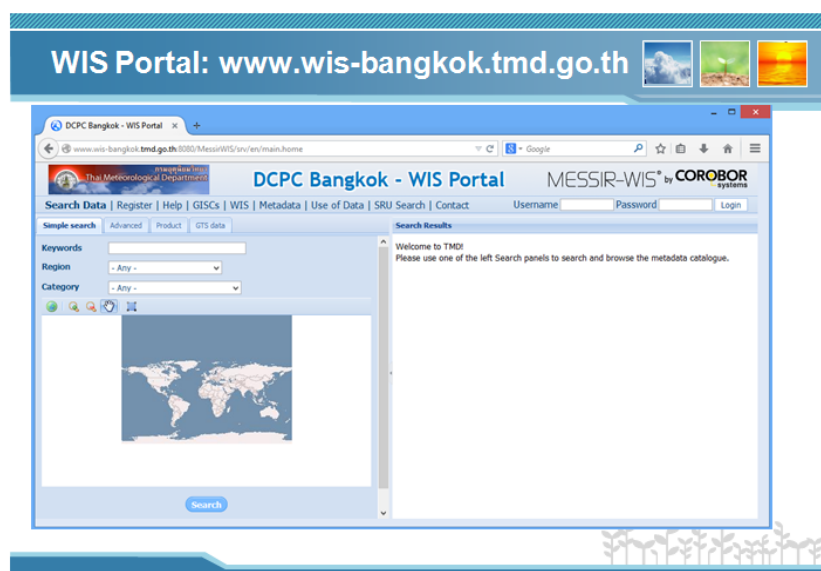
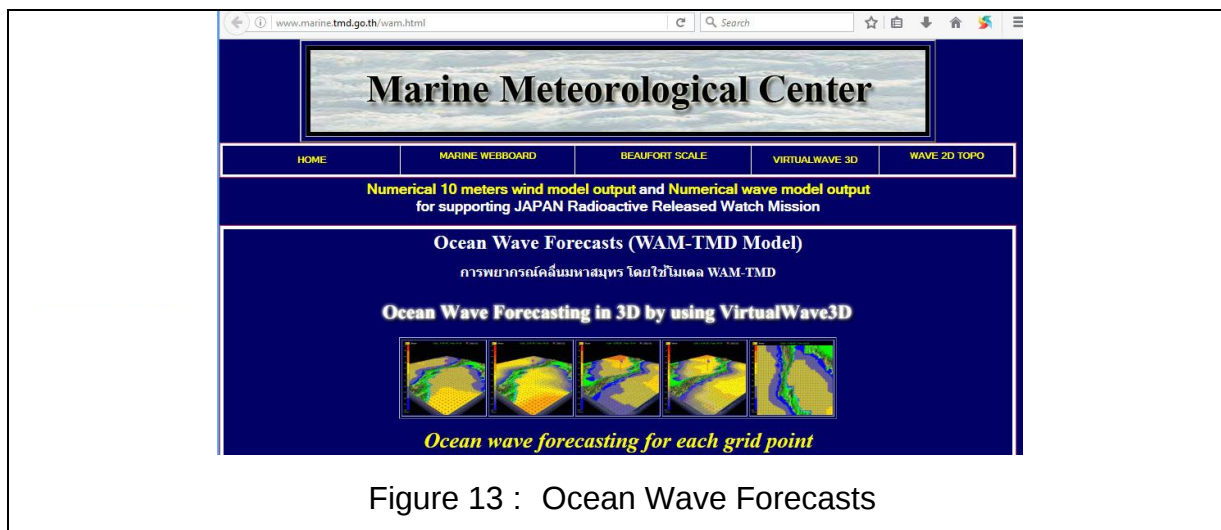


Figure 12 : DCPC Bangkok WIS Portal



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

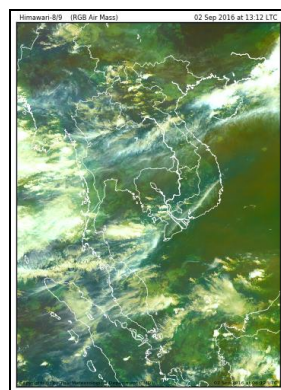
Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology				√		√	
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

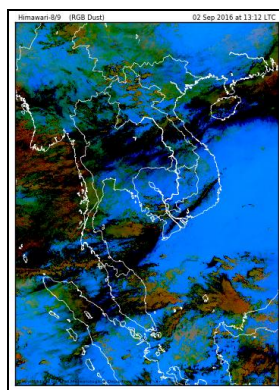
Member:	Thailand (TMD)	Name of contact for this item:	Dr.Wanchalearm Petsuwan
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Title of item 4 : Capacity Building on Radar Composite and Himawari-8

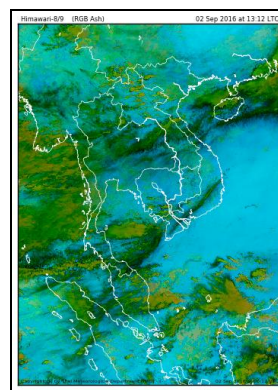
Meteorological Development Bureau of TMD has carried out Knowledge Management on Radar Composite and Himawari-8. The highlight is the techniques and practices of implementing python program for creating nationwide radar composite map in Geographical Information System (GIS) coordinate from the result of the lowest level intensity techniques (EIL) composite of each radar site by choosing nearest point and maximum value. In addition, the guide focuses on the best-practices for writing Python script to creating Red-green-blue (RGB) composite imagery and displaying color satellite images such as airmass RGB, dust RGB, ash RGB and natural color RGB to present information imagery from Himawari-8 satellite. This is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices on Radar Composite and Himawari-8 for Meteorological purpose.



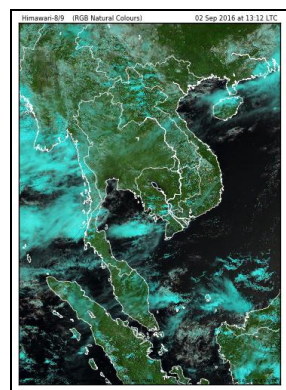
Airmass RGB



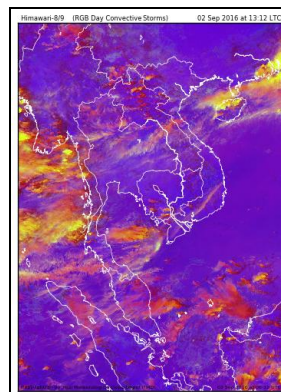
Dust RGB



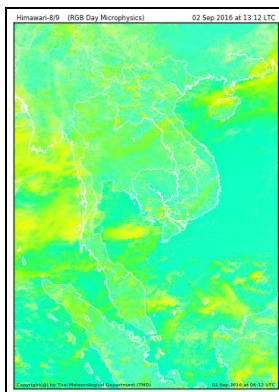
Ash RGB



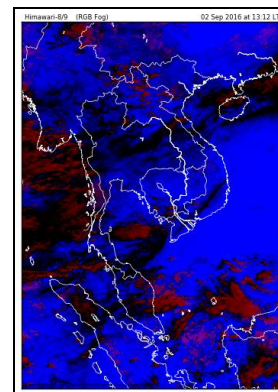
Natural color RGB



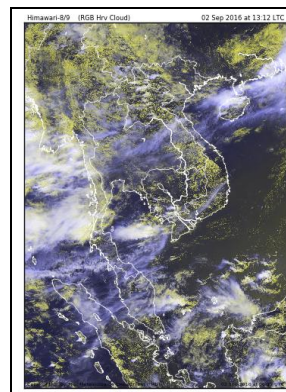
Day Convective
Storms RGB



Day Microphysics
RGB



Fog RGB



Hrv Cloud RGB

Figure 14 : RGB composite products are created by python script

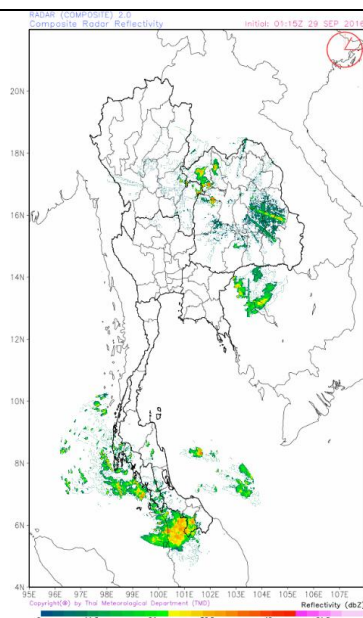


Figure 15 : Nationwide radar composite

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

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR							
Training and research						√	√
Resource mobilization or regional collaboration							

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Title of item 5 : Public weather awareness activities

The emphasis of disaster management efforts focus on communities and the people in local area. In Thailand, the public weather awareness was designed to disseminate general weather knowledge including a significant part on tropical cyclone and its impacts to students, teachers, elderly people and community etc. Otherwise, we stressed on severe weather information distribution through public via Social media and Mobile App.



Figure 16 : Public weather awareness activities in Southern Meteorological Centre, Meteorological Department

TMD held an academic seminar on the occasion of World Meteorological Day 2016 on March 23. The activity on the occasion of the WMO Day by organizing seminars to educate public better understanding the effects of global warming and extreme weather events.



Figure 17 : TMD held an seminar on the occasion of World Meteorological Day 2016

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

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR							
Training and research						√	√
Resource mobilization or regional collaboration							

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Title of item 6 : Flood impact from Southwest Monsoon in August and RAI in September

Started from 18th of May, Thailand is in the rainy season. The monsoon trough lies cross in the Northern Part of Thailand caused the heavy rainfall occurred in the upstream area.

Lately on 12th September the tropical storm 'RAI' that downgrade to tropical depression attack Thailand from Northeastern caused flooding in many provinces of Thailand from northeastern to the Northern region.

There are 22 Provinces investigated the flood in 2016.

Northern region are Mae Hong Son, Chiang Mai, Lampun, Lampang, Nan, Phayao, Phrae, Sukhothai, Pitsanulok Pichit and Petchabun.

Northeastern region are Nakhon Ratchasima, Chaiyaphum, Khonkaen and Ubon Ratchathani.

Central region are Kamphaengphet, Uthaithani, Nakhonsawan, Chinat, Lopburi, Angthong and Ayuthaya

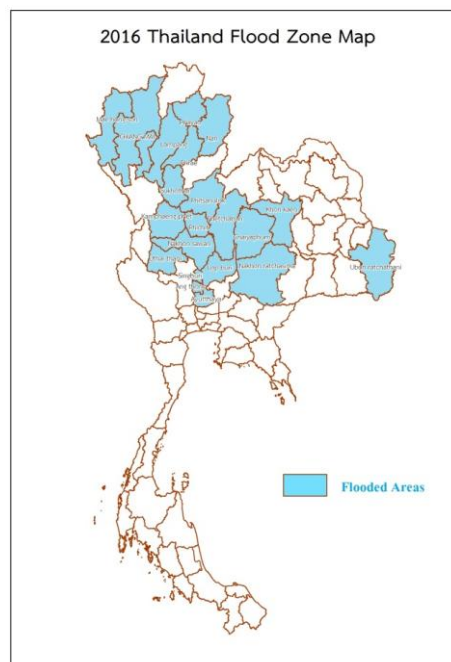


Figure 18 : Map of Flooding Province in Thailand 2016

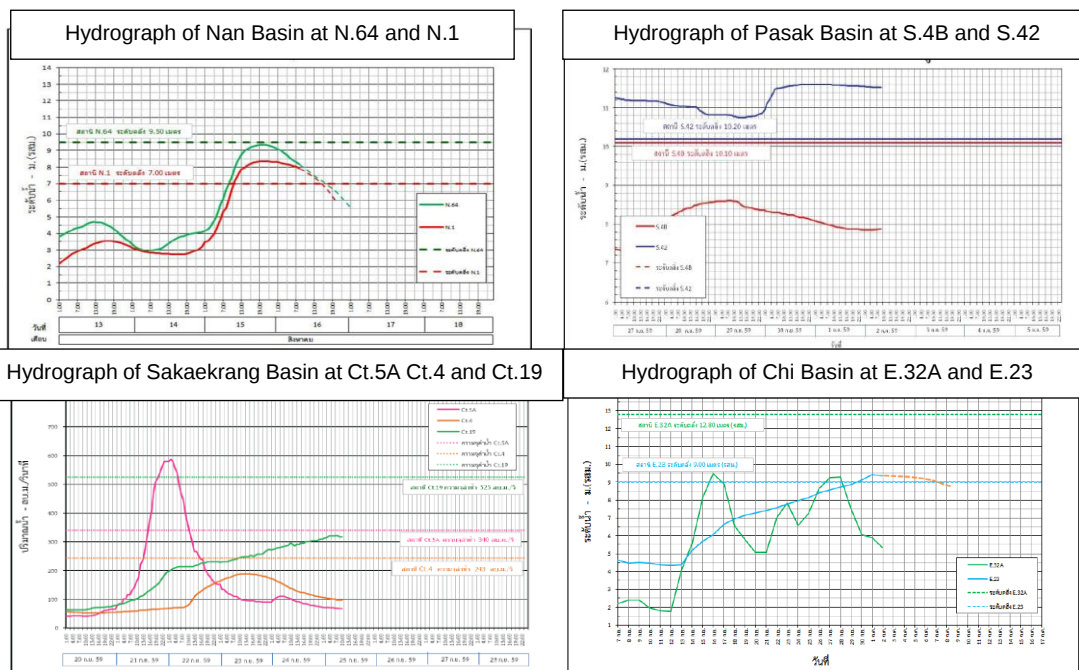


Figure 19 : Hydrograph of Nan Basin, Pasak Basin, Sakaekrang Basin and Chi Basin

The RID was responsible for monitoring, forecasting and mitigation of flood situation along with the other agencies.

The collaboration between RID and other agencies happened twice a week in term of the meeting and committee to monitoring, mitigation and summarized the situation including announce to media or public.



Figure 20 : The meeting to monitoring, mitigation and summarized the situation

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology		√		√	√		√
DRR							
Training and research							
Resource mobilization or regional collaboration							

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Title of item 7 : OSUFFIM Project (AOP4)

Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) project activities this year was the field survey in the southern region of Thailand for select the most suitable pilot city. Due to the activities last year was field survey in Hat Yai and Phuket, this year RID as the working group of hydrology took opportunity to visit the Hat Yai, Phuket and Dongguan City in China.

This program is the operation system for urban flood and will be very useful for the local officer to monitoring, forecasting, mitigation and decision making in flood situation.



Figure 21 : Field survey at Dongguan City, China

Due to the recent issue, the urban flood is very sensitive when it comes to the heavy rainfall. The drainage capacity and the warning system should be improved to reduce the impact. So this Co-Project will be very helpful.

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology				√		√	√
DRR							
Training and research							
Resource mobilization or regional collaboration							

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Title of item 8: The 2nd World Irrigation Forum and the 67th International Executive Council (IEC)

The 2nd World Irrigation Forum (WIF2) will be hosted at Chiang Mai city, Thailand from 6-12 November 2016 on the theme “Water management in a changing World: Role of Irrigation in Sustainable Food Production” with three sub-themes: (i) Key actors in balancing water, food, energy and ecology; (ii) Management of climatic extremes with focus on floods and droughts; and (iii) Key and smart actions to alleviate hunger and poverty through irrigation and drainage.

The triennial World Irrigation Forum (WIF) aims to bring together all the stakeholders involved in irrigation and drainage and allied sectors which alone can meet the growing food demand and address poverty, in times of changing climate and depleting freshwater resources and is key to the rural transformation. The Forum addresses the various multidisciplinary perspectives that encompasses agriculture water management for rural transformation and includes irrigation, drainage, flood management, drought, land reclamation, climate and environment disciplines.

WIF2 will also provide a special opportunity for corporates, where they can promote their products and services. This will be the largest business event relating to agriculture, water, and the environment. This mega event will also provide an opportunity to experience the newest skills and products simultaneously, and also allow in exchanging of information from worldwide experts in these important fields.



Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology				√			√
DRR							
Training and research							
Resource mobilization or regional collaboration							

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Title of item 9: Reduced Loss of Life from Typhoon-related Disasters.

DDPM promoted the CBDRM project to reduce risk disaster in vulnerable communities across the country by training people to prepare and respond to disaster.

Title of item 10 : Minimized Typhoon-related Social and Economic Impacts.

DDPM cooperates with other organizations such as ADPC and JICA to promote Business Continuity Plan (BCP) into private sector. The project assists them to continually operate while disaster occurs and also reduce socio and economic lost from disaster.

Title of item 11 : Improved Typhoon-related Disaster Risk Management in Various Sectors

DDPM cooperates with many organization and various sectors to strengthen capacity of disaster management such as Thai Red Cross, Save the Children, World Vision, Plan International, JICA, ADPC, UNDP, UNISDR and other relate.

Title of item 12 : Strengthened Resilience of Communities to Typhoon-related Disaster.

DDPM and Japan International Cooperation Agency (JICA) launched the "ASEAN Urban Resilience" which is the flagship project of Prevention and Mitigation working group under AADMER work programme 2010 -2015.

The project aims to enhance the resilience of ASEAN cities to disasters with the consideration of Climate Change Adaptation. One of expectation output is development of tools on building resilient in ASEAN such as guidebook

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

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR							
Training and research	√	√		√	√		
Resource mobilization or regional collaboration							

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