MEMBER REPORT

Philippines

ESCAP/WMO Typhoon Committee

13th Integrated Workshop

Chiang Mai, Thailand

5-9 November 2018

CONTENTS

I. Overview of tropical cyclones which have affected/impacted Member's area in 2017

- **Meteorological Assessment (highlighting forecasting issues/impacts)**

In 2018 only 18 tropical cyclones entered and developed inside the Philippine Area of Responsibility (PAR), five (5) were Tropical Depression, five (5) Tropical Storm (TS), two (2) Severe Tropical Storm (STS) and three (3) typhoon. From the 15 tropical cyclones shown in Figure 1, only five (5) made landfall and these were TS Bolaven (Agaton), TS Sanba (Basyang) that weakened into a Low Pressure Area (LPA) , TD (Henry), TD (Josie) and Typhoon Mangkhut (Ompong). Most of the TC's does not affect the Philippines, like TS Jelawat (Caloy), STS Maliksi (Domeng), TD (Ester), STS Prapiroon (Florita), Typ Maria (Gardo), TD (Henry), STS Ampil (Inday), TD (Josie), TS Yagi (Karding), TD (Luis), Typ Jebi (Maymay), TD (Neneng) and Typ Mangkhut (Ompong), Typ Trami (Paeng) and Typ Kong-Rey (Quennie).

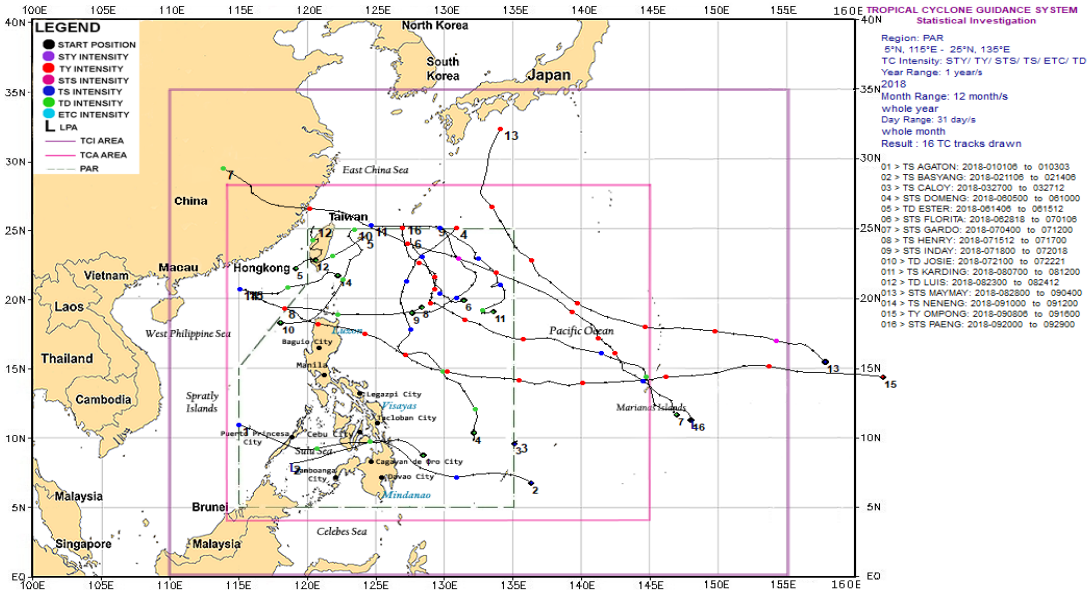


Figure 1. Tracks of Tropical cyclones that entered and developed inside the PAR in 2017

1. TS BOLAVEN (1801)

The LPA had entered the PAR on December 31st. At 4:00 PM (local time) on January 1st, the LPA developed into a tropical depression (TD) and was named locally as "Agaton" (max winds / gust = 55 / 65 kph). This prompted the issuance of the 1st Severe Weather Bulletin and the raising of Tropical Cyclone Warning Signals (TCWS) at 5:00 PM. TD"Agaton" made six landfalls during its passage and intensified into a Tropical Storm (TS) at 10:00 AM on January 3 over the West Phil. Sea and was named "Bolaven" by RSMC Tokyo, with maximum winds/gust of 65/80 kph, after traversing northeastern Mindanao and southern Visayas. A total of Php 554,724,551 was incurred from damages in infrastructure, Agriculture and private properties and affected 236,449 families in four regions of the country. There were 4 casualties and 9 injured due to flooding and landslides. (NDRRMC Final Report).

Figure 2. Track of TS Agaton

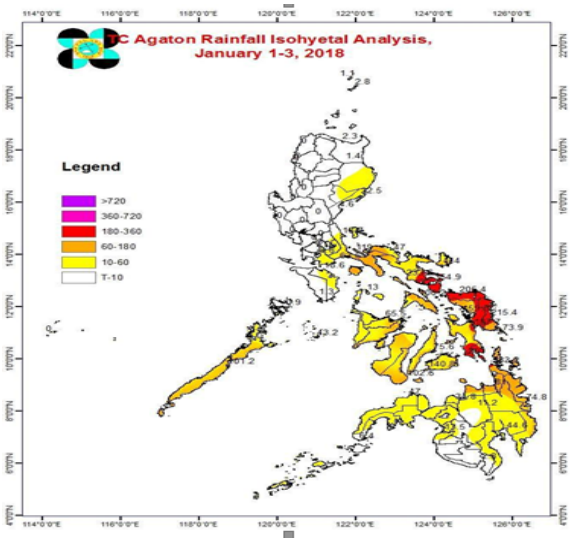


Figure 3. Spatial distribution of 24-hour rainfall during the passage of "Agaton" on January 1 - 3, 2018

Figure 4. Bolaven brings heavy rains that caused flooding over the province of Biliran.

Figure 5. Iligan City reeled from floods and landslide after the onslaught of the country's first 2018 storm.

Table 1. 4-Day Accumulated Rainfall

Station	31-Dec	1-Jan	2-Jan	3-Jan	TOTAL
LEGASPI CITY	44.8	11.8	77.5	144.3	278.4
VIRAC SYNOP	23.8	5.4	89.0	19.6	137.8
ROXAS CITY	68.0	29.5	33.0	3.0	133.5
MASBATE	117.4	45.8	43.6	10.8	217.6
SORSOGON	211.0	48.6	228.3	78.0	565.9
CATARMAN	114.8	59.1	113.6	32.7	320.2
CATBALOGAN	19.5	80.4	65.2	13.9	179.0
TACLOBAN CITY	15.9	152.4	27.6	7.7	203.6
BORONGAN	48.9	95.4	111.2	8.8	264.3
GUIUAN	35.7	52.8	18.0	3.1	109.6
PTO PRINCESA CITY	0.2	0.0	86.0	15.2	101.4
DUMAGUETE CITY	3.2	57.0	43.8	1.8	105.8
DAUIS BOHOL	21.6	140.8	0.0	0.0	162.4
MACTAN AIRPORT	T	75.6	0.0	0.0	75.6
MAASIN	4.8	200.2	0.8	0.0	205.8
SURIGAO CITY	29.7	178.8	1.4	3.0	212.9
DIPOLOG CITY	42.3	11.0	2.2	33.8	89.3
COTABATO CITY	0.6	0.0	0.3	13.2	14.1
EL SALVADOR CITY	12.4	34.8	0.0	T	47.2
MALAYBALAY	1.4	8.6	2.6	0.0	12.6
BUTUAN CITY	6.4	70.1	2.2	8.7	87.4
DAVAO CITY	T	44.0	0.6	0.0	44.6
HINATUAN CITY	8.3	26.6	33.0	15.2	83.1

2. TS SANBA (1802)

"**SANBA**" entered PAR as Tropical Storm in the afternoon of February 11, 2018. It then moved in a West Northwest direction at 25 kph in the general direction of Eastern Mindanao. Sanba maintained its intensity when it made landfall in Surigao del Sur in the morning of Sept. 13. 2018 after which it weakened into a Tropical Depession. It traversed the provinces of Surigao del Sur, Agusan del Norte and Negros Oriental. It weakened into a Low Pressure Area over the Sulu Sea before exited the PAR in the afternoon of Sept. 14, 2018. TS “Sanba” caused floodings and landslides in some Provinces but no casualties reported.

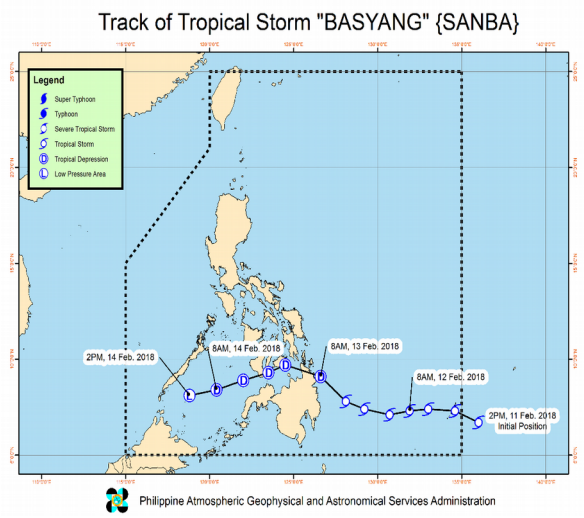


Figure 6. Track of TS Basyang

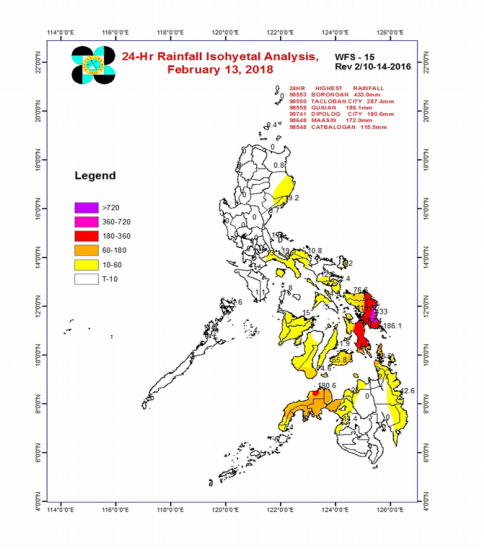


Figure 7. 24 Hr Rainfall Anaylysis Feb 13, 2018

24-HOUR RAINFALL (8AM 13 FEB – 8AM 14 FEB)

STATION	8-11AM	11AM-2PM	2-5PM	5-8PM	8-11PM	11PM-2AM	2-5AM	5-8AM	TO
BORONGAN CITY	7.0	21.0	56.0	81.0	38.0	118.0	75.0	37.6	43
TACLOBAN CITY	17.0	34.0	4.0	21.0	83.0	51.0	20.0	57.6	28
GUIUAN	12.0	15.0	24.0	17.0	26.0	22.0	42.0	28.5	18
DIPOLOG CITY	44.0	27.0	48.0	36.0	18.0	7.0	0.3	0.0	18
MAASIN CITY	41.0	9.0	0.0	2.0	0.0	1.0	0.0	118.8	17
CATBALOGAN CITY	2.0	13.0	16.0	10.0	12.0	21.0	25.0	16.3	11
SURIGAO CITY	63.0	16.0	0.4	3.6	0.6	0.0	0.0	0.2	8
CATARMAN, NORTHERN SAMAR	19.0	3.0	5.0	2.0	2.0	13.0	20.0	12.2	7
DUMAGUETE CITY	3.0	7.0	9.0	33.0	20.0	2.0	0.4	0.0	7

Figure 8. 24 Hr Rainfall on Feb 13-14, 2018

3. TS SON-TINH (HENRY)

A TD developed inside PAR from a larger circulation to the east of Luzon, called a Monsoon Depression, on 15 July 2018. It maintained a westward track towards extreme Northern Luzon where it made landfall in Camiguin, Fuga and Dalupiri Islands (Babuyan group of Islands, Cagayan) at 9:00 PM on 16 July, 1:00 AM and 1:30 AM on 17 July respectively. It intensified into a tropical storm at 8:00 AM on 17 July just before exiting the PAR.

The tropical storm occurred during a very active southwest monsoon episode such that its enhancement thereof resulted in widespread and persistent heavy rains and flash floods across much of western Luzon. No casualties reported.

4. TD (JOSIE)

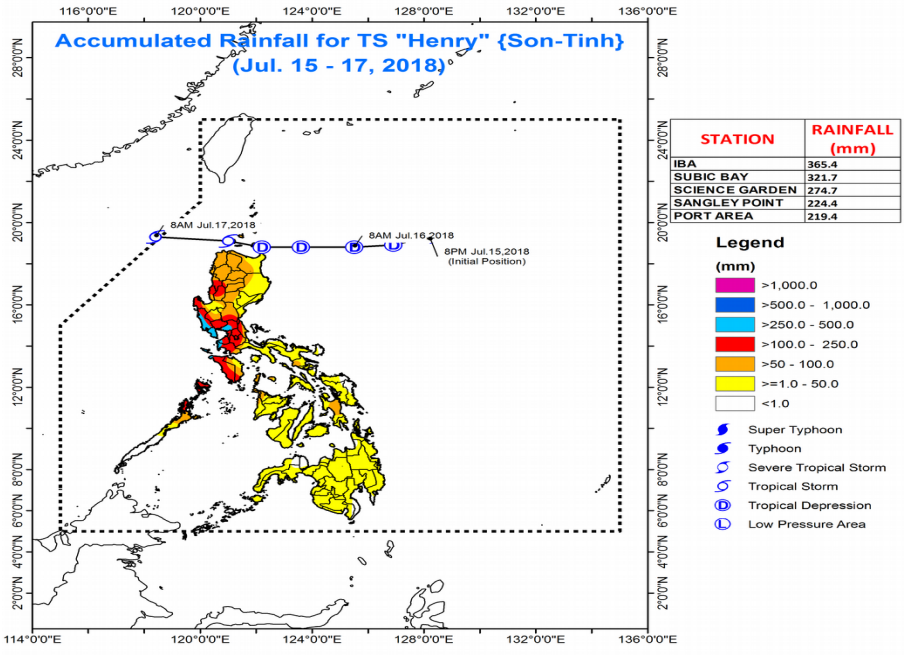
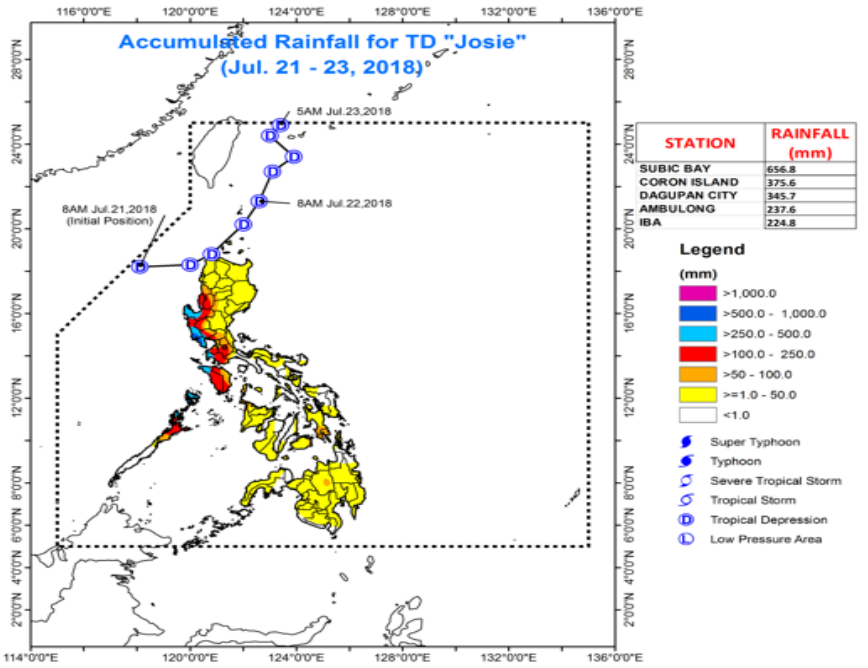


Figure 9. Accumulated Rainfall for TS Henry July 15-17,2018

“JOSIE" developed along the monsoon trough axis near the PAR boundary to the west of Luzon on 21 July 2018 at 8:00 AM. The curved track of the tropical depression steered towards the northern tip of Luzon before moving generally northward towards the southern islands of Japan. The TD did not made landfall but made its closest approach near Points Mairara and Negra in Ilocos Norte at around 6:00 PM on 21 July. During the entire warning period, JOSIE reached a peak intensity of 60 km/h and gustiness reaching 80 km/h. The TC weakening steadily as it proceeded generally northward by 22 July. The TD crossed the northern PAR boundary on 23 July at around 5:00 AM.

Due to the nature of its movement, JOSIE did not make landfall in any part of the country. However, the TC caused a significant enhancement of the Southwest Monsoon, which has been causing widespread and persistent rainfall across much of Western Luzon since the passage of the previous TCs.



Total accumulated rainfall during the passage of JOSIE (21 July – 23 July 2018)

5. TYPHOON MANGKHUT (1822)

Mangkhut was already a very strong typhoon with sustained winds of 205 kph and gust of 255 kph, when it entered the PAR on 12 September at 3:00 PM. While inside the PAR, OMPONG started its gradual transition from westward to a more west-northwestward movement at an average speed of 25 kph as it skirts the periphery of the weaker portion of the ridge of high pressure area. The typhoon made landfall over the remote area of Baggao, Cagayan at 1:40 AM on 15 September. Interaction with the rugged terrain of Northern Luzon after landfall caused the typhoon to weaken significantly after traversing landmass. OMPONG left the landmass of Luzon at around 10:00 AM on 15 September with winds of 170 kph and gust of 260 kph after traversing the mountainous area of Cordillera. It exited PAR later that day at 9:00 PM, with an estimated maximum sustained winds of 145 km/h and gustiness of up to 165 km/h. The typhoon continued northwestward towards southern China where it made landfall in China’s Guandong Province. The typhoon caused widespread damage across Northern and Central Luzon due to its intense nature and large size (~ 900 km). Interaction with the rugged terrain of

Northern Luzon have aggravated the nature of rainfall, which caused flooding and landslides especially in the mountainous Cordillera Administrative Region (CAR).

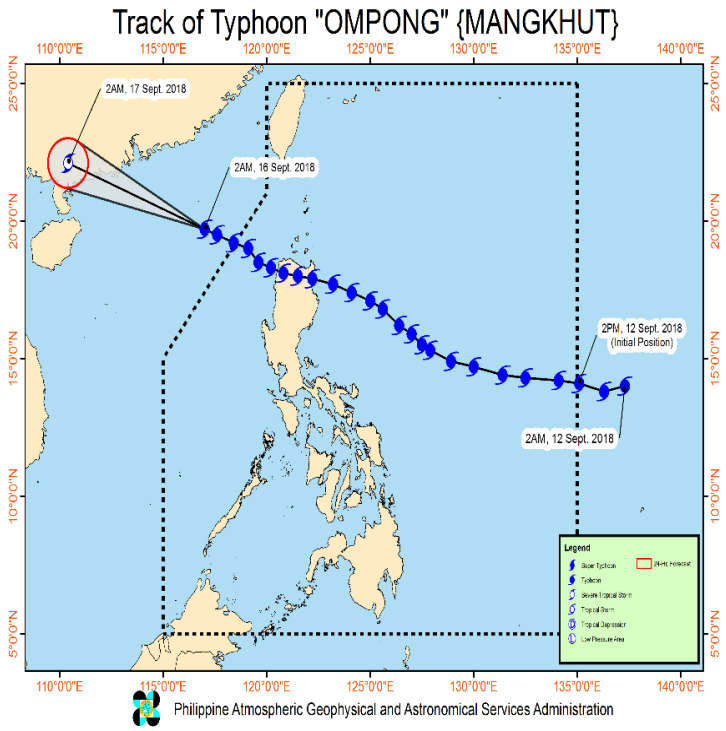


Figure 11. Track of TY Ompong

Table 2. Significant Meteorological Observations

STATION	Gustiness (m/s)	Gustiness (km/h)
Aparri	49	176
Basco	38	140
Tuguegarao	44	160
Casiguran	25	90
Baler	42	150
Calayan	32	115
Laoag	35	125
Baguio	20	75
Dagupan	22	80

*** Lowest recorded pressure (Tuguegarao) : 949.0 hPa**

*** Highest recorded Max sustained winds (Aparri): 30 m/s (108 km/h)**

*** No direct observations prior to landfall**

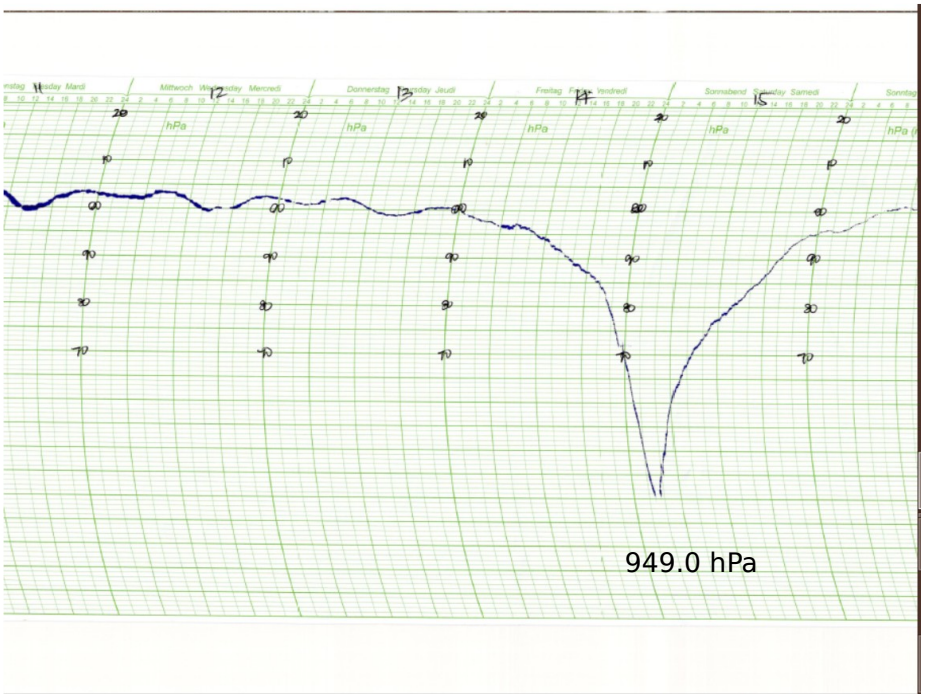


Figure 12. Tuguegarao City Microbarograph

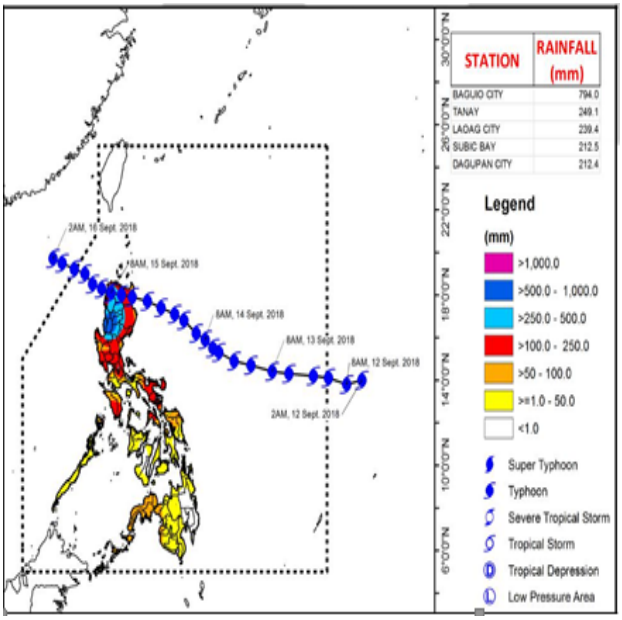


Figure 13. Rainfall Distribution during the passage of TY OMPONG (12 -15 September 2018)

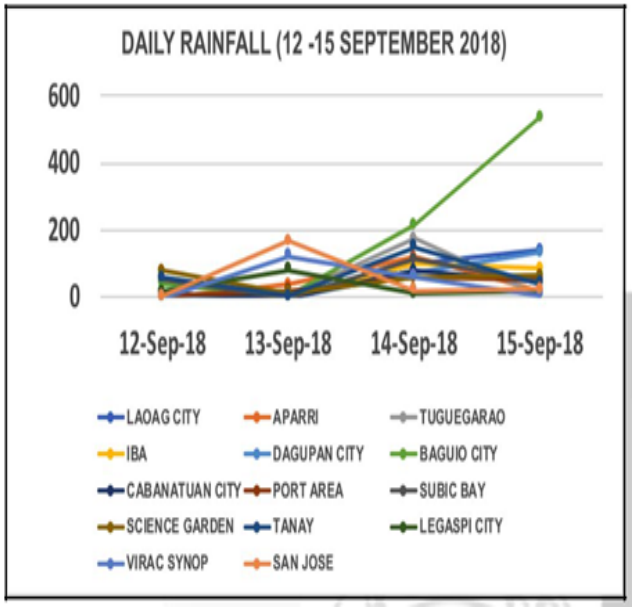


Figure 14. Daily Rainfall during the passage of TY OMPONG (12 -15 September 2018)

The highest rainfall was received over Luzon particularly in the Ilocos and Cordillera Administrative Regions (areas shaded in blue in *Figure 2*), with the highest observed 4-day rainfall (12 – 15 September) of 794 mm in Baguio City, Benguet. This value has exceeded the typical amount of rainfall for the month of September by 39.1%.

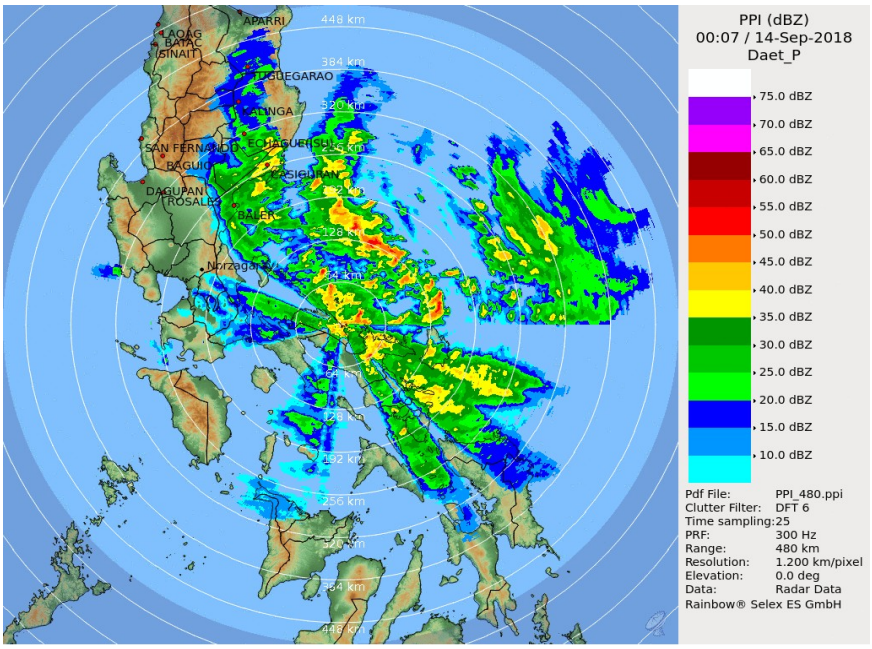


Figure 15. 10PM (Sept14), Latest on DAET Doppler Radar

TY OMPONG MADE LANDFALL OVER BAGGAO, CAGAYAN AT 1:40 AM (SEPTEMBER 15, 2018)

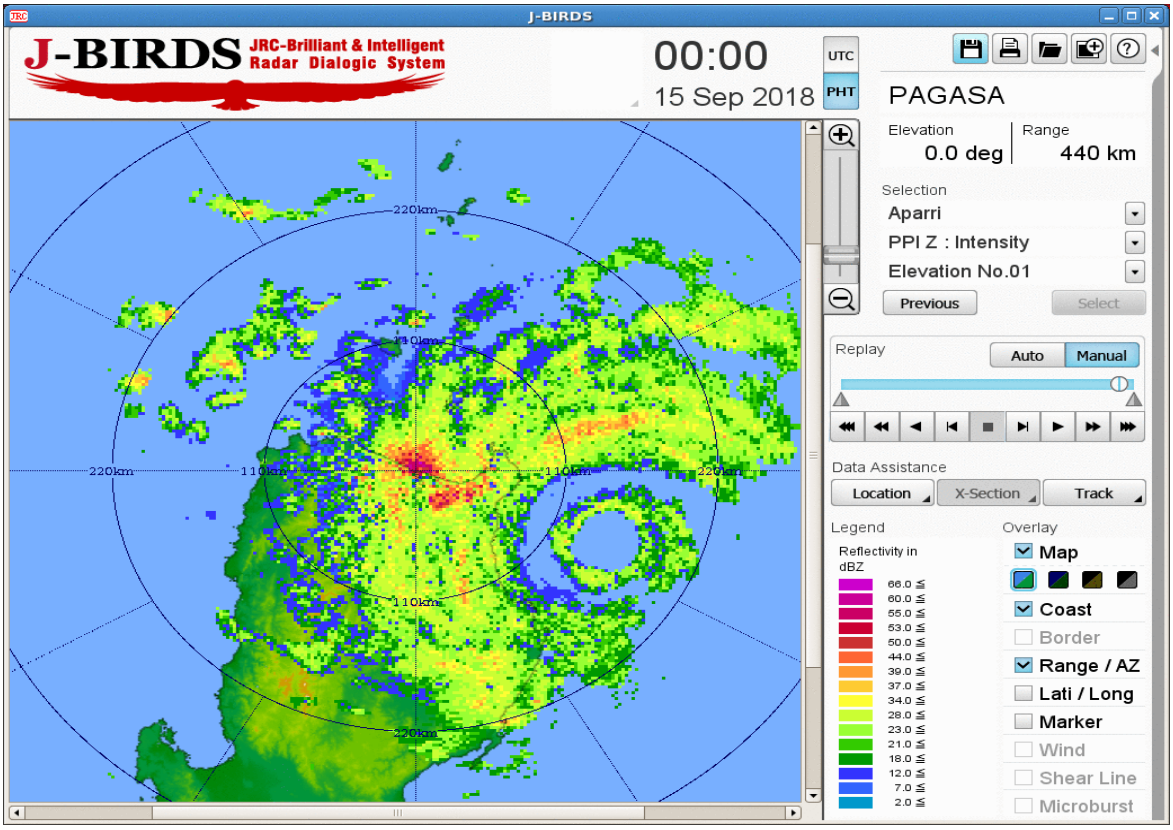


Figure 16. APARRI DOPPLER RADAR ANIMATION

Warning Information

- 23 Severe Weather Bulletins (SWB) 4 Tropical Cyclone Advisories (TCA)
- 14 International Warning for Shipping (IWS)
- The first TCA was issued on 10 Sept at 11:00PM and the first SWB was issued on 12 Sept. at 5:00PM.
- 37 provinces were placed under Tropical Cyclone Warning Signals (TCWS) during the passage of Typhoon Mangkhut.

Damage Statistics

- 82 casualties, 138 injured and 2 are missing
- A total of 681, 144 families were affected.
- Total cost of damages to infrastructure and agriculture was P33.6B in Regions 1,2,3 and the Cordillera Administrative Region (CAR). Site Rep. #48

Reported by the National Disaster Risk Reduction and Management Council (NDRRMC) as of 29 September 2018.

Effects of Typhoon Mangkhut

A deadly landslide in Barangay Loacan, Itogon, Benguet

Tuguegarao City after after the passage of Typ Mangkhut

All gone after losing his house to ferocious winds unleashed by Typ Mangkhut

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

Of the 17 tropical cyclones that impacted Philippines, only TS Bolaven and Typhoon Mangkhut caused severe damages to properties and agriculture due to flooding and landslides. There were 138 casualties caused by drowning and buried due to landslides.

PAGASA issued Flood Bulletins for telemetered River Basin and Flood Advisories for Non-Telemetered River Basin in Luzon and some regions in Visayas and Mindanao during the passage of these tropical cyclones.

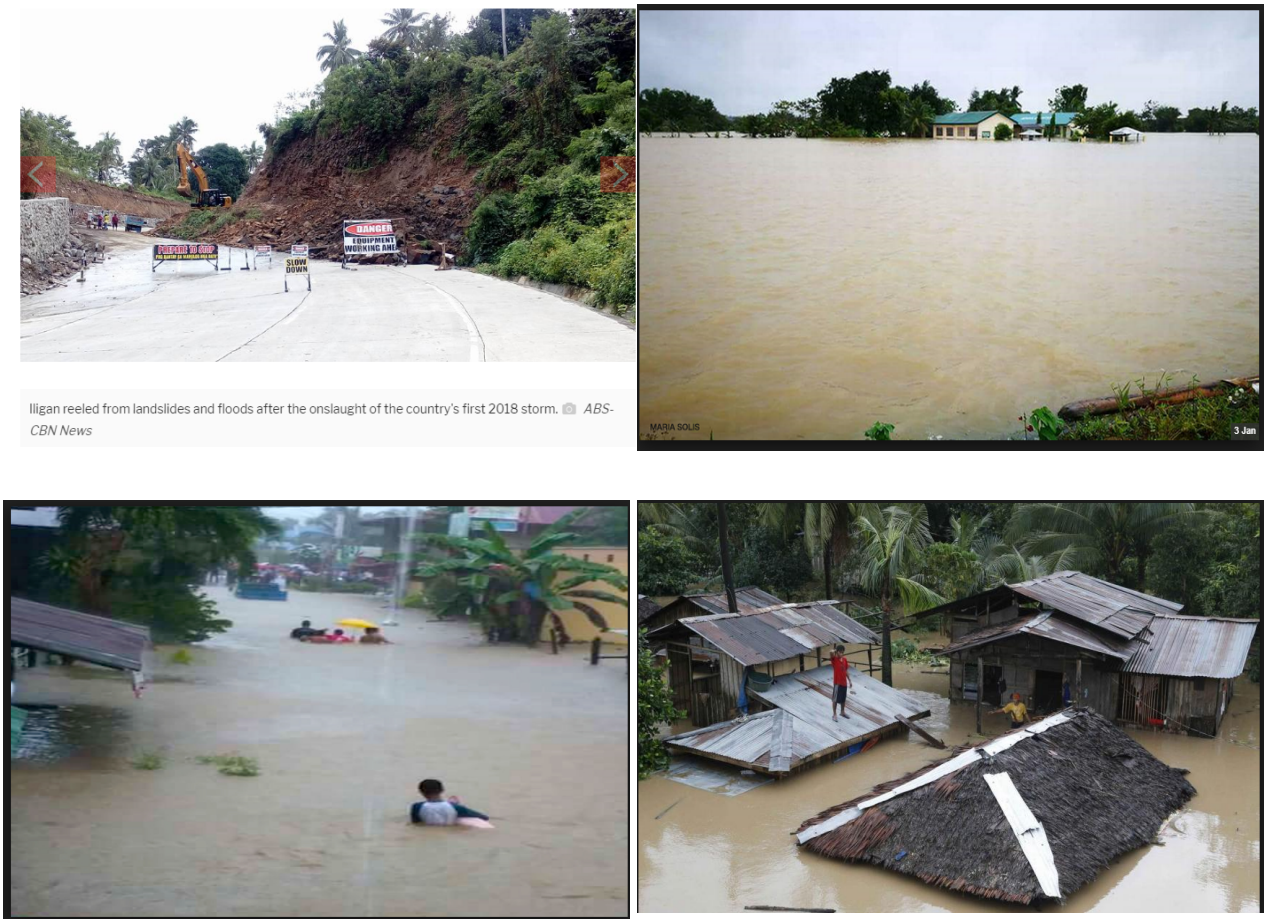


Figure 17. Flooding caused by TS Bolaven

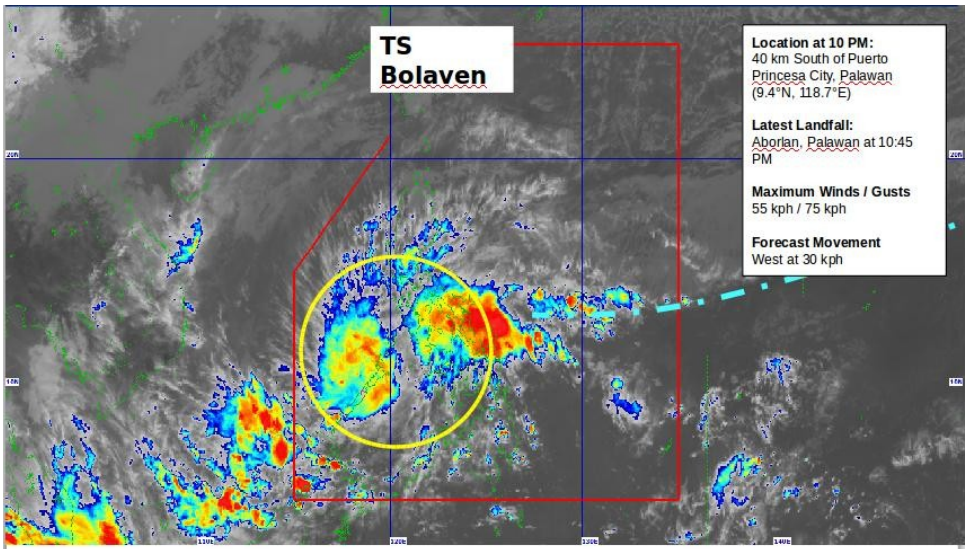


Figure 18. DOST-PAGASA – HIMAWARI ENHANCED- INFRARED (E-IR)
2 JANUARY 2018 TUESDAY

Effects of Typhoon Mangkhut

Flooding and flasfloods

Issued Warning

For 2018, a total of 485 General Flood Advisories were issued to different regions that served as warnings for possible flooding due to tropical cyclones and other heavy rain carrying system. Regions III, IVA and IVB, were issued most number of advisories since the location of these are prone to the effect of southwest monsoon especially if it is enhanced by tropical cyclones.

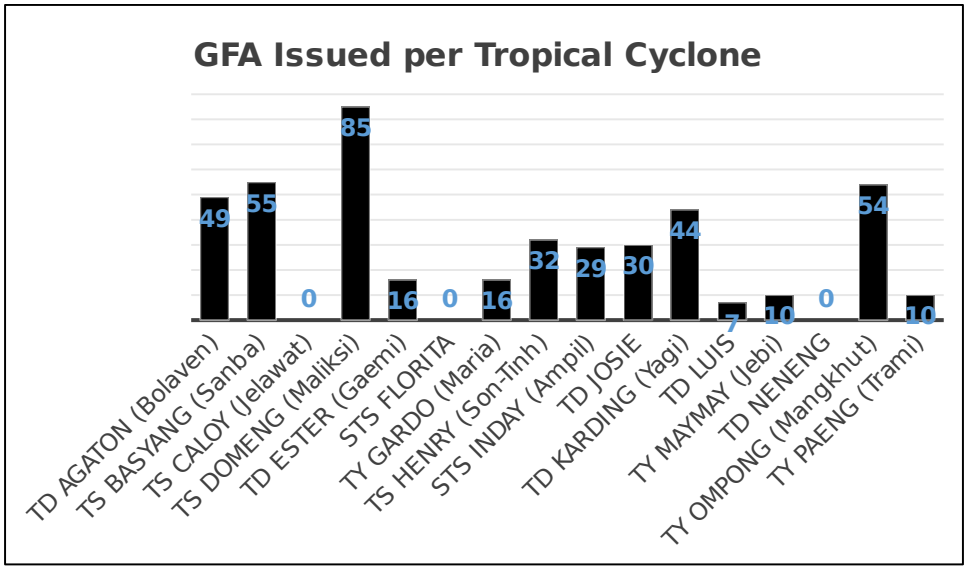


Figure 19. Total General Flood Advisories issued per region for 2018(as of October 2018)

Typhoon Domeng (Maliksi) caused the most number of GFA issuances for the Philippines because it stayed in the Philippine Area of Responsibility for quite some time enhancing the Southwest monsoon. Typhoon Ompong (Mangkhut) also caused the FFWS to issue a number of flood advisories for the country especially in the northern region.

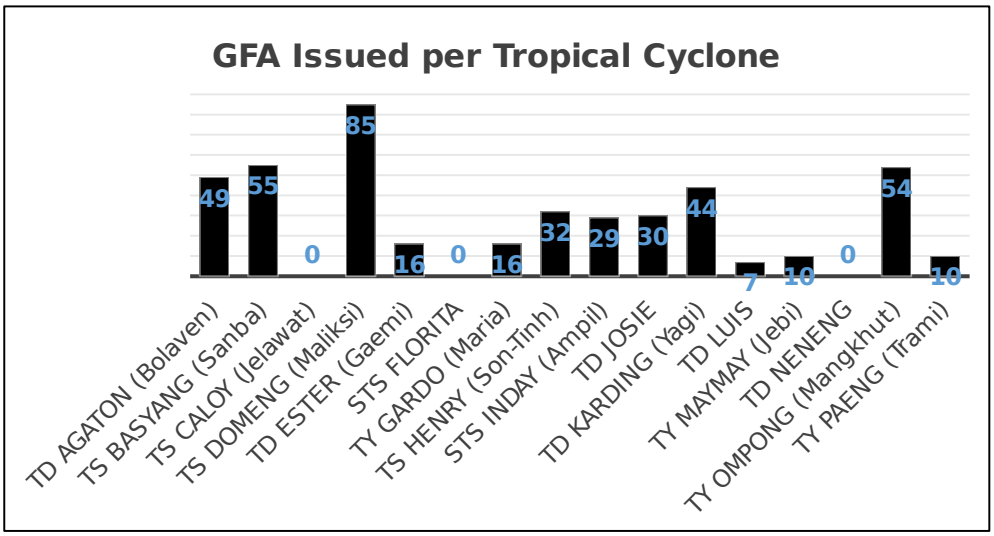


Figure 20. Total General Flood Advisories issued per Tropical Cyclone for 2018 (as of September 2018)

Among the telemetered river basin, Pampanga River Basin Flood Forecasting and Warning Center (FFWC) has issued the most flood bulletins and advisories with a total of 24. On the other hand, Agno River Basin FFWC issued a total of 22 similar warning to their respective warning areas. The warnings are mainly due to Typhoons Florita (Prapiroon), Gardo (Maria) and Tropical Depression Josie.

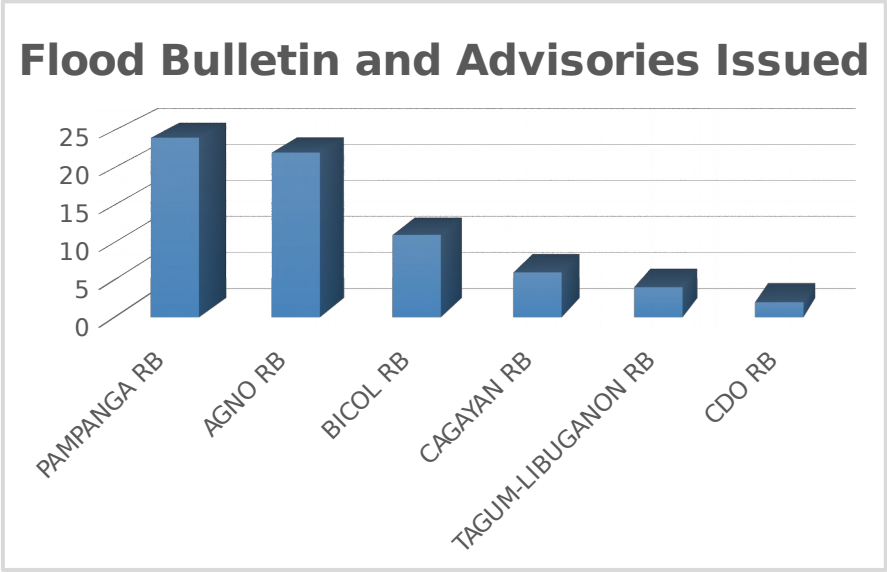


Figure 21. Total Flood Bulletins and Flood Advisories issued per Telemetered River Basin FFWC for 2018 (as of October 2018)

Because of the Tropical Cyclones that passed the areas in Luzon either enhanced or not by southwest monsoon, major dams located within different major river basins had undergone discharge operations since their elevations reaches the normal high. The table shows their scheduled water releases that prompt the FFWS to issue flood warnings to the target areas in the river downstream.

Table 3. Dam Discharge Operation

DAM	SOUTHWEST MONSOON	SOUTHWEST MONSOON/ LPA/ TD KARDING(Yagi)	SOUTHWEST MONSOON	TY OMPONG (Mangkhut)
Ambuklao	21/7 - 01/8	03-05/8	21/7 - 01/8	12-27/9
Binga	20/7 - 02/8		09/8 – 05/8	13-27/9
San Roque				15-27/9
Magat	29/7 - 01/8	08 -17/8		13-20/9

TC Members' Report

Summary of Progress in KRAs

Title of item (1):Reduced Loss of Life from Typhoon Related Disasters

1. Doppler Radar for Tropical Cyclone and Marine Observations

A new C-band and S-band Doppler Radar installation were ongoing in Agno, Bohol, Samar and Masbate. These Radars will be operational late this year or early next year. The radars would be used in monitoring tropical cyclones when the TC is over inland in any part of the country and over offshore as long as it is within the range. These radars will also cover the blind areas of the existing radars. This will also be used in rainfall monitoring and warning by the PAGASA Regional Services Division throughout the country.

FIG 22. RADAR STATIONS

Table 4. Existing and Under Construction Radars

SITE	BAND	TRANSMITTER	PEAK POWER	SITE ELEV.	BLDG. HEIGHT	MAX RANGE (KM)	VOLUME RANGE (KM)	FREQUENCY
Existing Site								
1. SUBIC	S	Magnetron	850 kW	516 m	40 m	480 km	240 km	2800 MHz
2. HINATUAN	S	Magnetron	850 kW	3 m	34 m	480 km	240 km	2705 MHz
3. TAGAYTAY	C (Dual Pol)	Magnetron	250 KW	752 m	30 m	480 km	240 km	5612 MHz
4. MACTAN	C (Dual Pol)	Magnetron	250 KW	25 m	21 m	480 km	240 km	5610 MHz
5. TAMPAKAN	S	Magnetron	850 kW	1044 m	23 m	480 km	240 km	2750 MHz
6. JARO, ILOILO	S	Magnetron	250 kW	10 m	21 m	480 km	240 km	2870 MHz
7. APARRI, CAGAYAN	S	Solid State	10 kW	2 m	34 m	440 km	200 km	2850 MHz
8. VIRAC, CATANDUANES	S	Solid State	10 kW	228 m	33.5 m	440 km	200 km	2850 MHz
9. GUIUAN, SAMAR	S	Solid State	10 kW	56 m	25 m	440 km	200 km	2850 MHz
10. BAGUIO	C	Magnetron	500 kW	2256 m	15 m	480 km	240 km	5640 MHz
11. DAET (under repair)	S	Magnetron	1 MW	9 m	21 m	480 km	240 km	2850 MHz
12. BALER (under repair)	S	Magnetron	1 MW	176 m	6 m	480 km	240 km	2830 MHz
13, BASCO (under repair)	C	Magnetron	250 kW	166 m	6 m	500 km	250 km	5600 MHz
14. QUEZON, PALAWAN		Magnetron	250 kW	17 m	21 m	500 km	250 km	5600 MHz
15. ZAMBOANGA		Magnetron	250 kW	7 m	24.6 m	500 km	250 km	5600 MHz
16. BUSUANGA, PALAWAN (under repair)		Magnetron	250 kW	220 m	18.6 m	500 km	250 km	5600 MHz
New (On-Going Site)								
1. AGNO, PANGASINAN	S	Magnetron						
2. BOHOL	S	Magnetron						
3. LAOANG, SAMAR	C	Solid State						
4. MASBATE	C	Solid State						

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

As of now, we find it very difficult to identify tornado in Radar images, we need enhancement training on Radar images analysis specially on tornado and hailstorm formation within the severe thunderstorm cells. It is still a problem to us to forecast this kind of weather phenomena.

2. **High Frequency Doppler Radar (Coastal Radar)**

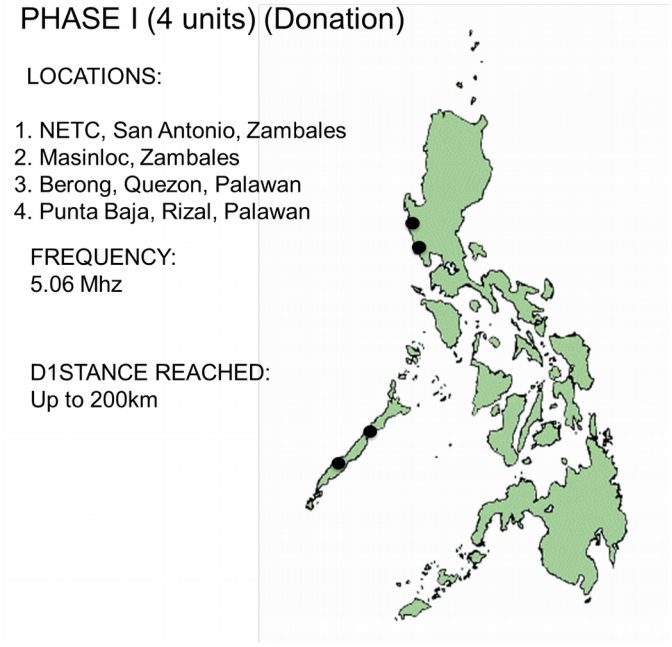
PAGASA has installed High Frequency Doppler Radar (Coastal Radar) along the nautical highway that connect the three main islands, Luzon, Visayas and Mindanao and in the inter-island shipping lanes where many Ferry Boats and small Sea Vessels are plying. These Coastal Radars are used to monitor the wind speed and direction, wave height and ocean current which can be used in the issuance of Gale Warning for small sea vessels and to monitor oil spill if sea accident happen. This can also be used to monitor and track weaker TC's.

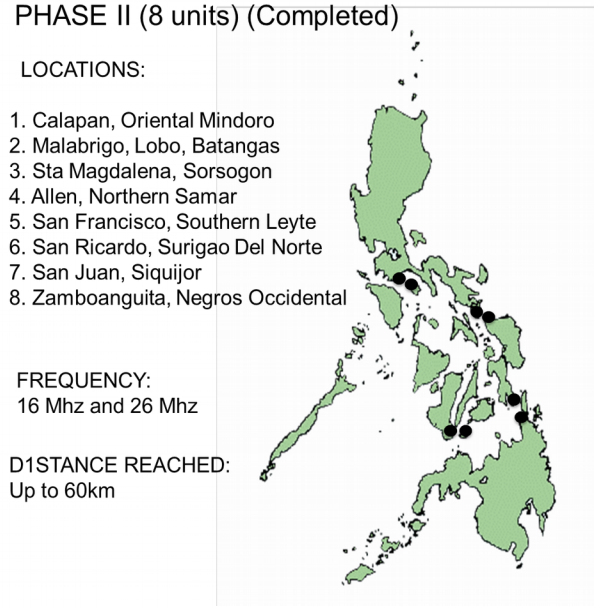
Identified opportunities/challenges, if any, for further development or collaboration:

As of now, construction is still going on for some areas and for those already completed, we are in the process of validating the data.

PAGASA HIGH FREQUENCY DOPPLER RADAR UPDATE (COASTAL RADAR)

- Four Phases





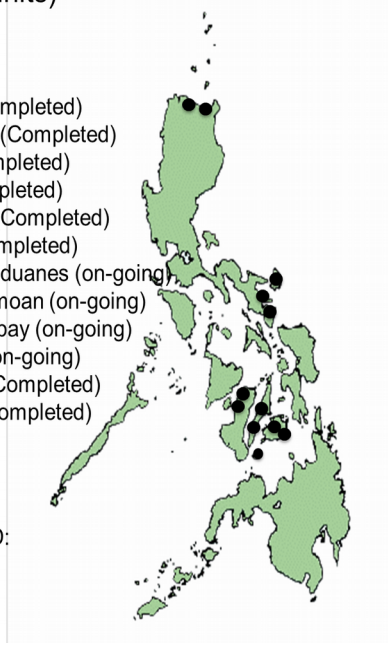
PHASE III (12 units)

LOCATIONS:

1. Buguey, Aparri (Completed)
2. Ballesteros, Aparri (Completed)
3. Carcar, Cebu (Completed)
4. Argao, Cebu (Completed)
5. Bacolod, Bacolod (Completed)
6. Silay, Bacolod (Completed)
7. San Andres, Catanduanes (on-going)
8. Guijalo Port, Caramoan (on-going)
9. Jonop, Malinao, Albay (on-going)
10. Panglao, Bohol (on-going)
11. Valencia, Bohol (Completed)
12. Maria, Siquijor (Completed)

FREQUENCY:
13 Mhz and 26 Mhz

D1STANCE REACHED:
Up to 60km



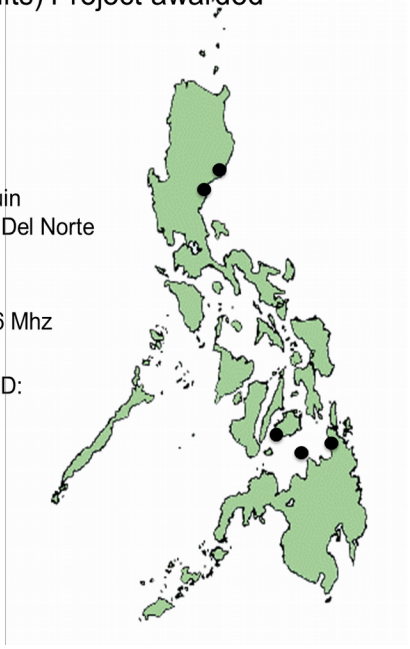
PHASE IV (5 units) Project awarded

LOCATIONS:

1. Delapigue, Baler
2. Dilasag, Aurora
3. Jagna, Bohol
4. Mambajao, Camiguin
5. Malimono, Surigao Del Norte

FREQUENCY:
5 Mhz, 13 Mhz and 26 Mhz

D1STANCE REACHED:
60km and 200km



THIRD PAIR LOCATION:

SAN RICARDO, SOUTHERN LEYTE
FREQ: 16MHZ, ANTENNA ELEMENT: 12 FOR RX, 4 FOR TX
SAN FRANCISCO, SURIGAO DEL NORTE
FREQ: 26MHZ, ANTENNA ELEMENT: 8 FOR RX, 4 FOR TX

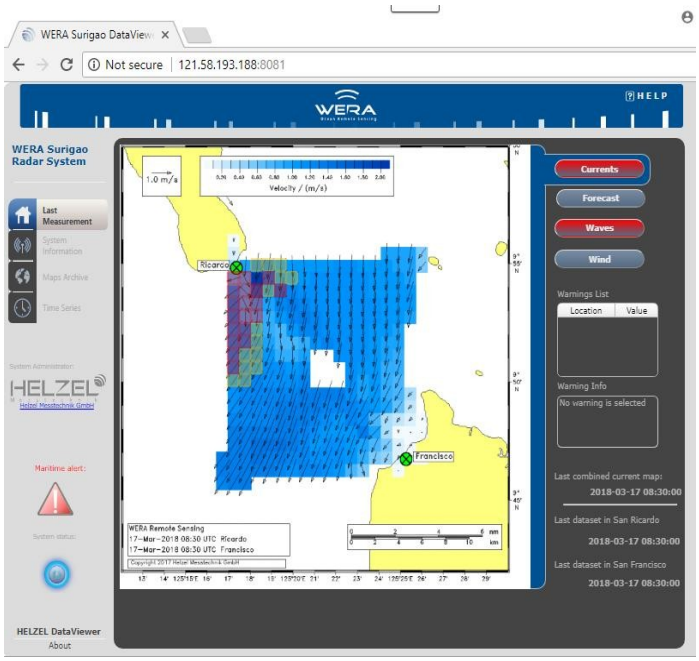


Figure 23. SAMPLE DATA DISPLAY

Figure 24. SAN RICARDO, SOUTHERN LEYTE

Figure 25. SAN FRANCISCO, SURIGAO DEL NORTE

ESTABLISHMENT OF FLOOD FORECASTING AND WARNING SYSTEM FOR 13 MAJOR RIVER BASINS

PAGASA as the National Meteorological and Hydrological Service (NMHS) of the Philippines is mandated to provide hydro-meteorological warnings for public safety. One of the main service of PAGASA is to provide flood warnings and information.

On these aspect, PAGASA has already established flood forecasting and warning systems for five (5) major river basins. The Philippines has a total number of eighteen (18) major river basins. PAGASA is currently undergoing an Automation and Modernization Programs on its services and one of the priority project under these programs is the further improvement of its flood forecasting and warning services. Below are tables showing the updates of the said project. Table 1 shows the update of the flood forecasting and warning centers. Of the thirteen major river basins, ten (10) centers are to be constructed. The Jalaur River Basin Flood Forecasting and Warning Center will be co-located with the Iloilo RADAR while the Cagayan de Oro and Tagoloan River Basin will be using only one (1) center. The status of the construction of the centers are shown in column number three (3). Table 2 shows the update on the installation of hydrological monitoring equipment in the thirteen major river basins.

Table 5: Update on the construction of the Flood Forecasting and Warning Centers

River Basin	Flood Forecasting and Warning Center (FFWC)		
	Location	**Status**	**Target Completion Date**
1. Abulog	Tuguegarao City	Project Completed	
2. Abra	Vigan City Nursery	Project Completed	
3. Ilog-Hilabangan	Kabankalan City Hall Cmpd.	Project Completed	
4. Jalaur	Iloilo RADAR (Co-located)		
5. Panay	Roxas Synoptic Station Complex	On-going	(December 2018)
6. Agusan	Prosperidad City	Contract terminated (87.15% - Dec 2016)	PAGASA take over (December 2018)
7. Tagum-Libuganon	Tagum City	Project Completed	
8. Davao	Davao Synoptic Station Complex	Project Completed	
9. Buayan-Malungon	Gen. Santos City Synoptic Station Complex	Project Completed	
10. Mindanao	Cotabato City Hall Compd.	Contract terminated	For Re-bidding
11. Agus	Iligan City	On-going	
12. Cagayan de Oro	MPRSD Compound El Salvador City	On-going	(December 2018)
13. Tagoloan			
Summary	Project Completed = 6 On-going = 3 Project Terminated = 2 **Total = 11**		

Table 2: Update on the installation of hydrological monitoring stations

River Basin	Hydro-Meteorological Monitoring Facilities (ARG/AWLG/AWS)		
	Funding Source	**Status**	**Target Completion Date**
1. Abulog	NPGA 2014	Final sites to be surveyed (with JICS)	December 2019
2. Abra	GAA	Conducted commissioning and testing (January 2018)	October 2018
3. Ilog-Hilabangan	GAA	On-going installation (40% Completed)	December 2018
4. Jalaur	RIMES Project	Project Completed	
5. Panay	GAA	On-going installation (98% Completed)	October 2018
6. Agusan	PMP	NOA: (Issued) NTP: (Issued)	March 2019
7. Tagum-Libuganon	GAA	Project Completed	
8. Davao	Equipment: NPGA 2012 Installation: GAA	For Commissioning and Testing	October 2018
9. Buayan-Malungon	Equipment: NPGA 2012 Installation: GAA	On-going Installation (85% Completed)	December 2018
10. Mindanao	PMP	NOA: (Issued) NTP: (Issued)	March 2019
11. Agus		(No project yet)	
12. Cagayan de Oro	CCC/NDMI	Project completed	
13. Tagoloan	Equipment: NPGA 2012 Installation: GAA	On-going Installation (85% Completed)	December 2018
Summary	Project Completed = 3 On-going = 8 For Survey = 1 (NPGA 2014) No Project yet = 1 **Total = 13**		

Title of item (2):Minimized Typhoon Related Social and Economic Impacts

Information and Educational Campaign to Strengthen the Readiness and Resilience of Communities to Typhoon-related Disasters

PAGASA conducted regular exercises and drills every year on tropical cyclone disaster prevention and preparedness with relevant government departments and organizations. Information and Educational Campaign (IEC) is also a continuing activities of the agency especially to the tri-media, local government units (LGU's) and other agencies involve in disaster preparedness, relief and rescue activities.

Figure 26. Information, Education and Communication Campaign for LGU

Figure 27. Flood Drill

Title of item (5):

Continual Capacity Building Through Various Trainings and Workshops

PAGASA also conducted regular workshops and trainings to PAGASA personnel to capacitate and enhanced their knowledge of the new technology used and to familiarize them with the products/information and warning that we issued during the occurrence of inclement weather.

Seminar/Workshop on Rainfall Warning System for Personnel of PRSDs
04-06 April 2018

Operational JMA Wave Modeling Training
WMO/RTC Training Room 2
09-13 April 2018

PAGASA Forecasters Training on the Use of Convective Scale Models (1st Batch)
23-27 April 2018

PAGASA Forecasters Training on the Use of Convective Scale Models (2nd Batch)
30 April – 04 May 2018

Training Workshop on Tropical Cyclone Forecasting and Analyses for Operation and Research
04-05 September 2018

Southeastern Asia-Oceania Flash Flood Guidance System (SAOFFGS) – In-Region Operations Training Workshop (Step 4)
11-15 September 2018

Meteorologists Training Course (MTC)
23 October 2017 – 10 October 2018

OVERVIEW OF TROPICAL CYCLONES WHICH HAVE AFFECTED/IMPACTED MEMBER'S AREA IN 2018
(Highlighting socio-economic and DRR issues/impacts)

Of the 17 tropical cyclones that impacted Philippines for 2018, with eleven (11) affecting population in the various regions, resulting to casualties, and causing damages to agricultural and infrastructure properties.

A. Affected Population

The table below shows the total number of families, persons, barangays, and municipalities/cities affected by the 11 Tropical Cyclones.

Table 6: Population

AFFECTED POPULATION			
1,829,874 Families	**7,572,577** Persons	**10,459** Barangays	**1,071** Municipalities/Cities

Of which, reflected in Table 2 are families and persons served inside and outside the evacuation centers.

Table 7: Population inside and outside **239** evacuation centers

INSIDE		OUTSIDE	
14,097 Families	**57,209** Persons	**89,700** Families	**396,376** Persons

Table 8: Comparative Analysis of Typhoons recorded from January to October 2018

NAME	AREAS AFFECTED	NO. OF AFFECTED		POP AFFECTED		POP DISPLACED				
						ECs	SERVED INSIDE		SERVED OUTSIDE	
	REG	MUN	BRGY	FAM	PERS		FAM	PERS	FAM	PERS
TD "AGATON" 01-03 January	MIMAROPA, VI, VII, VIII, X, CARAGA, ARMM	69	260	18,537	83,908	10	303	1,198	86	280
TS "BASYANG" 11-14 February	MIMAROPA, VI, VII, VIII, XIII	103	545	60,686	254,859	0	0	0	0	0
TS "CALOY" (I.N. JELAWAT) 27 March	NO EFFECTS									
TY "DOMENG" 05-10 June **TD "ESTER"** 14-15 June	I, III, MIMAROPA, CAR	11	11	3,599	13,477	0	0	0	0	0
TS "FLORITA" (I.N. PRAPIROON) 29 June - 01 July	NO EFFECTS									
TY "GARDO" (I.N. MARIA) 9-10 July	III, ARMM	5	0	24	87	1	5	18	0	0
TD "HENRY" 15-17 July **TS "INDAY" (I.N. AMPIL)** 18-21 July **TD "JOSIE"** 21-23 July	I, II, III, CALABARZON, MIMAROPA, VI, VII, CAR, NCR	185	1,835	532,066	2,231,101	98	10,528	43,694	77,603	339,302

NAME	AREAS AFFECTED	NO. OF AFFECTED		POP AFFECTED		POP DISPLACED				
						ECs	SERVED INSIDE		SERVED OUTSIDE	
	REG	MUN	BRGY	FAM	PERS		FAM	PERS	FAM	PERS
TD "KARDING" (I.N. YAGI) 7-11 August	I, II, III, CALABARZON, CAR, NCR	151	1,280	422,653	1,709,511	101	2,916	11,118	7,995	39,102
TD "LUIS" 23-24 August	I, CAR	68	611	61,713	250,572	2	2	5	966	4,116
TY "MAYMAY" 2-3 September	NO EFFECTS									
TD "NENENG" 10-11 September	NO EFFECTS									
TY "OMPONG" (I.N. MANGKHUT) 12-16 September	I, II, III, CALABARZON, MIMAROPA, V, VI, CAR, NCR	479	5,917	730,596	3,029,062	27	343	1,176	3,050	13,576
TY "PAENG" (I.N. TRAMI) 23-29 September	NO EFFECTS									
TY "QUEENIE" (I.N. KONG-REY) 1-4 October	NO EFFECTS									

NOTE: All figures are still subject to change as reports are yet to be finalized

B. Casualties

From 9 Typhoons that entered the Philippines, a total of 107 dead, 151 injured, and 6 missing were reported.

Table 9: Casualties

NAME	DEAD	INJURED	MISSING
TD "AGATON" 01-03 January	**4**	**9**	**0**
TS "BASYANG" 11-14 February	**0**	**0**	**0**
TY "DOMENG" 05-10 June **TD "ESTER"** 14-15 June	**3**	**3**	**0**
TD "HENRY" 15-17 July **TS "INDAY" (I.N. AMPIL)** 18-21 July **TD "JOSIE"** 21-23 July	**16**	**1**	**1**
TD "KARDING" (I.N. YAGI) 7-11 August	**2**	**0**	**3**
TY "OMPONG" (I.N. MANGKHUT) 12-16 September	**82**	**138**	**2**
TOTAL	**107**	**151**	**6**

NOTE: All figures are still subject to change as reports are yet to be finalized

C. Damage to Properties

A total of **₱40,310,026,155.00** ($745,377,702.57) worth of damages to agriculture and infrastructures were incurred from 7 Typhoons that entered the country. Of this, damages to Agriculture amounted to **₱30,788,268,951.00** ($569,309,706.93) while damages to infrastructure amounted to Infrastructure **₱9,521,757,204.00** ($176,067,995.64).

NAME	AGRI	INFRA	TOTAL
TD "AGATON" 01-03 January	527,244,551	27,480,000	554,724,551
TS "BASYANG" 11-14 February	167,955,031	-	167,955,031
TD "HENRY" 15-17 July **TS "INDAY" (I.N. AMPIL)** 18-21 July **TD "JOSIE"** 21-23 July	3,279,640,112	1,380,971,123	4,660,611,235
TD "KARDING" (I.N. YAGI) 7-11 August	43,711,273	952,290,000	996,001,273
TY "OMPONG" (I.N. MANGKHUT) 12-16 September	26,769,717,984	7,161,016,081	33,930,734,065
TOTAL	**30,788,268,951**	**9,521,757,204**	**40,310,026,155**

NOTES:

* *All figures are still subject to change as reports are yet to be finalized*
* *Bangko Sentral ng Pilipinas, Dollar Exchange Rate as of 15 October 2018 ($1 = 54.08)*

D. Challenges

1. Information Dissemination

Quick dissemination of alert and warning information

2. Information Management

Tools to capture and shared data/information within the organization and other stakeholders.

E. Technological Interventions (Project Status)

1. Alert and Warning

a. Emergency Warning Broadcast System (EWBS) Through Integrated Services Digital Broadcast Terrestrial (ISDB-T)

With the sustained interest of Filipinos to consume information through TV there are various initiatives of the Philippine government to develop improved ICTs to cater its citizens' needs to be informed, especially critical in times of impending disasters. An essential component in Disaster Preparedness, with the Philippines' geographically situated along the Pacific

Ring of Fire and Typhoon Belt, EWBS enables the ISDB-T system to send early warnings for decision-support, as well as to disseminate advisories and guidance on evacuation, food provisions, and medical assistance, among many others.

In the event of an impending emergency such as tropical cyclones, tsunami, floods, earthquake, and volcanic eruptions, DTTB Broadcasters are directed to send out early warning and/or alert messages at regular intervals as required by the National Disaster Risk Reduction and Management Council (NDRRMC), and other relevant agencies.

PAGASA and PHIVOLCS shall be the primary source of emergency alert(s) and/or warning message(s), which shall be submitted to NDRRMC for validation and approval for transmission by all DTTB Broadcasters.

b. Emergency Cell Broadcast System (ECBS)

The National Disaster Risk Reduction and Management Council (NDRRMC) and telecommunication company Smart Communications launched a cell broadcast system (CBS) to enable the quick transmission of warnings to the public in times of calamities.

The development of the emergency cell broadcast system (ECBS) boosts government confidence in its ability to provide timely, hazard-specific, and location-specific warnings to people.

This is the telecom company's compliance with Republic Act No. 10639 or the Free Mobile Disaster Alerts Act, which mandates all TelCos to implement free mobile alerts to the public in the event of calamities.

2. Information Management

a. National Loss and Damage Registry

The National Loss and Damage Registry (NLDR) provides a systematic valuation, validation, reporting, accounting, and database of losses and damages from the impact of natural hazards, including extreme weather events and sea-level rise attributed to climate change, as well as human-induced incidents. The NLDR supports the implementation of comprehensive disaster risk reduction and management, the integration of risk information systems, the development of risk financing, risk transfer and insurance mechanisms, and the strengthening of multi-hazard early warning systems and services at the national and local government levels.

The project aims to build and establish a scalable disaster loss and damage system and registry to be operated by the Office of Civil Defense for the NDRRMC. The NLDR is envisioned to be used for evaluation, validation, reporting, accounting, and databases of losses and damages due to natural and human-induced disasters.

b. IT-based PDNA Application Development

This activity aims to (1) discuss alignment of Philippine PDNA process with global standards and Disaster Recovery Framework (DRF);

and (2) discuss the development of a PDNA tablet or mobile-based application.

c. Data preparedness and Visualization

One of the priorities of Office of Civil Defense Operation Service Division was to improve the presentation and analysis of information for a better understanding of situation during emergencies. OCHA in coordination with the OCD Operations Service Division and with funding assistance from UNICEF

To come-up with database template for emergency response To develop dashboard template to visualize data during emergency Better understanding on how to utilize MS Excel to hasten data compilation and processing

d. Disaster Risk Reduction & Management Information System (DRRMIS)

DICT has partnered with the Office of Civil Defense (OCD), the implementing arm of the National Disaster Risk Reduction and Management Council (NDRRMC), in the development and implementation of strategic and systematic approaches to address the four thematic areas of the NDRRM Plan (NDRRMP): (1) Prevention and Mitigation, (2) Disaster Preparedness, (3) Disaster Response, and (4) Rehabilitation and Recovery. The four distinct yet mutually reinforcing thematic areas lead to the attainment of the country's overall DRRM vision: "safer, adaptive and disaster-resilient Filipino communities toward sustainable development." In achieving this, there have been various steps needed to establish and improve the end-to-end monitoring (monitoring and response), forecasting, and early warning systems. As the executive arm and secretariat of NDRRMC, the OCD has experienced difficulties and challenges in data gathering and consolidation of reports.

To address this, NDRRMC has identified the need for an information system to expedite the monitoring, analysis, and dissemination of reports and information, especially during emergency situations. The system shall be named Disaster Risk Reduction and Management Information System or DRRMIS. The information system shall be used by DRRM officers to input data and shall be a single source of truth (SSOT) for Filipino communities, wherein the concerned NDRRMC member agencies will be the ones to confirm which datasets are needed.

The primary objective of the DRRMIS is to be able to provide NDRRMC member agencies, especially the OCD, a web-based application system with high-availability and high-scalability to be used for the monitoring, submission, and consolidation of DRRM-related reports, which will be posted into the NDRRMC website.