MEMBER REPORT

ESCAP/WMO Typhoon Committee
41st Session

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Republic of the Philippines

CONTENTS

I. Overview of tropical cyclones which have affected/impacted Member's area in 2008

1. Meteorological Assessment (highlighting forecasting issues/impacts)

There were 20 tropical cyclones (TC) that entered or developed within the Philippine Area of Responsibility (PAR) from January to November 2008 and classified as 6 tropical depressions (TD) , 5 tropical storms (TS) and 9 typhoons (TY). The tracks of these tropical disturbances are shown in Figure 1. The number of TDs, TSs and TYs including the annual total is within the annual average during the past 59 years (1948-2006).

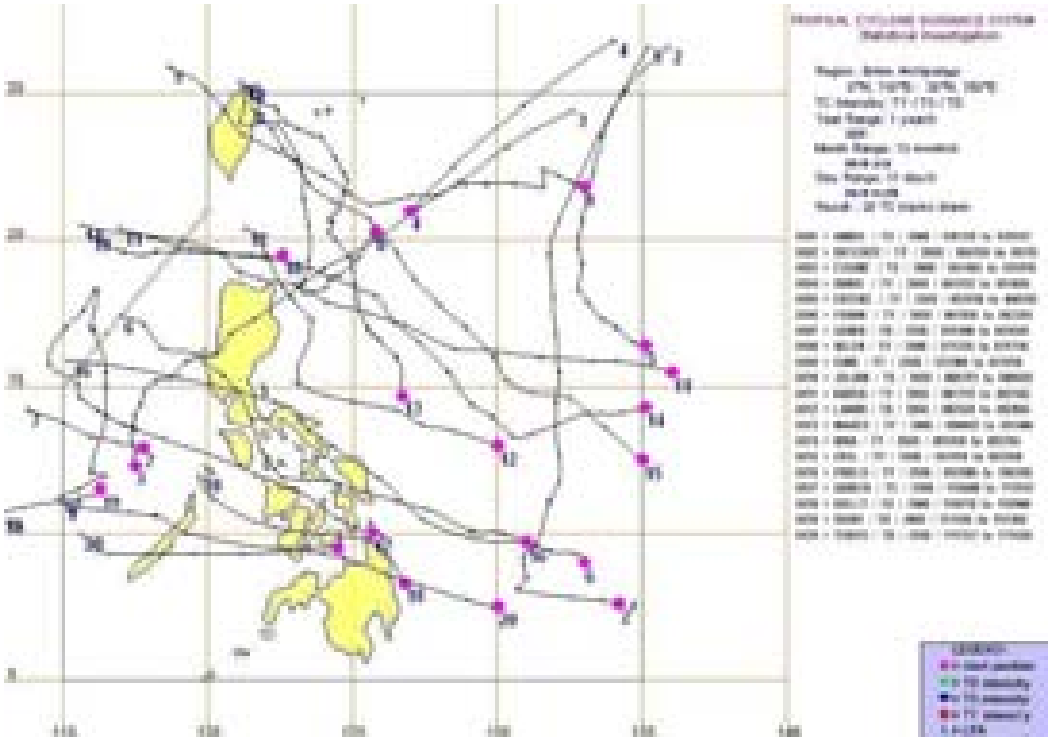


Figure 1. Tracks of Tropical Cyclones that crossed the PAR in 2008

The characteristics of TCs in 2008 in terms of area of development, intensity during landfall and tracks are described in the subsequent paragraphs.

The 8 TCs which made landfall in 2008 is within the annual average of 8-9. It will be recalled that the year with most landfalling tropical cyclones occurred in the Philippines in 1993 with 19 TCs while about 4 tropical cyclones made landfall in 1955, 1958, 1992 and 1997.

It is worth noting that TCs namely, STS Cosme, TD Gener and TD Siony developed in the South China Sea.

In terms of area of tropical cyclone development, 17 tropical cyclones developed within PAR while the rest developed outside PAR. The descriptions of the twenty (20) tropical cyclones that affected the Philippines are summarized below.

1). TS AMBO *(NEOGURI){0801}*

TC Neoguri (Figure 2) started as a low pressure area (LPA) east of Northern Mindanao and eventually became a tropical depression when it was tracked at 60 kms east of Tagbilaran City in the morning of April 14. It moved westward and passed Negros Oriental and Northern Palawan the following day. It crossed the western border of the PAR (in South China Sea) in the evening of April 15. The maximum winds/gustiness reached 65/80 kilometers per hour. The initial warning was issued at 5:45 AM, 14 April 2008 and the final bulletin was issued at 11 PM, 15 April 2008. A total of 8 Severe Weather Bulletins (SWB) and 8 International Warning for Shipping (IWS) were issued.

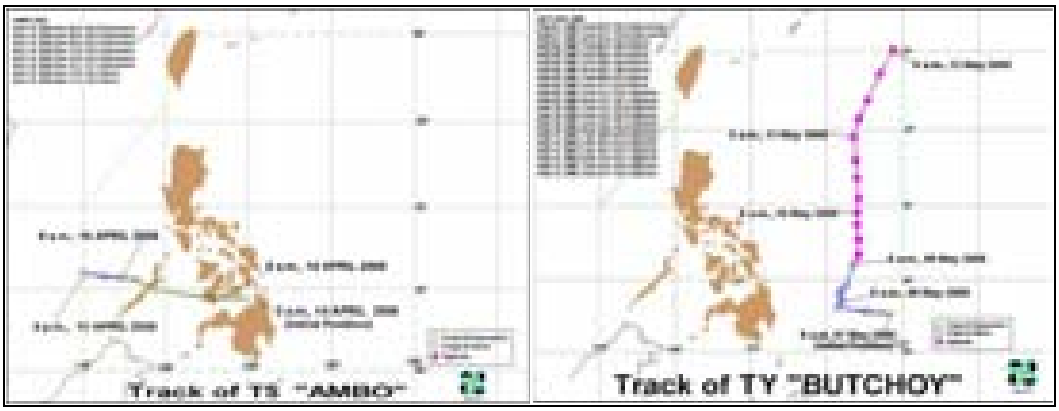


Figure 2 and 3. Tracks of TS Ambo (Neoguri) and TY Butchoy (Rammasun)

2). TY BUTCHOY *(RAMMASUN){0802}*

TC Rammasun (Figure 3) was as an active LPA for three days before it developed into a tropical depression in the morning of May 7 and after one day, it intensified into a Tropical Storm. It slightly veered to the NNW then to the NNE before it intensified and became a Typhoon before it left PAR through the northeastern border. TC Rammasun brought moderate to heavy rains over western Visayas and in Mindanao and caused landslides over central Mindanao. The maximum winds/gustiness reached 185/220 kilometers per hour. The initial warning was issued at 11 AM, 07 May 2008 and the final bulletin was issued at 11 AM, 12 May 2008. A total of 11 SWB and 21 IWS were issued.

3). STS COSME *(HALONG){0804}*

TC Halong (Figure 4) started as an active LPA west of Southern Luzon then developed into a tropical depression on May 14. It remained almost stationary then moved northward slowly. It intensified and reached STS category before it made landfall over Pangasinan-Zambales area causing severe damage to life and property over Pangasinan and Zambales provinces. The maximum winds/gustiness reached 185/220 kilometers per hour. The initial warning was issued at 5 PM, 14 May 2008 and the final bulletin was issued at 5 AM, 20 May 2008. A total of 21 SWB and 24 IWS were issued.

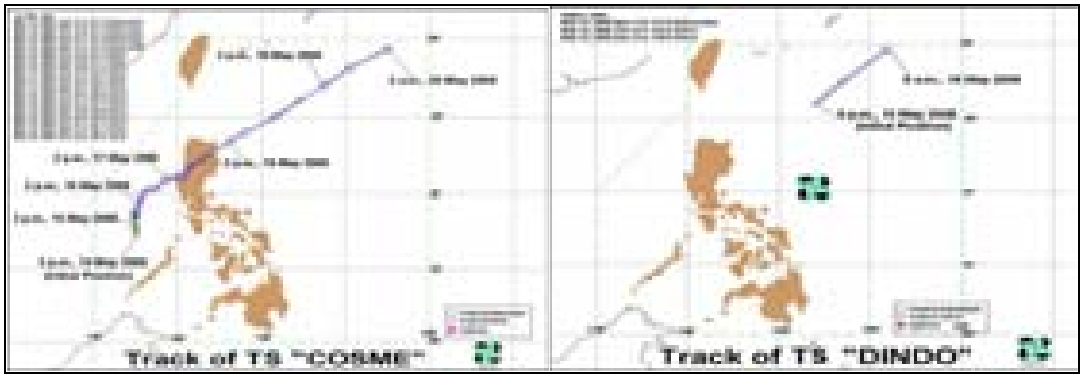


Figure 4 and 5. Tracks of TS Cosme (Halong) and TY Dindo (Matmo)

4). TY DINDO *(MATMO){0803}*

TC Matmo (Figure 5) developed from an active LPA east of Luzon before it intensified into a Tropical depression in the evening of May 15. It became a storm the following day and crossed the Northeastern border of PAR as it travelled northeastward. The maximum winds/gustiness reached 185/220 kilometers per hour. The initial warning was issued at 10 PM, 15 May 2008 and the final bulletin was issued at 11 AM, 160 May 2008. A total of 2 SWB and 3 IWS were issued.

5). TY ENTENG *(NAKRI){0805}*

TC Nakri (Figure 6) entered PAR as a tropical storm east of northern Luzon and slowly moved northwest and then northward. It crossed the northeastern border of the Philippines after three days. No storm warning signal was raised and no significant rainfall amounts were recorded related to this tropical disturbance. The maximum winds/gustiness reached 195/230 kilometers per hour. The initial warning was issued at 5 AM, 30 May 2008 and the final bulletin was issued at 11 AM, 02 June 2008. A total of 8 SWB and 14 IWS were issued.

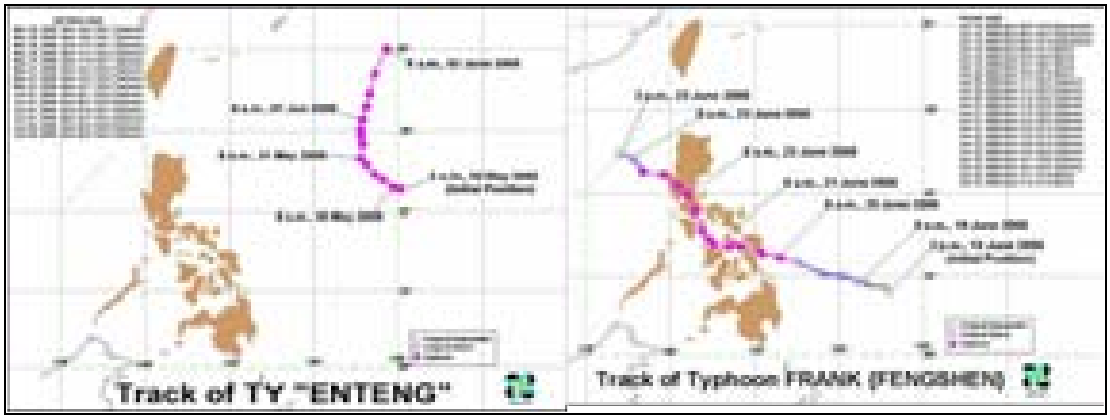


Figure 6 and 7. Tracks of TY Enteng (Nakri) and TY Frank (Fengshen)

6). TY FRANK*(FENGSHEN){0806}*

TC Fengshen (Figure 7) started as an LPA east of Mindanao then developed into a tropical depression at 2pm of June 18. It moved WNW and made landfall over eastern Samar after 2 days (June 20). Prior to landfall, it intensified into a typhoon over the Visayan sea and moved towards the coastal areas of northern Panay and

Romblon provinces. It gradually veered to the NNW direction crossing Romblon and passed very near Marinduque towards the southern Quezon-Batangas area. Fengshen crossed the Zambales-Pangasinan area towards the south China Sea. Strong winds and heavy rains were observed over southern Luzon, Visayas and Mindanao causing severe damage to life and property due to landslides and flashfloods in Panay Island including the sinking of 5 passenger, cargo and fishing vessels over the inland waters of southern Luzon and Visayas. The maximum winds/gustiness reached 160/195 kilometers per hour. The initial warning was issued at 5 PM, 18 June 2008 and the final bulletin was issued at 5 PM, 23 June 2008. A total of 20 SWB and 21 IWS were issued.

7). TD GENER

Originally an active LPA that crossed southern Luzon area (MIMAROPA), TD Gener (Figure 8) developed into a tropical depression over the South China Sea before crossing the western border early morning of July 05. No storm warning signal raised and no significant rainfall amounts recorded prior to its development. The maximum winds/gustiness reached 55 kilometers per hour. The initial warning was issued at 11:30 AM, 4 July 2008 and the final bulletin was issued at 10:45 PM, 05 July 2008. A total of 3 SWB and 5 IWS were issued.

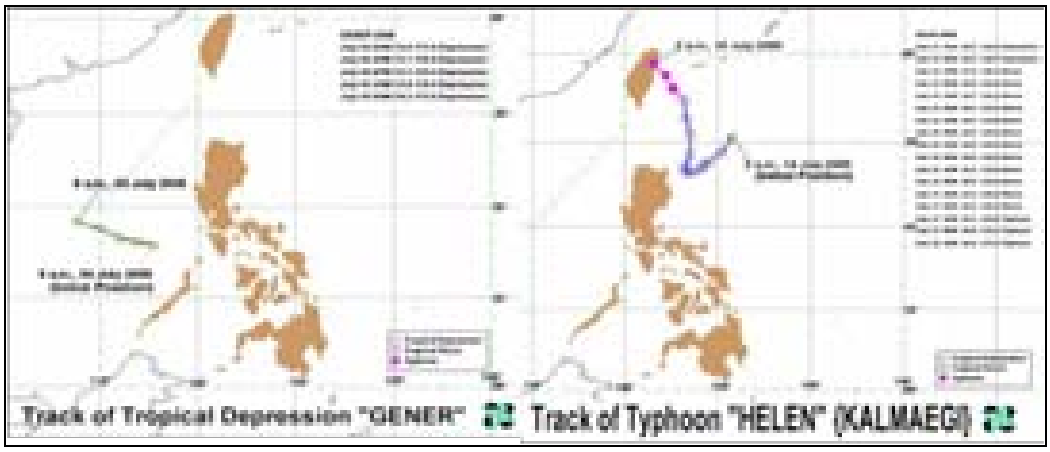


Figure 8 and 9. Tracks of TD Gener and TY Helen (Kalmaegi)

8). TY HELEN*(KALMAEGI){0807}*

TC Kalmaegi (Figure 9) started as an active LPA northeast of Northern Luzon for 2 days. It gradually moved west towards the Batanes group of islands but it veered to the north after 2 days and made landfall over central Taiwan. TC Kalmaegi contributed heavy rains over northern Luzon particularly the western section which caused widespread flooding in Ilocos Norte and Ilocos Sur. Public Storm Warning Signal (PSWS) #2 was raised over Batanes, Cagayan, Apayao, Isabela, Ilocos Norte while PSWS #1 over Abra, Kalinga, Mt. Prov. Ifugao, Nueva Vizcaya, Quirino, Aurora, Ilocos Sur, La Union, Benguet and Pangasinan. The maximum winds/gustiness reached 120/150 kilometers per hour. The initial warning was issued at 5 AM, 14 July 2008 and the final bulletin was issued at 5 AM, 18 July 2008. A total of 17 SWB and 17 IWS were issued.

9). TY IGME*(FUNG-WONG){0808}*

TC Fung-Wong (Figure 10) started as an active LPA inside PAR northeastof northern Luzon. It moved westward slowly towards the Batanes-Taiwan area. During the succeeding days, it gradually veered to the northwest and contributed moderate to heavy rains over extreme northern Luzon. PSWS #3 was raised over Batanes group including Babuyan and Calayan islands, PSWS #2 over Cagayan, Apayao, and Ilocos Norte, while PSWS #1 over Abra, Ilocos Sur, Kalinga, Mt. Prov., Benguet, La Union, Pangasinan, Zambales and Bataan. The maximum winds/gustiness reached 140/170 kilometers per hour. The initial warning was issued at 11:30 AM, 24 July 2008 and the final bulletin was issued at 5 AM, 29 July 2008. A total of 17 SWB and 19 IWS were issued.

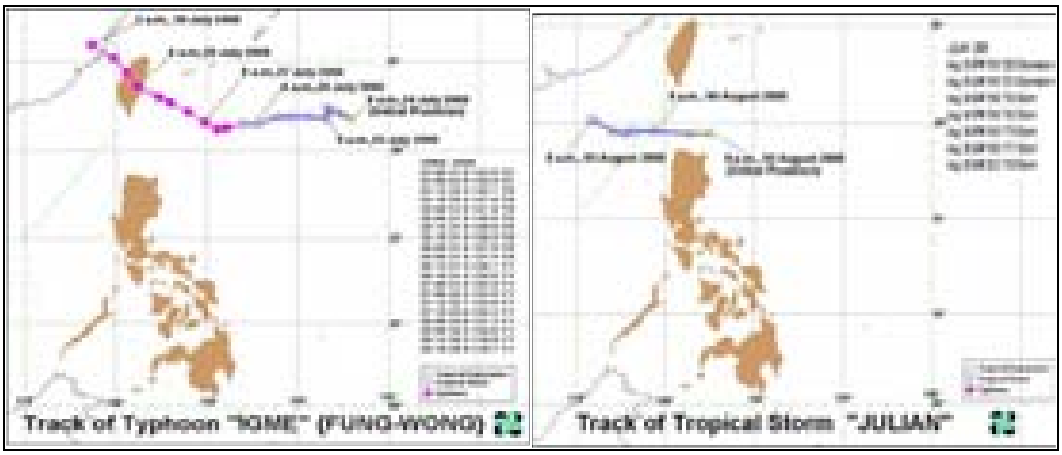


Figure 10 and 11. Tracks of TY Igme (Fung-Wong) and TS Julian (Kammuri)

10). TS JULIAN *(KAMMURI){0809}*

TC Kammuri (Figure 11) developed from an LPA northeastof northern Luzon. It moved west crossing the Batanes-Cagayan area and the western border of the PAR in the afternoon of August 4. “Kammuri” contributed significant amount of rains over Ilocos provinces and in the provinces along the western section of Central Luzon. PSWS #1 was raised over the Batanes group of islands, Northern Cagayan, Apayao, Ilocos Provinces, Abra and La union. The maximum winds/gustiness reached 75/90. The initial warning was issued at 11PM, 03 August 2008 and the final bulletin was issued at 10:30 AM, 05 August 2008. A total of 7 SWB and 4 IWS were issued.

11). TY KAREN *(NURI){0812}*

TC Nuri (Figure 12) was initially spotted as active LPA east of Central Luzon. It developed into a Tropical Depression before it entered PAR. It intensified into a storm and eventually to a typhoon when it was about 600 km east of Casiguran, Aurora. “Nuri” crossed the northern tip of Cagayan in the morning of August 20 and crossed the Babuyan Channel towards the South China Sea. TC Nuri brought significant amount of rain which caused flooding and landslides over Northern Luzon. Records showed heavy damage to properties and killed about 5 persons over Cagayan, Cordillera Autonomous Region (CAR) and over Ilocos Norte. PSWS # 3 raised over Cagayan, Isabela, Apayao, Calayan and Babuyan and Batanes group of islands. PSWS # 2 was raised over Ilocos Sur, La Union, Benguet, Abra, Kalinga, Ifugao, Mt. Province, Quirino, Nueva Vizcaya and Northern Aurora. PSWS # 1 over Rest of Aurora, Polilio Island, Nueva Ecija, Pampanga, Tarlac, Zambales and Pangasinan. The maximum winds/gustiness reached 140/170 kilometers per hour. The initial warning was issued at 11 PM, 17 August 2008 and the final bulletin was

issued at 5 PM, 21 August 2008. A total of 15 SWB and 15 IWS were issued.

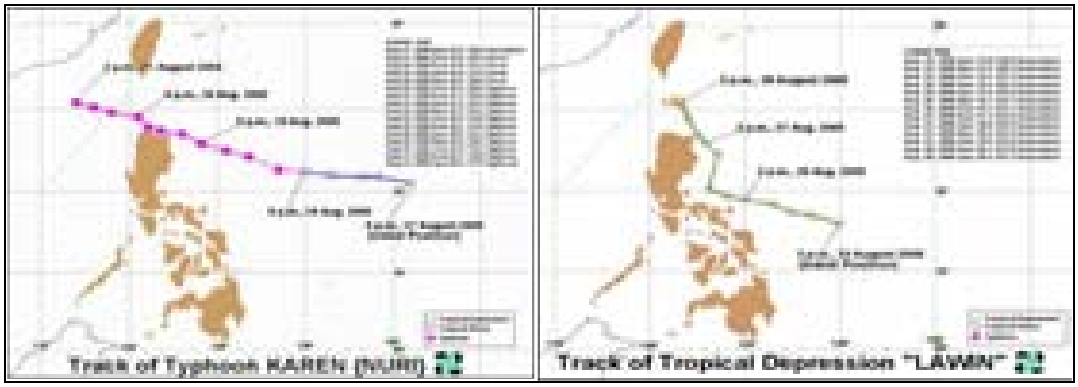


Figure 12 and 13. Tracks of TY Karen (Nuri) and TD Lawin

12). TD LAWIN

TC Lawin (Figure 13) started from a LPA east of the Bicol region and eventually developed into a tropical depression in the afternoon of Aug. 25. It moved west then WNW at an average speed of 17 kph towards eastern Luzon and gradually veered to the northwest and passed very close to Cagayan in the evening of Aug. 27. TD LAWIN weakened rapidly after crossing the Babuyan and the Batanes group of islands due to strong wind shear (middle and top clouds displaced). PSWS # 1 was raised over the provinces of Catanduanes, Northern Samar, Camarines provinces, Albay, Burias Is., Sorsogon, Ticao Is., Quezon including Polilio Is., Marinduque, Laguna, Rizal, Aurora, Bulacan, Pampanga, Nueva Ecija, Tarlac, Quirino, Nueva Vizcaya, Isabela, Cagayan, Babuyan and Calayan Group, Batanes, Apayao, Kalinga, Abra, Ifugao, Mt. Prov., Benguet, La Union, and Ilocos Provinces. LAWIN contributed moderate rainfall over region 2 particularly over the province of Cagayan. The maximum winds/gustiness reached 55 kilometers per hour. The initial warning was issued at 5PM, 25 August 2008 and the final bulletin was issued at 5PM, 28 August 2008. A total of 13 SWB and 13 IWS were issued.

13). TY MARCE*(SINLAKU){0813}*

TC Sinlaku (Figure 14) developed from an ALPA east of the Bicol region. It moved NW at an average speed of 15 kph and left PAR after it made landfall over northern tip of Taiwan in the afternoon of September 14. It rapidly intensified into a storm then to typhoon due to a warm sea surface temperature over the Philippine sea. "Sinlaku" brought moderate to heavy rains over northern and western Luzon including Metro Manila. Floods over the Metropolis and moderate damage to agriculture over northern Luzon were recorded. PSWS # 2 raised over Cagayan including Calayan and Babuyan Group of islands, Batanes, Isabela, and Northern Aurora, while PSWS #1 raised over the rest of Aurora, Polillio Island, Catanduanes, Quirino, Nueva Vizcaya, Benguet, Ifugao, Mt. Prov., Ilocos provinces, Abra, Kalinga and Apayao. The maximum winds/gustiness reached 175/210 kilometers per hour. The initial warning was issued at 11 AM, 8 August 2008 and the final bulletin was issued at 5 PM, 14 August 2008. A total of 25 SWB and 26 IWS were issued.

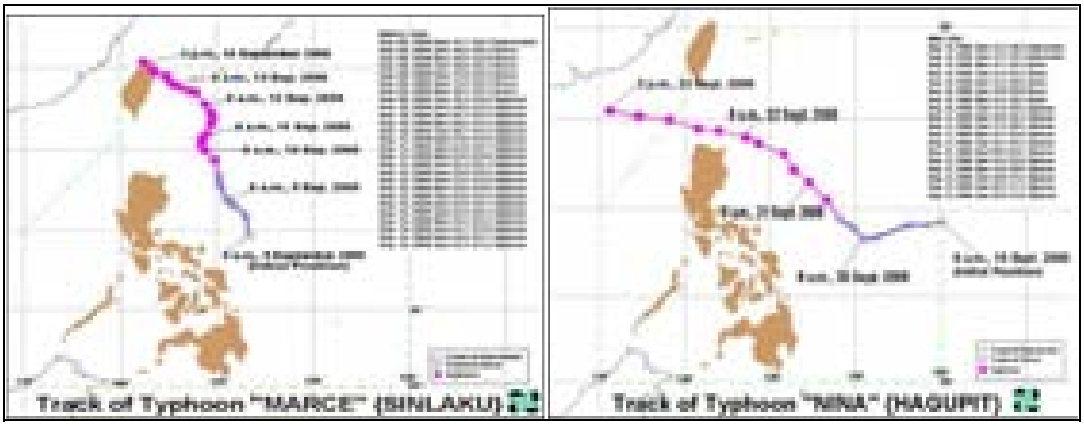


Figure 14 and 15. Tracks of TY Marce (Sinlaku) and TY Nina (Hagupit)

14). TY NINA (HAGUPIT) {0814}

TC Hagupit (Figure 15) started from a LPA east of Bicol region and entered PAR as Tropical Depression in the morning of September 19. It intensified into a Storm and eventually into a Typhoon. TC Hagupit crossed the Babuyan Channel in the afternoon of September 22 and crossed the northwestern border towards the South China Sea the following day. "Hagupit" has brought moderate to heavy rainfall over northern and western Luzon which caused flooding and landslides over the Cordilleras. PSWS #3 was hoisted over Batanes, Cagayan including Babuyan and Calayan group, Ilocos Norte, Apayao, PSWS # 2 over catanduanes, Isabela, Kalinga, Abra, Ilocos Sur, Mt. Prov., PSWS # 1 over Samar Prov., Camarines prov., Albay, Sorsogon, Quezon including Polillio Island, Aurora, Nueva Ecija, Nueva Ecija, Pangasinan, Ifugao, Benguet, La Union, Pampanga and Tarlac. The maximum winds/gustiness reached 175/210 kilometers per hour. The initial warning was issued at 11 AM, 19 August 2008 and the final bulletin was issued at 5 PM, 23 August 2008. A total of 16 SWB and 18 IWS were issued.

15). TY OFEL*(JANGMI){0815}*

TC Jangmi (Figure 16) entered the PAR as Tropical Storm east of Visayas in the early morning of September 25. It rapidly intensified while moving towards extreme Northern Luzon-Taiwan area. It made landfall over central Taiwan and exited the PAR noon of September 29. PSWS #3 was hoisted over Batanes, #2 over Calayan and Babuyan group of Islands and #1 over Isabela, Cagayan, Abra, Ilocos Provinces, Apayao, Mt. Province, Benguet, La Union, Pangasinan and Zambales. The maximum winds/gustiness reached 215/250 kilometers per hour. The initial warning was issued at 5 AM, 25 September 2008 and the final bulletin was issued at 11 AM, 29 September 2008. A total of 17 SWB and 18 IWS were issued.

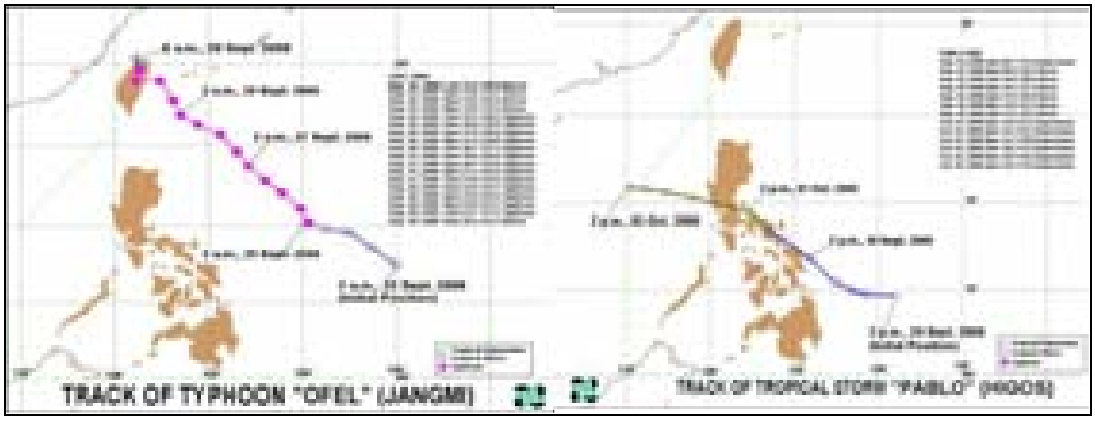


Figure 16 and 17. Tracks of TY Ofel (Jangmi) and TS Pablo (Higos)

16). TS PABLO*(HIGOS) {0817}*

TC Higos (Figure 17) originated from an ALPA east of Northern Mindanao afternoon of Sept. 29. It moved west northwest and crossed Northern Samar evening of Sept 30 and Bicol region the following day then towards Central Luzon and passed near Metro Manila afternoon of October 01. "Higos" brought moderate to heavy rains over Central Luzon and Visayas area that caused floodings over the Provinces of Bulacan and Pampanga. PSWS # 2 over Samar prov., Leyte including Biliran Island, Catanduanes, sorsogon, Albay, Masbate, including Burias and Ticao Islands, Camarines Prov., Marinduque and Quezon including Polillio Islands, Northern Oriental Mindoro, Batangas, Laguna, Cavite, Rizal and Metro Manila. PSWS# 1 over Surigao del Norte including Siargao and Dinagat Islands, Southern Leyte, Capiz, Aklan, Northern Iloilo, Northern Negros, Northern Cebu, Mindoro Provinces including Lubang island, Bataan, Pampanga, Bulacan, Zambales, Tarlac, Pangasinan, Nueva Ecija, Nueva Vizcaya, Quirino and Aurora. The maximum winds/gustiness reached 65/80 kilometers per hour. The initial warning was issued at 11 AM, 29 September 2008 and the final bulletin was issued at 5 PM, 02 October 2008. A total of 13 SWB and 13 IWS were issued.

17). TD QUINTA

TC Quinta (Figure 18) was spotted as a LPA east of Mindanao for two days before it developed into a tropical Depression when it was at 40 km Northeast of Surigao. PSWS #1 was raised over most parts of Northern Mindanao and Visayas and likewise over Masbate and Romblon provinces. It crossed the Visayas in the morning of November 6 bringing moderate to heavy rains over the area causing floods and landslides over western Visayas. "QUINTA" continued to move towards the direction of northern Palawan-Mindoro area and crossed the western border in the morning of November 8 towards the South China Sea. The maximum winds/gustiness reached 55 kilometers per hour. The initial warning was issued at 5 AM, 06 October 2008 and the final bulletin was issued at 11 AM, 08 October 2008. A total of 13 SWB and 17 IWS were issued.

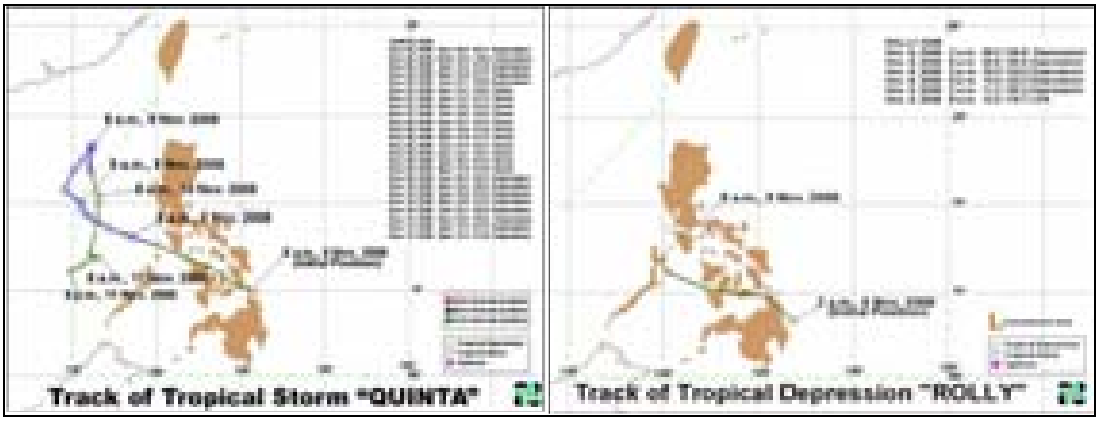


Figure 18 and 19. Tracks of TD Quinta and TD Rolly

18). TD ROLLY

TC Rolly (Figure 19) originated over the Philippine sea and started from an LPA east of Mindanao which consistently moved westward then developed into a Tropical depression at 120 kms east of Northern Mindanao. Immediately from the initial Bulletin issued, PSWS # 1 was raised over the provinces of Northern Mindanao and Central Visayas. "Rolly" crossed Central Visayas and weakened into a low pressure area over the Calamian Group the following day. The maximum winds/gustiness reached 55 kilometers per hour. The initial warning was issued at 5 AM, 08 November 2008 and the final bulletin was issued at 11 AM, 09 November 2008. A total of 6 SWB and 6 IWS were issued.

19). TD SIONY

TC Siony (Figure 20) was part of a cluster of convective clouds formed west of Southern Luzon. Based on the satellite imagery these clouds appeared to be part of the remnants of TD "QUINTA". "Siony" crossed the western border after 12 hours, however no Public Storm Warning Signal raised. The maximum winds/gustiness reached 55 kilometers per hour. The initial warning was issued at 5 AM, 12 November 2008 and the final bulletin was issued at 5 PM, 13 November 2008. A total of 3 SWB and 3 IWS were issued.

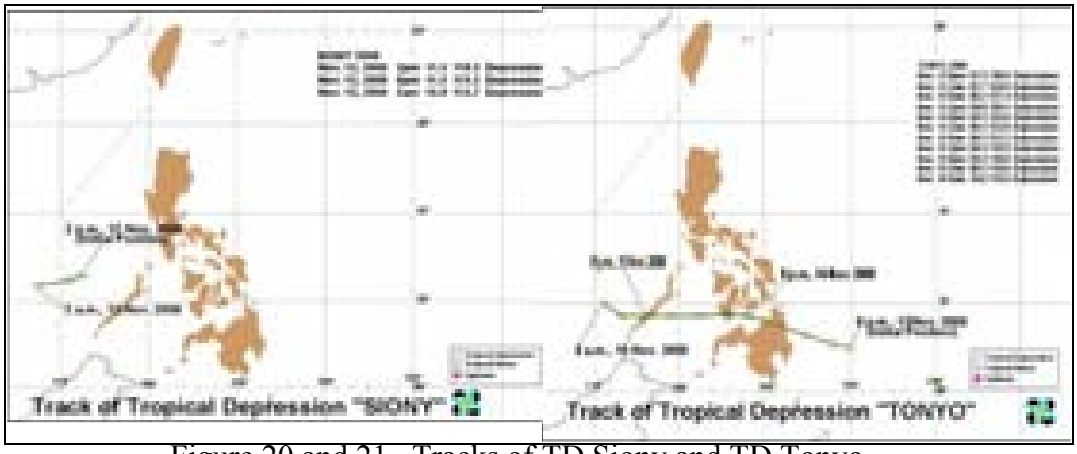


Figure 20 and 21. Tracks of TD Siony and TD Tonyo

20). TD TONYO

TC Tonyo (Figure 21) was an active an LPA that developed into a tropical depression 500 km east of Mindanao and immediately Signal # 1 was raised over the provinces of Eastern and Central Mindanao. "Tonyo" has slightly weakened while crossing the mountainous area of northern Mindanao causing heavy downpour and triggered flashfloods over Lake Lanao. The maximum winds/gustiness reached 55 kilometers per hour. The initial warning was issued at 11 PM, 13 November 2008 and the final bulletin was issued at 11PM, 15 November 2008. A total of 11SWB and 15 IWS were issued.

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

The twenty one (21) tropical cyclones that crossed PAR brought moderate to heavy rains that caused flooding and triggered landslides/flashfloods in eleven (11) regions in the Philippines.

The various flooding occurrences necessitated the issuance of 118 flood bulletins in the monitored river basins of Pampanga, Agno, Bicol and Cagayan and 120 flood advisories in non-telemetered river basins or regions in the country. The levels of the monitored reservoirs increased to spilling levels (refer to Table 1), however, the operation of the spillways did not cause flooding in the downstream areas.

In the later part of September 2008, flooding occurred in the middle Pampanga river basin due to the breaching of an irrigation dike during the passage of TD Pablo where heavy rains were recorded in the vicinity of the Penaranda river, a tributary of the middle Pampanga river.

Table 1. Maximum water levels of monitored reservoirs

Reservoir	Maximum WL (MASL)	Spilling Level (MASL)
Angat	213.09	212.00
Pantabangan	215.97	221.00
Binga	574.65	575.00
Ambuklao	751.51	752.00
San Roque	278.05	280.00
Magat	193.10	193.00

During the year, the only spillway operation made were the pre-releases in Magat dam. Ambuklao and Binga dams have operated their spillways, however, releases did not caused flooding in the intermediate basin between Binga and San Roque dams. All outflows from Binga and Ambuklao dams were stored in San Roque dam. Flooding occurred in the downstream area of Angat dam but this was due to local runoff.

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

For CY2008, 8 tropical cyclones affected a total of 1,414,130 families or more than 5 million people in 98 provinces (Table 2). About 653 people died due to the passage of 7 tropical cyclones. The worst tragedy was the sinking of the Princess of the Stars, the flag carrier of Sulpicio Lines, the prime shipping company of the country where 557 people were confirmed dead and 87 people have not been recovered due to the passage of Ty Frank in the Central Philippines on 20 June 2008. The tragedy put PAGASA "at the

center of the Storm" that resulted to a number of inquiries on the capability of PAGASA of issuing the correct forecast. What happened underscored the demand by the public for 3-hour update on tropical cyclone bulletins and warnings. However, the event paved the way for the provision of funding for the automation of PAGASA monitoring facilities to enhance its services. In addition, the proposed rationalization program of PAGASA was also approved which will allow the meteorological agency to beef up its human resources.

The total damages caused by the 8 tropical cyclones in terms of agriculture and infrastructure amounted to almost PhP20 Billion. Again, Ty Frank registered the biggest damage amounting to more than PhP13.5 Billion. More than 500,000 houses were partly damaged while about 131,700 houses were totally destroyed as listed in Table 3. The total cost of assistance provided to the victims from the government as well as non-government and private institutions amounted to more than PhP300 Million.

Most of the casualties were due to flooding/flashflood and drowning. The flooded areas due to the passage of the tropical cyclones and other weather disturbances is shown in Figure 22.

Table 2. List of Areas affected by flooding due to tropical cyclones and other weather causing phenomena

Name	Date	AREAS AFFECTED				POP AFFECTED		CASUALTIES		
		Region	Province	Municipality	Barangays	Families	Persons	Dead	Injured	Missing
1. TY Halong	May 14-20	I, II, III, VI, VII & CAR	5	77	1,510	287,278	1,496,635	61	33	3
2. TY Fengshen	Jun 18-22	I,III, V, VI CAR, IV-A, IV-B,VII,VIII, IX,X,XI,XII	58	419	6,377	958,515	4,776,778	557	826	87
3. TS Kalmaegi	Jul 14-18	I & II	3	16	189	12,208	54,318	2	2	
4. TY Fung-Wong	Jul 24-28	I & CAR	3	22	128	6,412	28,476	7	2	3
5. TS Kammuri	Aug 3-5	I & III	4	14	118	13,878	66,130	3	1	11
6. TY Nuri	Aug 17-21	I, II CAR	10	116	1,338	98,500	437,570	15	13	23
7. TY Hagupit	Sep 19-24	I,II,III,IV-B, VI,X & CAR	13	59	490	31,188	128,507	8	20	15
8. TS Higos	Sep 29-Oct 2	III	2	4	32	6,151	27,683			
Grand Total			98	727	10,182	1,414,130	5,519,462	653	897	143

Table 3. List of Damages due to the passage of tropical cyclones and assistance provided to affected persons

Name	Date	DAMAGES				Total Cost of DAMAGES	Total Cost of ASSISTANCE
		HOUSES		PROPERTIES (P MILLIONS)			
		Total	Partly	Agriculture	Infrastructure		
1. TY Halong	May 14-20	47,740	144,492	3,720,528,261.45	991,873,673.70	4,712,401,935.15	140,012,158.66

2. TY Fengshen	Jun 18-22	82,734	345,475	7,541,776,484.00	5,983,263,209.00	13,525,039,693.00	145,719,179.90
3. TS Kalmaegi	Jul 14-18			9,750,362.33	21,252,209.75	31,002,571.83	
4. TY Fung-Wong	Jul 24-28	28	54	1,894,029.75		1,894,02.75	205,155.00
5. TS Kammuri	Aug 3-5			9,510,658.80	33,000,000.00	42,510,658.00	376,800.00
6. TY Nuri	Aug 17-21	1,138	12,115	1,326,735,372.25	282,548,900.00	1,609,284,272.25	13,892,540.68
7. TY Hagupit	Sep 19-24	158	927	29,040,000.00	458,000.00	29,498,000.00	388,756.00
8. TS Higos	Sep 29-Oct 2			3,006,700		3,007,000.00	597,000.00
Grand Total		131,798	503,063	12,613,201,868.58	7,312,395,992.20	19,954,638,159.98	301,191,590.24

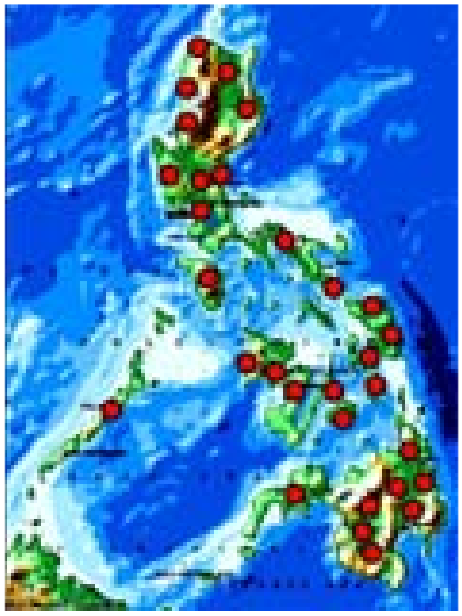


Figure 22. Areas that experienced floods/flashfloods/rainfall induced landslides in CY2008

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

The past year was undeniably the most productive year in terms of regional as well as international cooperation/collaboration and implementation and approval of foreign-assisted projects. The milestones that took place in 2008 were the result of the assistance to the PAGASA after the series of natural disasters in 2004 and 2006. Most of the activities in 2008 were geared towards the upgrading/rehabilitation of monitoring facilities such as upper air stations, radars and establishment of early warning facilities.

The key foreign partners that have contributed to the unprecedented advancement of PAGASA facilities and training of personnel include the World Meteorological Organization under its Voluntary Cooperation Program (WMO VCP), United Nations Development Programme (UNDP), United States Trade and Development Agency (USTDA), the Japan International Cooperation Agency (JICA), the Australian Agency

for International Development (AusAID), the Korea International Cooperation Agency (KOICA), and Taiwan Economic Cooperation Office (TECO).

The Korea Meteorological Administration (KMA) and the Ministry of Natural Resources and Environment (MoNRE) where the Vietnam Meteorological Department is attached have forged Memorandum of Understanding (MoU) with PAGASA on collaborative research, training and sharing of data.

Along with the locally funded upgrading of facilities, the biggest challenge is the sustainability in the operation and maintenance of new facilities and the hiring of young technical people who will be trained to operate the newly acquired facilities. With state of the art early warning system in place, there is more demand for better and effective forecasts hence the need for delivery of timely, accurate and understandable forecasts and warnings.

II. Summary of progress in Key Result Areas (For achievements/results which apply to more than one Key Result Area, please describe them under the most applicable Key Result Area. Then, at the end of the description, place in parentheses ( ) the other applicable Key Result Areas)

1. Progress on Key Result Area 1: Reduced Loss of Life from Typhoon-related Disasters. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

A redundant Meteorological Satellite High Resolution Imaging (MTSAT-HRIT) Ground System was installed in Cebu Complex Station and also the Moderate Resolution Imaging Spectro-radiometer (MODIS) Earth Station was installed at the Weather Flood Forecasting Center (WFFC) in the middle of CY2008. The MTSAT IR image is uploaded hourly in the PAGASA website.

The upgrading of the upper air stations in Cebu and Legazpi has been completed with funding from the Philippine government while the funding for the upgrading of the upper air station in Davao has been secured.

The upgrading of the World Area Forecast System (WAFS) in Quezon City and Cebu has been completed funded by the DOST-GIA of the Philippine Government. The implementation of the Aviation Information System (AVIS) through access to WAFS undoubtedly contributed to the safety and more efficient meteorological aviation services of PAGASA at Mactan International Airport.

The Philippines acquired a ground receiving system of the FengyunCast broadcast of the China Meteorological Administration in the first quarter of CY2008. The ground reception system provides images of FY-2C and FY-2D, among others, once every 15 minutes that effectively monitors the development, track and movement of tropical cyclones (Figure 23).

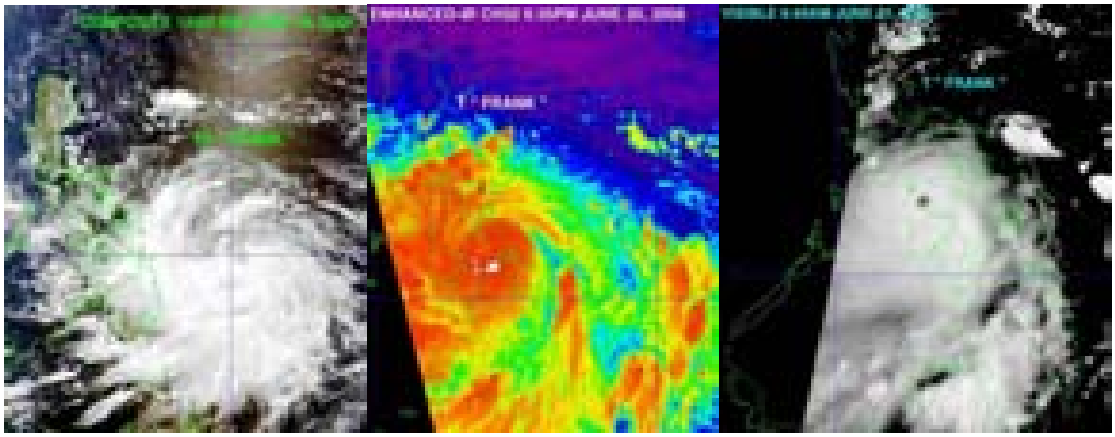


Figure 23. Imageries of the MTSAT and FY satellites

The 7 km x 7 km resolution HRM version has been developed in coordination with the Advanced Science and Technology Institute (ASTI), an agency under the DOST. This will be made operation in CY2009 once the required hardware (high speed computer) will be acquired by PAGASA. The development of the new version of HRM is made possible with the technical inputs and advise from Dr. Detlev Majewski of DWD.

The outputs of the 14km x 14 km resolution version of HRM showed higher accuracy compared with the other NWP such as GSM, MM5 and NAM (Eta) in tropical cyclone tracking for typhoons. Other models used for tropical cyclone tracks and intensity forecasting are based on global deterministic models as well as the ensemble prediction systems of ECMWF and JMA. Positions in tropical cyclone monitoring are based on the existing weather surveillance radars, satellite imagery and synoptic reports.

The Japanese version of the storm surge model that was presented in the International Wave and Storm Surge Forecasting Workshop in September 2007 in Manila is being fined tuned and is now on experimental mode.

b. **Hydrological Achievements/Results**

Improvement of the Flood Forecasting and Warning System (FFWS) in the Pampanga and Agno River Basins under the JICA Grant (Figure 24).

In May 2008, the Philippines started the implementation of Phase 1 which covers the Pampanga river basin (Figure 25) with the construction of additional five (5) rainfall and two (2) water level gauging stations, rehabilitation and upgrading of twelve (12) rainfall and nine (9) water level gauging stations as shown in Figure 26. The most important part of the project is the migration of the existing telecommunication frequency from 800-900MHz to 2.5GHz which will address the problem of interference from mobile phones. Coupled with the change in the frequency is the building of additional repeater stations and retrofitting the existing relay stations.

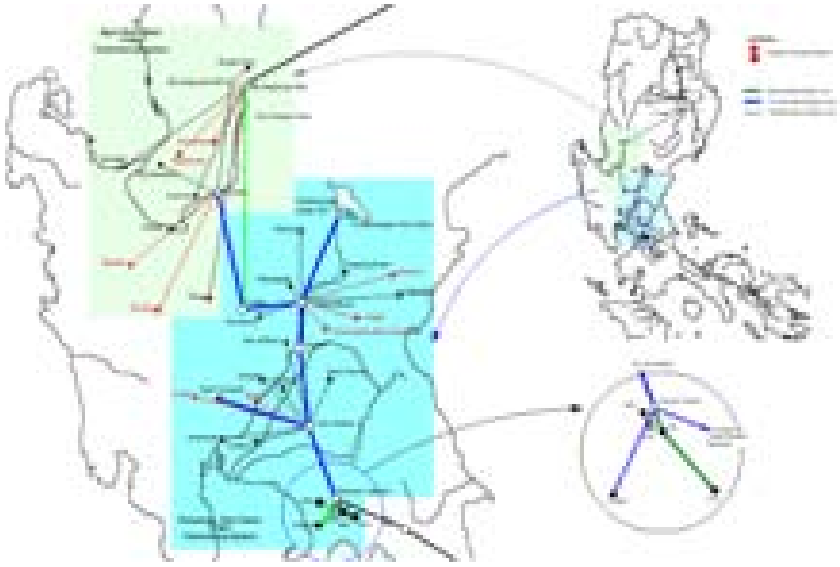


Figure 24. Proposed hydrometeorological network for the upgrading of the Pampanga and Agno river basins

Another milestone of the project is the transfer of the operation of Pampanga River Flood Forecasting and Warning Center (PRFFWC) from Quezon City to a new building in San Fernando, Pampanga (Figure 25). This was advocated to bring the operational services of the PRFFWC effectively and nearer to the most at risk communities with the flood hazard. The training of technical staff has been scheduled in January and February 2009 and Phase 1 will be in full operation by the end of March 2009.

Figure 25. The new Pampanga River Flood Forecasting and Warning Center

Figure 26. Upgraded hydrometeorological network of the Pampanga river basin

Establishment of Early Warning System for Disaster Mitigation in the Philippines under the KOICA Grant

The KOICA Grant project was conceived to establish early warning system (EWS) for flood in two major river basins namely, Jalaur river basin in Iloilo province (Central Philippines) and the Agus-Lake Lanao river basin in Mindanao, and the smaller Aurora and Allied basins in Aurora province (Figure 7). The list of monitoring equipment installed is shown in Table 4.

Table 4. List of Monitoring equipment under the KOICA Grant project

Monitoring equipment	Aurora (Aurora & allied river basins)	Iloilo (Jalaur river basin)	Lanao provinces (Agus-Lake Lanao watershed)
Raingauge	4	5	5
Water level gauge / Tide gauge	4/2	2	4
Evaporation pan	2	1	2
Automatic Weather Station (AWS)	2	1	2

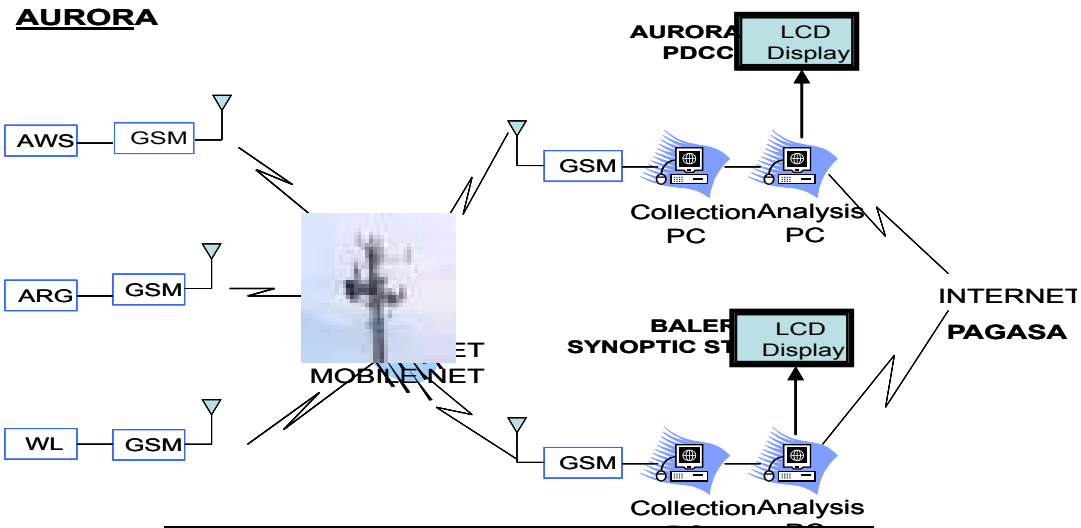
Note: 1 AWS was also set up at the Science Garden Agromet Station in Quezon City.

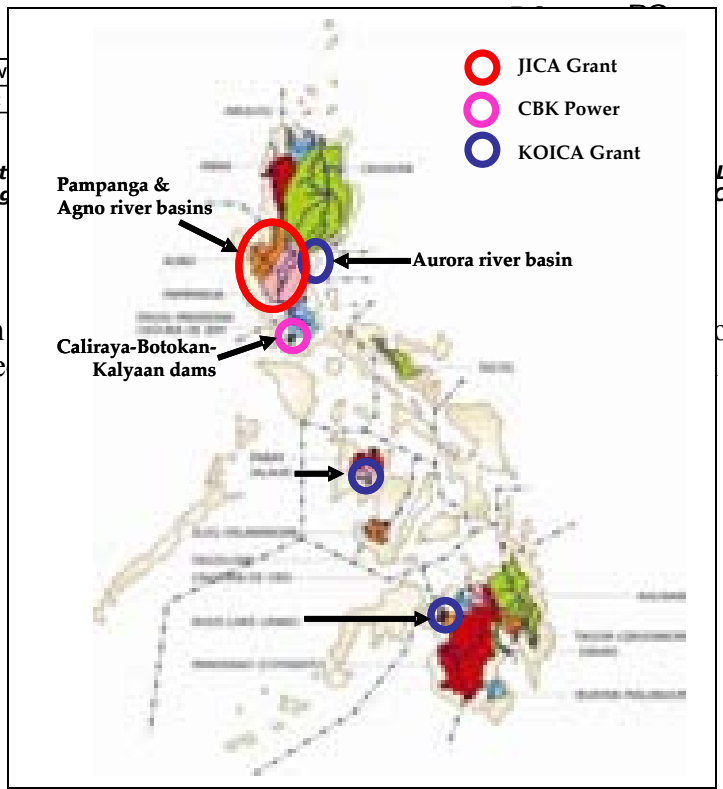
Compared with the existing FFWS in the monitored river basins of Pampanga, Agno, Bicol and Cagayan that operate on a fully automatic scheme and operated by the PAGASA, the KOICA project has been designed to integrate telemetry and

the participation of the community. The short messaging system (SMS) is employed in the transmission of observed rainfall and water level data to a central processing center that is operated by the local government units (LGUs) or simply the provincial disaster coordinating council. This set-up was based on the premise that the LGUs and the community must have a share in the operation of the system because they are in the best position to cope with the flood hazard. In most cases in the Philippines, flooding occurs on micro scales which necessitate the immediate response of the affected communities, hence, the so-called community based approach.

To ensure smooth coordination among stakeholders, a total of five (5) flood forecasting and warning operation centers were set up, 2 in Aurora (1 at the Provincial Disaster Action Center (PDAC)), 1 at the (PDAC) in Iloilo, 1 at the National Power Corporation Mindanao-Generation (NPC-MinGen) office and 1 central station in PAGASA. Each center is equipped with 2 PCs, 1 LCD and other EWS facilities (Figure 27).

The flood EWS in the three (3) project sites is now on its testing and commissioning stage and will be fully operational on the first quarter of CY2009.





The location … onitoring system installe… Figure 28.

Figure 28. Location map of various rainfall and river flow monitoring system

c. **Disaster Prevention and Preparedness Achievements/Results**

The PAGASA conducts a regular media conference once a year for the past five (5) years. However, this CY 2008, two (2) media conference cum workshops for media practitioners were conducted in January and November. The conferences/workshops were aimed to educate the media (print and broadcast) on hydrometeorological hazards such as tropical cyclones, floods, etc.

Since CY2005, the month of July has been declared by the National Disaster Coordinating Council (NDCC) as Disaster Consciousness Month and the third week of June has been declared as Typhoon and Flood Awareness Week. For CY2008, the event was celebrated with a forum and a press conference.

d. **Research, Training, and Other Achievements/Results**

6 staffs attended the training courses on weather forecasting, maintenance of meteorological equipment and hydrology on April 3-25 in Korea;
1 staff attended the International Training course on Satellite & Radar Meteorology on September 14 – 29 in China;
1 staff attended the Training program on Analysis of Communication, ocean and meteorological Satellite (COMS) Data on 18 September – 9 October in Korea;
A five-month Meteorological Technician Training Course was conducted from 20 November 2007 to 18 April 2008 and training on objective techniques was carried out from 29-31 October 2008.
17 staffs attended the Training Course in the Operation and Maintenance of the Radar Software and Hardware in connection with the upgrading of Baler radar on 23 November – 4 December in Baler, Quezon.

10 staffs attended the Workshop on Vaisala AviationMeteorology on November 13 in Makati City.

The PAGASA has signed a Memorandum of Understanding (MOU) with the Korea Meteorological Administration (KMA) which aims to:

a. Strengthen cooperation on the exchange of scientific knowledge on meteorology, seismology, climate, capacity-building of the National Meteorological Services, research and human resource development;
b. Conduct joint studies and coordination of the exchange of scientists, knowledge, skills, materials and publications;
c. Share and exchange information on programs of work, projects, activities and publications in which there may be mutual interest;
d. Make suitable arrangement for representatives of PAGASA and KMA to meet, as occasion demands, to review the progress of cooperation activities and to discuss future cooperation.

On 28 July 2008, a Vietnamese delegation headed by an official from the Ministry of Natural Resources and Environment (MONRE) and one of the officials of the Hydrometeorological Service of Vietnam visited PAGASA to discuss the drafting of MOU that would facilitate the:

a. Exchange of information on Sea level, Storm, and other weather-related natural disasters occurring in the South China Sea;
b. Research and application of forecast models on water circulation, oil slick and typhoon trajectory in the South China Sea; and
c. Training of personnel.

On 27-28 November, the Philippine Meteorological Society (PMS) conducted the 4th PMS Convention which was attended by local and foreign experts. After their presentation at the PMS convention, three (3) experts from the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and the Director of NOAA National Center for Atmospheric Science (NCAS) visited PAGASA and presented lectures on their on-going research activities and training programs.

From JAMSTEC), the following research works were presented:

1. Characteristics of atmospheric circulation and SST patterns associated with onset of summer rainy season in the Philippines by Dr. Ikumi Akasaka;
2. Impact of tropical cyclones on interannual rainfall variability over the western North Pacific by Dr. Hisayuki Kubota; and
3. Recovering meteorological data of the Philippines in the early 20th Century by Dr. Kooiti Masuda.

Professor Hung Soo Kim of Inha University in Korea attended the 4th PMS convention on 27-28 November and offered post graduate courses in hydrology and allied disciplines to PAGASA personnel for school year 2009.

Dr. Vernon Morris, Plan Investigator and Director ofNOAA NCAS presented a *Briefing on the initiatives of the NOAA Center for Atmospheric Sciences at Howard University.*

During the said meetings, possible collaborations with PAGASA were discussed such as conduct of researches and to avail of trainings at NOAA NCAS and Howard University.

e. Regional Cooperation Achievements/Results

Nil.

f. Identified Opportunities/Challenges for Future Achievements/Results

The Exchange of Note (E/N) on the Implementation of the JICA Grant Project: Improvement of Flood Forecasting and Warning System (FFWS) in the Pampanga and Agno River Basins covering the Agno river basin (Phase 2) was been signed on 13 October 2008 between the Ambassador of Japan and the Philippines' Secretary of Foreign Affairs.

The project *Enhancement of Tropical Cyclone Early Warning System* aims to improve the Philippine Atmospheric Geophysical and Astrological Agency's (PAGASA) weather forecasting capacity by introducing technology from Australia's Bureau of Meteorology (BOM). The outcome of the project is to improve PAGASA-DOST's forecasting capacity by 15%.

Incorporating BOM's tropical cyclone technology into PAGASA-DOST's current system, the project will introduce new functions for determining the consensus tropical cyclone forecast using eight different forecasting models, mapping of storm signals, mapping of storm surge inundation and other visualization materials; thus enabling PAGASA-DOST to better communicate its warnings to the emergency stakeholders. In addition, it will provide operational weather forecasters with better data manipulation and visualisation tools (graphical products) immediately during the presence of tropical cyclones. The additional information will not only enhance PAGASA-DOST's early warning capacity on tropical disturbance monitoring but also the agency's capacity to provide warning to threatened communities in the country.

The project has a duration of twelve (12) months which commenced with the dispatch of two experts from BOM with funding from the Australian Agency for International Development (AusAID).

The feasibility study grant provided by the U.S. Trade and Development Agency (USTDA) on the Upgrading of the Telecommunication Network of PAGASA's meteorological and Hydrological Services has been approved with the MOU signing (Figure 29) between the US Ambassador to the Philippines and the Secretary of the Department of Science and Technology on 13 February 2008. The signing was witnessed by Mr. Henry Steingass, USTDA Regional Director for South and Southeast Asia and Dr. Prisco D. Nilo, PAGASA Director.

Figure 29. MOU signing between the Honorable Estrella F. Alabastro, Secretary, Department of Science and Technology and Her Excellency Kristie A. Kenny, US Ambassador to the Philippines

The grant will determine the most suitable, practical and beneficial system, including the most feasible combination of all telecommunication options to address the current and future state of PAGASA's telecommunication network and is scheduled for implementation and completion in CY2009.

On 10-19 November 2008, the Norwegian Agency for Development Cooperation (NORAD) dispatched two (2) experts from the Norwegian Water and Energy Directorate to conduct a preliminary study on the proposed project: Improvement of Flood Forecasting & Warning System (FFWS) for Magat Dam & Downstream Communities shown in Figure 30. The projects aims to address the issues and concerns on the issuance of a timely and accurate flood forecasts and warnings in the Cagayan River Basin and the effective operation of the Magat dam for the safety of the communities in the downstream area. The components of the project include:

- Restoration of the FFWS/FFWSDO telecommunication system using VSAT network;
- Rehabilitation of existing monitoring FFWS/FFWSDO facilities;
- Installation of additional monitoring stations along the tributaries of the Cagayan river;
- Conduct researches on rainfall, inflow and flood forecasting and training;
- Establishment of a decision support system for the operation of Magat dam; and
- Conduct of intensive public information drives for stakeholders and the community.

Figure 30. The hydrological network of the Cagayan and Magat river basins

2. <u>Progress on Key Result Area 2</u>: Minimized Typhoon-related Social and Economic Impacts. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. **Meteorological Achievements/Results**

Please refer to Key Result Area 1(a).

b. **Hydrological Achievements/Results**

Please refer to Key Result Area 1(b).

c. **Disaster Prevention and Preparedness Achievements/Results**

Please refer to Key Result Area 1(c).

d. **Research, Training, and Other Achievements/Results**

As a continuing effort to promote awareness and preparedness of natural disasters, lectures were conducted by field personnel to teachers, students and local government officials and personnel. In parallel, PAGASA technical personnel also c ts re

Figure 31. Public information drive on hydrometeorological hazards

e. **Regional Cooperation Achievements/Results**

Nil.

f. Identified Opportunities/Challenges for Future Achievements/Results

Nil.

3. <u>Progress on Key Result Area 3</u>: Enhanced Beneficial Typhoon-related Effects for the Betterment of Quality of life. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. **Meteorological Achievements/Results**

Nil.

b. **Hydrological Achievements/Results**

The Joint Operation and Management Committee (JOMC) of the FFWSDO, an interagency committee that oversees the operation and maintenance activities of monitored major river basins and reservoirs in the Philippines conducted four (4) regular meetings. The Sub-Committee on Hydrology convened its members four (4) times to discuss the integration of the operation of Angat and Ipo dams.

The JOMC also had one (1) special meeting with the experts from NORAD during the preliminary assessment made on the Cagayan and Magat FFWS project.

Establishment of flood forecasting and warning system in the Caliraya-Botokan-Kalayaan (CBK) dams

As part of its social responsibility, the CBK Power Inc., a private company that operates and manages the Caliraya-Botocan and Kalayaan dams located in Laguna province has initiated and completed in the third quarter of CY2008 the establishment of flood forecasting and warning system in coordination with the National Power Corporation (NPC) and PAGASA. The operation of the EWS is similar with those established in the monitored major reservoirs in Luzon. The hydrological network which includes 6 rainfall and 3 water level stations can now be monitored at the PAGASA Weather and Flood Forecasting Center in Quezon City.

c. **Disaster Prevention and Preparedness Achievements/Results**

Nil.

d. **Research, Training, and Other Achievements/Results**

Nil.

e. Regional Cooperation Achievements/Results

Nil.

f. Identified Opportunities/Challenges for Future Achievements/Results

Nil.

4. <u>Progress on Key Result Area 4</u>: Improved Typhoon-related Disaster Risk Management in Various Sectors. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

The PAGASA Special Tropical Weather Disturbance Reconnaissance, Information Dissemination and Damage Evaluation (STRIDE) or called the PAGASA Quick Response Team is normally deployed to areas where meteorological hazards occurred to assess and conduct filed investigation and extend assistance in the mitigation of meteorological hazards and disaster reduction in areas affected by landfalling TCs, tornadoes, storm surges, etc.

During the past year, the team conducted on-the-spot observation and investigation for the passages of TS Halong and TY Fengshen. On 17 May 2008, the STRIDE Team was dispatched to Dagupan, Pangasinan where the predicted path of the storm will be. This was to establish surveillance post to take on-the-spot observation of meteorological parameters particularly maximum wind and its gustiness to be transmitted to the Weather Forecasting Section for reference purposes. As predicted, TS Halong made landfall over western Pangasinan.

For TY Fengshen, the STRIDE Team conducted ground truth verification and damage assessment in Samar and Tacloban City and 3 teams were also deployed to conduct post survey in Aklan, Roxas City, Iloilo City, Antique and Romblon.

Courtesy of PAGASA STRIDE Team

Figure 32. Impacts of TY Fengshen: a bridge that collapse and flooding of 6 feet deep in Iloilo province.

In parallel to these activities, other members of the STRIDE team were assigned at the NDCC office to brief concerned officials and the media on the status of tropical cyclone.

b. **Hydrological Achievements/Results**

Flood hazard mapping activities

One of the components of the UNDP Ready project is multi-hazard mapping for hydrometeorological and geological hazards. Under the project, the PAGASA undertakes flood hazard mapping for selected areas using a 1:10K scale base maps and storm surge hazard mapping using a 1:50K scale base maps. Project sites are selected in terms of their vulnerability to floods/flashfloods and storm surges.

For CY 2008, flood hazard maps in Subic Bay, Olongapo City, Cavite City, Angeles City, Pampanga, and Vigan City, Ilocos Sur were completed and several storm surge hazard maps were completed as shown in Figures 33 – 36. The hazard maps are provided to concerned local government units (LGUs) as inputs in updating their comprehensive land use plans (CLUPs). The hazard maps are also provided to the operations group as guide or reference in flood forecasting and warning.

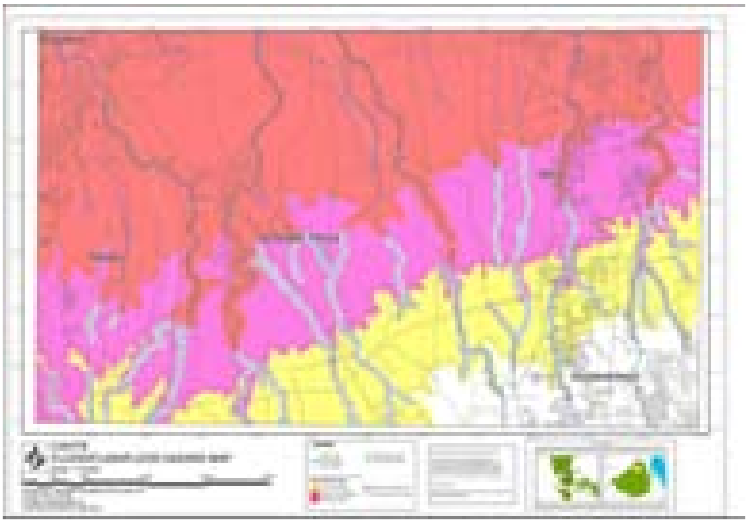


Figure 33. Flood hazard map of Cavite City

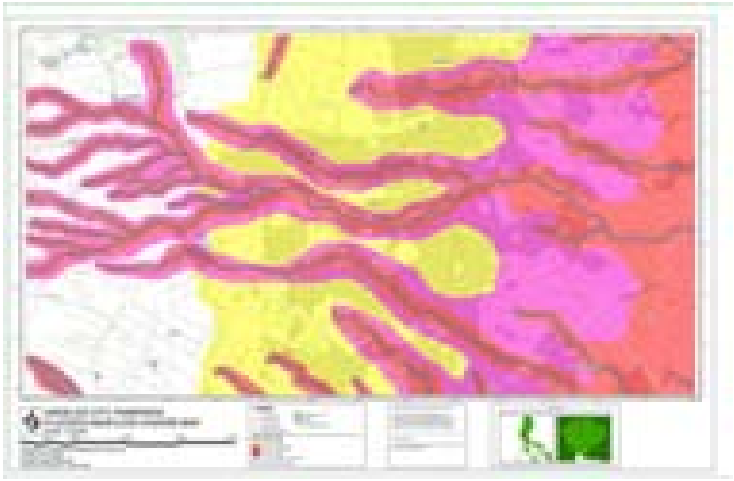


Figure 34. Flood hazard map of Angeles City, Pampanga

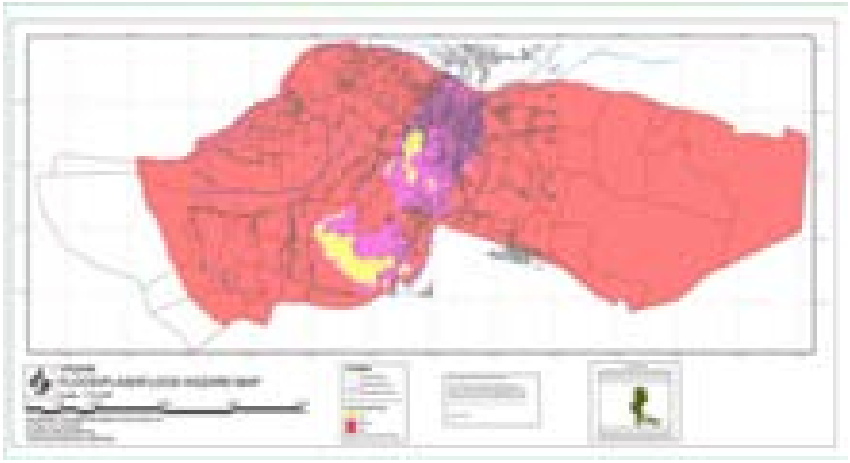


Figure 35. Flood hazard map of Vigan City, Ilocos Sur

Figure 36. Flood hazard map of Subic City

Storm surge hazard mapping was also conducted in Northern and Eastern Samar provinces.

c. Disaster Prevention and Preparedness Achievements/Results

- In the aftermath of the water induced disasters brought about by the passages of a series tropical cyclones in the later part of CY2004, the Philippine government through the Department of Science and Technology (DOST) Grant in Aid funds for the project entitled: Disaster Reduction through Establishment of Back-up Communication and Enhancement of Quick Tropical Cyclone Impact Assessment and Forecast Evaluation System. The project was implemented beginning CY2008 with the provision of back up communication facilities to all synoptic and hydrological field centers, as shown in Figure 37.

Figure 37. The back-up communication facilities

d. Research, Training, and Other Achievements/Results

Please refer to Key Result Area 1(d).

e. Regional Cooperation Achievements/Results

Please refer to Key Result Area 1(d).

f. Identified Opportunities/Challenges for Future Achievements/Results

Please refer to Key Result Area 1(d).

5. Progress on Key Result Area 5: Strengthened Resilience of Communities to Typhoon-related Disasters. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

Weather specialist/meteorologists in the field stations continuously provide regular lectures to the communities in their areas of concern on the early warning system of PAGASA for tropical cyclones and other hydrometeorological hazards.

b. Hydrological Achievements/Results

Hazards Mapping and Assessment for Effective Community Based Disaster Risk Management (UNDP Ready Project)

This undertaking is being funded by the Australian Agency for International Development (AusAID) through the United Nations Development Programme (UNDP) and is implemented by the member agencies of the National Disaster Coordinating Council (NDCC) namely, the PAGASA, the Philippine Institute of Volcanology (PHIVOLCS), the Mines and Geoscience Bureau (MGB), the National Mapping Resource and Information Authority (NAMRIA) and the Office of Civil Defense (OCD) who acts as the Project Management Office. The project components include multi hazard identification and disaster risk assessment of hydrometeorological (floods/flash floods, rainfall induced landslides and storm surge) and geological (volcanic and earthquake related) hazards, development of community based early warning system (floods and tsunami), development of IEC strategies and materials for specific target groups and mainstreaming of risk reduction into the local development planning process. For CY2008, the number of raingauges installed under the community based flood early warning system (CBFEWS) are listed below.

Province	Digital raingauge	8"standard raingauge
1. Laguna	16	3
2. Zambales/Olongapo City	15/5	3/1
3. Ilocos Sur	15	4
4. Cavite	10	0

The PAGASA also assisted non-government organizations (NGOs such as GTZ and CARE-ACCORD) in Dingalan, Aurora, Calabanga, Camarines Sur,

Iriga City and the local government units (LGUs) in San Jose del Monte, Bulacan in the installation of rainfall and water level gauges and as part of the CBFEWS in the areas mentioned. The CBFEWS has been instrumental in capacitating the communities in target areas to be better equipped in coping with the impacts of floods/flashfloods through the various trainings and IECs on rainfall and water level observation, data interpretation and issuance of appropriate warnings.

c. **Disaster Prevention and Preparedness Achievements/Results**

The PAGASA in coordination with the Office of Civil Defense organized dry runs/pilot testing on the operation of CBFEWS (Figure 38) as well as flood drills in areas where the 1:10K flood hazard map has been prepared. In the dry run or flood drill, the evacuation protocols of the community are integrated into the operation of the CBFEWS using the derived flood hazard map.

Figure 38. Activities during a flood drill or pilot testing of CBFEWS

d. **Research, Training, and Other Achievements/Results**

Under the CBFEWS program, on site training of observers, volunteers and LGUs on the observation, recording and transmission of rainfall and water level data. The LGUs who are in charge of the Disaster Operation Center of the locality are trained to analyze, interpret the observed data and issue the appropriate flood advisory or warning to at risk communities.

Figure 39. On-site training of observers, volunteers and LGUs

Please also refer to Key Result Area 2(d).

e. **Regional Cooperation Achievements/Results**

Nil

f. Identified Opportunities/Challenges for Future Achievements/Results

Nil.

6. <u>Progress on Key Result Area 6:</u> Improved Capacity to Generate and Provide Accurate, Timely, and understandable Information on Typhoon-related Threats. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. **Meteorological Achievements/Results**

Four (4) automatic weather stations (AWS) under the KOICA Grant Project: Establishment of Early Warning and Monitoring System in the Philippines are now operational. These are located in PAGASA Science Garden in Quezon City, Casiguran, Aurora, Marawi, Lanao del Sur and San Enrique, Iloilo.

Figure 40. Automatic weather station in Casiguran, Aurora

The upper air station in Tanay under the TECO project has been upgraded and now operational. Likewise, the upgrading of the upper air station in Laoag city has been completed under the WMO-VCP funding.

Figure 41. Inauguration of the upgraded upper air station in Tanay, Rizal

The basic design for the acquisition of three (3) Doppler radars by JICA has been completed.

The series of rain induced landslides and floods/flashfloods during the past couple of years underlined the need for more accurate rainfall forecasts. As a result of the unprecedented impacts on water induced disasters, the Philippine government started a big program to upgrade existing radars as well as enhance the network with the installation of additional radars. The radar program which started in CY2007 aims to have ten (10) operational radars by 2010 shown in Figure 42.

Figure 42. Radar network in the Philippines by CY2010

For CY2008, the preparatory works for the acquisition of Subic Bay, Tagaytay City, Mactan (Cebu) and Tampacan and Hinatuan in Mindanao are on-going with funding from the Philippine government. The upgrading of the existing radars in Baler and Baguio are likewise on-going. The basic design for the upgrading of three (3) existing radars in Aparri, Virac and Guiuan under the JICA Grant was completed. This will be followed by the conduct of detailed design in early 2009.

b. **Hydrological Achievements/Results**

The calibration and verification for Sapang Buho forecasting point of the Pampanga river basin using the Multiple Linear Regression (MLR) model has been completed while those of San Isidro and Arayat forecasting point are on-going which are all under the Pampanga river basin. Likewise, the same

model is being fine tuned in several forecasting points of the Agno, Bicol and Cagayan river basins.

c. **Disaster Prevention and Preparedness Achievements/Results**

On 23 October 2008, the PAGASA in coordination with SMART Communications, Inc., a telecommunication service provider launched the SMART Infoboard, a service rendered by SMART to PAGASA for the transmission, transfer, passage and communication of all forecasts and warnings and other information issued by PAGASA to the end users. The service is provided through Short Messaging System (SMS) and/or Internet/Email Platform utilizing a Global System for Mobile Communications (GSM) Network. All data, information, messages, statements and all forms of communiqués pass through Smart by virtue of the Services from the Texting public to Client and vice versa. The capabilities of Infoboard are:

- Receive feedback comments, suggestions, queries and other user-specific messages straight to the (a) InfoBoard web inbox, (b) personal email or (c) celfone.
- Provides general information, advisories and announcements to pre-registered SMART subscribers.

In partnership with SMART Communications, the Infoboard will definitely enhance the delivery of early warning services of PAGASA in the countryside for the safety of communities at risk by natural hazards. The website of The Infoboard for the PAGASA administrator and content providers is: www.theinfoboard-smart.net and the keywords shown below are used to access updates of warnings issued by PAGASA.

d. **Research, Training, and Other Achievements/Results**

Please refer to Key Result Area 1(d).

e. Regional Cooperation Achievements/Results

Nil.

f. **Identified Opportunities/Challenges for Future Achievements/Results**

The Technical Cooperation Project (TCP) under JICA which was proposed to improve the existing FFWS for the monitored major reservoirs of Angat,

Pantabangan, Binga/Ambuklao and Magat has been approved and its implementation will commence in the second quarter of CY2009.

7. Progress on Key Result Area 7: Enhanced Typhoon Committee's Effectiveness and International Collaboration. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

Nil.

b. Hydrological Achievements/Results

c. Disaster Prevention and Preparedness Achievements/Results

Nil.

d. Research, Training, and Other Achievements/Results

One (1) staff participated in the Training/Application Workshop on Extreme Floods, Phase II held in Bangkok, Thailand

One (1) staff attended the International Hydrometeorological Analysis and Forecasting Course in Boulder, Colorado that was sponsored by the National Oceanic and Atmospheric Administration (NOAA) and the World Meteorological Organization (WMO).

One (1) staff attended the East and Southeast Asia Regional Seminar on Flood Hazard Mapping conducted in Beijing, China, sponsored by ICHARM (PWRI), JICA and the Government of the People's Republic of China.

Three (3) staff members of PAGASA attended the Integrated Workshopon Coping with Climate Change in the Typhoon Committee Area on 22 – 26 September 2008 in Beijing, China.

Please also refer to Key Result Area 5(d).

e. Regional Cooperation Achievements/Results

The PAGASA has signed a Memorandum of Understanding (MOU) with the Korea Meteorological Administration (KMA) which aims to:

- Strengthen cooperation on the exchange of scientific knowledge on meteorology, seismology, climate, capacity-building of the National Meteorological Services, research and human resource development;
- Conduct joint studies and coordination of the exchange of scientists, knowledge, skills, materials and publications;
- Share and exchange information on programs of work, projects, activities and publications in which there may be mutual interest;

- Make suitable arrangement for representatives of PAGASA and KMA to meet, as occasion demands, to review the progress of cooperation activities and to discuss future cooperation.

On 28 July 2008, a Vietnamese delegation headed by an official from the Ministry of Natural Resources and Environment (MONRE) and the Deputy Director of the Department of Meteorology in Vietnam visited PAGASA to discuss an MOU that would facilitate the:
- Exchange of information on Sea level, Storm, and other weather-related natural disasters occurring in the South China Sea;
- Research and application of forecast models on water circulation, oil slick and typhoon trajectory in the South China Sea; and
- Training of personnel.

f. Identified Opportunities/Challenges for Future Achievements/Results

On 17 – 19 February 2009, the Philippines will host the East and Southeast Asia Regional Flood Hazard Mapping Seminar. The seminar will strengthen the capacity of professionals who have undergone training in Japan and it will also serve as an avenue to share experiences on flood hazard mapping techniques and flood disaster management tools. The seminar is sponsored by the International Centre for Water Hazard and Risk Assessment (ICAHRM), Public Works Research Institute (PWRI), and JICA in coordination with the Government of the Philippines. Eight (8) countries from East and Southeast Asia will participate in the seminar, as follows: Bangladesh, China, Indonesia, Malaysia, Vietnam, Cambodia, Laos, and the Philippines. Representatives from the Typhoon Committee and the Infrastructure Development Institute (IDI) of Japan will also attend the seminar.

III. Resource Mobilization Activities

Nil.

IV. Update of Members' Working Groups representatives

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