MEMBER REPORT

ESCAP/WMO Typhoon Committee
8th Integrated Workshop/2nd TRCG Forum

(Philippines)

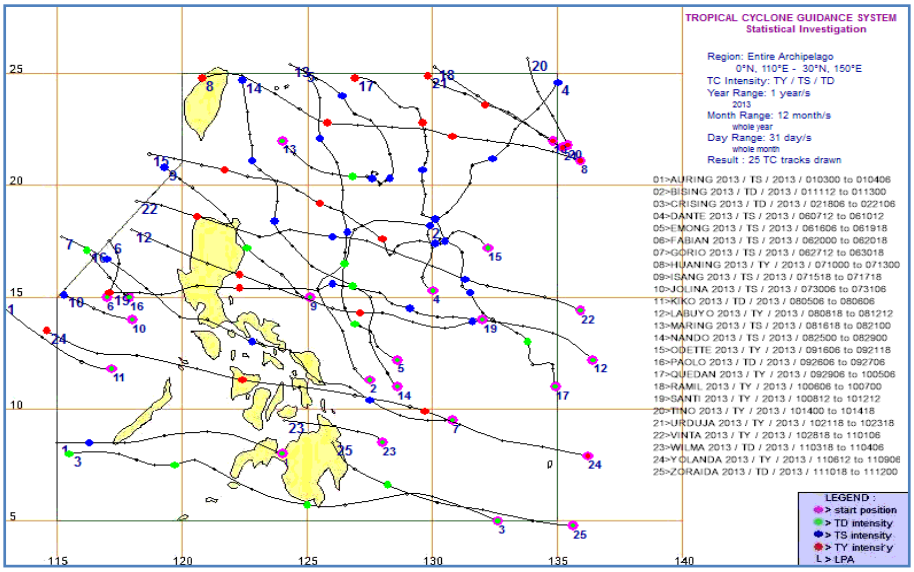
Macao, China
2 - 6 December 2013

CONTENTS

I. Overview of tropical cyclones which have affected/impacted Member's area in 2013 (Free format)

1. Meteorological Assessment (highlighting forecasting issues/impacts)

CY 2013 has been considered a very active year in terms of tropical cyclone formation over the unstable atmospheric condition of the northwest Pacific and a total of **25** tropical cyclones entered and developed inside the Philippine Area of Responsibility (PAR), six (6) of which are Tropical depression, nine (9) are tropical storm and the remaining ten (10) were typhoon intensity. From the 25 tropical cyclones shown in Figure below, ten (10) made landfall and devastated Visayas, Central and Northern Luzon.



The most devastated among the tropical cyclones in the Philippines are discussed below.

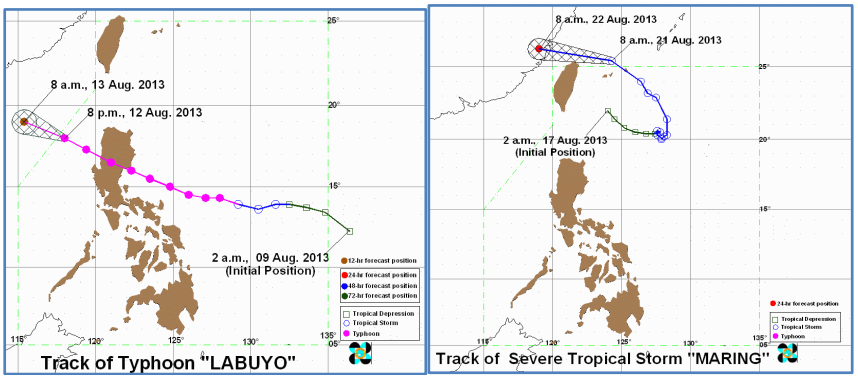
1.1 TYPHOON LABUYO (UTOR-1310)

LABUYO was the 3rd tropical cyclone that made landfall this year. Labuyo was already a Tropical Depression when it entered the PAR in the early morning of August 9. It then moved west northwest at 19 kph in the general direction of Eastern Luzon. Labuyo intensified rapidly into a storm at 75 kph near the center as it continued moving in the same direction and speed in the morning of August 10 and PSWS #1 was raised over Eastern Luzon. Labuyo intensified rapidly into a Storm at 95 kph near the center as it continued moving in the same direction and speed in the morning of August 10 and PSWS #1 was raised over Eastern Luzon. It intensified into a Severe Storm at 105 kph near the center in the afternoon of the same day as it moved in the general direction of Aurora-Isabela area. Labuyo intensified into a Typhoon at 120 kph near the center while maintaining its west northwest direction speed at 19 kph in the evening of August 10. **PSWS #2** was raised over **Eastern Luzon** and **PSWS #1** over the **rest of Northern and Central Luzon**. Typhoon Labuyo intensified rapidly at 140 kph near the center in the morning of August 11 and threatened Aurora and Isabela Provinces. **PSWS #3** were raised in some provinces of Luzon as it gained more strength at 175 kph near the center and gustiness of 210 kph. It continued moving in the same direction and speed closer to Aurora Province in the evening of August 11. Labuyo accelerated at 22 kph and made landfall in Casiguran, Aurora in the early morning of August 12 where heavy damage occurred. It weakened at 150 kph near the center after crossing the rugged terrain of Quirino, Nueva Viscaya, Benguet and La Union in the morning of the same day. It weakened further at 140 kph near the center as it exited the landmass over the northern

part of La Union. It then accelerated and moved northwest at 24 kph over the West Philippine Sea in the afternoon of the same day. It intensified slightly at 150 kph near the center as it continued moving in the same direction and speed and was out of the PAR on the evening of August 12 and the final bulletin was issued. **PSWS #3** over Isabela, Aurora, Quirino, Nueva Viscaya, Mt. Province, Beneguet, Ifugao, Abra, Kalinga, La Union,m Ilocos Sur and Pangasinan. **PSWS #2** over Ilocos Norte, Apayao, Cagayan, Tarlac, Pampanga, Nueva Ecija, Quezon including Polilio is., Zambales, Camarines Provinces and Daet **PSWS #1** over Batanes Group, Babuyan and Calayan Group, Bataan, Laguna, Cavite, Batangas and M. Manila. **Damage-**P1.6B; **Casualties** – 11 Persons

1.2 TY MARING *(TRAMI-1312)*

Typhoon **MARING** (Trami) was a Low Pressure Area northeast of Basco, Batanes and developed into a **TD** in the early morning of August 17. It then moved **SE** at 11 kph over the Bashi channel. Maring shifted to **ESE** direction while maintaining its speed and intensity of 55 kph near the center in the evening of the same day. It again changed direction to the east slowly as it intensified into a storm at 65 kph near the center, in the morning of August 18. It remained almost stationary for almost 48 hours as it intensified at 75 kph near the center. Maring again increase its strength to 85 kph near the center with gustiness of 105 kph in the morning of August 19. T.S. "Maring" enhances the southwest monsoon while it was almost stationary, bringing heavy to intense rains over Luzon particularly the western section that caused extensive flooding over the National Capital Region and to other provinces in Luzon in the morning of August 20. Maring started moving north at 19 kph as it intensified at 95 kph near the center. It then moved WNW at 20 kph in the morning of August 21and exited the Philippine area of responsibility. **Damage –P1.4 B; Casualty – 32 Persons**



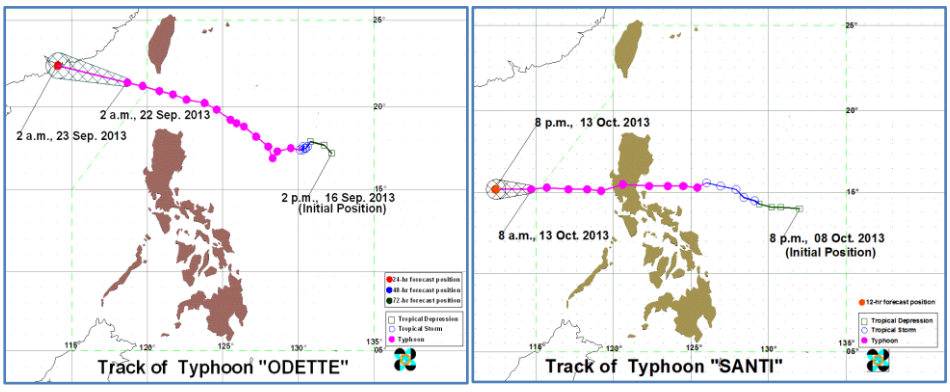
1.3 TYPHOON ODETTE (USUGI-1319)

It was spotted as a Low Pressure Area 750 km east of Casiguran, Aurora and developed into a **TD** in the afternoon of Sept. 16. It initially moved west slowly then remained almost stationary for the next 36 hours as it intensified into a storm in the morning of Sept. 17. Odette gained strength at 85 kph near the center in the early morning of Sept. 18 as it started west at 9 kph. It intensified further at 105 kph near the center with gust of 130 kph in the morning of the same day as it moved WNW slowly. Odette intensified into a typhoon at 120 kph with gust of 150 kph in the evening of the same day as it moved at 13 kph in the same direction. It intensified at 130 kph with gust of 160 kph in the early morning of Sept. 19 as it moved west at 13 kph. It gained more strength at 140 kph near the center with gust of 170 kph in the early morning of Sept. 19 as it moved towards Northern Luzon. Typhoon Odette intensified rapidly at 195 kph near the center with gust of 230 kph in the early morning of Sept. 20 and P**SWS #4** was raised over the Batanes group of islands. Typhoon Odette strength reaches 205 kph near the center with gust of 240 kph in the morning of the same day as it approached Batanes area. It then moved WNW at the same speed of 13 kph in the evening of the same day endangering Batanes group of islands. It gaines more strength at 215 kph with gust of 250 kph in the

early morning of Sept. 21 before making a landfall at 7 Am of the same day in the southern tip of Itbayat island. Odette was the strongest typhoon that Batanes Province has experienced and flooding occurred in Calayan island where 753. 6mm of rainfall was recorded. It weakened at 185 kph after making a landfall and also due to the frictional effect of the landmass and Taiwan. Odette continued moving in the same direction and speed in the afternoon of the day, away from the country. It weakened at 160 kph near the center in the morning of Sept. 22 and exit PAR.
PSWS #4 - Batanes group of islands, **PSWS #3** - Calayan and Babuyan group of islands, **PSWS #2** – Cagayan, Apayao and Ilocos Norte, **PSWS #1** – Abra, Kalinga, Isabela, Ilocos Sur, La Union, Mt. Province, benguet and Ifugao

1.4 TY SANTI *(NARI-1325)*

SANTI (DANAS) was the 2nd tropical cyclone for the month of Oct. and the 19th for the year 2013. It was a **LPA** 925 km east of Catanduanes embedded in the **ITCZ** and developed into a **TD** in the evening of Oct. 8. It initially moved **WNW** at 15 kph over the Philippine Sea. In the morning of Oct. 9, it slowed down at 9 kph and intensified at 65 kph near the center with gust of 80 kph. **PSWS #1** was raised over Catandunes as it intensified slightly at 75 kph with gust of 90 kph in the early morning of Oct. 10 as it moved towards eastern Luzon. Santi gained more strength at 95 kph near the center with gust of 120 kph in the late morning of the same day while maintaining its **WNW** direction at 11 kph. It intensified into a typhoon at 120 kph near the center with gust of 150 kph in the early morning of Oct. 11, while moving towards the province of Aurora and **PSWS #3** was hoisted over Aurora, **PSWS #2** in Soutern part of Northern Luzon and northern part of Central Luzon and PSWS #1 over the rest of Luzon. In the late morning of the same day, Santi gained more strength at 130 kph near the center with gust of 160 kph as it moved closer to Aurora in a westward direction at 15 kph. It again gained more strength at 150 kph near the center with gust of 180 kph as it continued moving closer to Aurora in the afternoon of the same day. Santi made landfall in the southern part of Aurora at 11 Pm of the same day. It then crossed the provinces of Nueva Ecija, Tarlac and Zambales in the early morning of Oct. 12. Severely affected areas happened in the provinces along the path of Santi and heavy flooding occurred in Bulacan Province. Santi weakened at 130 kph near the center after crossing Central Luzon and was over the West Philippine Sea in the morning of Oct. 12. It the continued moving westward at 15 kph then accelerated at 19 kph with the same direction in the morning of Oct. 13 and exited in the western part of **PAR. PSWS #3** over Aurora, Quirino, Nueva Viscaya, Tarlac, Nueva Ecija, Pangasinan, Bulacan and Zambales. **PWSW #2** over Isabela, Mt. Province, Ilocos Sur, La Union, Benguet, Ifugao, Bataan, Metro Manila, Rizal, Northern Quezon, Cavite and Laguna. **PSWS #1** over Cagayan, Apayao, Ilocos Norte, Abra, Kalinga, Camarines Norte, Camarines Sur and Rest of Quezon. **Casualty- 13 Persons, Damage- P3.2B**



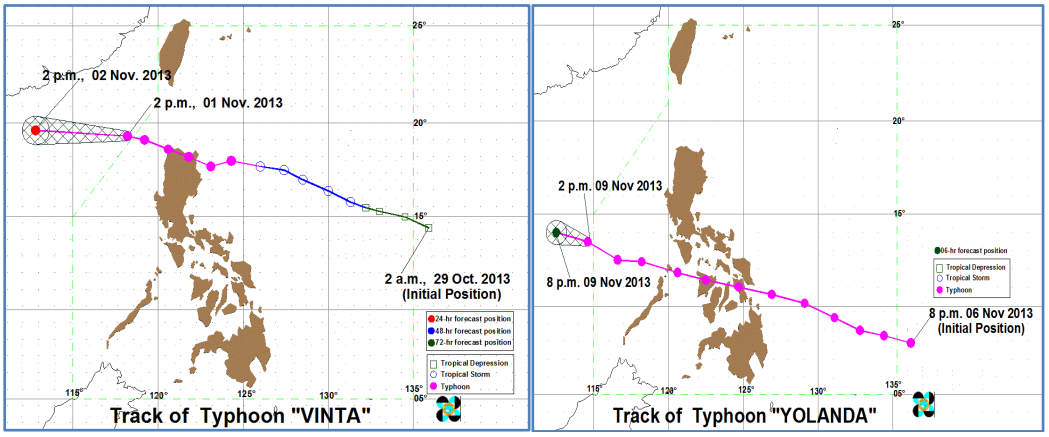
1.5 TY VINTA (KROSA-1329)

TY VINTA (KROSA) was the 8th tropical cyclone that made landfall for the year 2013. It was already a **TD** with maximum winds of 55 kph near the center, when it entered the **PAR** in the morning of Oct. 29. It was moving **WNW** at 26 kph the slowed down at 19 kph in the same direction towards eastern Luzon in the evening of the same day. **PSWS #1** was hoisted over Aurora and Isabela Area as Vinta intensified into a storm with winds of 65 kph and gust of 80 kph. Vinta shifted to the west at 26 kph in the morning of Oct. 30 and the whole of Luzon was raised to **PSWS #1.** It again intensified at 85 kph with gust of 100 kph in the afternoon of the same day as it moved towards northern Luzon and **PSWS #2** was raised extreme northern Luzon and **PSWS #1** over the rest of Luzon. Vinta intensified into a severe storm at 105ph near the center with gust of 130 kph, in the early morning of Oct. 31 and **PSWS #3** were raised over Cagayan and Apayao Provinces as it continued moving west at 26 kph towards Cagayan Province. Vinta intensified into a typhoon with maximum winds of 120 kph near the center and gust of 150 kph in the late morning of the same day, as it continued moving towards extreme northern Luzon and **PSWS #3** were raised over Cagayan including Calayan and Babuyan group of islands, Apayao and Ilocos Norte. In the afternoon of the same day, it intensified at 130 kph near the center and gust of 160 kph and made landfall in the afternoon of the same day. It crossed the provinces of Cagayan, Apayao and Ilocos Norte and was over the western seaboard of Laoag City in the early morning of Nov. 1. Some houses were damage and trees were uprooted bur not very severe. Vinta then moved **WNW** at 22 kph while over the West Philippine Sea, moving away from the country. It exited in the western border of the **PAR** in the afternoon of the same day and the final bulletin was issued. **Casualty -3 persons, Damage – P207 M**

1.6 TY YOLANDA (HAIYAN- 1330)

TY YOLANDA (HAIYAN) was the 23rd tropical cyclone for the year 2013 and the 9th that made landfall and also one of the most destructive for almost a decade, and one of the strongest typhoon. It was already a typhoon with maximum sustained winds of 195 kph near the center and gust of 230 kph when it entered the **PAR** at midnight of Nov. 6. It was moving **WNW** at a faster pace of 30 kph over the Philippine Sea. In the early morning of Nov. 7, Yolanda intensified at 215 kph with gust of 250 kph moving in the same movement towards eastern Visayas. It accelerated at 39 kph in the same direction while gaining more strength at 225 kph near the center and gust of 260 kph in the evening of the same day, threatening eastern Visayas. Yolanda intensified further at 235 kph with gust of 275 kph in the early morning of Nov. 8 increasing its threat to Visayas Provinces. **PSWS #4 (>185kph)** were raised over the Provinces of Samar and Leyte in the afternoon of July 7 and included Masbate, Northern Cebu, Panay Island, Southern Mindoro Provinces and Northern Palawan in the evening issuance of Severe Weather Bulletin . Typhoon "Yolanda" made landfall over Guiuan, Eastern Samar in the early morning (4:40Am) of Nov. 8 and the 2nd landfall was in Tolosa, Leyte (7:00 Am) then crossed northern Leyte for two hours and made another landfall in Daanbantayan, northern tip of Cebu Province (9:40 Am), made the 4th landfall in Bantayan island (10:40 Am), 5th landfall was in Conception, Iloilo (12:00) in the island of Panay then crossed northern Panay and was over Sulu Sea in the early afternoon. After traversing Sulu Sea, and again in the evening, it again hit the island of Busuanga in Northern Palawan (8:00 Pm). Yolanda weakened at 195 kph with gust of 230 kph after crossing Northern Visayas due to the landmass interaction and cold air intrusion. It exited PAR after traversing West Philippine Sea in the afternoon of Nov. 9. **PSWS #4** over Samar and Leyte Provinces, Northern Cebu, Masbate, Romblon, Aklan, Antique,Iloilo, Capiz, Southern Mindoro Provinces, Northern Palawan and Dinagat Province. **PSWS #3** over Rest of Cebu, Rest of

Mindoro, Rest of Palawan, Sorsogon, Negros Provinces, Bohol, Albay, Surigao del Norte, Biliran Province, Burias island, and Marinduque. **PSWS #2** over Bataan, M. Manila, Rizal, Cavite, Laguna, Batangas, Southern Quezon, Camarines Sur, Lubang island., Siquijor and Camiguin. **PSWS #1** over Pampanga, Zambales, Bulacan, Camarines Norte, Rest of Quezon, Catanduanes, Surigao del Sur, Misamis Oriental and Agusab del Norte. Casualties; **More than 7000**



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

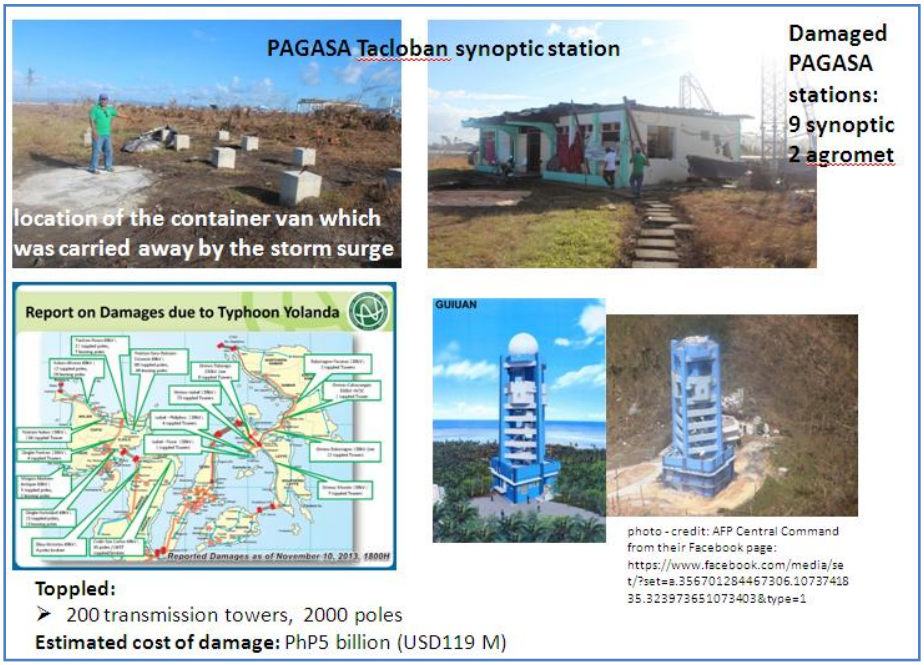
There were 18 flood bulletins and 4 flood advisories issued in the monitored river basins of Pampanga, Agno Bicol and Cagayan while 190 General Flood Advisories were issued in the various regions where ungauged major and principal river basins in the country. The major reservoirs in Binga, Ambuklao, Magat and Angat operated their spillways while La Mesa dam overflowed. Although there was considerable inflow from the Binga and Ambukalo dams, the San Roque dam which is located downstream of Binga and Ambuklao was able to contain the volume of water of 377 million cubic meters from three (3) tropical cyclones (Labuyo, Maring and Lando) that affected the watersheds of the upper Agno river.

Post flood investigations were undertaken in the Pasig-Marikina (Metro Manila) and nearby provinces and in the Pampanga river basin due to the passage of Tropical Storm Trami (Maring) coupled with the enhanced Southwest monsoon in August 2013.

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

The past year (2013) has been a highly devastating year in terms of damages brought about by tropical cyclones to the passage of Typhoon Yolanda (Haiyan). It registered the highest damages and casualties on record based on the data from the National Disaster Risk Reduction and management Council (NDRRMC). The islands in the Visayas in Central Philippines wherenit wreaked havoc were so vulnerable to a monster like Haiyan. It caught worldwide coverage and attention especially DRR related agencies. TY Haiyan brought into fore how effective are the existing DRR initiatives and identified what are the gaps and needs to cope with such a magnitude of disaster. Regional

discussions are still on-going and quite a number of Expert Mission will be conducted in the Philippines.



Impacts of Typhoon Haiyan (Yolanda) as of 30 Nov 2013

Region	Casualties	Injured	Missing	Damaged houses	Damages (PhP)
Region IV-A	3	4		840	65,235,774.00
Region IV-B	19	61	6	33499	1,756,977,952.00
Region V	7	21		11828	870,800,564.84
Region VI	238	464	22	496,303	12,928,033,459.37
Region VII	74	348	5	123,627	3,093,510,905.00
RegionVIII	5,289	25,237	1726	497,657	11,682,306,475.00
Region IX	1	1		20	
Region XIII	1	0		5,114	203,504,000.00
Total	**5,632**	**26,136**	**1,759**	**1,168,109**	**30,600,369,130.21**

Source: National Disaster Risk Reduction and Management Council (NDRRMC)

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

After the devastation of Typhoon Haiyan in Philippines and Vietnam, numerous regional cooperation assessment will be undertaken in terms of the meteorological, hydrological and DRR aspects of Haiyan. The Typhoon Committee will play a pivotal role in all these discussion considering that Ty Haiyan occurred in the Typhoon Committee area.

II. Summary of progress in Key Result Areas

KRA 1: Reduced Loss of Life from Typhoon related Disasters

Title of item: **Update typhoon monitoring, forecasting, and warning system (Meteorology)**

a) Installation of Forecasters' Workstations – April 2013
These workstations were installed at different PAGASA Regional Services Divisions and other PAGASA Users. The COSMO Model was an integral part of the acquisition of Forecasters' Workstation which was installed last March 2013. Trainings for Admin & Users (PRSDs and Central Office) were conducted in March 2013. Integration of Satellite Facilities (Upgrading, acquisition, installation, training)

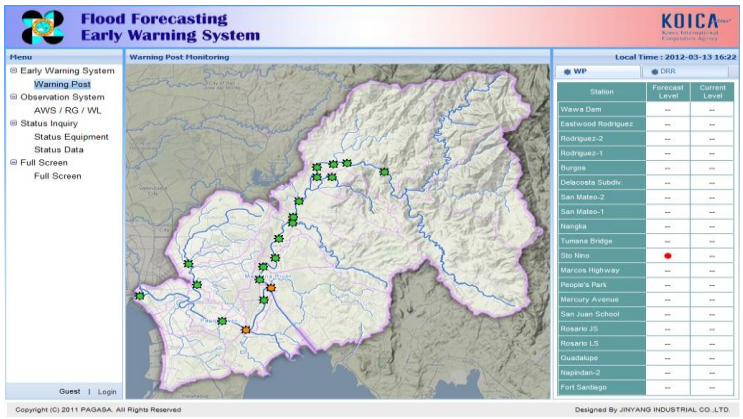
b) FIXED AND MOBILE SATELLITES - Fixed Geostationary Satellite Receiving System were installed in Tuguegarao last June 8, 2013 and El Salvador in Mindanao last June 18, 2013, one Geostationary Satellite Receiving System is to be used by STRIDE Team as a new and cost effective satellite ground station that is portable and easy to transport. The system was delivered last June 11, 2013.

c) Improve tropical cyclone forecast accuracy, including forecast of intensity and track of typhoon as well as typhoon induced wind, rainfall and storm surge.
For Storm surge forecast, the JMA SS Model was run and simulated and the results of simulation were the basis of forecasts issued to the public.

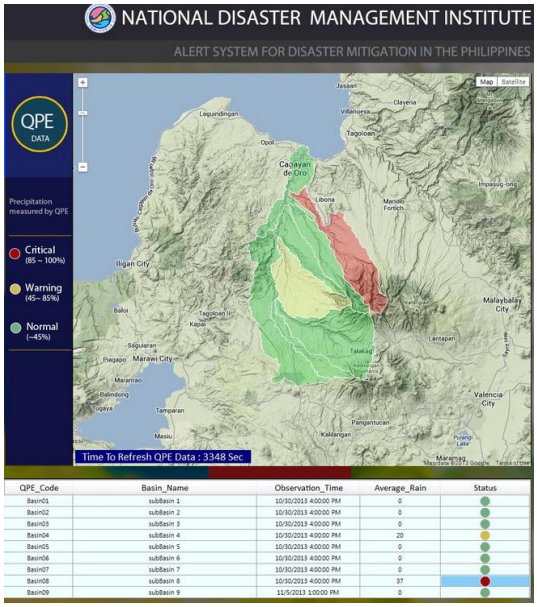
d) Verification of TC Forecast Track Error (24H, 48H, 72H)
Tropical Cyclone forecast track were verified from year 2007 to 2012. For the 24, 48 and 72 hour period. During 2009 and 2010 tropical cyclone events have the highest error occurred while 2010 to 2012 have a decreased in the forecast error.

Title of item: **Establishment and improvement of urban flood risk management systems to selected cities (Hydrology)**

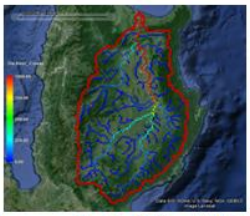
a) Enhanced Flood Forecasting and Warning in Metro Manila
The FFWS for the Pasig-Marikina river basin which include a large portion of the Metro Manila was enhanced through the establishment of additional rainfall, water level gauging stations and 20 warning stations under the project: Establishment of a Flood Warning and Monitoring System for Disaster Reduction in Metro Manila with funding from the Republic of Korea. Flood warnings in the form of pre-recorded flood messages can now be heard from the warning stations which are strategically located along the Pasig-Marikina river.



b) Establishment on flash flood warning system including debris flow and landslides
The Flash Flood Alert System (FFAS) will alert downstream communities in Cagayan de Oro City for impending flash flood resulting from intense rainfall (threshold) derived from the QPE of radar data and automatic weather stations. This is an initiative of the Disaster Management Institute (NDMI) of Korea in response to the flash flood that occurred in Cagayan de Oro City during the passage of TS Washi on 17 December 2011.



c) The Integrated Flood Alert System (IFAS) was applied in the Cagayan and Pampanga river basins. The IFAS is a distributed rainfall-runoff model that employs remote sensing data from microwave satellites to simulate flooding to improve river management. The project is jointly implemented by the Asian Development Bank (ADB) and the Japan Aerospace Exploration Agency (JAXA) in the Philippines, Bangladesh and Vietnam. For the Philippine component, IFAS is targeted to be used operationally in the flood season of 2014. Verification of Global Satellite Mapping of Precipitation (GSMaP) will be done based on existing and installation of 3 rainfall gauges within the Cagayan river basin.



Screenshot of the IFAS in the Cagayan river basin

IFAS will be made operational in the Cagayan, Pampanga and Agno river basins in 2014.

KRA 2: Minimized Typhoon-related Social and Economic Impacts

Title of item: **Establishment of flood forecasting systems to selected river basins (Hydrology)**

a) Establishment of FFWS Centers for the 13 major river basins (8 in Mindanao, 3 in the Visayas and 2 in Luzon) are also being established.
With funding provided by the Philippine Government, 3 FFWS Centers are currently being put up in 3 major river basins in Mindanao, namely: Tagum-Libuganon in Tagum City, Davao (Davao City), and Buayan-Malungun in General Santos City.

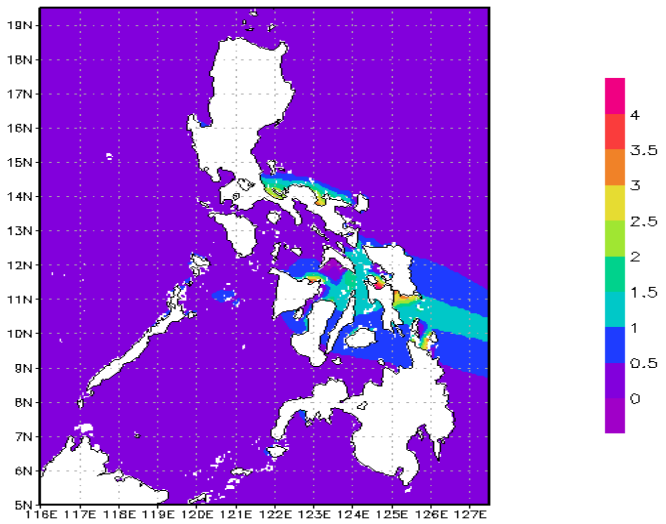
b) A network of telemetered rainfall and water level gauging stations using radio as main communication system for flood forecasting and warningsystem are also being established in major river basins in Tagum-Lubuganon, Cagayan dseo Oro and Mandulog river basins in Mindanao.

KRA 4: Improved Typhoon-related Disaster Risk Management in Various Sectors

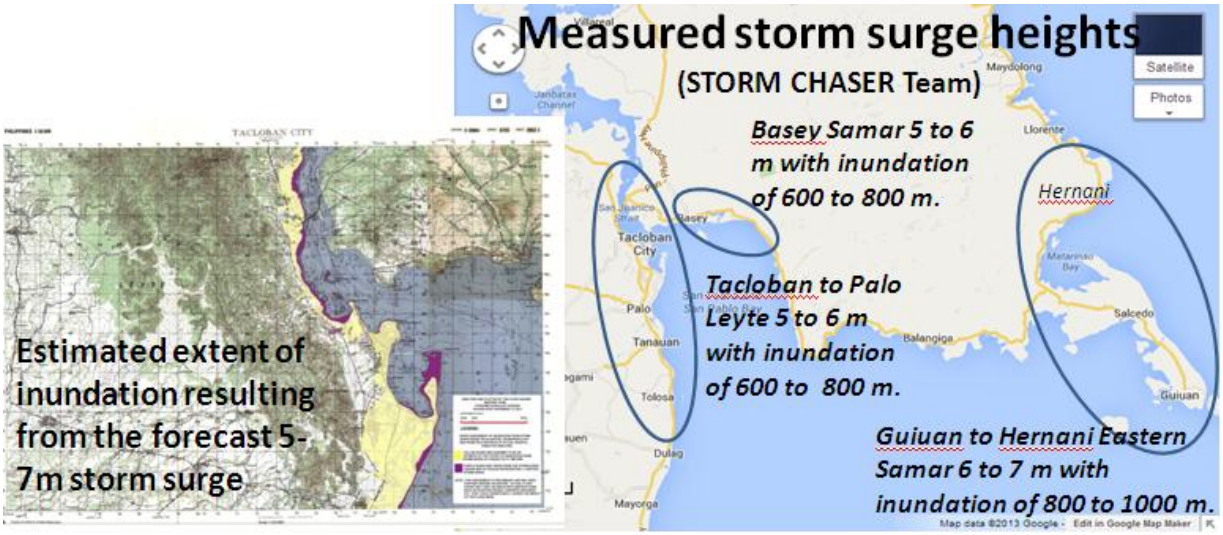
Title of item: **Establishment and improvement of QPE/ QPF and storm surge warning services (Meteorology)**

With the operationalization of 9 Doppler radars in the Philippines, output of the Weather Research Forecasting (WRF) model provided better QPE/QPF estimates.

- Storm surge warning were provided during the passage of Typhoon Haiyan (Yolanda) based on the forecast storm surges of the JMA model. This is a result of the training of 2 PAGASA staffs in Bangkok, Thailand courtesy of the Asian Disaster Preparedness Center (ADPC).



Highest Storm surge output by the JMA model ~ 3.57 m (minus astronomical tide)
(PAGASA forecast: 5-7 meters)



Title of item: **Preparation of inundation and water-related Hazard Maps (Hydrology)**

Four (4) flood hazard maps were completed in the provinces of Cavite, Laguna, Rizal and Bulacan under the Ready project for Greater Metro Manila Area (GMMA) under the AusAID/UNDP project.

Title of item: **Development of comprehensive countermeasure for extraordinary flood disaster (Hydrology)**

- assisted the Assessment Team from Korea, Laos and Thailand in the site survey of the flood prone areas in the Pampanga river basin
- discussion with government officials in charge of FFWS for dam operation activities, particularly those from Pantabangan, Angat and San Roque dams;
- Provided pertinent data and information to the Team

Post flood investigation was conducted during the passage of Tropical Storm (Trami) coupled with the enhanced Southwest Monsoon that inundated Metro Manila and fringed provinces. Survey and analysis of the flood disaster in the Pampanga river basin in August 2013 was also undertaken.

KRA 5: Strengthened Resilience of Communities to Typhoon-related Disaster (Meteorology)

a) Lectured topics for DRRM, Atmospheric Science, Satellite Meteorology, etc.
b) Delivered lecture to PCG Deck Officer's Trainings.
c) Delivered lecture to PRSD forecasters in relation to the formulation of forecast products
d) Participated in the STCC-COSTA Meetings on Space Technology Applications
e) Participated with different seminars/workshops both local and abroad.
f) Issued Weather Bulletins and Warnings for the 25 tropical cyclones that entered and developed inside PAR.
g) Issued Gale Warnings to Local Fishermen and to all small seacrafts.

Title of item: **Establishment and sustaining community based FFWS (Hydrology)**

Community based flood forecasting and warning systems (CBFFWS) have been implemented by foreign donors such as the World Food Programme (WFP), GIZ and AusAID/UNDP, national government agencies i.e. the Regional offices of the Office of Civil Defense (OCD), and the local government units. This year the areas where CBFFWS were installed include the Regions 2 and 5, CAR, IVA, and XIII (CARAGA Region).

Title of item: **Provision of on-the job training on flood forecasting systems (Hydrology)**

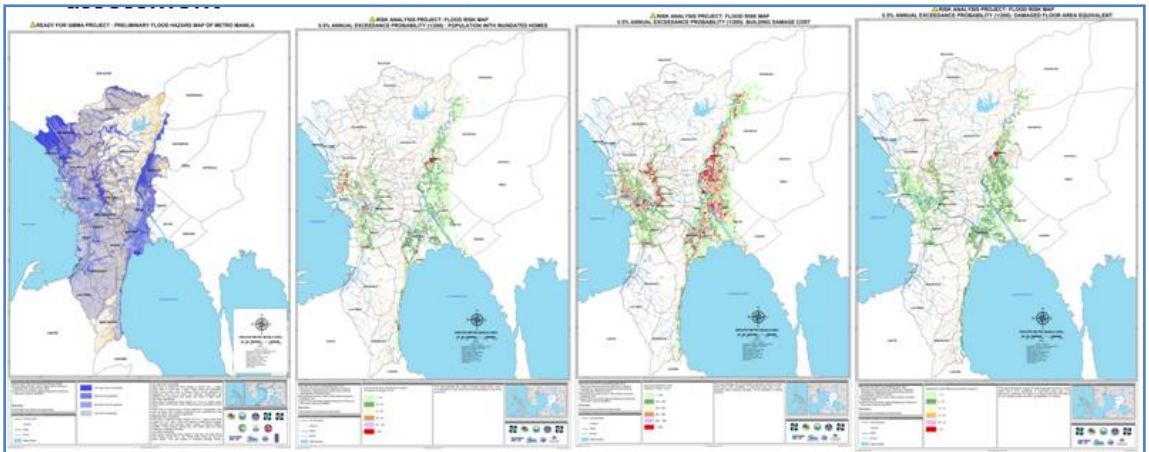
Various lectures were conducted on flood early warning systems. In addition, several flood drills were carried out in Metro Manila, the provinces of Bataan, Laguna.

On-going - **Hydrologists Training Course (HTC)** based on a curriculum designed by the World Meteorological Organization (WMO) and the International Hydrological Programme (IHP) of UNESCO.

- Objective: provide the participants (who are mostly engineers) with knowledge on operational hydrology.
- Commenced in late July 2013 include 9 months theoretical phase followed by a 2-months on the job training
- Participants who will successfully complete the course will be recruited and deployed in the FFWS Centers of the 13 major river basins in the country. The 35 participants include both local and foreign (2) participants.

Title of item: **Implementation of techniques on urban flood inundation mapping, hazard mapping and flood disaster assessment (Hydrology)**

Following the devastation of the National Capital Region (NCR) in September 2009 with the passage of Tropical Storm Ketsana, the derived flood risk maps were completed. With assistance from Australia Agency for International Development (AusAID) and Geoscience Australia (GA) under the Risk Analysis Project, Flood hazard map and flood risk map of 0.5% annual exceedance probability (1/200) population with inundated homes and Flood hazard maps of 0.5% annual exceedance probability (1/200) with Building damage cost (left) and damage flood area equivalent were developed.



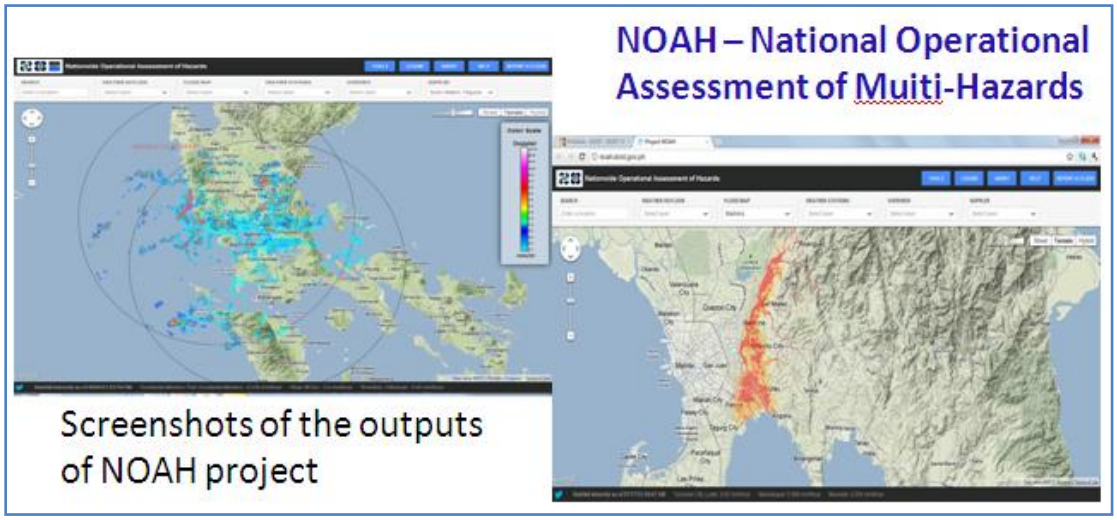
Flood hazard map (left) and flood risk map of 0.5% annual exceedance probability (1/200) population with inundated homes

Flood hazard maps of 0.5% annual exceedance probability (1/200): Building damage cost (left) and damage flood area equivalent

KRA 6: Improved Capacity to Generate and Provide Accurate, Timely, and understandable Information on Typhoon-related Threats.

Title of item: **Improve hydrological products which meet users' requirements. (Hydrology)**

The Department of Science and Technology (DOST) is currently implementing the NOAH project which provides forecast inundation maps. These maps are posted in the DOST and PAGASA websites for the local government units to access during inclement weather or emergency conditions.



Screenshots of the outputs of NOAH project

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

1. To immediately replace the damaged monitoring instruments in the affected synoptic and agromet stations;
2. To enhance the knowledge of forecasters about storm surge;
3. Enhancement of IECs with emphasis on the impacts of storm surges;
4. Formulation of an SOP for Coastal Hazards such as Storm Surge;
5. Conduct of a scientific assessment report on Ty Haiyan;
6. To update of all hazard maps on floods, storm surge; conduct risk mapping on storm surge prone areas;
7. To re-design, construct/rehabilitate all damaged PAGASA stations (disaster proof buildings) ;
8. To establish all-weather, disaster-proof communication system.
9. Embark on massive IEC on Storm Surge
10. Assist various Expert Missions on Typhoon Haiyan
11. Continue the establishment of FFFWS Centers and FFWS in non-telemetered major river basins
12. Application of remote sensing data to improve river management

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

KRA =	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Meteorology	1	0	0	1	1	0	0
Hydrology	3	1	0	2	3	1	0
DRR							
Training and research	1				1		
Resource mobilization or regional collaboration							

Member: Philippines

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