

**JMA/WMO WORKSHOP ON EFFECTIVE TROPICAL CYCLONE WARNING  
IN SOUTHEAST ASIA**

Tokyo, Japan  
11-14 March 2014

**Country Report**

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**Summary**

The Philippines is prone to Tropical Cyclone occurrences due to its geographical location. An average of 20 Tropical Cyclones occur each year and about 8 or 9 of these make landfall. With it comes heavy rains resulting to flooding of large areas, landslides along mountain slopes, strong winds and storm surges which often results in heavy casualties to human life and destructions to crops and properties. Thus, it is of utmost importance for PAGASA to have an effective Tropical Cyclone Warning System to mitigate the adverse effects of this weather system for the benefit of the whole nation.

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## **1. Tropical Cyclone Monitoring, Analysis and Forecasting**

### **1.1 Tropical Cyclone Monitoring**

#### **1.1.1 Tropical Cyclogenesis Monitoring**

As a Low Pressure Area (LPA) develops within or near the Philippine Area of Responsibility (PAR), it is closely monitored by PAGASA. One of the techniques used is persistence. If the cloud cluster of this LPA persists for more than 1 day the higher the chance it may develop into a Tropical Depression. Also, PAGASA consults other meteorological center and cyclogenesis models for the prognosis of this LPA.

#### **1.1.2 Tropical Depression (TD) Warnings**

When a Low Pressure Area (LPA) located inside the PAR intensifies into a Tropical Cyclone (TC) or when it enters the PAR already a TC, PAGASA issues a Weather Bulletin (Alert/Warning) and International Warning for Shipping. It is promptly disseminated to the National Disaster Risk Reduction Management Council (NDRRMC) and the Office of Civil Defense (OCD) and other agencies involved in disaster management and to various media such as television, radio, newspaper and social media and is also uploaded into the PAGASA website.

#### **1.1.3 Challenges, Needs and Improvement Plans**

An intensive training on the use of Dvorak technique and other techniques in determining the intensity of the TC and to further develop a criteria for tropical cyclogenesis and operational monitoring of the development of tropical depression in order to issue appropriate warnings,

## **1.2 Tropical Cyclone Analysis**

### **1.2.1 Parameters and Methods**

<b>Parameter</b>	<b>Time (UTC)</b>	<b>Methods</b>	<b>Other sources</b>
Tropical Cyclone Position	00 06 12 18	The use of a combination of analysis and when in doubt compare it to the position of different meteorological agencies i.e. JMA, JTWC and making adjustments if necessary to adapt it to the analysis made by PAGASA.	The use of available synoptic observation data, upper air, radar and satellite together with the comparison from other meteorological agencies such as JMA, JTWC, KMA, etc.
Tropical Cyclone Intensity	00 06 12 18	The use of all available observation analysis such as ground data (wind, mean sea level pressure), upper air data (wind and geo-potential height) and remote sensing data (radar and satellite)	<ul style="list-style-type: none"><li>• The use of available synoptic observation data, upper air data, radar and satellite images.</li><li>• DVORAK Technique.</li><li>• Multiplatform Tropical Cyclone Surface Winds Analysis (MTCSWA) of NOAA NESDIS</li></ul>

### 1.2.2 Challenges, Needs and Improvement Plans

- Further training of forecasters on TC tracking especially of Tropical Depressions and low intensity Tropical Storms especially at night and on DVORAK technique.

## 1.3 Tropical Cyclone Forecasting

### 1.3.1 Parameter and Method

Parameter	Issuance Time (UTC)	Lead time (hours)	Methods
TRACK	00 06 12 18	24 hrs 36 hrs 72 hrs	<ul style="list-style-type: none"><li>• Analog Method (Persistence and Climatology)</li><li>• Based on NWP either locally run (e.g. WRF, COSMO) and from other sources (GSM, NAVGEM, GFS etc.)</li><li>• Manual Analysis of weather charts.</li><li>• Deep Layer Mean Analysis.</li><li>• TC Track Forecast of foreign members (JMA, JTWC, etc.)</li></ul>
CENTRAL PRESSURE	NIL	NIL	NIL
MAXIMUM SUSTAINED WINDS	NIL	NIL	NIL
STRONG WINDS AREAS	NIL	NIL	NIL

### 1.3.2 Challenges, Needs and Improvement Plans

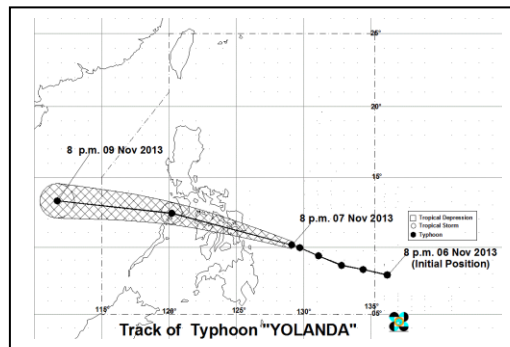
- The Agency needs to have access to better NWP products (maybe from other Meteorological Centers).
- Acquisition of a TC Workstation
- Automatic Delineation of Storm Warning Areas

## 1.4 Tropical Cyclone Products

### 1.4.1 TC Products

- **TC Forecast Track Map** – a graphical product showing the track of the TC such as its recent movement, forecast movement (24, 48 and 72 hour positions) as well as

the area of uncertainty. This product is available on the Agency's website and is incorporated as well in the Weather Bulletin.

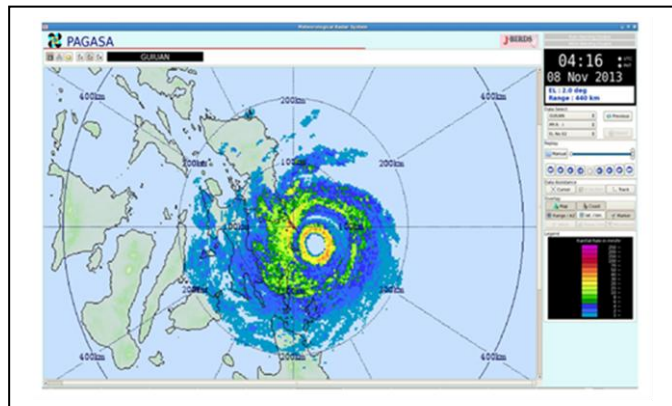
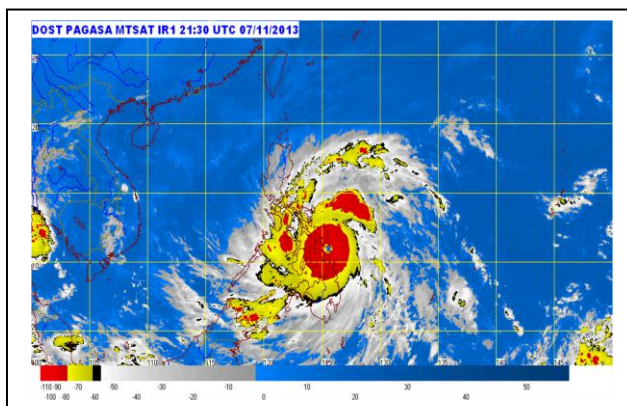


- **TC Hourly Update** – hourly information on the position of the TC (lat./long), distance from a reference point (city/town), intensity and the direction and speed of movement. This is posted at the Agency's website, facebook and twitter account.

#### HOURLY UPDATE ON TS "ZORAYDA"

DATE/TIME	COORDINATES	INTENSITY/DIRECTION/SPEED	LOCATION/DISTANCE
11/11/2013			
8 AM	5.0 N/ 134.0 E	TD @ 55KPH / WEST @ 20KPH	925 KM SE OF HINATUAN
9 AM	5.0 N/ 133.8 E	TD @ 55KPH / WEST @ 20KPH	885 KM SE OF HINATUAN
10 AM	5.0 N/ 133.6 E	TD @ 55KPH / WEST @ 15KPH	870 KM SE OF HINATUAN

- **Satellite and Radar Imageries** – hourly update of satellite and radar images of the TC. Also posted at the Agency's website and uploaded to facebook and twitter.



- **NWP Products** – MSLP, wind and rainfall products of GSM and WRF are also posted in the website.

#### 1.4.2 Challenges, Needs and Improvement Plans

- Ensuring that the Products are understood and received on time by the end-users.
- Automatic dissemination of products

#### 1.5 Computing Platform (including software)

- None as of this time

### 2 Numerical Weather Prediction Status for Effective Warning

#### 2.1 NWP in Operational Use

Model	Domain (square degree)	Resolution (horizontal & vertical)	Initial Time	Forecast Range (hours)	Run by (own/foreign centers)
Global Spectral Model	20°S to 60°N, 60°E to 200°E,	125 X 125 km	00, 06, 12, 18	84 and 198	JMA
WRF	2°N to 25°N, 115°E to 135°E,	12 X12 km and 3X3 km	Hourly	84 hours	PAGASA

## 2.2 Application Techniques of NWP Products for Operational Forecasts

The output of these numerical models are used during a tropical cyclone event as a forecast guidance in addition to other available data. The rainfall, wind intensity as well as the forecast movement of the TC are the commonly used products.

## 2.3 Challenges, Needs and Improvement Plans

There is a need for comprehensive training on the utilization of numerical model output and to have an ensemble analysis. The plan to provide model output statistics (MOS) for each model to provide higher confidence on the output of each model.

## 3. Storm Surge

### 1) Storm Surge Information

- a. ☒ Issuing b. ☐ not issuing

(For those who answered “b.” in 1))

### 2) What is the reason?

- a. No use (inland / no storm surge) b. No forecast are available  
c. Other ( )

(For those who answered “a.” in 1))

### 3) How the information is issued?

- a. Independent storm surge information b. ☒ Included in TC information  
c. Other ( )

### 4) What products (observations /forecasts) are referred to?

- Storm surge height in meters

### 5) If your Service runs a storm surge model by yourself, please describe the way in detail.

Model	Domain and resolution	Forecast Range (hours)	Frequency	Considered factors (Tide/ensemble/ inundation, etc.)
JMA Storm Surge Model		72 hours	Every 6 hours	MSLP and forecast track of the TC

### 6) In case your Service issue storm surge forecast without your own model, please briefly explain the operational procedure.

## 4. Effective Warnings

#### 4.1 Emergency Response for TC Disasters

##### 4.1.1 Legal Framework for TC Disaster Management

In the Philippines, the disaster management was guided by Republic Act 101201 known as AN ACT STRENGTHENING THE PHILIPPINE DISASTER RISK REDUCTION AND MANAGEMENT SYSTEM, PROVIDING FOR THE NATIONAL DISASTER RISK REDUCTION AND MANAGEMENT FRAMEWORK AND INSTITUTIONALIZING THE NATIONAL DISASTER RISK REDUCTION AND MANAGEMENT PLAN that can be downloaded thru: [http://www.ndrrmc.gov.ph/index.php?option=com\\_content&view=article&id=45:republic-act-no-10121&catid=24:disaster-risk-reduction-and-management-laws&Itemid=39](http://www.ndrrmc.gov.ph/index.php?option=com_content&view=article&id=45:republic-act-no-10121&catid=24:disaster-risk-reduction-and-management-laws&Itemid=39). PAGASA as a member of the council is mandated to provide warnings and related information for community preparedness.

##### 4.1.2 Emergency Response Mechanism

The National Disaster Risk Reduction and Management Council (NDRRMC) convenes to make preparatory steps to mitigate the adverse impact of a Tropical Cyclone and mobilizing member agencies during disaster for response such as evacuation and relief efforts. After the disaster, the council is still in charge with rehabilitation. The council is from the National level down to the smallest unit of the government which is the barangay.

##### 4.1.3 Organs Responsible for Warnings and Evacuation Orders

Severe Weather Phenomena	Organs responsible for Warnings	Organs responsible for Evacuation Orders
Tropical Cyclone	PAGASA	Local Government Unit
Heavy Rain	PAGASA	Local Government Unit
Strong Wind	PAGASA	Local Government Unit
River Flood, Flooding	PAGASA	Local Government Unit
Storm Surge	PAGASA	Local Government Unit

#### 4.2 Warnings/Advisories for Severe Weather Phenomena

##### 4.2.1 Tropical Cyclone

Warnings/Advisories and corresponding emergency responses	Whenever a Tropical Cyclone enter or develop inside the Philippine Area of Responsibility (PAR), PAGASA issues a Severe Weather Bulletin Alert level if there is no public storm warning signals raised and if there is a necessity to raise storm warning signals, a Severe Weather Bulletin, Warning level is issued to areas which are to be affected. These are promptly sent to the NDRMMC and a parallel dissemination to the National Offices down to the community level using all forms of media. The Local Government Units have the primary responsibility to undertake appropriate actions commensurate to the warning.
Potential Disaster Risks	<ul style="list-style-type: none"><li>• Strong Winds</li><li>• Flooding</li><li>• Landslides</li><li>• Storm Surge</li></ul>

<b>Target (warning areas)</b>	The Weather Advisory is issued to give general information regarding the TC while the Severe Weather Bulletin Alert/Warning is issued to warn affected provinces of the impending threat brought by a TC to the locality.				
<b>Meteorological variables/indices used for criteria/thresholds for warnings/advisories</b>	<ul style="list-style-type: none"> <li>• Surface Wind intensity</li> <li>• Rainfall amount</li> </ul>				
<b>Criteria/Thresholds</b>	<b>For Strong Winds:</b> <ul style="list-style-type: none"> <li>• Public Storm Warning Signal (PSWS) No. 1 – winds of not more than 60 kph maybe expected in <i>at least 36 hours</i>*</li> <li>• PSWS #2 – winds of 61 to 100 kph may be expected in <i>at least 24 hours</i>*</li> <li>• PSWS #3 – winds of 101 to 185 kph may be expected in <i>at least 18 hours</i>*</li> <li>• PSWS #4 – winds of more than 185 kph may be expected in <i>at least 12 hours</i>*</li> </ul> <p>* times are valid only the first time the signal numbers are raised.</p>				
<b>Contents of Warning/Advisory Message</b>	<ul style="list-style-type: none"> <li>• Areas where Public Storm Warning Signals are raised and potential impact of the winds</li> <li>• MSLP / Range of surface wind intensity</li> <li>• Storm surge height</li> <li>• Range of estimated rainfall amount within the radius of the TC.</li> <li>• Potential landslides areas</li> </ul>				
<b>Sample Warning/Advisory Message</b>	<b><u>PUBLIC STORM WARNING SIGNAL</u></b>				
	<b>PSWS</b>	<b>LUZON</b>	<b>VISAYAS</b>	<b>MINDANAO</b>	<b>POTENTIAL IMPACTS OF THE WINDS</b>
	<b># 4</b> (Winds of more than 185 kph is expected in at least 12 hrs)	Extreme Northern Palawan including Calamian Group of Islands, Southern Occidental Mindoro and Southern Oriental Mindoro	Aklan, Capiz, Antique, Iloilo and Guimaras		<ul style="list-style-type: none"> <li>• Coconut plantation may suffer extensive damage</li> <li>• Many large trees maybe uprooted</li> <li>• Rice and corn plantation may suffer severe losses</li> <li>• Most residential and institutional buildings of mixed construction material maybe severely damaged</li> <li>• Electrical power distribution and communication services maybe severely disrupted</li> <li>• In the overall, damage to affected communities can be very heavy</li> <li>• The situation is potentially very destructive to communities</li> <li>• All travel and outdoor activities should be cancelled</li> <li>• Evacuation to much safer shelters should have been completed earlier since it maybe too late under this situation</li> </ul>

	# 3 (Winds of 101 - 185 kph is expected in at least 18 hrs)	Rest of Mindoro Provinces, Romblon and the Rest of Northern Palawan including Puerto Princesa City			<ul style="list-style-type: none"> <li>Heavy damage to agriculture</li> <li>Some large trees uprooted</li> <li>Majority of nipa and cogon houses unroofed or destroyed considerable damage to structures of light to medium construction</li> <li>Moderate to heavy disruption of electrical power and communication services</li> <li>Travel by land, sea and air is dangerous</li> </ul>
	# 2 (Winds of 61-100 kph is expected in at least 24 hrs)	Lubang Island, Batangas, Marinduque, Rest of Palawan, Burias Island, Masbate and Ticao Island	Negros Provinces, Cebu and Biliran Island		<ul style="list-style-type: none"> <li>Moderate damage to agriculture</li> <li>Rice and corn adversely affected</li> <li>Few large trees uprooted</li> <li>Large number of nipa and cogon houses partially or totally unroofed</li> <li>Some old galvanized iron roofing may roll off</li> <li>Travel by all types of sea vessels is risky</li> <li>Travel by all types of aircrafts is risky</li> </ul>
	# 1 (Winds of 30-60 kph is expected in at least 36 hours)	Metro Manila, Bataan, Cavite, Rizal, Laguna, Quezon, Camarines Provinces, Albay and Sorsogon	Samar Provinces, Leyte Provinces, Camotes Island, Bohol and Siquijor	Camiguin, Surigao del Norte and Dinagat Province	<ul style="list-style-type: none"> <li>Twigs and branches of trees may be broken</li> <li>Some banana plants may tilt or land flat on the ground</li> <li>Rice in flowering stage may suffer significant damage</li> <li>Some nipa and cogon houses may be partially unroofed</li> <li>Sea travel of small seacrafts and fishing boats is risky</li> </ul>
	<ul style="list-style-type: none"> <li>Public Warning Signal elsewhere are now lowered.</li> <li>Yolanda is now traversing Sulu Sea and expected to cross Calamian Group of Island between 8:00 – 9:00 pm then will exit the Philippine landmass this evening towards the West Philippine Sea.</li> <li>Estimated rainfall amount is from 10.0 - 20.0 mm per hour (Heavy - Intense) within the <b>400 km</b> diameter out of 600 km diameter of the Typhoon.</li> <li>Sea travel is risky over the seaboard of Northern Luzon and over the eastern seaboard of Central Luzon.</li> <li>Residents in low lying and mountainous areas under signal #4, #3, #2 and #1 are alerted against possible flashfloods and landslides. Likewise, those living in coastal areas under the aforementioned signal #4, #3 and #2 are alerted against storm surges which may reach up to 7-meter wave height.</li> <li>The public and the disaster risk reduction and management council concerned are advised to take appropriate actions and watch for the next bulletin to be issued at 11 PM today.</li> </ul>				

#### 4.2.2 Heavy Rain

<b>Warnings/Advisories and corresponding emergency responses</b>	<b>HEAVY RAINFALL WARNING LEVELS</b> <ul style="list-style-type: none"> <li><b>YELLOW (Advisory)</b> – community AWARENESS. Monitor the weather condition in 2 hours and wait for the next PAGASA ADVISORY.</li> <li><b>ORANGE (Alert)</b> – community PREPAREDNESS. Be on ALERT for possible EVACUATION.</li> <li><b>RED (Action)</b> – community RESPONSE. EVACUATION.</li> </ul>
<b>Potential Disaster Risks</b>	<ul style="list-style-type: none"> <li><b>YELLOW (Advisory)</b> – FLOODING IS POSSIBLE in low lying areas and areas near the river-channel. LANDSLIDE IS POSSIBLE in mountainous areas.</li> <li><b>ORANGE (Alert)</b> – FLOODING is threatening. LANDSLIDE LIKELY in mountainous areas.</li> <li><b>RED (Action)</b> –SERIOUS FLOODING and LANDSLIDE IS EXPECTED in mountainous areas. Take precautionary measures.</li> </ul>



<b>Target (warning areas)</b>	<ul style="list-style-type: none"><li>• <i>Cities or Municipalities</i></li></ul>						
<b>Meteorological variables/indices used for criteria/thresholds for warnings/advisories</b>	<ul style="list-style-type: none"><li>• <i>Observed Rainfall and rainfall amount estimated from Doppler radars</i></li></ul>						
<b>Criteria/Thresholds</b>	<ul style="list-style-type: none"><li>• <i>YELLOW – rainfall observation is 7.5 mm to 15 mm within 1 hour is expected to fall and most likely to continue for the next 3 hours.</i></li><li>• <i>ORANGE - rainfall observation is 15 mm up to 30 mm within 1 hour and most likely to continue or if continuous rainfall for the for the past 3 hours is more than 45 mm to 65 mm.</i></li><li>• <i>RED - rainfall observation is more than 30 mm within 1 hour or if continuous rainfall for the past 3 hours is more than 65 mm.</i></li></ul>						
<b>Contents of Warning/Advisory Message</b>	<i>Contents/Information: weather system causing the heavy rains, warning level, areas to be affected (cities/municipalities), potential impact to the community, advice to the public as well as to concerned agencies and the time of the next issuance of the Warning/Advisory.</i>						
<b>Sample Warning/Advisory Message</b>	<div><div><b><u>Heavy Rainfall Warning No. 01</u></b></div><div><b>Weather System: Typhoon “YOLANDA”</b> <b>Issued at: 4:00PM, 08 November 2013 (Thursday)</b></div><table><tr><th>WARNING LEVELS</th><th>AREA/S</th><th>IMPACT</th></tr><tr><td>YELLOW</td><td>Batangas, Cavite, Laguna, Quezon and Rizal</td><td>Possible FLOODING in low lying areas</td></tr></table><div><ul style="list-style-type: none"><li>• The public and the disaster risk reduction and management council concerned are advised to MONITOR the weather condition and watch for the next advisory to be issued at 7pm today.</li><li>• For more information and queries, please call at telephone numbers <b>927-1335</b> and <b>927-2877</b> or log on to <b>www.pagasa.dost.gov.ph</b>.</li></ul></div></div>	WARNING LEVELS	AREA/S	IMPACT	YELLOW	Batangas, Cavite, Laguna, Quezon and Rizal	Possible FLOODING in low lying areas
WARNING LEVELS	AREA/S	IMPACT					
YELLOW	Batangas, Cavite, Laguna, Quezon and Rizal	Possible FLOODING in low lying areas					

#### 4.2.3 Strong Wind

<b>Warnings/Advisories and corresponding emergency responses</b>	<ul style="list-style-type: none"> <li>• WEATHER ADVISORY – AWARENESS</li> <li>• WEATHER BULLETIN ALERT – PREPAREDNESS</li> <li>• WEATHER BULLETIN WARNING - RESPONSE</li> </ul>
<b>Potential Disaster Risks</b>	<ul style="list-style-type: none"> <li>• WEATHER ADVISORY – NO RISK YET</li> <li>• WEATHER BULLETIN ALERT – NO RISK YET TO THE COMMUNITY BUT SHIPPING SECTOR IS WARNED OF THE THREAT OF A TC</li> <li>• WEATHER BULLETIN WARNING – RISKS FROM STRONG WINDS, HEAVY RAINFALL, FLOODS, LANDSLIDES AND STORM SURGES</li> </ul>
<b>Target (warning areas)</b>	<ul style="list-style-type: none"> <li>• PROVINCES</li> </ul>
<b>Meteorological variables/indices used for criteria/thresholds for warnings/advisories</b>	<ul style="list-style-type: none"> <li>• ESTIMATED MEAN SEA LEVEL PRESSURE</li> <li>• SURFACE WIND INTENSITY</li> </ul>
<b>Criteria/Thresholds</b>	<ul style="list-style-type: none"> <li>• <b>Public Storm Warning Signal (PSWS) No. 1</b> – winds of not more than 60 kph maybe expected in at least 36 hours*</li> <li>• <b>PSWS #2</b> – winds of 61 to 100 kph may be expected in at least 24 hours*</li> <li>• <b>PSWS #3</b> – winds of 101 to 185 kph may be expected in at least 18 hours*</li> <li>• <b>PSWS #4</b> – winds of more than 185 kph may be expected in at least 12 hours*</li> </ul> <p>* times are valid only the first time the signal numbers are raised.</p>
<b>Contents of Warning/Advisory Message</b>	<p><i>Contents/Information: local name of the TC (if TC is a storm category, the International name given by RSMC is also included, time of issuance and its validity, impact statement as to what transpired during the past 6 hours, position/location of the TC, intensity, movement, areas with Storm Warning Signals and the potential impact of the wind, estimated rainfall amount within the radius of the TC, possible landslide and storm surge areas, state of the sea and other information and advice to the public and concerned agencies.</i></p>
<b>Sample Warning/Advisory Message</b>	<p>Same as 4.2.1 Sample Warning/Advisory Message</p>

#### 4.2.4 River Flood

<b>Warnings/Advisories and corresponding emergency responses</b>	<ul style="list-style-type: none"> <li>• <b>Flood Bulletin</b> <ul style="list-style-type: none"> <li>➢ Flood forecasts issued in major telemetered river basins by the respective centers of the Pampanga, Agno, Bicol and Cagayan River Basins</li> <li>➢ Prepared 2x daily during flood watch. In the event that there is a significant rise in the water level, an intermediate basin flood bulletin is</li> </ul> </li> </ul>
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*issued at 10:00 AM and 10:00 PM.*  
*Time of issuance : Twice daily at 4:00 AM and 4:00 PM*  
*Contents / Information : Date and time of issuance, validity period of the bulletin, average basin rainfall (cumulative), forecast rainfall for the next 24 hours, expected hydrological response of the basin and its tributaries, advice to the concerned agencies to take appropriate measures.*

- **General Flood Advisory**

- *Simplified flood bulletin.*
- *Issued when there is a significant rainfall based on past/current observation and the forecast rainfall from numerical weather prediction models, satellite based information and estimates from radar.*
- *Issued to non-telemetered river basins without flood early warning systems (FEWS).*
- *Hydrological information for the concerned public to be aware or prepare for the expected flood or high stream flow.*

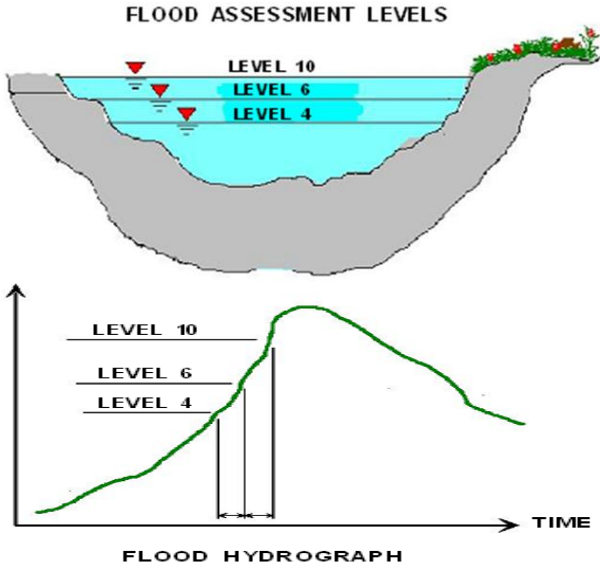
*Time of issuance: Once daily or as the need arises*

*Contents/Information: present weather, observed rainfall from the nearest PAGASA synoptic station, forecast rainfall, rivers that are likely to be affected, expected hydrological response of the river system and advice to the concerned agencies.*

*Below is the list of flood forecast terminologies used in the above mentioned warnings/advisories with the corresponding meaning to public.*

<b>FLOOD FORECAST TERMINOLOGIES</b>	<b>MEANING TO CONCERNED PUBLIC</b>
<b>Flooding is possible</b> ✓ In effect when the expected rise of station water level (WL) shall exceed <b>LEVEL 4</b> within the next 24 hrs.	Suggest <b>AWARENESS</b> Possibility of flooding within the next 24 hours.
<b>Flooding is threatening</b> ✓ In effect when the expected rise of WL exceeds LEVEL 6 within the next 24 hrs; or when the observed WL is between <b>LEVEL 6 and 10</b> .	Suggest <b>PREPAREDNESS</b> Threat of flooding within the next 24 hours.
<b>Flooding is expected to persist</b> ✓ In effect when the observed WL and the expected WL are below <b>LEVEL 10</b> within the next 24 hours.	Suggests <b>RESPONSE</b> Flooding will remain or persist within the next 24 hours.
<b>Flooding is no longer possible /threatening /expected to persist</b> ✓ In effect when the observed WL below Level 10 is generally receding and no immediate significant rise is expected.	There is no prospect or possibility of flooding based on the observed and forecast rainfall.

Potential Disaster Risks	<b>1. Hydrological Forecast</b>	<i>Issued daily during non-flood watch period or during low flow periods or when the expected stream flow are generally normal.</i>
	<b>2. Flood Bulletin</b>	<i>Issued during flood watch.</i>
	<b>3. General Flood Advisory</b>	<i>Issued when there is a significant rainfall based on past/current observation and the forecast rainfall from numerical weather prediction models, satellite based information and estimates from radar.</i>
	<b>*(Note): Please refer to the flood forecast terminologies table above for the corresponding effect or "risk"</b>	
Target (warning areas)	Currently, flood forecasts are issued in major telemetered river basins in Luzon by their respective Flood Forecasting and Warning Centers (FFWC). Target areas are specified mainly considering the importance of areas, susceptibility to flood, and effectiveness of flood forecasting warning as follows:	
	<b>RIVER CENTERS</b>	<b>TARGET AREAS</b>
	<i>Pampanga River FFWC</i>	<i>Provinces of Pampanga, Bulacan and Nueva Ecija</i> <ul style="list-style-type: none"> <li>➤ <i>Pampanga River from Sapang Buho to San Isidro</i></li> <li>➤ <i>Pampanga River from Arayat to Sulipan</i></li> <li>➤ <i>Candaba swamp and its surrounding areas</i></li> </ul>
	<i>Agno River FFWC</i>	<i>- Provinces of Pangasinan and Tarlac</i> <ul style="list-style-type: none"> <li>➤ <i>Entire Pangasinan Plain including the major city/municipalities of Dagupan, Lingayen, Bugallon, Sta. Barbara, Bayambang and Rosales</i></li> <li>➤ <i>Central part of Tarlac province including the municipalities of Gerona, Tarlac, Paniqui and Moncada</i></li> </ul>
	<i>Bicol River FFWC</i>	<i>- Provinces of Camarines and Albay</i> <ul style="list-style-type: none"> <li>➤ <i>Central part of the basin, from Lake Baao to Lake Bato</i></li> <li>➤ <i>Alluvial plain extending around Naga City</i></li> <li>➤ <i>Sipocot river basin downstream from Sipocot</i></li> </ul>
	<i>Cagayan River FFWC.</i>	<i>- Provinces of Cagayan and Isabela</i> <ul style="list-style-type: none"> <li>➤ <i>Areas along the lower reaches from Tuguegarao to Aparri</i></li> <li>➤ <i>Alluvial plain along the river course from Ilagan to Tumauini, Isabela</i></li> </ul>
Meteorological variables/indices used for criteria/thresholds for warnings/advisories	Real-time hydrometeorological data (hourly) such as <b><u>rainfall</u></b> and <b><u>water level</u></b> records are transmitted automatically to the RFFWC of the relevant river basin by telemetry system. The real-time data are also transmitted to the HMD-FFWS simultaneously by telecommunication system and/or other communication systems. The real-time data shall be used for flood forecasting and processed primarily for database.	

	<p><i>In addition to the hydrometeorological data, other information and forecasting tools such as <b><u>satellite images</u></b>, <b><u>radar observations</u></b>, <b><u>weather forecast</u></b>, etc. shall be collected and referred to the flood forecaster.</i></p>						
<p><b>Contents of Warning/Advisory Message</b></p>	<p><i>Certain water levels at the gauging station are utilized as reference to warn the people in the flood prone areas on the severity of the flood. Known as flood warning water levels (FWWLs), these of the PAGASA's FFW system are specified by the water levels equivalent to the specified percentage of the river capacity. The following table gives the definitions and the respective operational and forecasting significance of the FWWLs.</i></p> <p style="text-align: center;"><b>(Flood Warning Water Levels)</b></p> <table border="1"> <tr> <td><b>Alert Level</b></td><td><i>The water level at the gauging station when the channel reach/lake/swamp the station representing, is estimated to be <b>40%</b> full on the average.</i></td></tr> <tr> <td><b>Alarm Level</b></td><td><i>The water level at the gauging station when the channel reach/lake/swamp the station representing, is estimated to be <b>60%</b> full on the average.</i></td></tr> <tr> <td><b>Critical Level</b></td><td><i>The water level at the gauging station when the channel reach/lake/swamp the station representing, is estimated to be <b>100%</b> full.</i></td></tr> </table> <div style="text-align: center;">  <p><b>FLOOD ASSESSMENT LEVELS</b></p> <p><b>FLOOD HYDROGRAPH</b></p> </div>	<b>Alert Level</b>	<i>The water level at the gauging station when the channel reach/lake/swamp the station representing, is estimated to be <b>40%</b> full on the average.</i>	<b>Alarm Level</b>	<i>The water level at the gauging station when the channel reach/lake/swamp the station representing, is estimated to be <b>60%</b> full on the average.</i>	<b>Critical Level</b>	<i>The water level at the gauging station when the channel reach/lake/swamp the station representing, is estimated to be <b>100%</b> full.</i>
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<b>Critical Level</b>	<i>The water level at the gauging station when the channel reach/lake/swamp the station representing, is estimated to be <b>100%</b> full.</i>						
<p><b>Sample Warning/Advisory Message</b></p>	<p><b>Sample PUBLIC WARNINGS:</b>  <i>People living near the mountain slopes of the above mentioned places are advised to be alert for possible occurrence of flash floods and landslides. Likewise, people living near or along the river course and those in the flood-prone/low-lying areas near the above mentioned river systems are advised to be alert for possible flooding. The local risk reduction and management councils are advised to take appropriate actions.</i></p> <p><i>Below is a sample flood bulletin issued by Pampanga River Flood Forecasting and</i></p>						

## Warning Center (PRFFWC):



Department of Science and Technology  
PHILIPPINE ATMOSPHERIC, GEOPHYSICAL AND ASTRONOMICAL SERVICES ADMINISTRATION (PAGASA)  
Pampanga River Flood Forecasting and Warning Center, Hydro-Meteorology Division/NCR-PRSD  
Brgy/Maimpis, San Fernando, Pampanga (Gov Site) <http://www.prffwc.webs.com/>

FLOOD BULLETIN NO. 4 – PAMPANGA RIVER BASIN AND ALLIED RIVERS				EXPECTED FLOOD SITUATION:	P =POSSIBLE T =THREATENING	O =OCCUR F =PERSIST
ISSUED AT: 4:00AM, 07 JULY 2008 VALID UNTIL THE NEXT ISSUANCE AT 4:00PM TODAY UNLESS THERE IS AN INTERMEDIATE BULLETIN						
BASIN RAINFALL AS OF 2:00 AM TODAY: PAST 34-HR = 180 MM				FORECAST 24-HR = 5 TO 15 MM		
BASIN EXPECTED RESPONSE:						
WATER LEVEL STATION (STN)	RIVER/ SWAMP/ WATER LEVEL (WL) TREND AT STATION	FLOOD SITUATION MESSAGE	PARTICULAR LOW-LYING AREAS			
PAMPANGA RIVER (R.) • SAPANG BUHO	NOW AT 6.65 M / GRADUAL RECEPTION TO REACH BELOW 6.50 M. CRITICAL WL	FLOODING IS NO LONGER EXPECTED TO PERSIST. A FINAL MESSAGE	PALAYAN CITY, NATIVIDAD, LLANERA			
• MAYAPYAP	NOW AT 4.55 M / LEVELING OFF ABOVE 4.50 M. CRITICAL WL	FLOODING IS EXPECTED TO PERSIST UNTIL THIS AFTERNOON	STA. ROSA, SAN LEONARDO			
• SAN ISIDRO	NOW AT 4.27 M / RAPID RISE TO REACH ABOVE 6.00 M. CRITICAL WL	FLOODING IS EXPECTED TO OCCUR BEGINNING BEFORE SUNDOWN	SAN ISIDRO, CABIAO			
• ARAYAT	NOW AT 5.30 M / GRADUAL RISE TO REACH ABOVE 6.00 M. ALARM WL	FLOODING IS THREATENING BEGINNING EARLY AFTERNOON	CANDABA, SAN LUIS, ARAYAT, SAN SIMON			
PAMPANGA/ TRIB. ANGAT R.: • SULIPAN	NOW AT 3.52 M / SLOW RISE TO REACH ABOVE 3.80 M. ALERT WL	FLOODING IS POSSIBLE BEGINNING BEFORE NOON	APALIT, CALUMPIT, SAN RAFAEL, PULILAN			
TRIBUTARY RIVER: PENARANDA R. • PENARANDA	NOW AT ____ M / STILL BELOW ____ M. ALERT WL	---	---			
RIO CHICO R. • ZARAGOZA	NOW AT 12.58 M / SLOW RECEPTION TO REACH BELOW 12.50 M. ALARM WL	FLOODING IS NO LONGER EXPECTED TO OCCUR, A FINAL MESSAGE	SAN ANTONIO			
SWAMP: CANDABA • CANDABA	NOW AT 3.90 M / GRADUAL RISE TO REACH ABOVE 4.50 M. ALARM WL	FLOODING IS THREATENING BEGINNING LATE AFTERNOON	SAN MIGUEL, SAN ILDEFONSO, PULILAN			
ALLIED RIVER: ABACAN R. • MEXICO	NOW AT ____ M / SLOW RECEPTION TO REACH BELOW ____ M. ALERT WL	FLOODING IS NO LONGER POSSIBLE. A FINAL MESSAGE	MEXICO, STA. ANA			
GUAGUA R. • SASMUAN	NOW AT ____ M / STILL ABOVE ____ M. ALERT WL	FLOODING IS POSSIBLE UNTIL TOMORROW MORNING	SASMUAN, LUBAO, GUAGUA			
COASTAL FLOODING IN THE LOW-LYING SEASHORE AREAS			HAGONOY, PAOMBONG			
THE RESIDENTS AND THE LOCAL DISASTER RISK REDUCTION AND MANAGEMENT COUNCILS CONCERNED ARE ADVISED TO TAKE APPROPRIATE ACTION						

SAMPLE BASIN FLOOD BULLETIN

Division Chief/Center Chief/ Center Forecaster

## 4.2.5 Storm Surge

Warnings/Advisories and corresponding emergency responses	<ul style="list-style-type: none"> <li>STORM SURGE WARNING – Evacuation of affected coastal areas.</li> </ul>
Potential Disaster Risks	<ul style="list-style-type: none"> <li>Possible loss of lives especially in coastal towns without storm surge resilient evacuation centers</li> <li>Damage to coastal infrastructure due to big waves and inundation.</li> </ul>
Target (warning areas)	<ul style="list-style-type: none"> <li>Provincial coastal areas</li> </ul>
Meteorological variables/indices used for criteria/thresholds for warnings/advisories	<ul style="list-style-type: none"> <li>Estimated MSLP</li> <li>Forecast position of the TC</li> </ul>

<b>Criteria/Thresholds</b>	
<b>Contents of Warning/Advisory Message</b>	<i>Contents/Information : The warning is included in the Weather Bulletin Warning and states the areas affected and the possible wave height of the storm surge in meters.</i>
<b>Sample Warning/Advisory Message</b>	<ul style="list-style-type: none"> <li><i>Residents in coastal areas under Public Storm Warning Signals #4, #3 and #2 are alerted against storm surges which may reach up to 7-meter wave height.</i></li> </ul>

### 4.3 Supporting Meteorological Information for Warning/Advisory Messages

Name of Information	Potential Disaster Risks	Target (areas)	Issuance (update) Time	Contents

### 4.4 Institutional Coordination

#### 4.4.1 Coordination with Disaster Management Authorities

<b>Warning Coordination</b>	<i>PAGASA is a member of the National Disaster Risk Reduction and Management Council (NDRRMC) a body mandated to do disaster prevention and mitigation, disaster preparedness, response, rehabilitation and recovery.</i>
<b>Needs from Disaster Management Authorities</b>	<i>Weather warning/advisories and information that is laymanized and can reach up to the barangay level.</i>

#### 4.4.2 Partnership and Coordination with Media

*[For the immediate and appropriate dissemination of your warnings/advisories to the public as an easy-to-understand message, close coordination with media on warnings/advisories is also vitally important. Please describe your efforts regarding coordination with media on a routine basis and in the case of emergency.]*

<b>Warning Coordination</b>	<i>Broadcast, television and print media as well as the social media are actively involved in the dissemination of our warning/advisories. Once a TC enters or develops inside the PAR, the Agency together with the NDRRMC immediately conducts a Press Conference and repeatedly do these until such time that the TC no longer poses a threat to the country. The PTV 4, a television channel owned by the government has set-up a studio right inside the premises of the Agency and airs hourly updates of the position and location of the TC.</i>
<b>Needs from Media</b>	<i>Laymanized warnings/advisories</i>

### 4.5 Challenges (and Future Plan)

*A Tropical Cyclone Workstation and platform and better NWP products are much to be desired. An accurate and timely disseminated laymanized warnings/advisories that the general public as well as the Disaster Managers/LGUs can easily understand and can be receive on time so that they can carry out appropriate actions to mitigate the adverse effects brought about by a TC.*