



Weather Forecast and Disaster Risk Reduction

ESPERANZA O. CAYANAN, Ph.D.
Chief, Weather Division
PAGASA



**GOOD WEATHER
FORECAST**

**DISASTER RISK
REDUCTION**

**PAGASA Initiatives to
improve weather
forecast & warning
system**

**Components of good
early warning system
for disaster risk
reduction**

**Philippine
Atmospheric,
Geophysical &
Astronomical
Services
Administration**



Legal Mandate

To provide protection against natural calamities and utilize scientific knowledge as an effective instrument to insure the safety, well being and economic security of all the people, and for the promotion of national progress.

Mission

Deliver reliable and relevant weather-related information, products and services to develop communities resilient to typhoons, floods, rain-induced landslides, storm surges, extreme climatic events climate change and astronomical hazards

Vision

The Center of Excellence for weather related information and services

❖ ***The Philippines, through the PAGASA, is a Member of the World Meteorological Organization (WMO), a specialized body of the United Nations.***



- **ICT Division**
- **Info & Public Awareness Division**

OFFICE OF THE ADMINISTRATOR

3 Deputy Administrators

- Administration & Engineering Services
- Operations & Services
- Research & Development

**Administrative
Division**

**Financial, Planning
and Management
Division**

**Engineering and
Technical Services
Division**

Weather Division

**Climatology and
Agrometeorology
Division**

**Hydro-Meteorology
Division**

**Research &
Development and
Training Division**

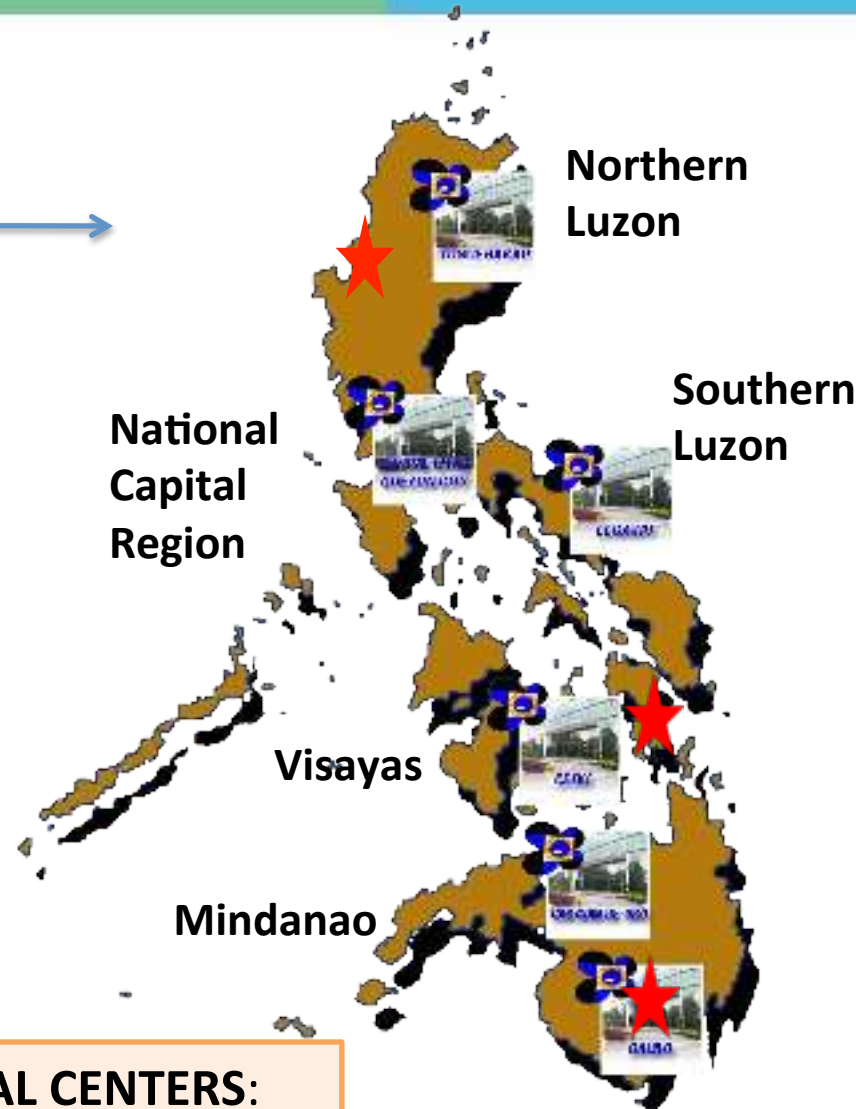
**PAGASA Regional
Services Divisions
(5)**

- National Capital Region
- Northern Luzon
- Southern Luzon
- Visayas
- Mindanao

**PAGASA
Regional
Services
Divisions (5)**

Field Stations

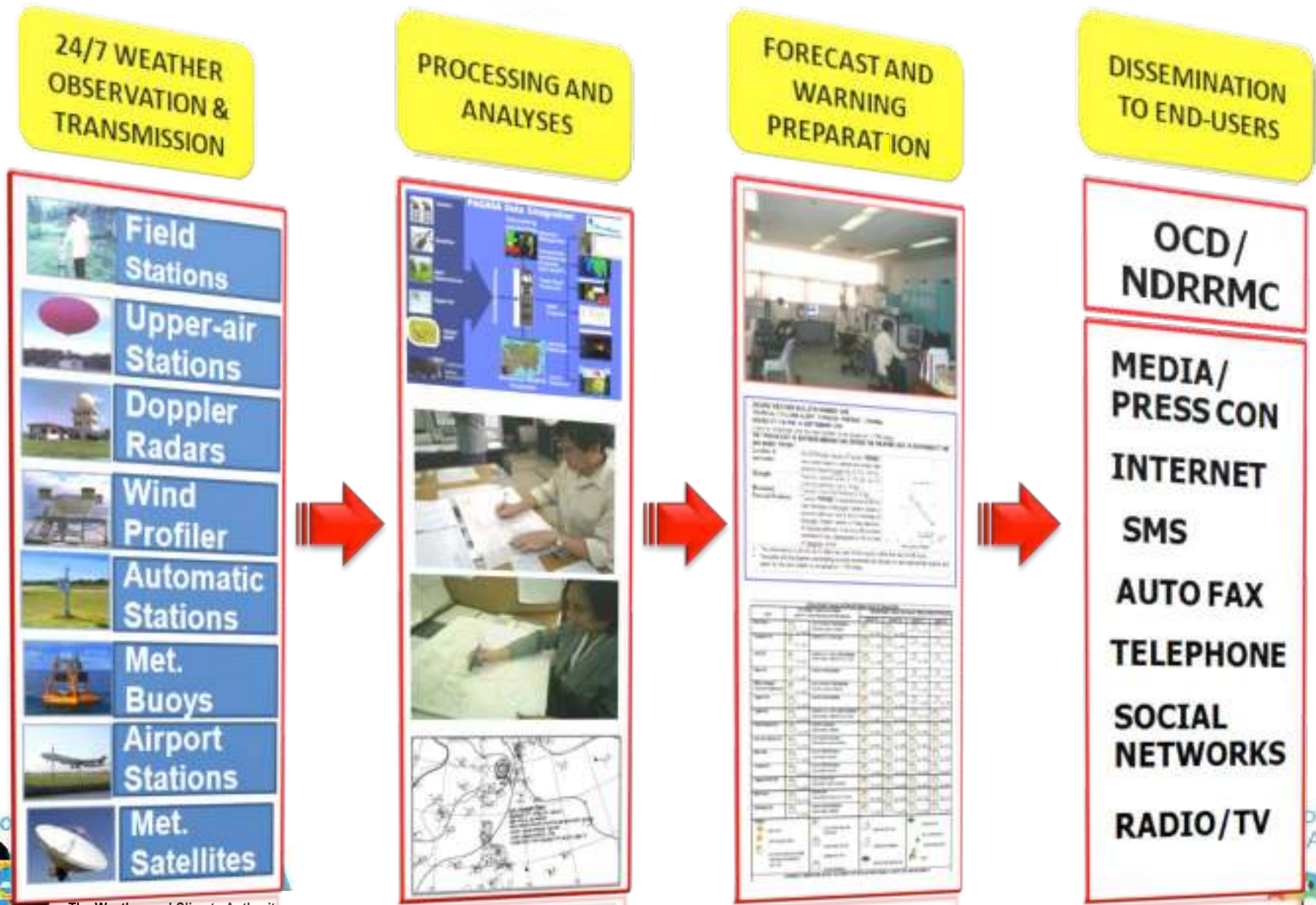
- Synoptic Observation Network
- Flood Forecasting Warning Centers
- Radar Network
- Agromet Observation Network
- Upper-Air Observation Network
- AWS Network
- Rainfall Station Network



ADDITIONAL REGIONAL CENTERS:

- San Fernando, La Union
- Tacloban
- Davao

END-TO-END EARLY WARNING SYSTEM



PAGASA MODERNIZATION LAW : R.A. 10692

PAGASA INITIATIVES

**Upgrading of observing and
monitoring facilities & equipment**

MONITORING FACILITIES/EQUIPMENT

**WEATHER
STATIONS**

● **58 Synoptic Stations** → **73**

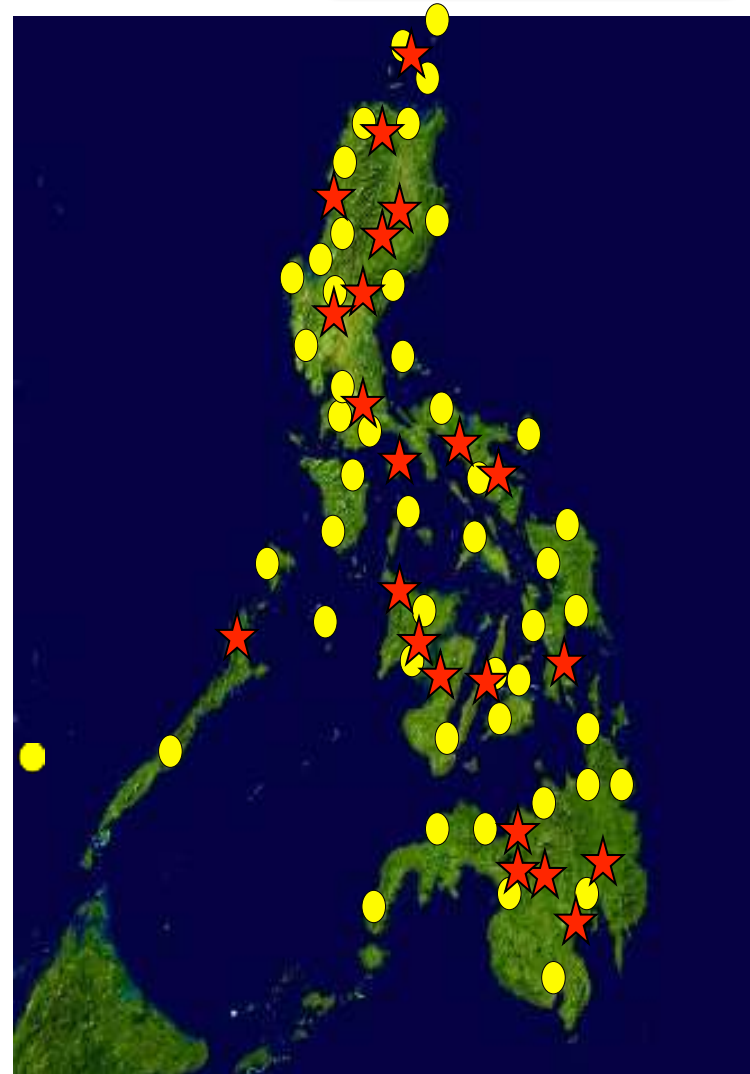
★ **23 Agromet Stations**

Additional Synoptic Stations: 15

Synoptic: Bataan, Marinduque, Biliran, Siquijor, Antique, Kalinga, Apayao, Quirino, Isabela, Banaue

Synoptic/Agromet: La Carlota

Synoptic/Airport: Kalibo, Panglao, Laguindingan, Camiguin



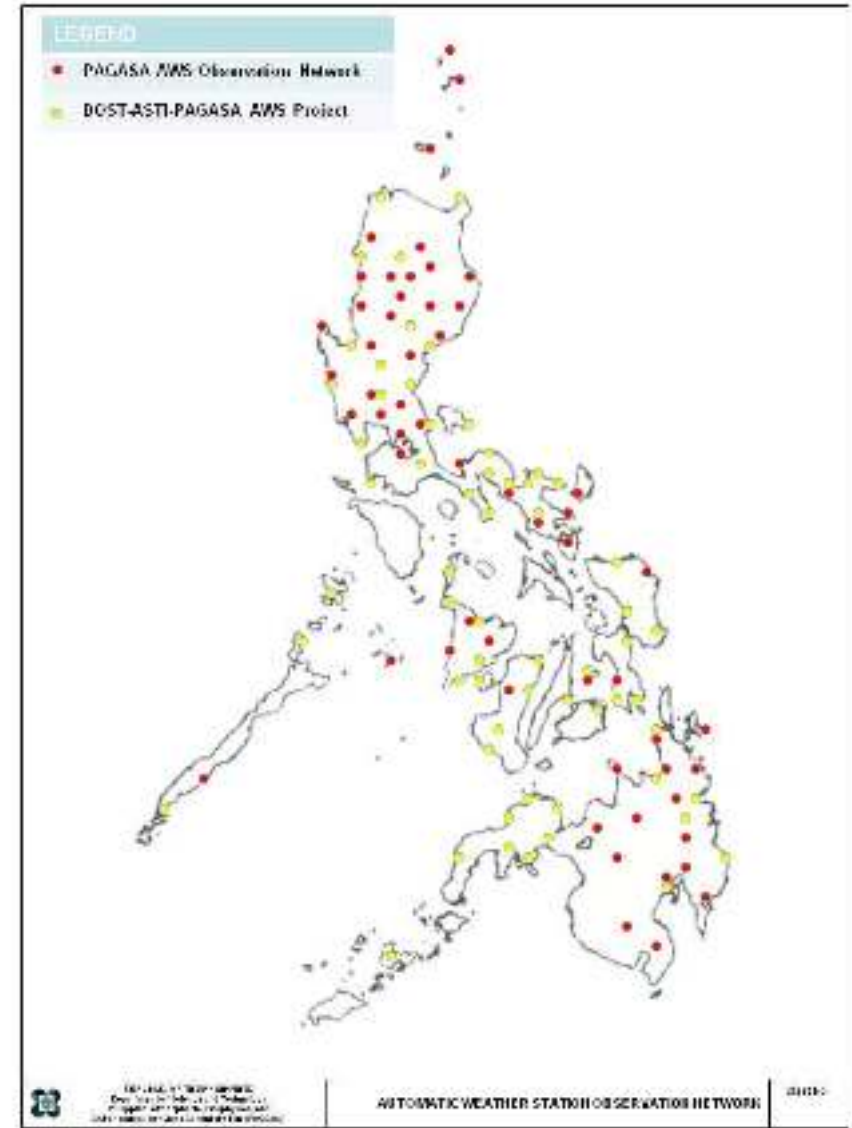
MONITORING FACILITIES/EQUIPMENT

GRAWMET/Win9000 - Laoag Stn (dual)
Lockheed (PC Software - Win9000) - for Tanay, Baguio, Puerto Princesa, Davao, El Salvador, Tuguegarao
Meteo modem - Guiuan radar station
Vaisala (PC Software - DIGICORA) - Legaspi station, Cebu Station



Automatic Weather Stations

No. Obs.	No. of station	Observation every	Measured elements
AWS1	78	60mins	Temp, Hum, Pressure, 10m Wind, Rain, Solar radiation
AWS2	80	15mins	Temp, Hum, Pressure, Rain, 2m Wind
ARG	87+100	15mins	Rain



RADAR NETWORK

Aparil Station
 18° 21' 36.36" N 121° 38' 06.59" E
 Site Elevation: 2 m



S-band
 2013

Baguio Station
 16° 21' 21.88" N 120° 33' 33.12" E
 Site Elevation: 2256 m



S-band
 2009

Subic Station
 14° 49' 19.44" N 120° 21' 49.68" E
 Site Elevation: 516 m



S-band
 2009

Tagaytay Station
 14° 09' 31.28" N 121° 01' 12.49" E
 Site Elevation: 752 m



C-band
 2011

Tampakan Station
 6° 31' 15.81" N 125° 04' 47.41" E
 Site Elevation: 1690 m



S-band
 2012



Basco Radar Station
 20° 25' 14.87" N 121° 57' 54.76" E
 Site Elevation: 166 meters

C-band
 2014



Palawan Radar Station
 9° 13' 50.01" N 118° 00' 20.09" E
 Site Elevation: 17 meters

C-band
 2015



Baler Station
 15° 44' 57.73" N 121° 37' 55.37" E
 Site Elevation: 176 m

S-band
 2008



Virar Station
 13° 37' 47.18" N 124° 20' 2.59" E
 Site Elevation: 226 m

S-band
 2012



Guluan Station
 11° 02' 48.48" N 125° 45' 19.55" E
 Site Elevation: 56 m

S-band
 2013



Mactan Station
 10° 19' 20.80" N 123° 58' 48.47" E
 Site Elevation: 25 m

C-band
 2011



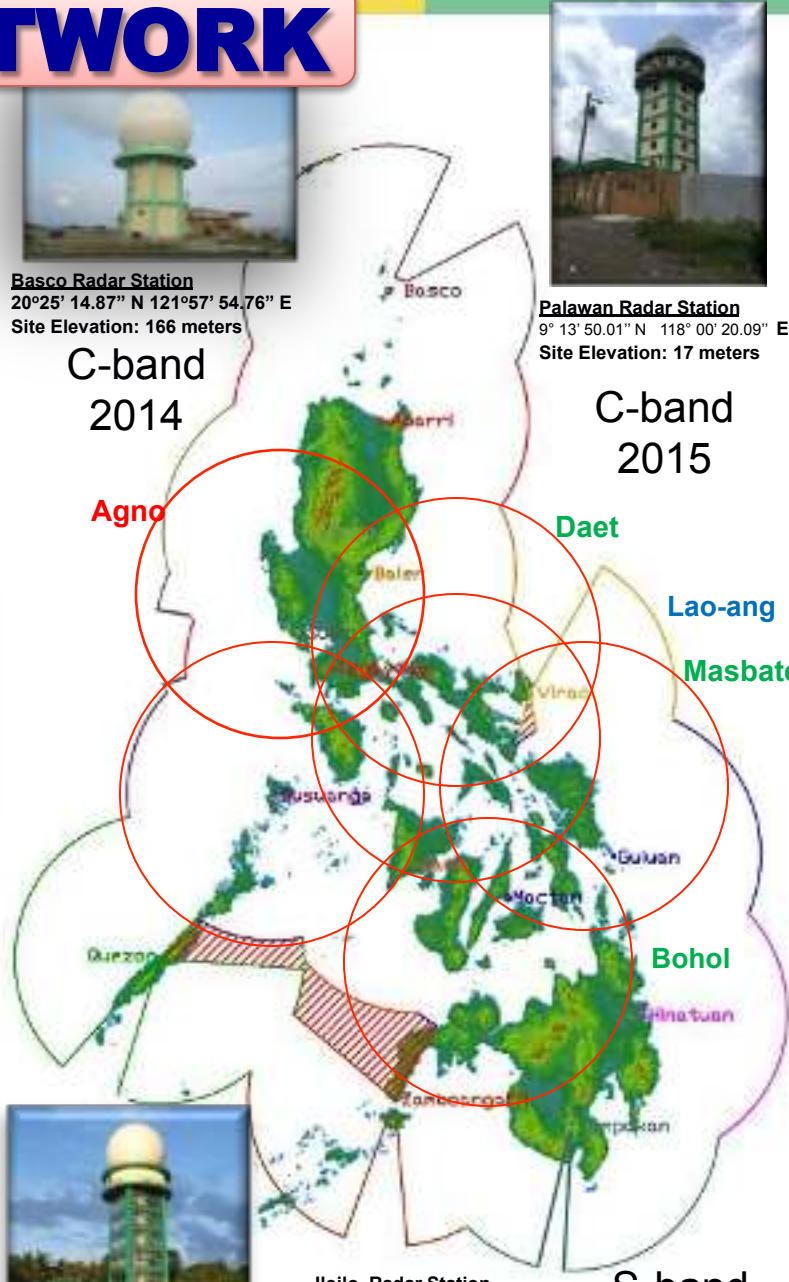
Hinatuan Station
 8° 22' 02.37" N 128° 20' 18.73" E
 Site Elevation: 3 m

S-band
 2011

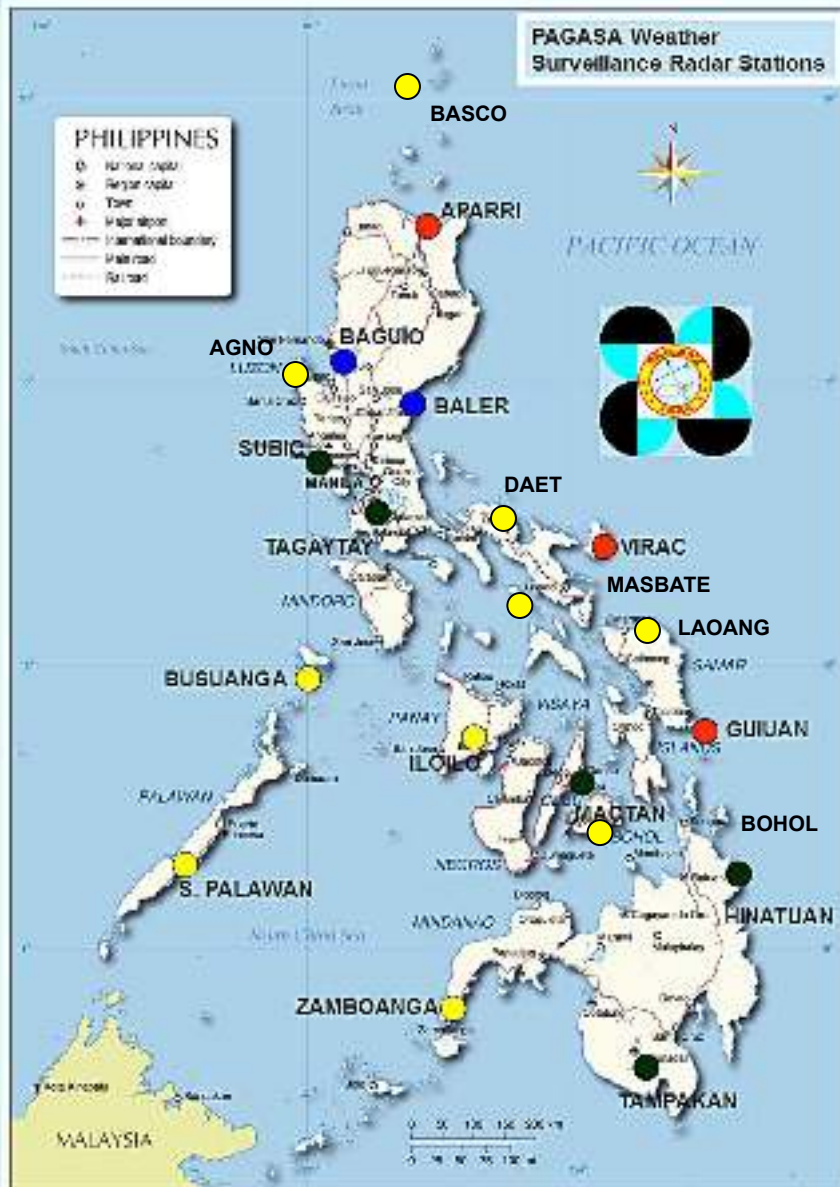


Iloilo Radar Station
 10° 46' 20.08" N 122° 34' 45.08" E
 Site Elevation: 10 meters

S-band
 2015



RADAR NETWORK



No.	RADAR STATION	STATUS
1	APARRI	OPERATIONAL
2	BAGUIO	OPERATIONAL
3	BALER	FOR REPLACEMENT
4	SUBIC	OPERATIONAL
5	TAGAYTAY	OPERATIONAL
6	VIRAC	FOR REHABILITATION
7	GUIUAN	OPERATIONAL
8	MACTAN	OPERATIONAL
9	HINATUAN	OPERATIONAL
10	TAMPAKAN	OPERATIONAL
11	BASCO	FOR REPLACEMENT
12	ILOILO	OPERATIONAL
13	PALAWAN	OPERATIONAL
14	ZAMBOANGA	2017
15	BUSUANGA	2018
16	DAET	2018
17	BOHOL	2019
18	AGNO	2019
19	MASBATE	2019
20	LAOANG	2019



Mobile X-band Radar



PAGASA Mobile Radars:

- QC Headquarter for Storm Chasers
- Baler, Aurora
- Guiuan

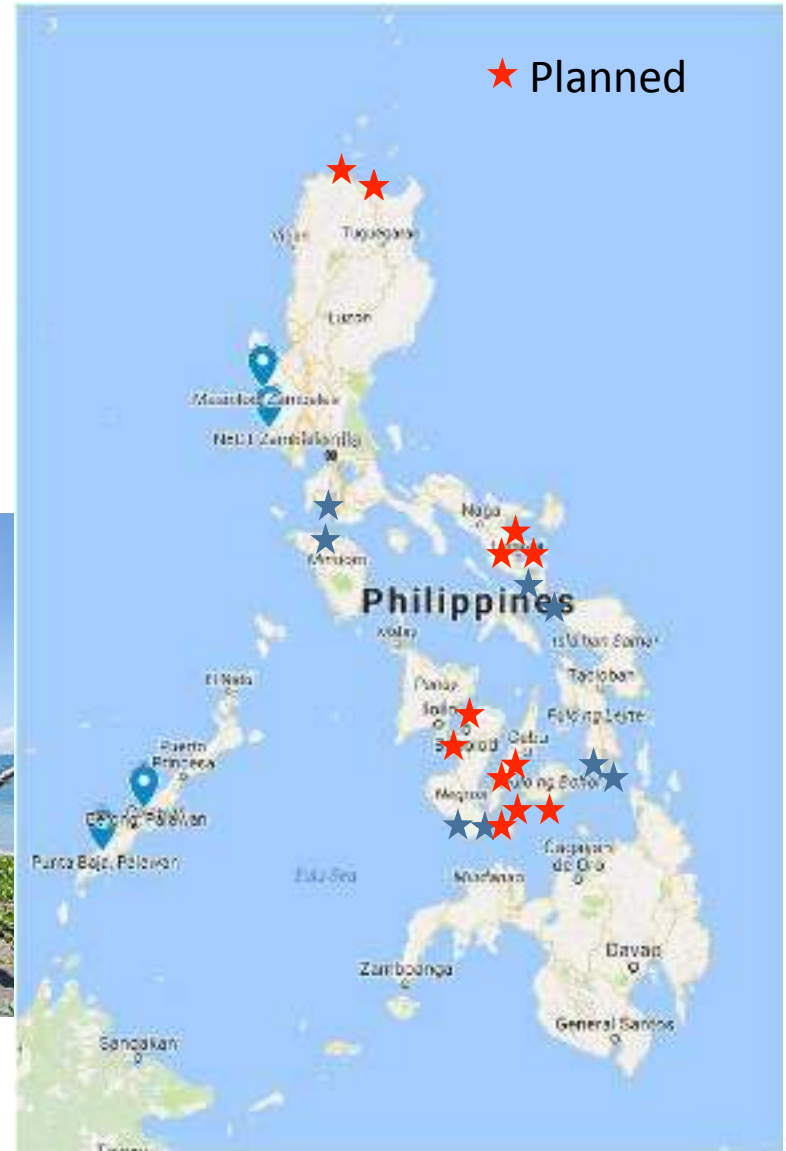
6 more radars acquired by 2020

Coastal Radar

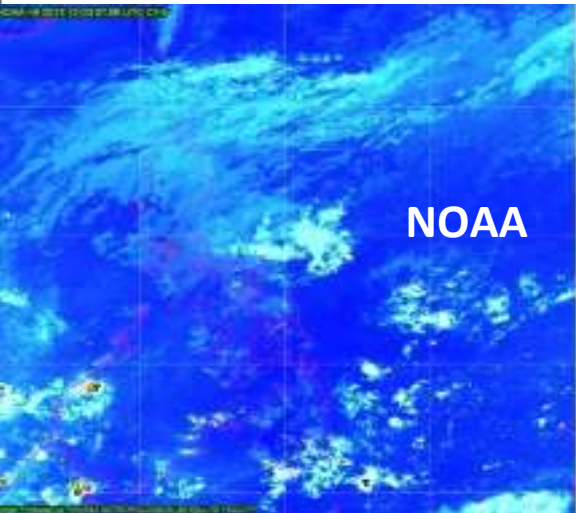
High Frequency Doppler Radar (HFDR)

EXISTING CODAR/HFDR

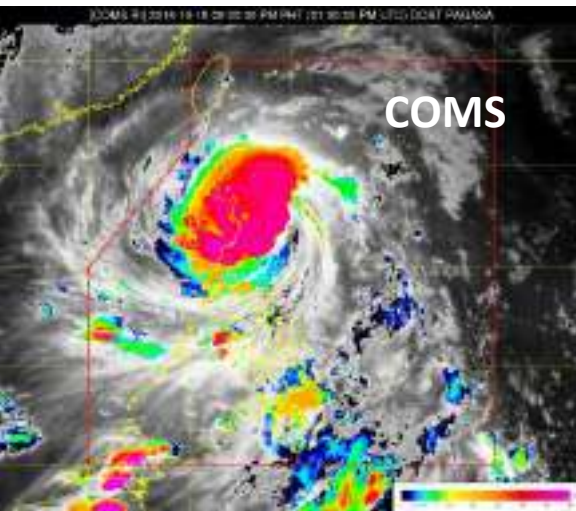
1. NETC & MASINLOC, ZAMBALES
2. BERONG & PUNTA BAJA, PALAWAN
3. LOBO, BATANGAS & CALAPAN, MINDORO
4. SORSOGON & ALLEN, N.SAMAR
5. S.LEYTE & SURIGAO
6. ZAMBOANGUITA & SIQUIJOR



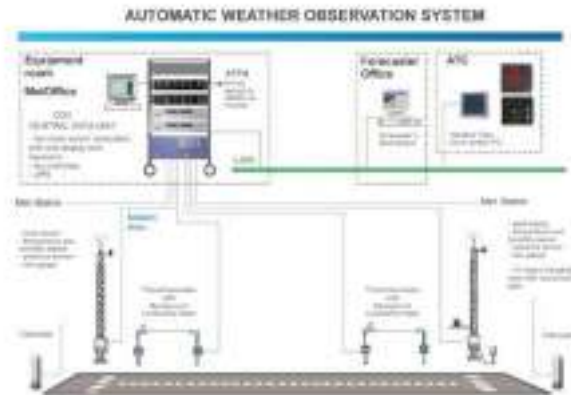
SATELLITE RECEIVING FACILITY



Station SATELLITE	WFFC	CEBU
HIMAWARI	1	1
MODIS NPP	1	
FY-2E	1	
NOAA COMS	1 1	













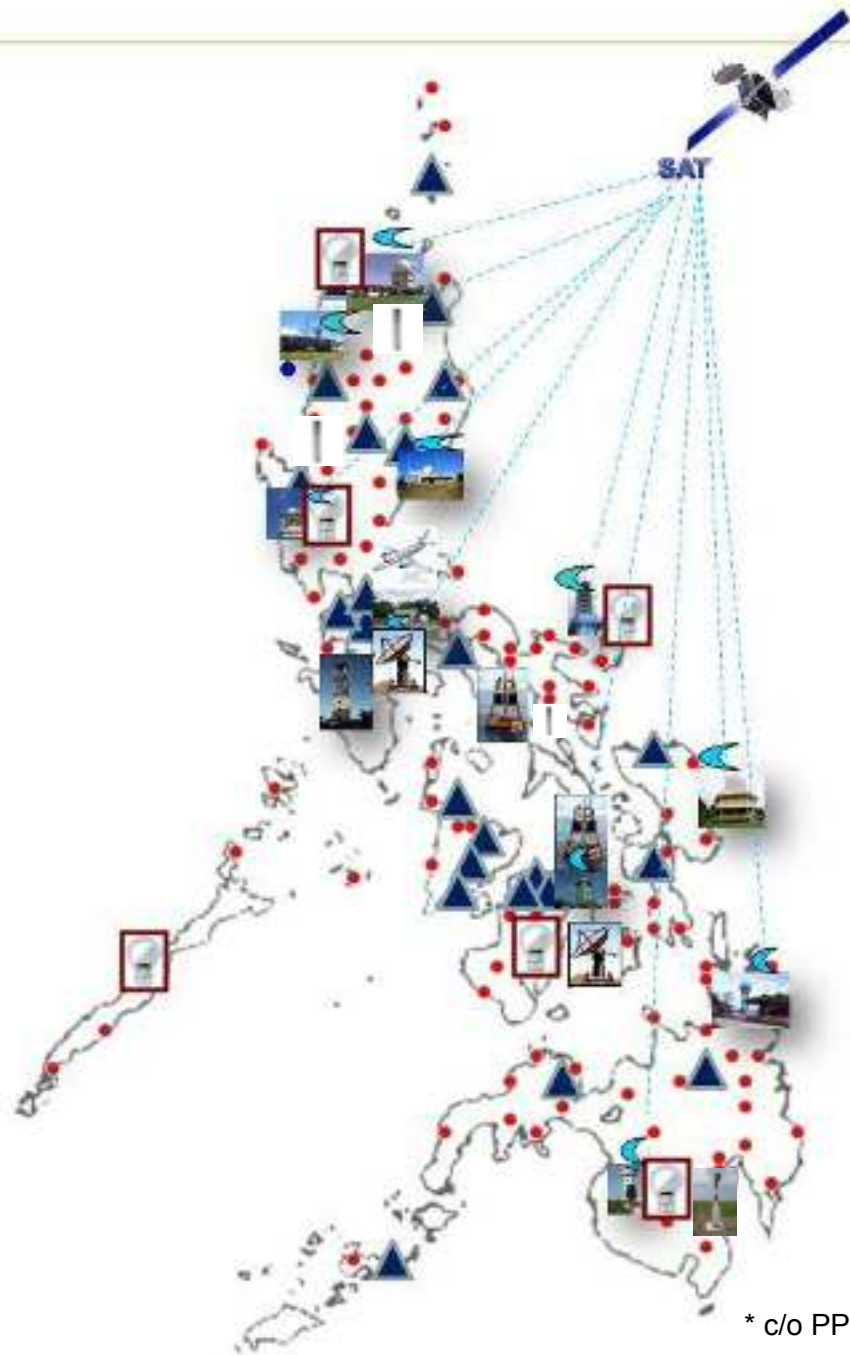
AVIATION WEATHER OBSERVING STATION (AWOS)



MET-HYDRO FACILITIES

LEGEND:

	AWS (157)
	ARG (187)
	Radar (13)
	Upper Air Stations (9)
	Marine Buoy (2)
	MTSAT/MODIS/FY2E/ NOAA, COMS, (WAFS)
	AWOS - 3
	Wind Profiler (1)
	VSAT – 16 facilities
	FFWS – 7 River Basins



* c/o PPDU

INSTRUMENT CALIBRATION FACILITY



For Pressure

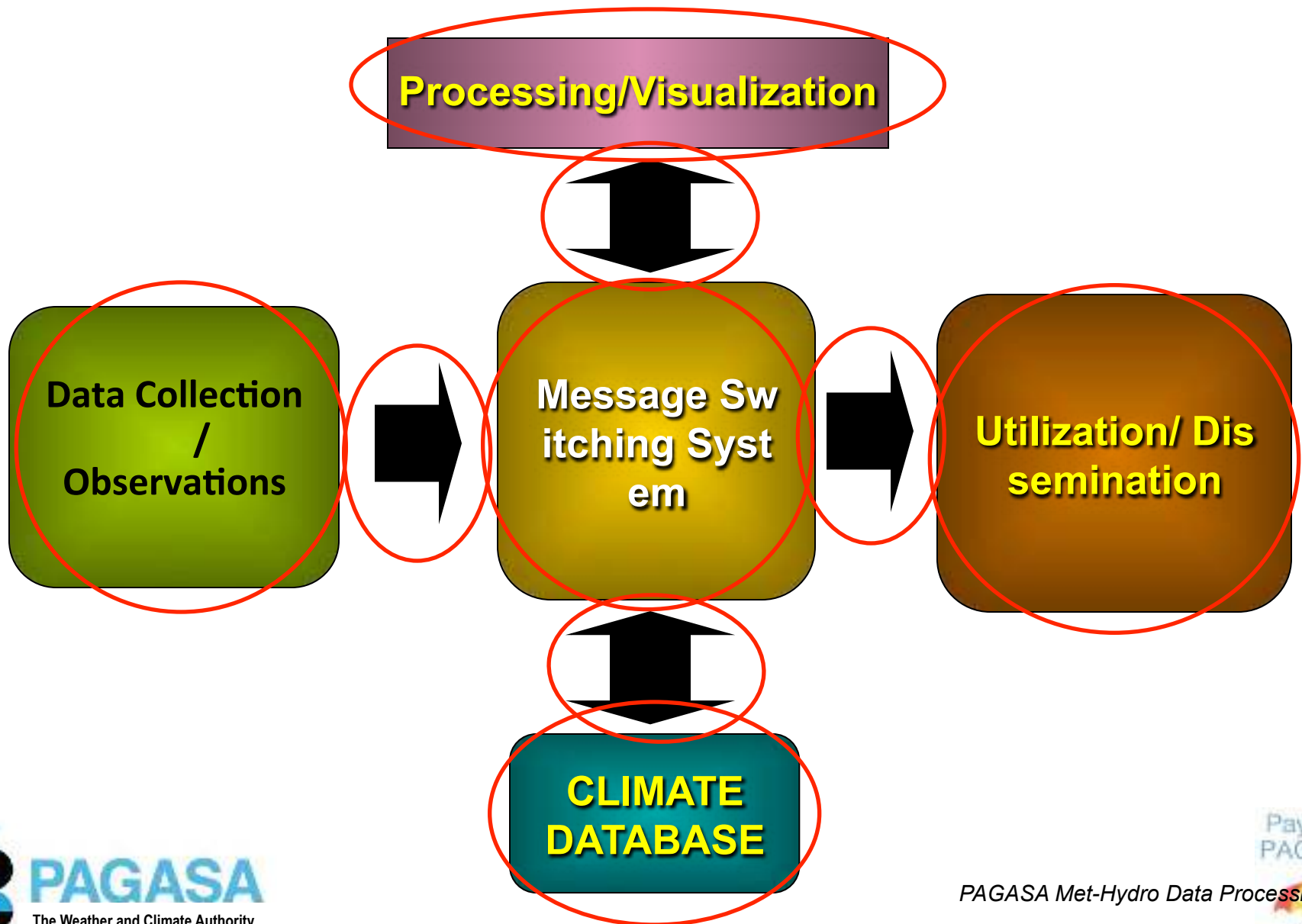


For Temperature

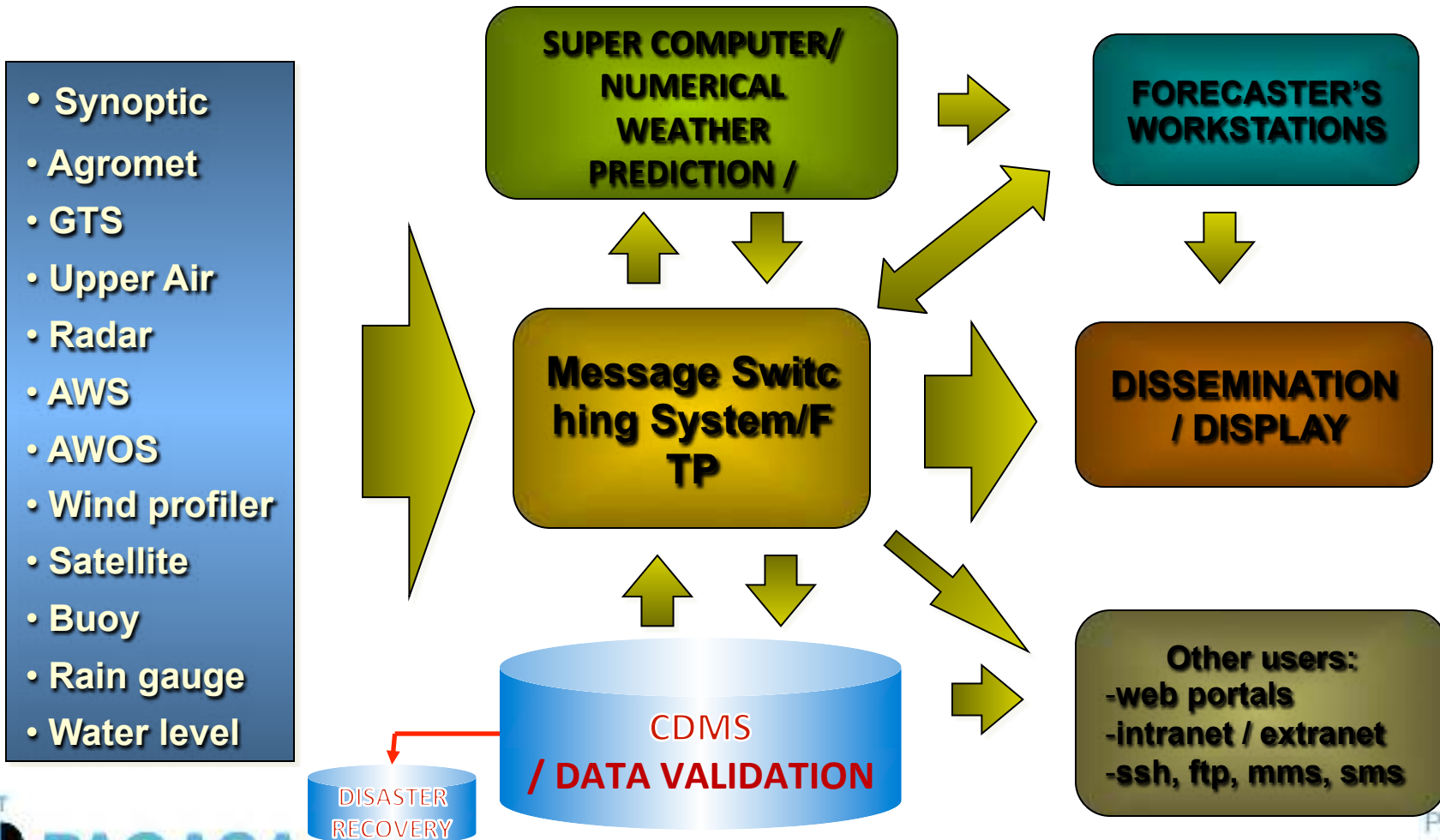
Wind Tunnel



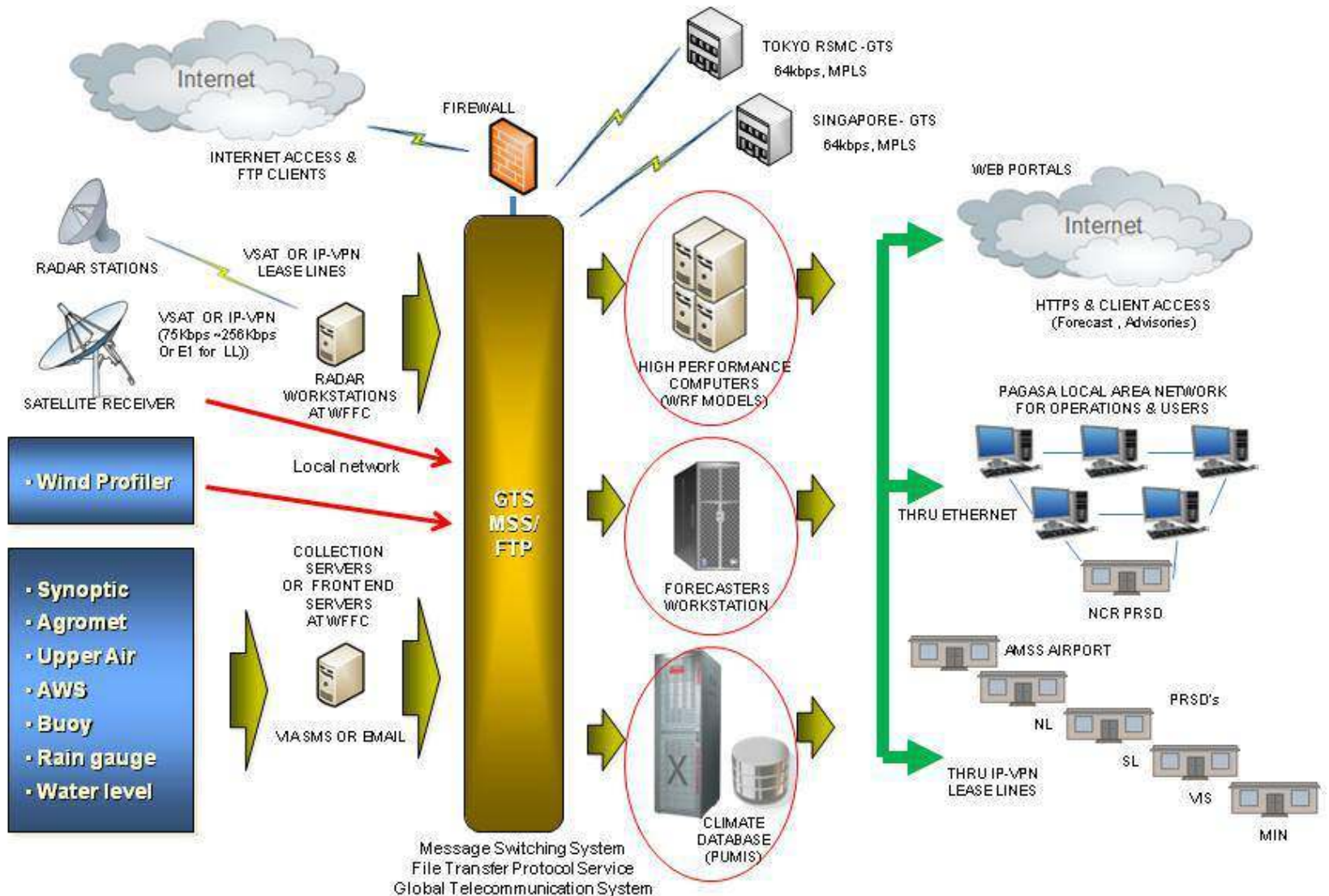
DATA PROCESSING: BASIC CONCEPT



NEW DATA PROCESSING CONCEPT



MET-HYDRO NETWORK



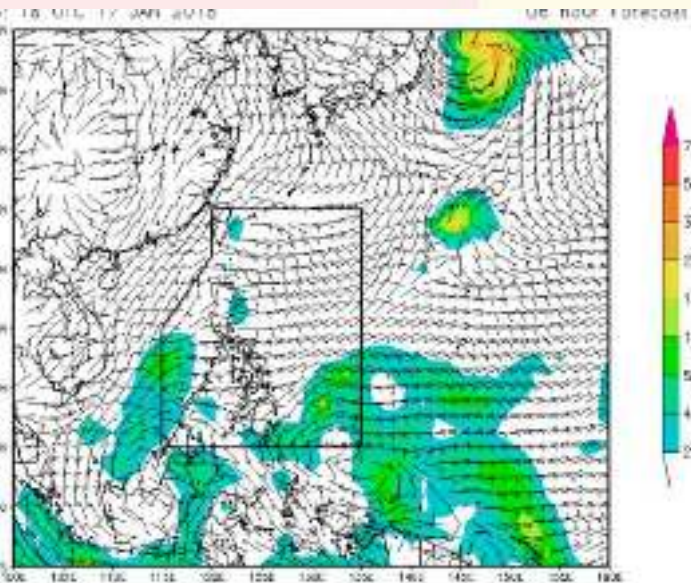
- Wind Profiler
- Synoptic
- Agromet
- Upper Air
- AWS
- Buoy
- Rain gauge
- Water level

Forecasting Tools

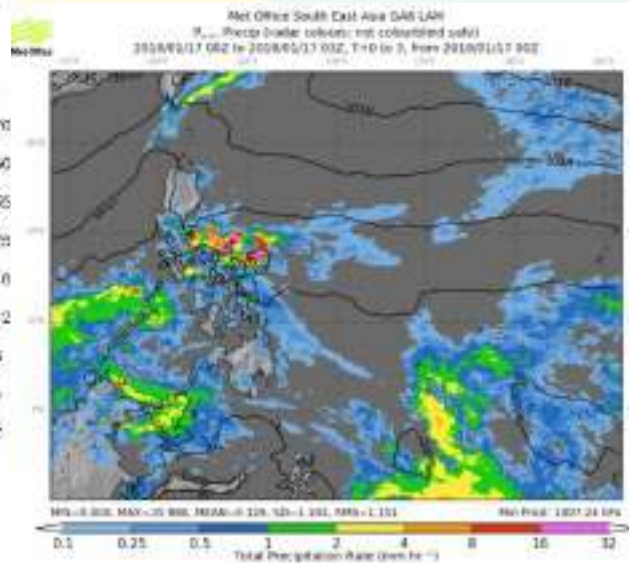
- Weather Maps
- Numerical Models



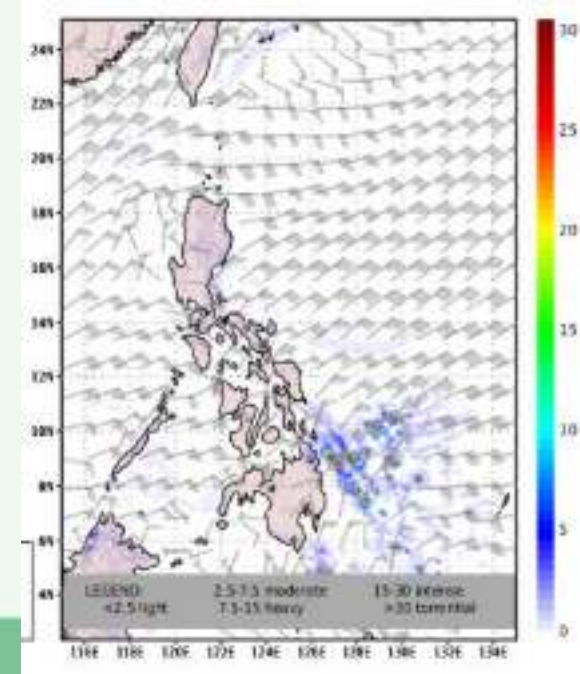
GSM - JMA



Unified Model -UKMO



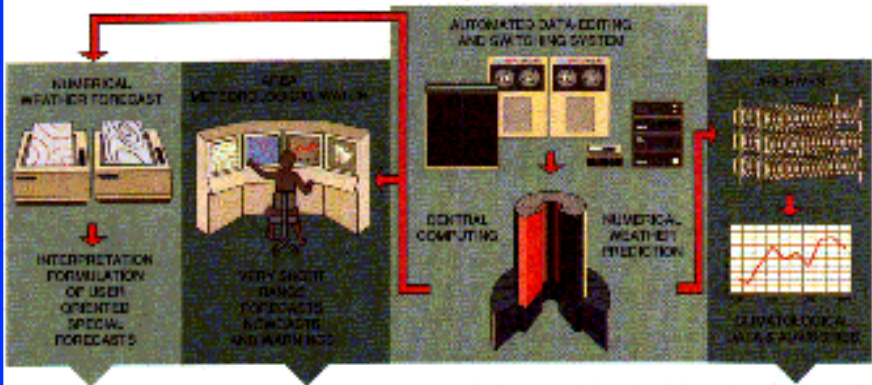
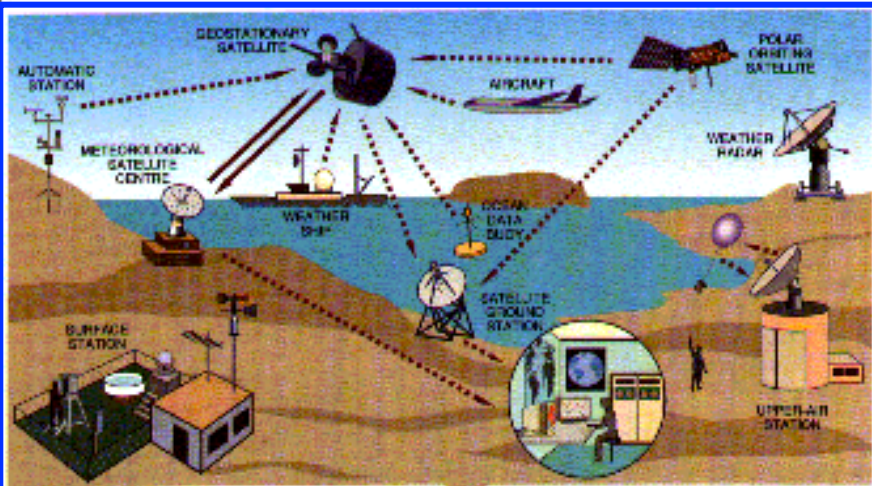
WRF - PAGASA





Weather Forecasting and Warning Services

Weather Forecast and Warning Products






1. Public weather forecasts
2. Shipping forecast
3. Gale Warning
3. Aviation forecasts:
 - a) Terminal Aerodrome Forecast
 - b) Airways and Terminal Forecast
 - c) SIGMET: TC, TSTM & Volcanic Ash
 - d) Flight Documentation Folder
4. Weather Advisory
5. For Tropical Cyclones (TC)
 - a) Tropical Cyclone Advisory
 - b) Severe Weather Bulletin Alert
 - c) Severe Weather Bulletin Warning
 - d) TC Warning for Shipping
6. Special Weather Forecast/Outlook
7. Forecast for Selected Local and Asian Cities and Tourist Destination






PAGASA

Early Warning System (EWS)

THUNDERSTORM WARNING SYSTEM

WARNING	MEANING	DISSEMINATION
Information 	Thunderstorm is <i>less likely to develop</i> in the Metro Manila area	This will be disseminated thru SMS, Twitter and website
Watch 	Thunderstorm formation is <i>likely within the next twelve (12) hours.</i> This is more general than a warning.	This will be disseminated thru SMS, Twitter, website and fax
Warning 	Thunderstorm is <i>threatening a specific area(s) within the next 2 hours.</i> Updates will be issued as frequent as necessary	This will be disseminated thru SMS, Twitter, website and fax

HEAVY RAINFALL WARNING SYSTEM

RAINFALL VALUES (mm) FOR METRO MANILA	MEANING	LEVELS
<p>YELLOW RAINFALL ADVISORY Rainfall of 7.5 to 15 mm per hour has fallen or expected to fall and most likely to continue for the next 3 hours.</p>	<p>Community AWARENESS FLOODING is POSSIBLE in low-lying areas and near river channels</p>	<p>Advisory</p> 
<p>ORANGE RAINFALL ADVISORY Rainfall of more than 15mm up to 30mm within 1 hour has fallen or expected to fall or if continuous rainfall for the past 3 hours is more than 45mm to 65mm and most likely to continue for the next 3 hours.</p>	<p>Community PREPAREDNESS FLOODING is THREATENING in low-lying areas and near river channels</p>	<p>Alert</p> 
<p>RED RAINFALL WARNING Rainfall of more than 30mm within 1 hour has fallen or expected to fall or if continuous rainfall for the past 3 hours is more than 65mm and most likely to continue for the next 3 hours.</p>	<p>Community RESPONSE SEVERE FLOODING is EXPECTED Take necessary precautionary measures</p>	<p>Emergency</p> 

Southern Luzon PRSD HEAVY RAINFALL WARNING SYSTEM

LEGAZPI City , DARAGA, STO. DOMINGO, MALILIPOT

RAINFALL VALUES (mm)	MEANING	WARNING
<i>Observed accumulated rainfall of 50-60 mm within 24hr and rainfall likely to continue</i>	Community AWARENESS Keep on Monitoring for weather Updates	Advisory YELLOW
<i>Observed accumulated rainfall of 50-60mm for the past 24 hr with accumulated rainfall of 40-60 mm within the last 6 hours and still likely to continue.</i>	Community PREPAREDNESS FLOODING AND LANDSLIDE IS possible or threatening in low lying areas and along the river	Alert ORANGE
<i>Observed accumulated rainfall of 100-120mm for the past 30 hr with accumulated rainfall > 60 mm within the last 6 hours and still likely to continue.</i>	Community RESPONSE FLOODING AND LANDSLIDE is threatening or expected to occur	Emergency RED

Gale Warning

Issued when winds speed associated with the monsoon surge is expected to reach to at least 35 knots (65 kph) near the coast of the country













Weather Advisory

provides information on the existence of Southwest Monsoon, Low Pressure Area, or Tail-end of a Cold Front, etc. that will cause floods or flashfloods and landslides.

Tropical Cyclone Warning Signals

(TCWS)

TCWS	LEAD TIME (hrs) on 1 st issuance	WINDS (KPH)	IMPACTS	
#1 	36	30 - 60	<ul style="list-style-type: none"> • Light damages to crops • Cancellation of sea travel 	
#2 	24	61-120	<ul style="list-style-type: none"> • Moderate to heavy damages to crops and fish ponds • Partial disruption of power distribution and communication 	
#3 	18	121-170	<ul style="list-style-type: none"> • Widespread disruption of power & communication • Road closure due to uprooted trees and fallen transmission line 	
#4 	12	171-220	<ul style="list-style-type: none"> • Roads closed due to fallen trees & collapsed bridges • Total power disruption 	
#5 	12	more than 220	Catastrophic damages (Delubyo) 	

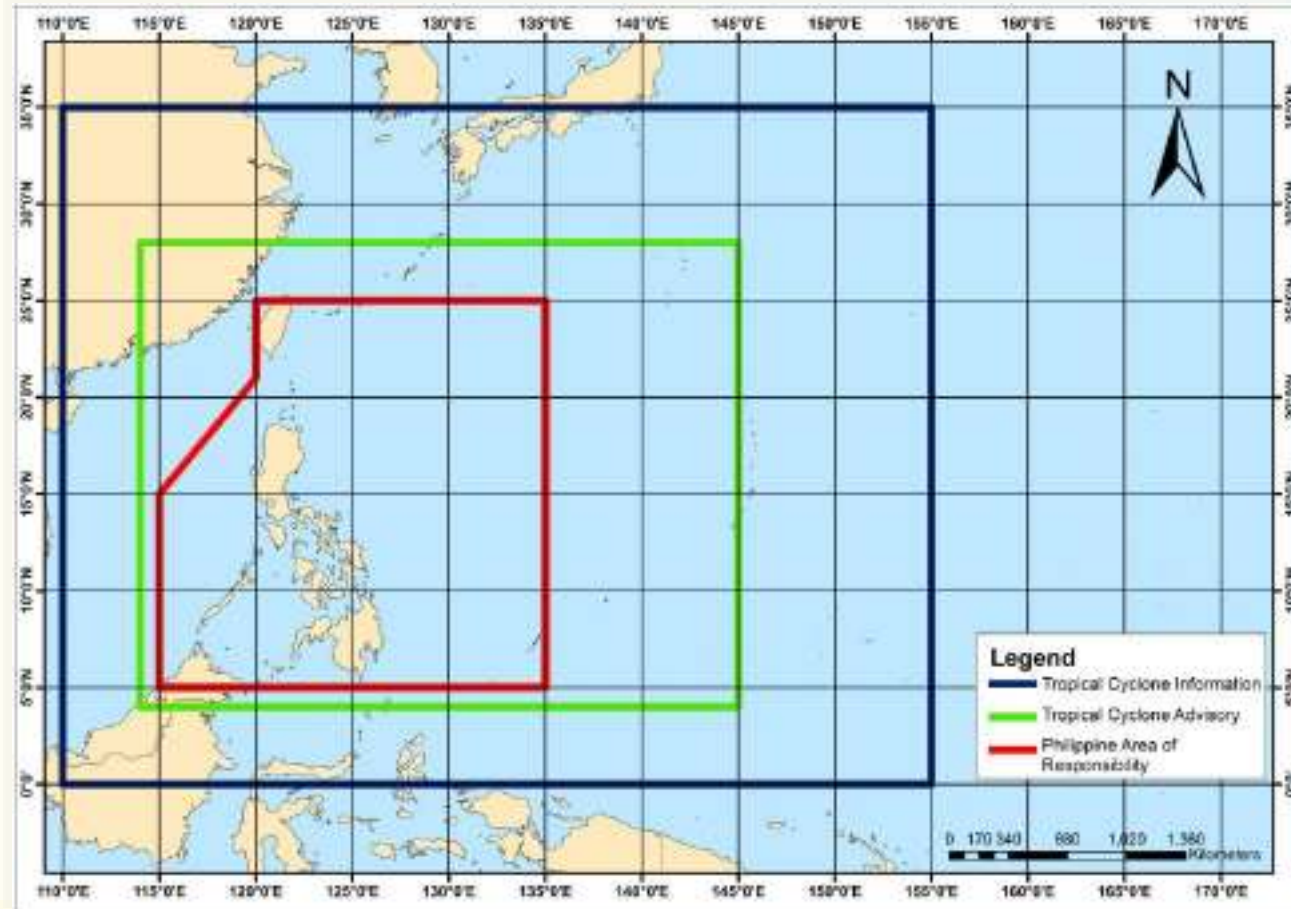
Philippine Tropical Cyclone Classification

CATEGORY	INTENSITY	
	Kilometer per hour (kph)	Nautical miles per hour [knots] (kt)
1. Tropical Depression (TD)	61 or less	33 or less
2. Tropical Storm (TS)	62- 88	34 - 47
3. Severe Tropical Storm (STS)	89 - 117	48 - 63
4. Typhoon (TY)	118 - 220	64 - 120
5. Super Typhoon (STY)	more than 220	more than 120

Based on the classification of tropical cyclones being used in the warning systems intended for international users and exchanges among the Typhoon Committee Members (Category 1-4, from Chapter 4, Typhoon Committee Operational Manual, Meteorological Component, 2015 Ed.)

SEVERE WEATHER BULLETIN (SWB)

- **TC Information** will be provided when over the WN Pacific Ocean outside PAR
- **TC Advisory** over green area.
- **Severe Weather Bulletin** within PAR

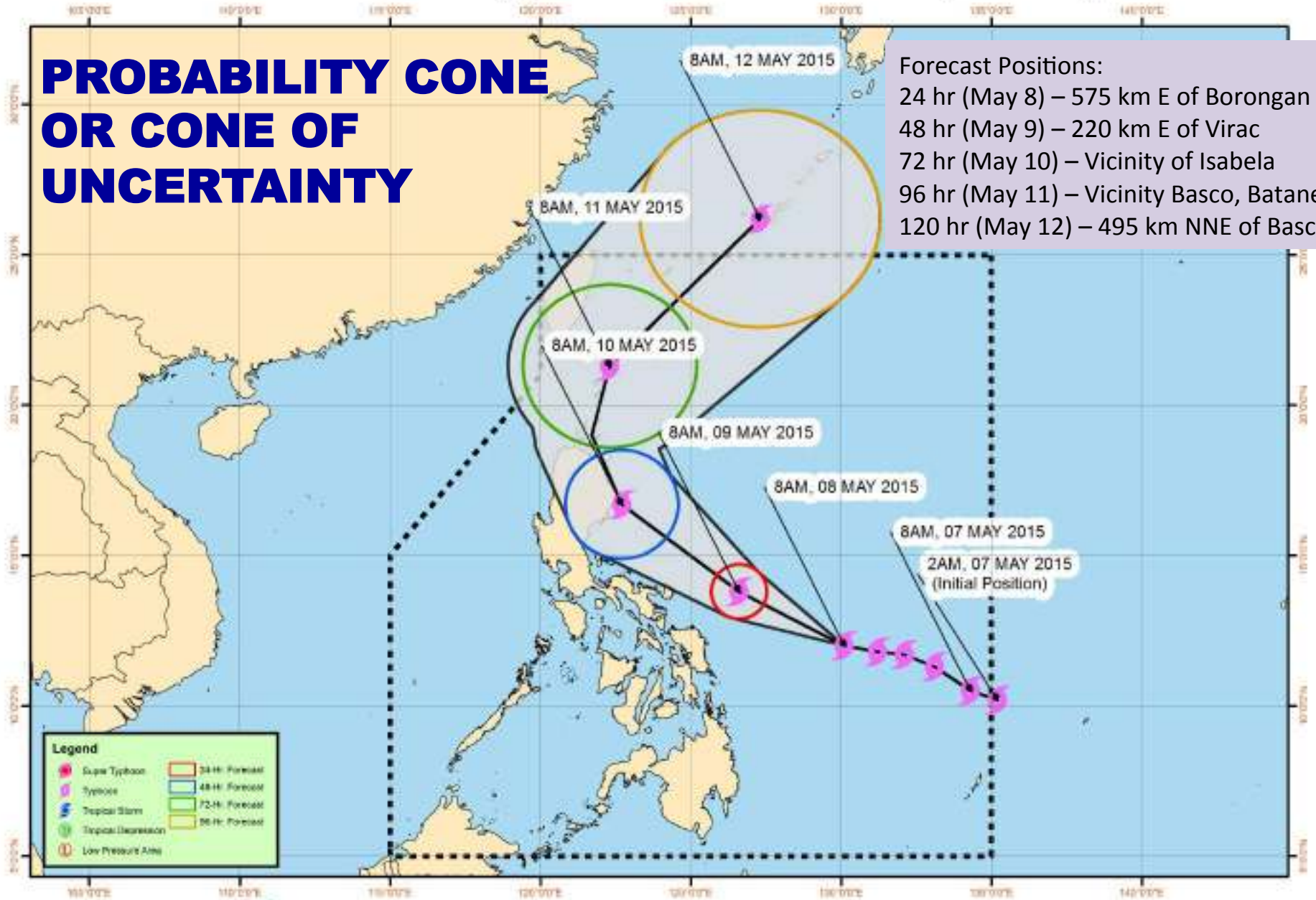


Track of Typhoon "DODONG" {NOUL}

PROBABILITY CONE OR CONE OF UNCERTAINTY

Forecast Positions:

- 24 hr (May 8) – 575 km E of Borongan
- 48 hr (May 9) – 220 km E of Virac
- 72 hr (May 10) – Vicinity of Isabela
- 96 hr (May 11) – Vicinity Basco, Batanes
- 120 hr (May 12) – 495 km NNE of Basco



Information Packages

Dissemination Channel

End Users/ Beneficiaries

Tropical cyclone advisories & warnings

Office of the President

Office of the Civil Defense

Quad-Media

PAGASA Field Stations

Regional Centers

Local Government

Disaster Response Agencies

Regional Centers

Local Government

General Public

Tropical Cyclone Warnings for Shipping

Navigators

Aviation Forecasts / warnings

Airline Pilots

Warning Dissemination

Information Dissemination



Conduct Press Conferences and press briefing in PAGASA every 6 hours

Information Dissemination



HOW IS THE WARNING/ BULLETIN DISSEMINATED ?



www.facebook.com/PAGASA.DOST.GOV.PH



<http://www.pagasa.dost.gov.ph>



@dost_pagasa

Mobile Website:

Please visit

m.pagasa.dost.gov.ph/weather



Google Public Alerts



<http://google.org/crisismap/philippines>

Public Storm Warning Signal 1
 Status: In effect

Locations: Cebu, Iloilo, Manila, Negros Occidental, Negros Oriental, Zamboanga, Davao, Zamboanga City, Zamboanga Peninsula, Zamboanga, Zamboanga City, Zamboanga Peninsula, Zamboanga

Issued at 08:00 AM on 08/08/2015
 This signal is in effect from 08:00 AM on 08/08/2015 to 08:00 AM on 08/09/2015.

Location of origin: In the Philippines, the center of Tropical Depression "GABRIEL" was determined as available data at 2:00 AM on 08/08/2015. It is expected to be in the south of Davao City, with a 100 km radius of Public Storm Warning Signal 1 in the Philippines Area of Responsibility (PAR) by 08:00 AM on 08/09/2015.

Recommended actions:

- 1. Residents should be advised to remain in their homes and avoid going outside.
- 2. Residents should be advised to avoid going to the beach or other coastal areas.
- 3. Residents should be advised to avoid going to the beach or other coastal areas.
- 4. Residents should be advised to avoid going to the beach or other coastal areas.

What to do:

- 1. Residents should be advised to remain in their homes and avoid going outside.
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What to do:

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New PAGASA Website

The screenshot displays the new PAGASA website interface. At the top, there is a navigation bar with 'GOVPH' and links for 'Home', 'Transparency', and 'Product and services'. On the right, it shows the 'Philippine Standard Time' as 07:30:12 AM on 18 January 2018. Below the navigation bar, the main header includes the Department of Science and Technology logo, the text 'Philippine Atmospheric, Geophysical and Astronomical Services Administration - The Weather and Climate Authority', and a 'BETA' badge. A secondary navigation bar lists categories: 'General Weather', 'Aviation', 'Marine', 'Tropical Cyclone', 'Flood', 'Agriculture', 'Astronomy', 'Climate', and 'Regional Forecast'. The main content area is divided into two primary sections. The left section, titled 'Metro Manila', features a search bar and displays current weather: 'PARTLY CLOUDY SKIES WITH ISOLATED RAINSHOWERS' with a temperature of 23°C. It also lists 'Winds: Nil-0.4 km/hr', 'Precipitation: 0 mm/hr', and 'Humidity: 91%'. Below this, a forecast for the next five days (Thursday to Monday) shows a high of 31°C and a low of 23°C. The right section, titled 'Active Warnings', shows a map of the Philippines with a color-coded legend for 'General Flood Advisory' and 'Issued at: 07:30 AM'. A vertical color scale on the right indicates precipitation levels in mm/hr. At the bottom of the main content area, there is a 'Meteogram for SCIENCE GARDEN, QUEZON CITY, PH, Philippines' which is a line graph showing temperature, precipitation, air pressure, and wind over a 24-hour period. The temperature line fluctuates between approximately 23°C and 31°C, with precipitation bars indicating rain events. The bottom of the page features the DOST PAGASA logo with the tagline 'The Weather and Climate Authority' and a 'Payong PAGASA' logo with a colorful umbrella icon.

<http://bagong.pagasa.dost.gov.ph>

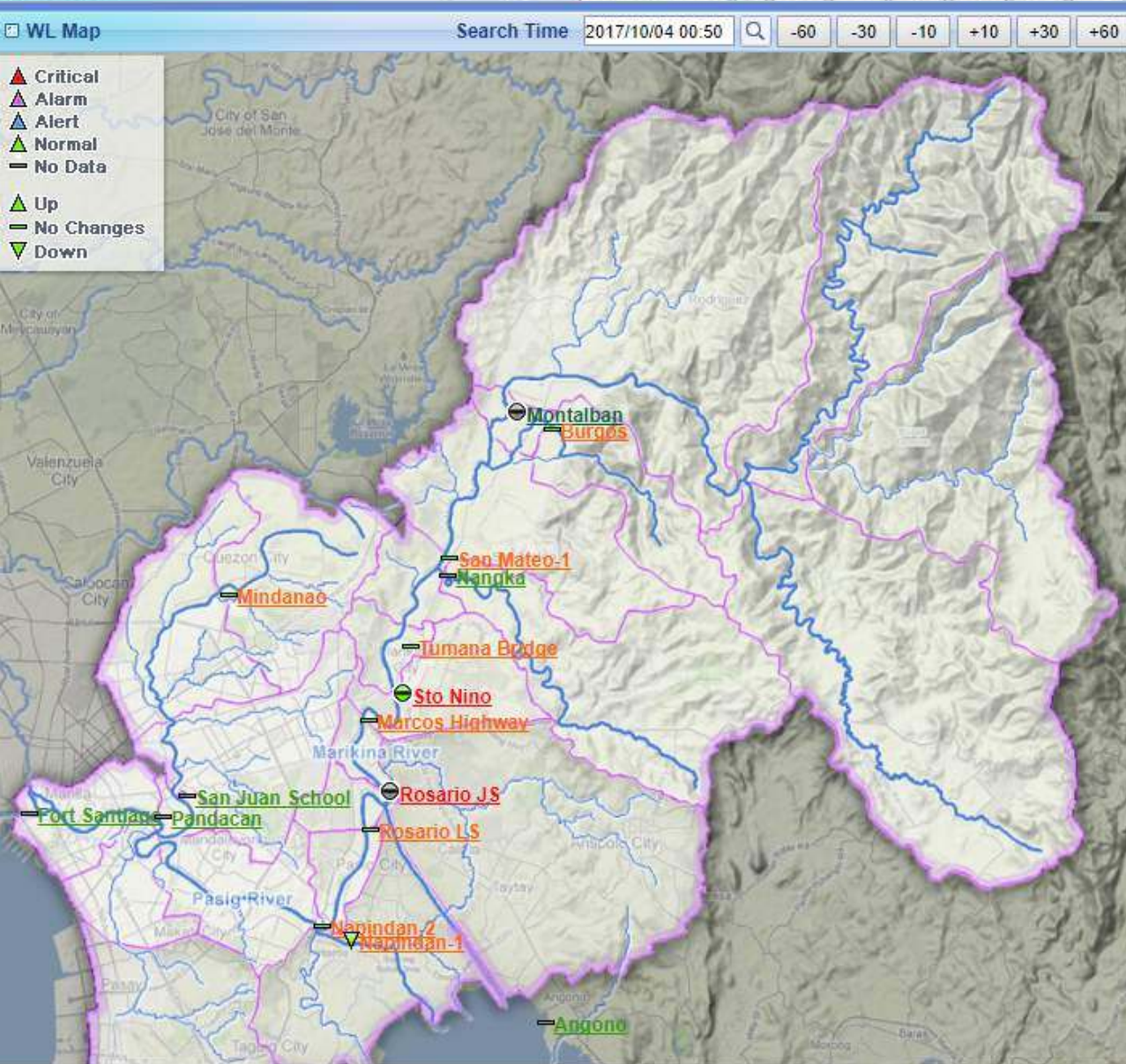
Flood Forecasting & Warning Services

Flood Forecasting & Warning Products/Services

- Basin Flood Bulletins for the Telemetered Basins and General Flood Advisories for the Non-Telemetered River Basins
- Dam Discharge Warning Information during Spilling Operation of the Monitored Dams
- Establishment of Community-based Flood Early Warning System (CBFEWS)
- Daily Hydrological Forecasts during non-flood Watch
- Public Information Drives (PID) or IEC



PASIG-MARIKINA FLOOD FORECASTING AND WARNING SYSTEM

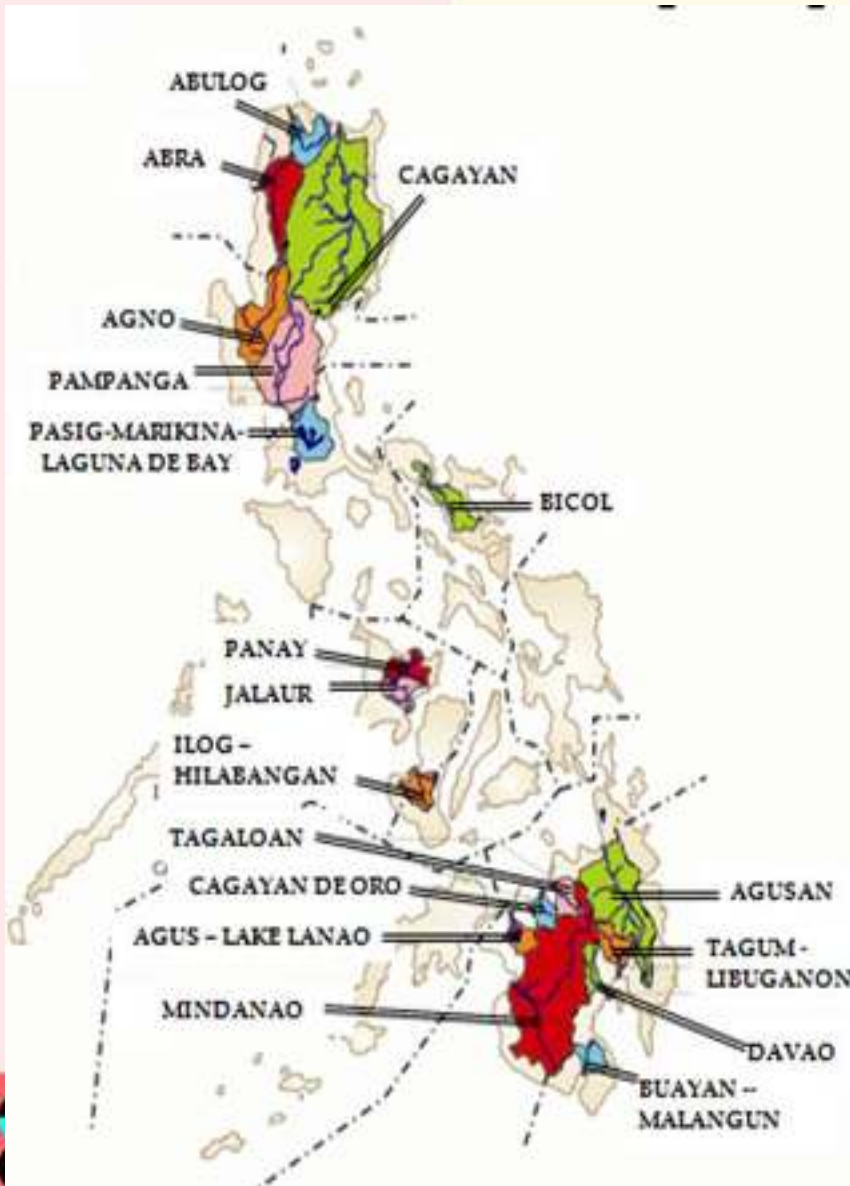


Time : 2017/10/04 00:50

Station	WL [El.m]	Alert [El.m]	Alarm [El.m]	Critical [El.m]
Montalban	-	23.00	23.60	24.20
Burgos	26.43	27.40	27.90	28.40
San Mateo-1	15.83	18.00	19.00	20.00
Nangka	-	18.00	19.00	20.00
Mindanao	32.15	33.00	34.00	35.00
Tumana Bridge	12.45	17.26	18.26	19.26
Sto Nino	12.27	15.00	16.00	17.00
Marcos Highway	13.80	14.50	15.50	16.50
Rosario JS	-	13.50	14.00	15.00
San Juan School	-	12.00	12.50	13.00
Fort Santiago	-	11.00	11.50	12.00
Pandacan	-	11.00	11.50	12.00
Rosario LS	11.72	13.00	13.50	14.00
Napindan-2	11.69	14.00	14.50	15.00
Napindan-1	11.47	13.50	14.00	14.50
Angono	-	12.50	13.00	14.00

Station Color	
PAGASA Major Station	MMDA Major Station
PAGASA Station	MMDA Station

ESTABLISHMENT OF FLOOD FORECASTING & WARNING SYSTEM (FFWS) IN 18 MAJOR RIVER BASINS



Completed FFWS :

1. Pampanga
2. Agno
3. Bicol
4. Cagayan
5. Pasig-Marikina
6. Tagum-Libuganon
7. Cagayan de Oro
8. Buayan-Malungon

WAY TO GO

PAGASA MODERNIZATION LAW : R.A. 10692

- 1) **Component 1 - Modernization of Physical Resources and Operational Techniques**
- 2) **Component 2 - Enhancement of Research and Development Capability**
- 3) **Component 3 - Establishment of Regional Weather Service Centers**
- 4) **Component 4- Establishment of PAGASA Data Center**
- 5) **Component 5 – Enhancement of Weather Data Collection and**
- 6) **Component 6 – Creation of a Human Resource Development Program**
- 7) **Component 7 – Development of Regional and International Cooperation Program(HRDP)**

LESSONS LEARNED DURING HOLIDAY TROPICAL CYCLONES



Damage of TS Urduja in Biliran



Damages of STS Vinta in Lanao del Norte



Good forecast is useless if it:

- does not reach the communities to be affected
- Not properly understood & NO proper action is undertaken
- Ignored due to festive or holiday activities

ENHANCE IEC & COMMUNICATION FACILITIES/PROTOCOL

For any early warning system to succeed, several components are necessary:

- **Technology** to detect and monitor the hazard;
- **Communication systems** to alert the public;
- **Local leaders** trained to make the right decisions;
- A **public** that is educated to react appropriately to warnings; and
- **Response protocols** — such as evacuation plans — prepared and rehearsed well in advance of the threat.

All these elements must work well, both individually and in harmony.

Failure in any **one** of these elements can mean **failure of the whole early warning system.**

THANK YOU!

Website:

www.pagasa.dost.gov.ph

Facebook: 

www.facebook.com/pagasa.dost.gov.ph

Twitter: 

@dost_pagasa

Typhoon

+632-9271541

+632-9271335

Climate

+632-4351675

+632-4340955

Flood

+632-9266970

+632-9204052

IEC

+632-4342696

+632-9279308

