Philippine Atmospheric, Geophysical &
Astronomical Services Administration

ANNUAL REPORT 2012

...tracking the sky helping the country

Enhancing competency for improved service through modern meteorological technologies

Mission

Protecting lives and properties through timely, accurate and reliable weather-related information and services.

Vision

Center of excellence for weather related information and services

Core Values

Intergrity, Commitment and Public Service Orientation.

Table of Contents

Message

Mario G. Montejo
DOST Secretary

Every year, new technologies, knowledge and innovations in the field of Science and Technology (S&T) emerge to provide windows of opportunities to better serve and empower the Filipino people. It is with great pride that I congratulate the men and women of PAGASA-DOST for consistently taking every opportunity to improve and transform into a better and more relevant organization.

In recent years, the PAGASA-DOST has performed its tasks with improved excellence. The technical skills of our weathermen and completion of project facilities, most notably the Doppler radars, and the valued input of Automatic Weather Stations (AWS), the continued acquisition of modern equipment to upgrade the present system, and the vigorous personnel development, vastly enhanced the weather forecasting capability of PAGASA-DOST. The advent of the National Operational Assessment of Hazards or NOAH Project is the ultimate culmination of the grandiose effort to provide real-time data of typhoon, flood hazards, and other disaster related data.

Though the year 2012 was capped by tragic event before the year ended due to destruction wrought by Typhoon Pablo, PAGASA-DOST had proven its reliabilty as a warning agency. The disseminated collective information pertaing to the typhoon was accurate and timely. There were other significant factors why Pablo resulted to a nightmarish disaster. But despite this sad incident, the trust and conference of our countrymen with PAGASA-DOST remained high.

Amidst the myriad of challenges that they have faced, the agency still remains focused in its strong commitment to carry out their mission in protecting the lives and properties of our people against the lurking dangers of typhoon and flood hazards.

Notably, His Excellency, President Benigno Simeon Aquino III gave praise for its landmark improvement in the level of PAGASA-DOST performance. The President remarked that their agency had risen to become a respectable and credible institution.

My trust and confidence in the PAGASA-DOST family will always remain, as I have personally been a witness to their sincerity to serve our country and its people. For this, the Department will always be a support to all their endeavors to protect and uplift the lives of every Filipino, especially the poorest and most vulnerable.

Message

Dr. Nathaniel T. Servando
Administrator

For two consecutive years, Northern Mindanao bore the brunt of devastating tropical cyclones. These meteorological disasters are unusual and perpexing if one would seriously consider PAGASA historical record on Tropical Cyclone Sendong claimed the lives of more than a thousand lives mostly in the cities of Cagayan de Oro and Iligan. A year later, in December 2012, the more powerful typhoon Pablo wrecked havoc in the provinces of Compostela Valley, Davao oriental and Surigao leaving hundreds of lives lost and widespread destruction to properties, agriculture and infrastructure.

In these two tragic events, however, PAGASA has proven its worth as a dependable government agency which carried out its mandated tasks and mission exceptionally well. The dedication, competence and diligence of PAGASA men and women were again demonstrated as they closely watched and tirelessly follow every movement of these meteorological hazards. The accuracy and timeliness of information provided by PAGASA on Sendong and Pablo were a solid affirmation of its vastly improved forecasting capability. Inspite of this, however, the forces of nature reigned and prevailed.

With the apparent changes in climatology and hydro meteorological patterns not only here in the country, but in other regions of the world, PAGASA is now aggressively facing these new challenges. Though the agency has already achieved the technical dexterity and excellence through the enhancement of acquired skills aided by newly deployed modern equipment, PAGASA personnel will zealously continue in providing our countrymen vital service to mitigate or eliminate the dangers of hydro meteorological threats.

To sustain this, PAGASA, in the immediate future will maintain its strategic path towards full modernization. For the year, two Doppler radar were completed namely: Virac and Aparri, to complement the seven existing ones. Several Automatic Weather Station (AWS) are scheduled to be installed in various across the country to ensure the accessibility of weather data to its end users. These projects will strengthen the weather forecating capability of PAGASA almost at par with the standard of meteorological agencies abroad. Apart from these, flood forecasting centers will soon be established in Visayas and Mindanao to cover their major river basins for protection from hydrological threat in those areas.

In summary, we would like to assure our countrymen that our strong commitment to fulfill our noble tasks and mission will always be in our hearts and in minds.

Introduction

A look back

Month	Key Events	Venue
January	51st Climate Outlook Forum (25-Jan.)	PAGASA
	ASTI-PAGASA-MMDA MOA Signing (17-Jan.)	MMDA
	Project for Strengthening Flood Forecasting and Warning System in the Bicol River Basin (Kick Off Meeting) (10-Jan)	PAGASA
	Program Review and Analysis (PRA) PAGASA (26-28-Jan.)	Talisay, Batangas
February	Joint Coordination Committee (JCC) JICA FFWS-BRB (24-Feb.)	PAGASA
	52nd Climate Outlook Forum (28-Feb.)	PAGASA
	National Astronomy Week (24-Feb)	PAGASA
March	62nd World Meteorological & 147th National Meteorological Day	PAGASA
	APEC Training Course on QPE-QPF (27-30-March)	Crown Plaza, Mla
	GROC Seminar (NL-PRSD) 21-24-March	Baguio City
	Press Launch & MOA Signing (Project COMET) (14-March.)	PAGASA
	Training Seminar on JMA – TCC (One Month Probabilistic Forecast) 13-15 March	PAGASA
April	Expert Mission in the Philippines (TCDIS, Disaster Prevention Technologies in Korea), (FARD,FFFS)(23-April)	PAGASA
	Orientation Seminar on Operational Hydrology for MPRSD (9-13 April)	Davao City
	Orientation Seminar on Operational Hydrology for NL-PRSD (15-22 April)	Tuguegarao City
	Supervisory Development Course (SDC) (16-18, 23-25, April)	PAGASA
May	54th Climate Outlook Forum (22-May)	PAGASA
	Orientation Seminar on Operational Hydrology for NCR-PRSD (7-11 May)	PAGASA
	Orientation Seminar on Operational Hydrology for VPRSD (14-18 May)	Puerto Princesa City
	Lecture on Satellite Techniques & Data Application (11-May)	PAGASA
	Values Orientation Workshop for NCR-PRSD (May 30-Jun 2)	Subic Bay, Zamb.
	Supervisory Development Course PRSD Personnel (May 7-9)	Puerto Princesa City
	Expanded Working Group Meeting (FFWS for DAM Operation) May 23	PAGASA
	VIRAC RADAR Inauguration (May 2, 2012)	Virac, Catanduanes
June	Transit of Venus (Astronomical Observatory)(Jun 6.)	UP, Campus, Q.C.
	Supervisory Development Course for PAGASA Personnel (June 6-8,2-24)	PAGASA
	Values Orientation Workshop for VPRSD (June 14-17)	Cebu City

Month	Key Events	Venue
July	Supervisory Development Course for PAGASA Personnel (July 4-6)	PAGASA
	Project NOAH Inauguration (July 6)	Marikina City
	NSTW@MALL of ASIA	Pasay City
	MTC-2012 TERM 1 & 2	PAGASA
	SEMINAR Workshop on the Use of AWS Data for Disaster Preparedness	
	(Tacloban City and Catbalogan City Region 8) (July 30-31)	Region8.
August	MID Year PRA (Aug. 8-9)	PAGASA
	Seminar Workshop for Mediamen (Aug. 25-27)	Clark, Pampanga
	Signing MOA (PTV4) Aug. 14)	PAGASA
	PAGASA Seminar workshop for ABS-CBN and GMA7 (Aug. 4,11,17,18)	PAGASA
	Signing of MOU KOREA Astronomy Space Science Institute (Aug. 17)	PAGASA
	Trainors Training on Basic Meteorology and Agrometeorology (Aug 28 – Sep1)	PAGASA
	Values Orientation Workshop (Aug. 21-23)	Davao City
September	DOST – PAGASA Smart ARG Inauguration (Sept 19-20)	La Trinidad, Benguet
	Groundbreaking Ceremony (Radar Station)	Iloilo City
	Values Orientation Workshop (Sept 13-19)	Legazpi City
October	57th Climate Outlook Forum (Oct. 24)	PAGASA
	2012 NSTW Mindanao Cluster (Oct 10-13)	GenSan City
	DOST Project NOAH for Mobile and Infoboard Launch	PAGASA
	Final Seminar for Strengthening of (FFEWS) for Dam Operation (Oct. 16)	PAGASA
	MTC Closing Ceremony Batch 2012 (Oct. 23)	PAGASA
	Values Orientation Workshop for Central Office Performed (Oct. 10)	PAGASA
November	PAHRODF – PAGASA (Nov. 9)	Timberland, Montalban
	Forecasters Training on Signal Polarization S-Band Doppler Radar System	PAGASA
	IEC AWS @ Kalinga and Ifugao (Nov. 19)	PAGASA
December	58th Climate Outlook Forum (Dec. 12)	PAGASA
	TY Pablo (Presscon) Dec. 3	PAGASA

A look back

JANUARY

PRA, Balai Isabel, Batangas
January 26-28, 2012

A regular activity being undertaken by PAGASA to assess the performance of the agency during the year and to discuss the plans and commitment for the coming year. Participated by the members of the Executive staff and planning officer of each Division.

51th Climate Outlook Forum
Amihan Conference Room, PAGASA Central Office
January 25, 2012

Monthly Climate Outlook Forum was held at Amihan Conference Room, PAGASA Central office. The Forum was attended by representatives from the various agencies of government and private sector entities. The Forum serves as an avenue to increase the level of awareness of the participating agencies from the public and private sectors and to be updated on the development of the La Niña phenomenon. Also included are the review of the climate conditions during the last two months, the status of major dams, and extended forecasts, among others. As a tradition in the previous forums, participants were encouraged to actively participate in the discussions, towards a fruitful meeting of minds.

ASTI-MMDA-PAGASA MOA signing
MMDA office
January 17, 2012

Kick off meeting for the project "Strengthening of Flood Forecasting and System in Bicol River Basin"
Amihan Conference Room, PAGASA Central Office,
January 10, 2012

Overall and recommendations of scientific research on the Typhoon Sendong
Amihan Conference Room, PAGASA Central Office
January 31, 2012

FEBRUARY

6th Joint Coordination Committee (JCC) Meeting for the project "Strengthening Flood Forecasting and Warning system for Dam Operation (FFWSDO)" February 24, 2012

National Astronomy Week

Annual celebration of the National Astronomy week held 2nd week of February. Participated by students teachers and researchers.

MARCH

Annual celebrations

62nd World Meteorological and 147th National Meteorological Day, March 22-23, 2012

The PAGASA as a member of the World Meteorological Organization (WMO) joined the rest of the international meteorological community in celebrating the 62nd World Meteorological Day which was celebrated worldwide by its 189 member countries every 23rd March. WMO 2012 was also celebrated in conjunction with PAGASA's 147th National Meteorological Day marking the agency's founding anniversary.

Beefing up the celebrations, various activities were lined-up during the whole day celebration for PAGASA employees which included Thanksgiving Mass, Aero dance, Games, Awarding of Loyalty and Service Awards and Homecoming of PAGASA Retirees to honor their contributions and services to the agency. The PAGASA conducted an Open-house on Planetarium and Astronomical Observatory for the general public, High School treat to the realm of Science of Meteorology (Pre-arranged with selected schools in QC) and Scientific Forum on PAGASA-DOST – Public Private Sector Forum which was aimed to recognize the important benefits provided by weather, climate and water information to different socioeconomic sectors. Presenters/Resource Speakers from the private sectors during the scientific forum were from the Mango/Agriculture Industry; Water Sector Industry; and Telecommunications Industry and Television Network acknowledge for their important role in the dissemination of weather information. A highlight of the day's celebration was the conferment of the Wind Vane Awards to individuals and institutions for their valuable support to PAGASA's programs/ projects in strengthening of disaster risk reduction activities in 2012.

This year, WMO adopted the theme "Powering our future with weather, climate and water" which focused on the critical roles of weather, climate and water services in powering a sustainable future for us and for generations to come.

APEC Training Course on Quantitative Precipitation Estimation/Forecasting (QPE/QPF) March 27-30, 2012

The Course was designed for weather forecasters, hydrologists, and water management officials,

who are in the front line during the incidence of extreme climatic events and mandated to prepare recommendations on disaster preparedness.

The excessive rainfall being experienced recently by many state economies in the Asia-Pacific region resulted to flooding that caused wide devastation and loss of lives. The Quantitative Precipitation Estimation/Forecasting (QPE/QPF) is an important disaster management and emergency preparedness tool being used by national weather offices to quantitatively assess the expected amount and impact of rainfall accumulated over a specified time and over a particular area. The tool is very important during the occurrences of heavy rainfall brought about by typhoons and monsoons.

Twenty two foreign participants (including the 5 experts) from nine (9) APEC eligible economies and 30 local participants from PAGASA, NAPOCOR, and NIA attended the training.

The methodologies comprised of lectures, country presentations, discussions wherein the participants exchanged and shared experiences on lessons learned from high impact rainfall events, new techniques and development of QPE/QPF and hand hands-on exercises that enabled them to understand the uses and applications of the new technology.

The participants visited the Angat Flood Forecasting and Warning System for Dam Operation and Pampanga River and Flood Forecasting and Warning Center which showcased the hydrological system of the prime catch area of Central Luzon.

Certificates of Participation were given to the participants and Certificates of Appreciation were awarded to the experts and resource speakers.

APRIL

Handover of Virac Doppler radar for the completion of the installation of Doppler radar in Virac, Catanduanes

2012 Expert Mission in Philippines TCDIS, Disaster Prevention Technologies in Korea (FARD, FFFS), April 23, 2012

In order to coordinate efforts on the implementation of various activities under the Disaster Risk Reduction Component to better support the socio-economic development process in the Typhoon Committee Area and to help accomplish the DRR related goals and objectives in the Strategic Plan, the Typhoon Committee has established the Working Group on Disaster Risk Reduction (WGDRR) with the following Terms of Reference and operational modalities.

The WORKING GROUP on DISASTER RISK REDUCTION (DRR) of the Typhoon Committee promote cooperation among the Members in the implementation of activities under the Disaster Risk Reduction Component of the Committee's Strategic Plan with the aim to support the socio-economic development process and enhance cooperation among the Members in all three components. Towards this end, the WGDRR is expected to advise and assist the Committee in the following:

- Identifying priority issues and areas of cooperation in the Disaster Risk Reduction Component;
- Promoting and facilitating the exchange of experiences and knowledge on latest developments and techniques related to the above issues and areas;
- Coordinating and implement priority activities and programmes of the Committee aiming at strengthening capacity of the Members in Disaster Risk Reduction;
- Mobilizing resources to carry out priority activities of the Committee related to the Disaster Risk Reduction Component;
- Promoting measures for more effective cooperation with other components of work of the Committee, including the development of a conceptual framework on multi-hazard early warning systems and public out-reach programmes;
- Reporting overall progress in the implementation of the DRR component of the Strategic Plan; and
- Recommending to the Committee priority areas, programmes and activities for cooperation in Disaster Risk Reduction research by related experts of the Members.

MAY

Inauguration of Virac Doppler radar held on May 02, 2012.

The Virac Doppler Radar Station is located at Bgy. San Buenavista, Bato, Catanduanes. A state of the art radar using solid state magnetron type emission power of 10 kw as compared to 500 kw power used by a conventional radar. A JICA grant aid project, which amount to Php560M. The construction started in July 2010 and was completed in February 2012 by the Japan Weather Association as consultant, Consortium of Marubeni and Shimizu Corporation as contractor and Japan radio Company for the telecommunication.

His Excellency President Benigno Simeon Aquino III led the successful inauguration held on May 2, 2012. Present during the inauguration were DOST Sec. Montejo, Dr. Servando, Sec. Almendras, JICA Officials, Gov. Cua, Gov. Salceda, Cong. Sarmiento, SUWECO officials, AKO party list, Representative from different sectors such as LGUs, Cabinet secretaries, VIPs/guests, national & local media, and other officials from the national and local government. The President delivered the inaugural address.

The inauguration activity included the cutting of ceremonial ribbon, unveiling of marker with the President and assisted by the representative of JICA, tour within the newly constructed facilities and blessing of the area. After the unveiling of marker, Dr. Servando gave a briefing/orientation of the project and led the inspection of the radar.

A total of 600 personnel attended the activity. The security was tight where the host/PAGASA team up with PSG for properly identifying the VIPs/guests in entering the area. Phil. Marine, Phil. Army and PNP together with PSG were in-charge of the security one week before the inauguration. For the program concerns: security - PSG; venue - Protocol office; stage - RTVM & media - MARU. PMS was the overall in charge of the event together with SLPRSD staff and PAGASA overall committees.

JUNE

Kick-off meeting on Terminal Evaluation of the project "Strengthening of Flood Forecasting and Warning System for Dam Operation (FFWSDO), Amihan Conference Room, PAGASA Central Office, Quezon City on June 19, 2012.

The Kick off meeting was participated by the Evaluation Team composed of the Japanese team namely: Mr. Hayato Nakamura, Project Formulation Adviser (Disaster Management) Poverty Reduction Section, JICA Philippine Office, Ms. Makiko Somo, Consultant, Soft Tech Consultants, Japan, Dr. Akihisa Okuda, Comprehensive River Management Expert, Advisor, DPWH, Mr. Kessy Reyes, Program Officer, JICA Philippine Office, with Mr. Motoki, and Mr. Azuma consultant of the project PAGASA, and from the Philippine side Emma Agagas, NEDA, head Team evaluator Philippines side, Ms. Nancy T. Lance, Senior Weather Specialist, Planning Unit, PAGASA and Mr. Ryan Christopher Viado, Science Research Specialist, DOST-PCIEERD. Results of the evaluation were presented during the meeting.

Typhoon and Flood Awareness Week 2012 (June 17-22, 2012)

JULY

Launching of Project NOAH on July 06, 2012 in Marikina City

His Excellency President Benigno Simeon Aquino III led the launching of the DOST Nationwide Operational Assessment of Hazards (NOAH) a program designed to serve as sentinel or watchman that will address the serious challenges brought by extreme hazard events held at Barangay Nangka, Concepcion , Marikina City on July 06, 2012.

A team composed of PAGASA and PHIVOLCS, DOST front runner service agencies in disaster risk mitigation efforts, together with DOST-ASTI in collaboration with the UP National Institute of Geological Science (NIGS) and UP College of Engineering joined efforts to develop innovative information system, tools and technologies to be used by the government to help prevent disasters especially in the most vulnerable areas throughout the country.

PAGASA provides satellite, images, radar, synoptic, Automatic Weather Stations (AWS), Automatic Rain Gauge (ARG), data needed for the Program NOAH's Operation.

NOAH will work to integrate current disaster science research and development projects and initiate new efforts within the DOST to achieve this objective.

AUGUST

Signing of Memorandum of Understanding (MOU) between Korea Astronomy Space Science Institute (KASI) and PAGASA

The signing of the Memorandum of Understanding between Korea and Philippines represented by Dr. Pilho Park, President, KASI and PAGASA, was the culmination of the Letter of Intent signed by Mr. Sungki Cho, Manager, Office of International and Public Relations, KASI and Dr. Nathaniel T. Servando, Administrator, PAGASA on 21 June 2012. The signing was assisted by Dr. Flaviana D. Hilario, Acting Deputy Director for Research and Development, PAGASA and Dr. Cynthia P. Celebre, Chief Research and Development and Training Division (RDTD), PAGASA. The MOU forms the framework for cooperation between the parties to indentify and achieve shared goals and objectives, and to facilitate and develop a genuine and mutually beneficial exchange process and research relationship. This is non-binding and does not impose any legal or financial obligation or liabilities to either party.

In the MOU, both parties encourage the following activities to promote international cooperation in the field of astronomy and space science:

- Establish ties of friendship and cooperation in astronomy and space science.
- Encourage and support highly qualified young Filipino researchers and education resources
- Promote academic collaboration and public outreach programs
- Support technical assistance in astronomy and space science.

SEPTEMBER

Ground breaking ceremony of the Iloilo radar station

Dr. Nathaniel T. Servando, Administrator, PAGASA, with PAGASA and LGUs officials

The ground breaking ceremony held in Buntatala, Jaro, Iloilo City is one of the three (3) radars to be installed under the project entitled "Enhancement of Doppler Radar Network for National Weather Watch, Accurate Forecasting and Flood Early Warning" an initiative to upgrade PAGASA's capability of weather and flood forecasting and nationwide with acquisition and use of state-of-the art Doppler radars. It aims to establish three (3) Doppler Weather Radar Stations at the Western Seaboard of the country to complete the coverage and monitoring of weather systems in the Philippines. This will involve the acquisition and installation of one (1) new S-band Polarization Doppler radar, the construction of buildings towers in western parts of the country at Iloilo, Palawan and Zamboanga Peninsula and provision of associated operation and maintenance facilities. It will also provide reliable and real time data for the provision of hourly tropical cyclone updates as well as monitor thunderstorm and heavy rains in real time.

The project is consistent with the "Millennium Development Goal "to eradicate extreme poverty and to address the threat and impact of weather and climate disaster; and is in line with the sixteen (16) point agenda, Climate Change Adaptation and Disaster Risk Reduction Management enhanced national, sectoral, regional and local development plans under the PDP 2011-2016 of the Aquino Administration. To have better equipment and infrastructure contributes to better services on uplifting the living conditions, human development and national progress in line with the commitment made in the "Hyogo Framework of Action 2005-2015; Building the Resilience of Nations and Communities to Disasters, with the over-all goal protecting the lives and properties of our countrymen from future disasters.

The ceremony was participated by the DOST Region VI officials led by Director Rowen Gelonga and PAGASA personnel led by the PAGASA Administrator Dr. Nathaniel Servando.

Inauguration of PAGASA-DOST-SMART ARG Co-Location Project in Atok, Benguet

Inauguration of the ARG in Atok Benguet is one of the 63 ARG sites nationwide identified by PAGASA and SMART under the 2011 co-location agreement. PAGASA has completed the installation of the said ARGs in SMART's Cell sites located in strategic places in Luzon, Visayas, and Mindanao.

Mr. Darwin Flores of SMART, Mr. Arnold Inumpa of PST – CAR, Benguet and Mayor of Atok, Benguet.

SMART is helping empower the local officials and residents through a communication solution useful for efficient information dissemination in the most crucial times. The Telco offers the Info board solution where local government officials and disaster risk reduction and management council can quickly send and receive official bulletins situation reposts via SMS.

The inauguration coincide with the seminar workshop on the use of automatic weather station (AWS) data and automatic rain gauge (ARG) for disaster preparedness under the project entitled "Development of Hybrid Weather Monitoring System and Production of Weather and Rain Automated Stations" – DOST-ASTI-PAGASA

DOST-PAGASA Sports Festival

As part of the DOST Sport fest 2012, bowling is one of the events participated by PAGASA. A back to back celebration as both women and men emerged

champions on the recently concluded DOST bowling tournament, held from June to August 2012 at Alabang Metropolis, Muntilupa City.

OCTOBER

Meteorologist Training Course (MTC), Training Room, Central Office PAGASA, Quezon City October 23, 2012

The Meteorologists Training Course (MTC) has been designed for future weather forecasters. This course will not only equip them with the basic knowledge and skills in operational weather and flood analysis and forecasting, but also in climate monitoring and prediction as well as in research and development. At the end of the course, the participants will be able to acquire broad knowledge and understanding of the different atmospheric processes and develop skills in performing operational duties in the Agency i.e., weather, flood and climate analysis and forecasting as well as in research and development and other non-operational activities.

This course was opened to PAGASA employees, personnel of other National Meteorological and Hydrological Services (NMHSs) in Regional Association (RA) V (Southwest Pacific), and other interested applicants who met the entrance requirements. There were 82 applicants (21 PAGASA employees, 56 non-PAGASA and 5 from Philippine Navy) considered to take the Qualifying Examination held on 27 September 2011 at three designated testing centers, namely, National Capital Region (NCR) in WMO/PAGASA Regional Training Center, 2/F, Science Garden, Agham Road, Diliman, Quezon City; Visayas in Mactan, Visayas PRSD Office; and Mindanao in El Salvador City, Misamis Oriental, Mindanao PRSD Office. There were 41 participants who qualified to undergo the MTC training (13 PAGASA employees, 22 non-PAGASA and 6 WMO/Foreign Fellows from RA V countries). Two personnel from the Philippine Air Force and two from the Philippine Navy (PN) were considered as additional participants.

The course was conducted for 44 weeks whole day sessions. It was composed of theoretical and practical phases. The theoretical phase consisted of two terms conducted for a total of 32 weeks, Term I (09 November 2011 – 16 March 2012), and Term II (26 March – 24 October 2012).

A Study Tour was conducted at Tanay PAGASA Station in Sitio Mayagay, Bgy. Sampaloc, Tanay Rizal; International Rice Research Institute (IRRI) in UP Los Baños; Agno River Basin Flood Forecasting in Carmen Rosales, Pangasinan; Baguio Synoptic and Radar Stations in Baguio City and Subic Radar Station in Subic, Zambales.

The practical phase of the course was held for 12 weeks, eight weeks in the Weather Division, two weeks in Hydro-Meteorology Division, one week in Climatology and Agrometeorology Division and one week in Research & Development and Training Division. A total of 34 participants successfully completed the course.

PAGASA participated in National Science & Technology Week Celebration

The PAGASA featured latest technonolgy and innovation utilized in Weather Forecasting. The agency exhibits comprising the Rainfall Warning System, Climate in the Philippines, Community-Based Flood Early Warning System, including the Agency Profile.

The DOST has also line-up various activities in keeping with the theme, "Science, Technology and Innovation: Working Together for Growth and Development" which was held in SMX Convention Center, Pasay City on 10-14 July 2012.

NSTW celebration

The 2012 National Science and Technology Week is annual celebration of the DOST community and other partners with various sectors that highlights the DOST's latets research and development results as well as developed technologies, innovations and winning inventions from the regions.

Aside from the DOST line agencies and councils, this year's event was also participated in by different academic institution, business sectors and other government institutions to showcase their developed technologies in the areas of food, agriculture and aquaculture, biotechnology, alternative energy, environment, health pharmaceuticals, manufacturing/engineering, nanotechnology and information communication. This occassion was also designed to make researchers, scientists, businessmen and investors interact for technology transfer and commercialization, making S&T outputs usuable and accessible to the people.

Highlighted during the event was the High Impact Technology Solutions (HITS) developed and implemented by various DOST Research and Development Institutes. PAGASA as one of the DOST's line agency, showcased the new technologies and interventions it has developed in terms of disaster prevention and mitigations.

Likewise, the NSTW celebrations were also conducted in the 4 regional levels, the Northern Luzon Cluster S&T Fair which was held in Batac Ilocos Norte, Visayas Cluster S&T Fair was held in Tacloban City, and Mindanao Cluster S&T Fair was held in General Santos City and Southern Cluster S&T which was held in Pampanga. These also served as the venue in showcasing the local science community's research and development, as well as technology outputs in raising the awareness and appreciation of the general public for science and tecnology.

Technology and Connectivity for Disaster Preparedness DOST's Project NOAH for Mobile and Info board launch

The Department of Science and Technology's (DOST) Project NOAH (Nationwide Operational Assessment of Hazards, the country's most advanced weather and flood monitoring system, cannot only be accessed via its website (noah.dost.gov. ph) but also through a new mobile app for android devices.

With DOST's project NOAH for mobile, people's productivity and safety are no longer at the mercy of weather disturbance. Every Filipino can prepare for sudden changes in weather condition anytime, anywhere.

Software Engineer and Web App developer Rolly Rulete created DOST's Project NOAH for mobile for free. The former DOST's scholar understands how important to have accurate and real-time information about the weather when it comes to keeping people safe because his father Mamerto makes a living as a fisherman in Surigao del Sur.

Rulete, together with his colleagues and the Smart Developer Network (SMART.Dev. Net) further developed the apps until it was ready for the public. It is now available for free via "Google Play".

Final Seminar for the project Strengthening Flood Forecasting and Warning System for Dam Operation – October 16, 2012

JICA Technical Cooperation Programme (TCP) Project for Strengthening of Flood Forecasting and Warning System for Dam Operation (SFFWSDO) conducted a final seminar held on October 16, 2012 at Shangri-La Hotel Ortigas Center, Mandaluyong Metro Manila. The final seminar was conducted to:

1) commemorate the 40th anniversary of the development of the FFWS in the Philippines with the assistance of JICA;

2) present the overall accomplishment of the Project and the current status of the Project activities; and

3) share and transfer the knowledge and experiences on dams and integrated water resources management in Monsoon Asia.

The seminar was participated by agencies involved in the project the PAGASA, NIA, NPC and JICA expert and representative.

NOVEMBER

Forecasters' Training on Single Polarization S- Band Doppler Weather Radar System, 2nd Floor Training Room, PAGASA Central Office, Diliman Quezon City, 12-16 November 2012

GROC-NCR-PRSD
2nd floor Training Room, PAGASA Central Office, Diliman Quezon City, November 20-21, 2012

DECEMBER

3rd Regional Climate Outlook Forum
CAD Conference Room, December 3, 2012

The 3rd Regional Climate Outlook Forum was held at the Climatological and Agrometeorological Division (CAD) Conference Room on Dec. 3, 2012. The activity was undertaken through videoconferencing with the participants from the National Met-Hydro Agencies in Asia such as Vietnam, Brunei, Singapore, Malaysia and Philippines. Each country, including the Philippines, presented their climate forecasts for December 2012 – May 2013 season and shared their experiences in terms of climate forecasting. The next regional climate outlook forum will be held in March 2013.

Enhancement of Weather Forecasting Capabilities

Rainfall Warning System (RWS) for Metro Manila

Ms. Cecilia A. Monteverde[1], Esperanza O. Cayanan[1], Ph. D., *et al.*[2]

[1]*Philippine Atmospheric, Geophysical and Astronomical Service Administration (PAGASA)*
Department of Science and Technology (DOST)

I. Abstract

PAGASA monitors continuously (24/7) the weather condition and analyses the observed data and model forecasts to provide forecast and warnings for significant weather events. PAGASA's warnings are usually based on wind speed and not on rainfall intensity. The Rainfall Warning System (RWS) is an end-to-end rainfall warning decision support tool developed for PAGASA's operation in providing timely and accurate warnings. There are two (2) types of warnings being issued for RWS. The Thunderstorm Warning System (TSTM-WS) for localized and short duration type of rainfall and Heavy Rainfall Warning System (HR-WS) for widespread rainfall condition due to large-scale synoptic weather system. The warning categories are classified according to the level of severity and required actions. Heavy Rainfall Warning is a three-stage color coding system based on the rainfall threshold criteria. Area based warnings are disseminated thru SMS, Twitter, Facebook and website. These have been successfully tested during Typhoon "Gener" (Saola) Mesocyclone,Habagat and many thunderstorm events. Validation/intercomparison of radar/satellite rainfall-derived estimates is suggested for future enhancement of the system.

Keywords: rainfall warning system, doppler radar, meteorological tools, thunderstorm, heavy rainfall, rainfall thresholds, color-coded warnings.

II. Introduction

Tropical Storm "Ondoy" in September 2009 and the "Habagat" in August 2012 have more than underscored the importance of having an early warning system. The very basic knowledge of how much rain can we expect in a given time at a given place will be of great help to the Local Government Units (LGUs) and other concerned agencies to take immediate response measures to the eventuality of flood that can cause disaster.

Metro Manila has been selected as the pilot area since they are often subjected to recurrent flooding due to its geographical location and urban setting (Figure 1). About 80% of the total annual rainfall occurs during the wet season, from May to October. MMDA has identified the areas which are prone to flooding. Starting the 1990s, flooding became more frequent and widespread. A local thunderstorm alone can easily flood the low-lying areas of Metro Manila.

As part of the commitment of PAGASA to provide early warnings to protect lives and properties, the Rainfall Warning System or simply "RWS" was established initially for Metro Manila. This will eventually be replicated for the entire country. This become operational since June 2012. This project is aimed to establish an end-to end decisionsupport tool designed to provide meaningful information to decision makers, stake-holders and communities to protect lives, livelihood and properties about heavy rainfall. events that may cause flooding. It also aimed to provide an easy to interpret information that allows individuals and communities to take appropriate action.

Figure 1: RWS Pilot Area

III. Methodology

The workflow are outlined below and the schematic diagram of the RWS component is shown in Figure 2:

- Development of rainfall thresholds based on the correlation of rainfall to flood events;

-For monitoring and warning development, RWS uses deifferent meteorological tools and equipment such Doppler RADAR, satelite, upper air and in-situ observation and numerical model outputs;

-Identification of rain-causing weather system whether large scale synoptic system or localized type of system;

-The two (2) types of warnings issued under the RWS include the following: Thunderstorm Warning System (TSTM-WS) (Figure 3a) for short duration and localized rain causing weather and the Heavy Rainfall Warning System (HR-WS) (Fig. 3b) for long duration and widespread rainfall caused by large scale synoptic weather system. (e.g. Tropical Cyclone, monsoons, etc); and

-Disseminataion of Weather Watches/Advisory/Warnings to authorities and general public using all means of communication with sufficient lead time so that appropriate actions can be done.

Figure 2: RWS tools, equipment, component & workflow

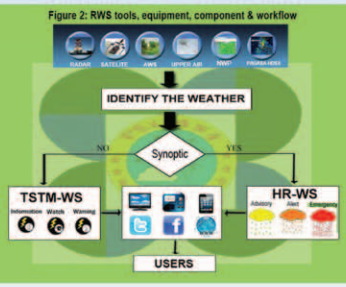


Figure 3a. TSTM-WS

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

Figure 3b. HR-WS

WARNING	MEANING	DISSEMINATION
Advisory	Community AWARENESS FLOODING IS POSSIBLE in low-lying areas and areas near the river channel.	This will be disseminated thru SMS, Twitter and website
Alert	Community PREPAREDNESS FLOODING IS THREATENING	This will be disseminated thru SMS, Twitter, website and fax
Emergency	Community RESPONSE SERIOUS FLOODING is EXPECTED EVACUATION to higher grounds	This will be disseminated thru SMS, Twitter, website and fax

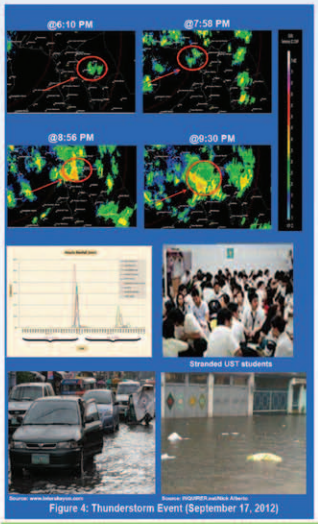


Figure 4: Thunderstorm Event (September 17, 2012)

Results and Discussion

This report will focus on the two extreme weather events in 2012 - the Thunderstorm event and Enhanced Southwest Monsoon or "Habagat".

Case Study 1: Thunderstorm Warning – September 17, 2012

Thunderstorm is a localized storm cloud producing lightning and thunder and often brings heavy rainfall with a spatial scale varying from a few kilometers and time scale of less than an hour to few hours. Figure 4 shows the series of images of thunderstorm formations on the night of 17th September 2012. At 8:24pm, Thunderstorm Advisory was issued by PAGASA that will affect Quezon City, it has a lead time of less than an hour. It shows that at 7:58pm, cloud formations were observed over the NW part of Obando, Bulacan and NNW of San Jose del Monte, Bulacan. These rapidly developed and then moved towards the central Metro Manila area. At 8:56pm, the two cloud cells merged and by 9:41pm it fully grown into a huge thundercloud bringing much rainfall. At 9:00pm, Science Garden Station registered 50.0mm of rainfall within an hour and at 10:00pm, Port Area Station received 40.0mm of rainfall (as shown in the graph). This event brought widespread flooding in various areas in Metro Manila.

Case Study 2: Enhanced Habagat – August 1-8, 2012

When a cyclone is over the North of Northern Luzon or the Taiwan-Okinawa area, the Southwest wind flow or "Habagat" is enhanced causing prolonged rainfall over the western section of the country. On August 1 - 8, 2012, Habagat and a series of thunderstorms brought very intense rainfall which submerged most parts of the National Capital Region and nearby provinces (Figure 5). During the wrath of Habagat (August 1 to 8), the accumulated rainfall was recorded at 1199.1 mm which is about 237.8% of the normal monthly rainfall. The total normal rainfall for August for Science Garden, Q.C. is 604.2 mm. Light to heavy continuous rains was observed as it reached its peak on August 6th and 7th amounting to 323.4 mm or 64.1% and 391.4mm or 77.6% of the normal monthly rainfall respectively. In comparison with TS Ondoy (2009), the big volume of rainfall (300mm) brought about by TS Ondoy increased abruptly over the 3 hours while during Habagat, the 300 mm of rainfall was accumulated gradually over the 22 hours. Habagat caused widespread flooding in 36 cities, 175 municipalities and 17 provinces and with estimated damaged value of P651.4 Million and P2.4Billion on agriculture and infrastructure respectively. There are about 934,285 families or 3,457,774 persons affected and one hundred nine (109) casualties were reported.

The cross-section of Subic Radar images show that the highest reflectivities are situated near the cloud base which means that the high rainfall rates are over Metro Manila. It is also noted that the most intense cores with > 45 dBZ reached as high as 10 kms. There were 13 RED (>30 mm/hr) warning signals that were issued by PAGASA thru SMS, Twitter, Facebook and posted in the website.

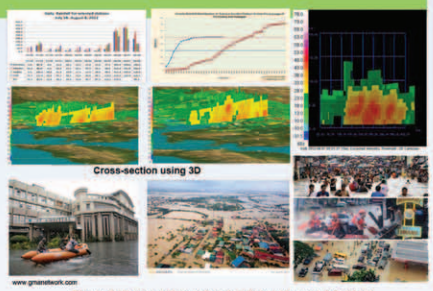


Figure 5: Habagat Heavy Rainfall Event (August 1-8, 2012)

IV. Conclusion

Preliminary studies of the 2012 rain events showed the importance of using Doppler Radar and other meteorological tools in providing rainfall warnings in Metro Manila. RWS is an end-to end decision support tool which provided forecast in detecting Thunderstorms and Heavy rainfall. The provision of an easy to interpret information empowered the decision-makers and the people to take action. The system was tested during the occurrence of "Typhoon Gener (Saola)", "Mesocyclone," "Habagat," and a number of thunderstorm events. During Habagat, there were 13 RED warning signals texted and tweeted to the public.

An interactive RWS website will soon be launched that will serve as a gateway for the dissemination of real-time rainfall warnings to alert the decision-makers and the general public when an extreme event will occur. Warnings can be graphically monitored with hydrometeorological data, graphs and maps in a simple, user-friendly format.

At present, RWS continues to develop, an Operations Manual and Quick Reference Guide are also being finalized that will serve as "Toolkit" for the Forecasters and other technical users. Continuous development will be done to improve its scope and to include other tools.

Finally, it is planned to extend this study by using more cases and validating these cases in order to provide more timely and accurate warnings to more ensure the safety of lives and properties.

Future Direction

- Due to the great variability of the intensity and distribution of precipitation, more radar and satellite ground truth should be done for different synoptic cases such as convective & stratiform events & tropical weather systems.
- Continuous improvement of the RWS to include validation/verification.
- Replicate the system to other PAGASA Regional Services Divisions (PRSDs) nationwide.
- Popularize the usage and customization of RWS to LGUs and the general public thru Information, Education and Communication.

Background

RWS was conceptualized using the information from different meteorological centers which established their own rainfall warning.
-Hongkong Observatory
-Thailand Meteorological Center
-Central Weather Bureau, Taiwan

Acknowledgement

RWS is spearheaded by the Research and Development and Training Division of PAGASA in collaboration with the other Divisions. Special thanks to all the members of the RWS "Technical WorkingGroup (TWG) who made significant contribution in the implementation and development of the system, including Lourdes R. Sulapat, Shirley J. David, Sharon Juliet M. Arruejo, Ma. Cristina C. Uson, Nivagine Nievares, Raymond C. Ordinario, Resly George Q. Amador, Julie M. Nimes, Mary May Calimoso, Benie de Leon and Nikos Viktor B. Peñaranda. The work would have not been possible without them. Heartfelt thanks are also due to Dr. Nathaniel I. Bervando, Dr. Flaviana D. Hilario, Dr. Vicente B. Malano, Dr. Cynthia P. Celebre, Dr. Susan R. Espinueva and Mr. Robert Suen for their encouragement and all-out support to the Project.

"tracking the sky.....helping the country"

www. pagasa.dost.gov.ph

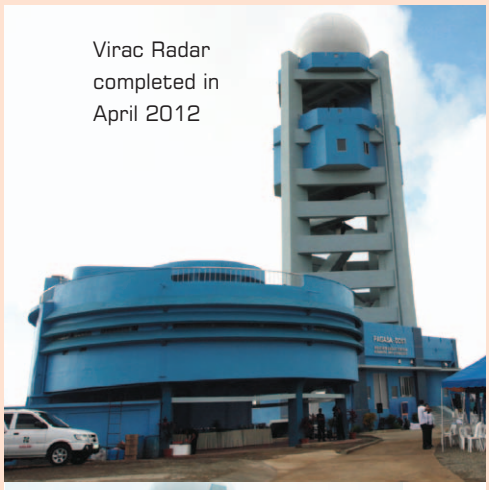
by: Nick & Andrew

PAGASA undertakes the establishment of Rainfall Warning System (RWS) applicable for Metro Manila. The RWS is a decision support tool designed to alert concerned communities and emergency managers about heavy rainfall event that would cause or aggravate flooding. The study was conceived to serve the needs of decision-makers and other stakeholders and provide meaningful information that allows individuals and communities to protect their lives and properties. Early warning information empowers people to take action when a disaster is about to happen.

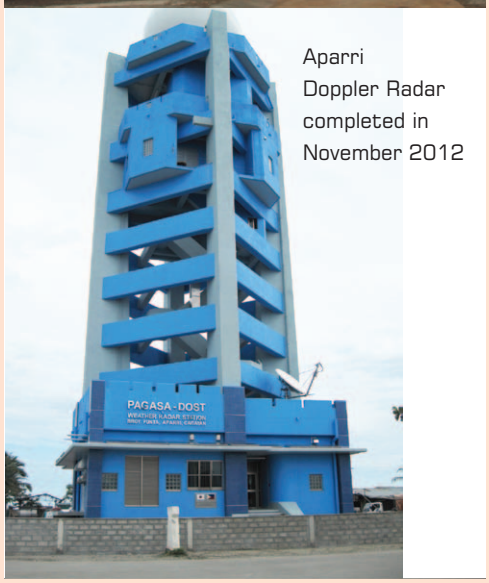
The main objectives of the project is to develop end-to end rainfall warning decision support tool designed to alert the concerned communities and decision makers about the occurrence of heavy rainfall event caused by local convective and synoptic weather systems and to provide easy to interpret information that allows individuals and communities to protect their lives and properties.

Completion of Virac and Aparri Doppler Radar

The two Doppler radars are part of the JICA Grant-In-Aid project entitled "Improvement of Meteorological Radar System in the Philippines".



Virac Radar completed in April 2012



Aparri Doppler Radar completed in November 2012

Completion of Tampakan Doppler Radar in South Cotabato

Tampakan Doppler Radar
Completed in December 2012-OP funding

Activities

- Information and Communication
- Weather Forecast
- Climate Change
- Numerical Prediction Model Development
- Research and Development

Information and Communication

Establishment of Communication, Ocean, and Meteorological Satellite (COMS) Analysis System

The main role of PAGASA is to cope with climate change and to provide the local weather information. Recently, the demands on the intensive monitoring and the enhanced technology of weather prediction have been raised because the hazardous weather condition and severe weather activity become more difficult to predict due to the Earth environment change, i. e. climate change.

For the intensive monitoring, the real-time global observation data is required. Hence, satellite data is inevitable and the domestic needs about the acquirement, analysis and interpretation system of satellite data have been increased. Also it is strongly required to build the database system and the international partnership for the analysis of the impact over local area by climate change. The project objectives are as follows:

- Intensive monitoring and enhanced support of local weather forecast,
- Development of earlier warning system for hazardous weather and disaster,
- Strengthening capacity and provision of meteorological information and analysis,
- Provision of service and production of weather forecast through expansion and improvement of Meteorological infra and its experts, and
- Coping with climate partnership by acquiring the accumulated technical and operation know-how from KOREA and sharing the related information and research results

Local Workstation: Tuguegarao City, Legazpi City, Lapulapu City, and El Salvador City. The four (4) locations are the centers of the newly created offices of the PAGASA Regional Services Divisions (PRSDs), which are namely the Northern Luzon, Southern Luzon, Visayas and Mindanao PRSDs.

Scope of the Project:

Dispatch of Korean Experts

- Expert in management to be a Project Manager for the overall project.
- Experts in H/W installation & S/W development for the establishment of COMS data receiving system & analysis
- Expert in training & education for system operation
- Expert in satellite data analysis for satellite data management

Technical Training

- Training course for satellite system operation
- System management and operating technique for the operation of COMS data receiving and analysis system
- Linux system management and operation
- Network management and operation
- Number of trainees & training period: Five (5) trainees for two (2) weeks

Training course for satellite data analysis and interpretation

- COMS data analysis & weather forecast utilization
- Meteorological image (picture) analysis & processing techniques
- Number of trainees & training period: Five (8) trainees for two (2) weeks

Provision of Equipment & Materials
(Please refer to Figure 1 for H/W configuration)

- Satellite receiving antenna and data receiver
- Date processing & storage equipment (Server, Work station, Storage etc)
- Networks & security equipments (Switch, Firewall etc)
- Software (PGI Compiler, WAS, DBMS etc)

Other equipments (UPS, RACK, Printer etc)
Components & Customizing of Software System Package
System configuration and description

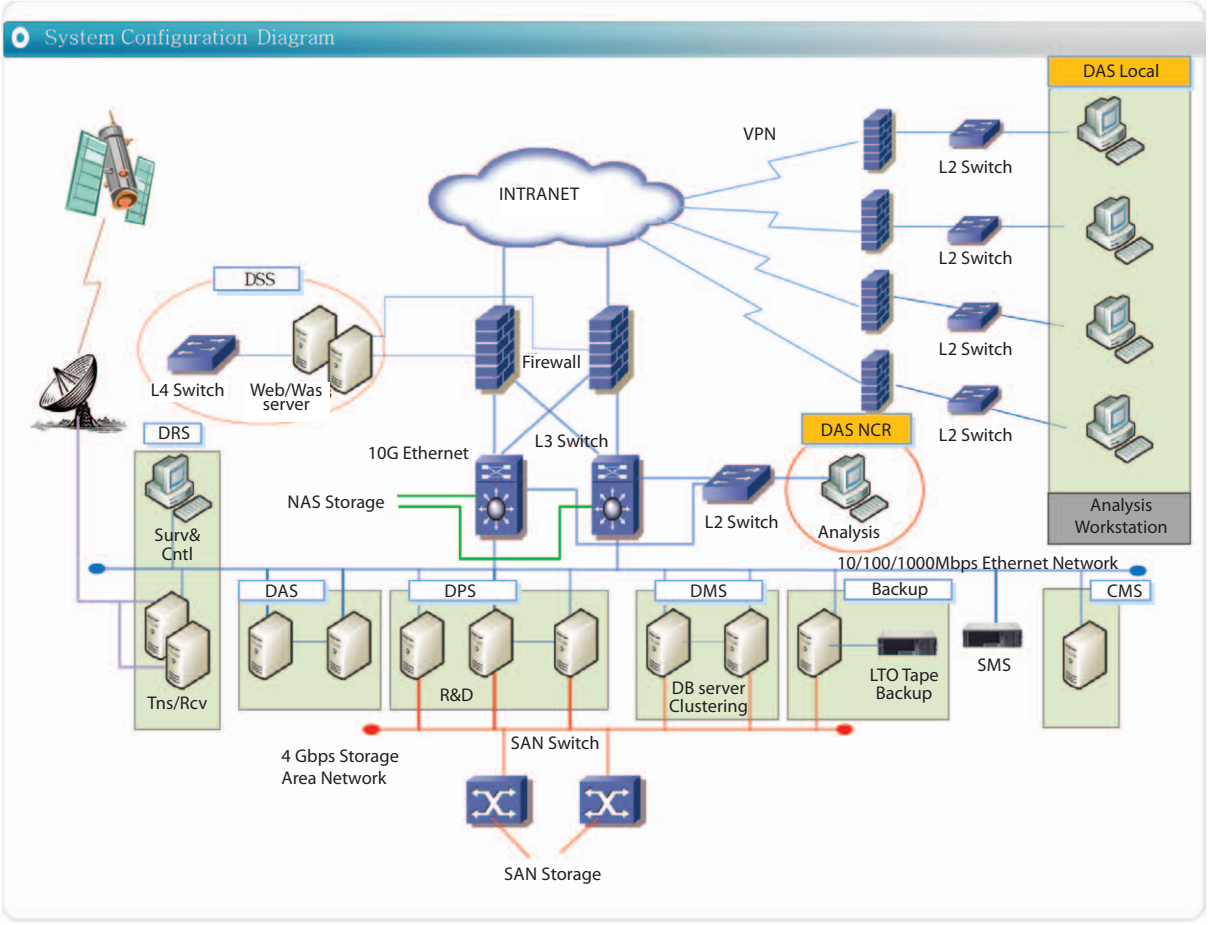


Figure 1 for H/W configuration

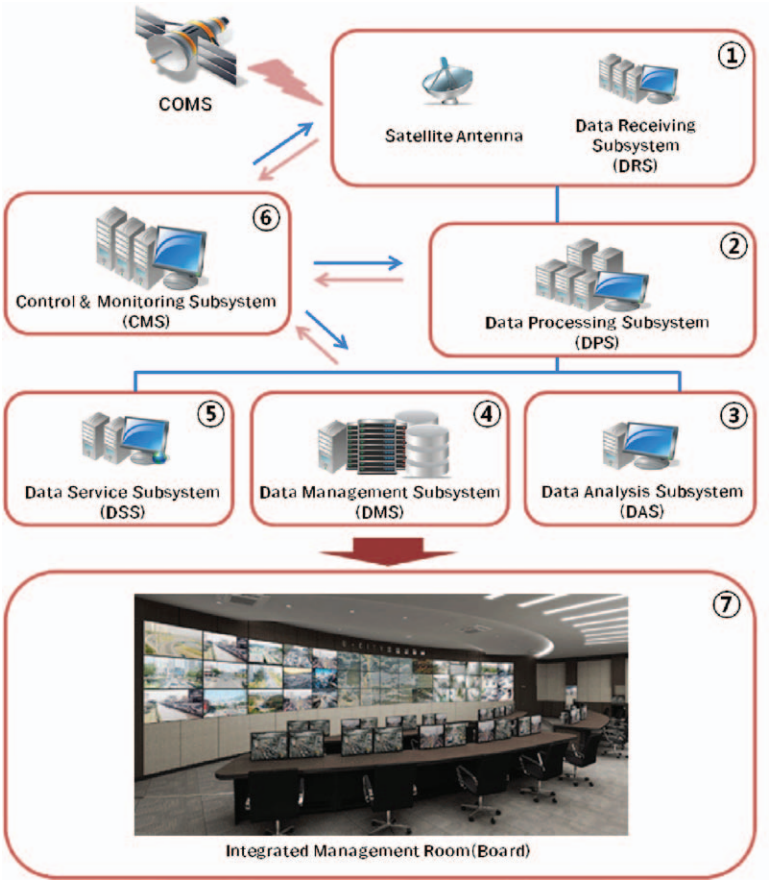


Figure 2 Internet Services On Weather Information

Weather Forecasting and Tropical Cyclone Warning

PAGASA has regularly issued public weather forecasts, including a five-day weather outlook, shipping and aviation forecasts. PAGASA has also provided specially packaged weather information for Mt. Mayon, Mt. Bulusan and other selected areas. During the year, (19) tropical cyclones entered the Philippine Area of Responsibility (PAR) as shown in Figure 1. The occurrences of TCs are within the normal condition.

The benefits gained through the provision of forecasting and warning services in terms of preparedness and mitigation of the adverse impacts of tropical cyclone, thereby, reducing losses may not be expressed in concrete terms. But definitely, the immeasurable gains redounded to the advantage of the local communities, in particular, and the country in general.

Likewise, on-going implementation of the projects for the upgrading of forecasting and warning system of PAGASA, such as, the JICA Doppler radar projects (Virac, Guiuan & Aparri), Mindanao Doppler radars (Tampakan and Hinatuan) and Cebu Doppler radar were almost complete, while the PGMA Doppler radar in Subic and Tagaytay were already completed and are now operational.

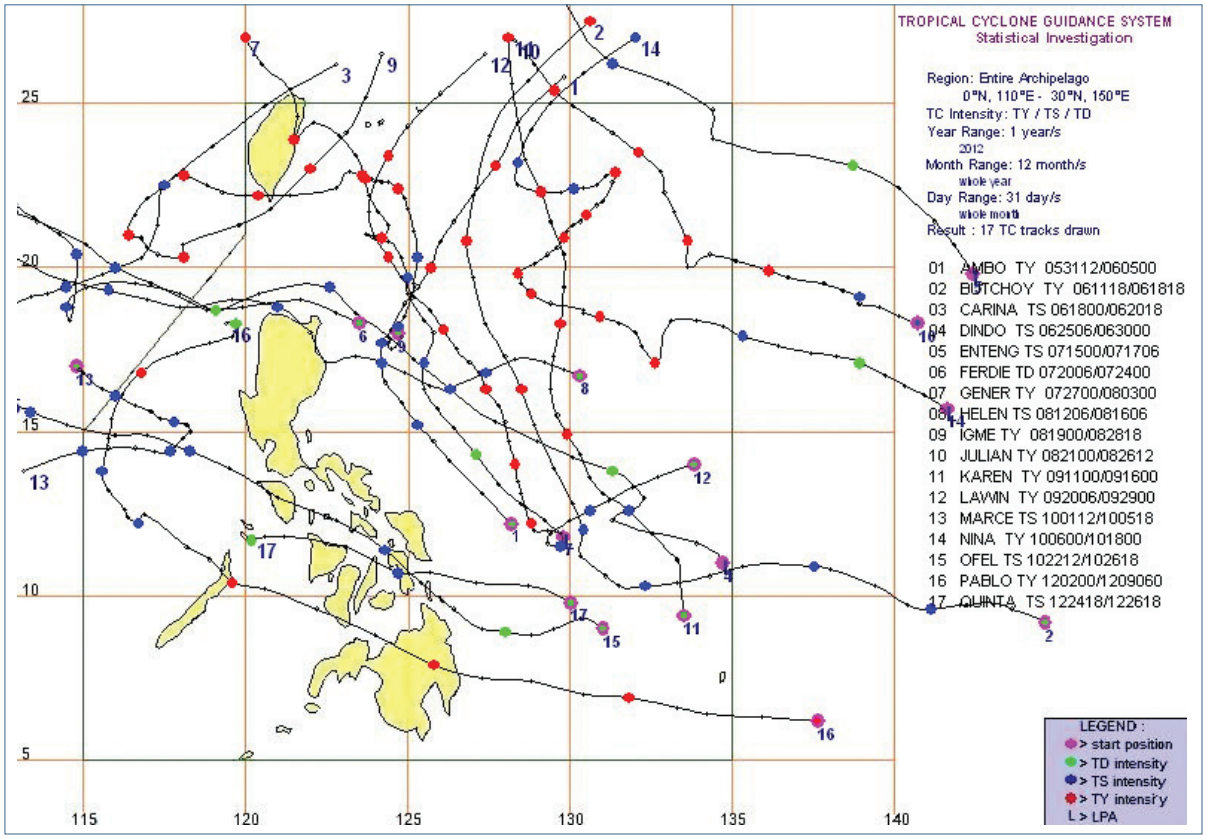


Figure 3 Tropical Cyclone that entered the PAR

PAGASA Numerical Prediction Model Development

PAGASA uses the following models:.

GSM (Global Spectral Model). This is used by RSMC Tokyo and received at PAGASA in grib format. The model is being run twice daily at TAMSS for 1200 UTC and 0000 UTC forecast products at 6:00AM and 12:00 noon with processing time of 30 minutes Forecast products are available to weather forecasters at 6:30AM and 12:30PM. The model resolution is 1.25 degrees (~ 125km)

GSM Limited Area Pressure Analysis. Display of GSM output for isobaric analysis from 00 – 72 hour forecast period for 0000UTC and from 00 – 192 hour forecast period for 1200UTC.

GSM Limited Area Rainfall Patterns. Display of GSM output for isohyet analysis from 24 – 72 hour forecast period for 0000UTC and from 24 – 192 hour forecast period for 1200UTC.

GSM Limited Area Streamline Analysis at 850,700,500,300 and 200hPa. Display of GSM output for wind analysis (streamline) from 00 – 72 hour forecast period for 0000UTC and 1200UTC.

GSM Limited Area Streamline Analysis at 980hPa. Display of GSM output for wind analysis (streamline) from 00 – 72 hour forecast period for 0000UTC and from 00 – 192 forecast period for 1200UTC.

GSM Limited Area Geopotential Heights at 850,700,500 and 200hPa. Display of GSM output for thickness analysis from 00 – 72 hour forecast period for 0000UTC and 1200UTC.

GSM Limited Area Temperature at 980 hPa. Display of GSM output for isotherm analysis from 00 – 72 hour forecast period and from 00 – 192 hrs forecast period for 1200UTC.

TXLAPS (Tropical Extended Limited Area Prediction System). The TXLAPS is being used operationally at the Bureau of Meteorology in Australia, accessed by registered users like PAGASA thru internet. It provides products for 0000 and 1200 UTC. The 1200 UTC products are accessed at 6:30AM and available to Forecasters at 6:40AM. The 0000UTC products are accessed at 1:20PM and available to the Forecasters at 1:40PM. It has resolution of 2.5 degrees (250km)

TXLAPS Sea Level Pressure Product. TXLAPS output of mean sea level pressure for 24 and 48 hour forecast at 00UTC and 12UTC.

TXLAPS Surface Rainfall. TXLAPS output of mean sea level pressure for 24 and 48 hour forecast at 00UTC and 12UTC.

TXLAPS Surface Wind. TXLAPS output of winds (barb) in map form for 24 and 48 hour forecast at 00UTC and 12UTC.

TXLAPS Level Winds. TXLAPS output of winds at the 850, 700,500,300, 200 hPa for 24 and 48 hour forecast at 00UTC and 12UTC.

TXLAPS Level Temperature. TXLAPS output of temperature at the 850, 700,500,300, 200 hPa for 24 and 48 hour forecast at 00UTC and 12UTC.

WAVE (Spectral Wave Model). The wave model was developed by METEOFRANCE. Winds (in grib format) from the Global Spectral Model (GSM) are used to drive (input) the Philippine waters and obtain the wind-generated waves (wave forecasts) for 72 hours (output). Wave Model is run operationally twice a day with processing time of 30 minutes and the products are available to weather forecasters at 6:30AM and 12:30PM. The model resolution is 1.25 degrees (~ 125km)

Wave Height and Direction. Display of Wave model output from analysis to 72 forecast hour.

Surface Wind. GSM display of winds (speed and direction) at the surface from analysis to 72 forecast hour used as input to the Wave model.
0N/1E → 0400N/132 00E →04 00N/120 00E →07

NAVGEM (Navy Global Environmental Model) is a global numerical weather prediction computer model run by NOAA

PAGASA-WRF constitutes two (2) domains. The first domain runs on a 12x12 km grid and the much smaller domain which gives a much higher resolution, is domain 2 that is simulated using a 3kmx3km grid. A lead time is up to 72 hours for both domains.

GFS - The Global Forecast System (GFS) is a global numerical weather prediction system containing a global computer model and variational analysis run by the NWS. This mathematical model is run four times a day and produces forecasts up to 16 days in advance, but with decreasing spatial and temporal resolution over time. It is widely accepted that beyond 7 days the forecast is very general and not very accurate, and most nongovernmental

agencies rarely use any of the model's results beyond 10 days (especially because there is no other 16-day model with which to compare). Along with the ECMWF's Integrated Forecast System (IFS), the CMC's Global Environmental Multiscale Model (GEM), both of which run out 10 days, the Naval Research Laboratory NOGAPS model, which runs out eight days, and the UK Met Office's Unified Model, it is one of the four predominant synoptic scale medium-range models in general use.

The model is run in two parts: the first part has a higher resolution and goes out to 192 hours (8 days) in the future; the second part runs from 192 to 384 hours (16 days) at a lower resolution. The resolution of the model varies in each part of the model: horizontally, it divides the surface of the earth into 35 or 70 kilometre grid squares; vertically, it divides the atmosphere into 64 layers and temporally, it produces a forecast for every 3rd hour for the first 192 hours, after that they are produced for every 12th hour. The GFS is also used to produce model output statistics, in three ranges: every hour for 24 hours, every three hours out to three days, and every 12 hours out to eight days.

In addition to the main model, the GFS is also the basis of a 20-member (22, counting the control and operational members) ensemble that runs concurrent with the operational GFS and is available on the same time scales. This is variously referred to as a "Global Ensemble Forecast System" (GEFS or GENS) or the "Medium Range Forecast" (MRF). Ensemble model output statistics are also available out to 8 days. The GFS ensemble runs alongside that of the GEM to form the North American Ensemble Forecast System.

NCEP - The PAGASA National Centers for Environmental Prediction (NCEP) delivers national and global weather, water, climate and space weather guidance, forecasts, warnings and analyses to its Partners and External User Communities. These products and services are based on a service-science legacy and respond to user needs to protect life and property, enhance that nation's economy and support the nation's growing need for environmental information.

Climatological and Agrometeorological Services

The Climatological and Agrometeorological Division (CAD) has consistently provided support to the agricultural sector. Vital agro-meteorological information were disseminated to the farmers for farming activities and proper farm management and necessary planning. Farmers make use of the information to increase income by minimizing weather induced losses and prevent unnecessary waste of time and material input. During the year, 366 Daily Farm Weather Forecasts and Advisories (FWFA) were issued to 42,822 recipients. Likewise, 10-day Regional-Agro weather forecasts and advisories for agriculture were provided while 36 Philippine Agroclimatic Review & Outlook were also issued. Other beneficial climatological information were also published.

Increasing demand for climate forecasts as important inputs in agricultural planning for climate sensitive crops, such as rice and corn during the occurrence of extreme climate events, has been observed. Since the Philippines relies chiefly on rice and corn as staple food, the application of climate forecasts for agriculture will be replicated in all the agricultural areas in the country. In addition, agrometeorological research stations will be established in state colleges and universities to obtain the database as well as the information for studies on cropping calendar, plant pest and disease control. Increased collaboration on improving the crop yield must be strengthened with state universities and colleges. Likewise, implementation of the projects - MDGF 1656: Strengthening the Philippines Institutional Capacity to Adapt to Climate Change, a Spanish grant & UNDP project and Climate Change Adaptation Project, funded by World Bank, should be completed.

Activities were carried out to develop and evaluate techniques for the improvement and operationalization of medium-term and long-term climate information, monitoring and prediction services for industry, agriculture and other sectors. A Climate Outlook Forum was conducted monthly to appraise specific sectors and the general public of the climate outlook and related information for specific periods.

Climate Modelling

Climate change modeling infrastructure is being enhanced in order to produce high resolution climate projections appropriate for impact studies. Climate impacts studies require scenarios of climate change at very high spatial and temporal resolution. These scenarios are derived from global climate model projections using downscaling methods.

Providing climate change scenario

In 2011 PAGASA came up with a report entitled "Climate change in the Philippines" under the project "MDGF 1656: Strengthening the Philippines Institutional Capacity to Adapt to Climate Change" funded by Spanish Government. The "Climate change in the Philippines" (Fig. 1) report is an important document to guide decision-makers in strategic planning and policy formulation. Highlighted in this Report are the present (baseline) climates, key findings of future climates in 2020 and 2050 in the Philippines under the three emission scenarios, and how would these future climates impact on the different key sectors and systems, including how adaptation could be pursued. The present (baseline) climate gives the current changes in the Philippine climate in terms of temperature, rainfall and extreme events, including tropical cyclone occurrence. The key findings on future climates (e.g., in 2020 and 2050) in each of the provinces are presented in terms of temperature increase and rainfall change by seasons (e.g., DJF or northeast monsoon season, MAM or summer season, JJA or southwest monsoon season, and SON or transition from southwest to northeast monsoon season) and changes in frequency of daily extreme events in graphs and/or tables. It also provides us with the opportunity to understand future changes in climate and how these changes will affect the Philippines. It also illustrates the impacts of climate change on agriculture, human health, coastal, and forestry resources as well as adaptation efforts sector.

In order to generate projections of temperature increase and rainfall change in the Philippines in the future, the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) used the PRECIS (Providing Regional Climates for Impact Studies) model in two time frames; 2020 and 2050. This model was developed by the UK Met Hadley Centre (in the United Kingdom) to facilitate impact, vulnerability and adaptation assessments in developing countries where capacities to do climate modeling are still not fully developed or do not exist. Three of the emission scenarios developed by the Intergovernmental Panel on Climate Change in its Special Report on Emission Scenarios (IPCC SRES) were chosen to run the models; namely, A2 (high-range), A1B (mid-range), and B2 (low-range). The A2 scenario is at the so-called higher end of the emission scenarios (although not the highest), and is preferred by most countries because from an impacts and adaptation point of view, if man can adapt to a larger climate change, then the smaller climate changes of the lower end scenarios can also be adapted. On the other hand, the A1B scenario is considered because the future climates in the next 30-40 years will be greatly influenced by past emissions, principally due to the long lifetimes of carbon dioxide. The B2 scenario representing the low-range emissions is therefore, the most unlikely, even if it represents the low end.

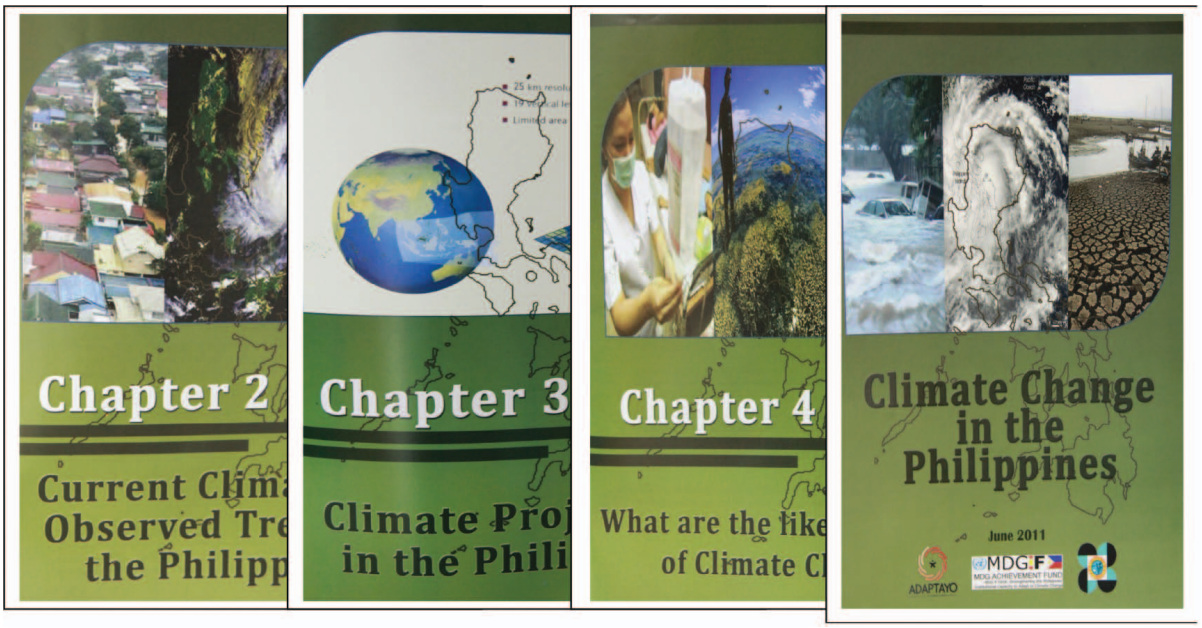


Figure: Climate Change Publication through MDGF project.

On research and development activities, PAGASA stepped up its efforts to develop systems and techniques to improve its operational forecasting and warning capabilities. These activities are supportive of the R&D priorities of the Department of Science and Technology (DOST), which aim primarily to enhance agricultural and industrial productivity, water resources and energy production. Completed and on-going projects/research studies by the agency are the following:

R & D published:

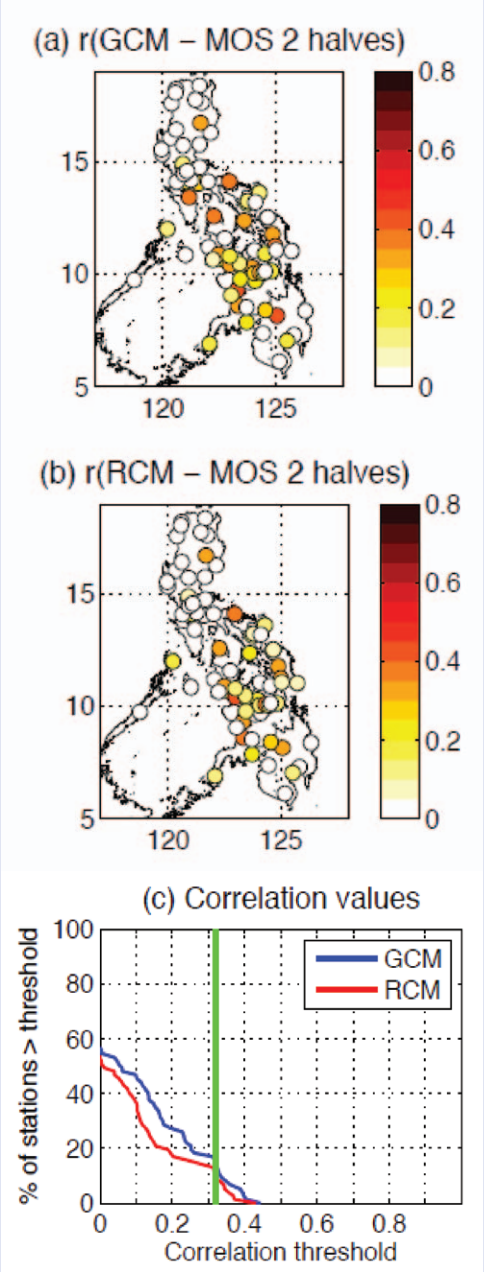
Downscaling of Seasonal Rainfall Over the Philippines: Dynamical versus Statistical Approaches

by Anthony Joseph R. Lucero, AW Robertson, et al.
Published in April 2012 – Monthly Weather Review, American Meteorological Society

Abstract

The additional value derived from a regional climate model (RCM) nested within general circulation model (GCM) seasonal simulations, over and above statistical methods of downscaling is compared over the Philippines for the April{June monsoon transition season. Spatial interpolation of RCM and GCM grid box values to station locations is compared with model-output statistics (MOS) correction. The anomaly correlation coefficient (ACC) skill at the station scale of seasonal total rainfall is somewhat higher in the RCM compared to the GCM when using spatial interpolation. However, the ACC skills obtained using MOS of the GCM or RCM wind fields are shown to be generally and rather equally superior. The ranked probability skill scores (RPSS) are also generally much higher when using MOS, with slightly higher scores in the GCM case.

Very high skills were found for MOS correction of daily rainfall frequency as a function of GCM and RCM seasonal-average low-level wind fields, but with no apparent advantage from the RCM. MOS-corrected monsoon onset dates often showed skill values similar to those of seasonal rainfall total, with good skill over the central Philippines. Finally, it is shown that the MOS skills decrease markedly and become inferior to those of spatial interpolation when the length of the 28-year training set is halved. The results may be region dependent, and the excellent station data coverage and strong impact of ENSO on the Philippines may be factors contributing to the good MOS performance when using the full-length dataset over the Philippines.



Prediction of Rice Production in the Philippines Using Seasonal Climate Forecast

by Anthony Joseph R. Lucero, N Koide, et al.

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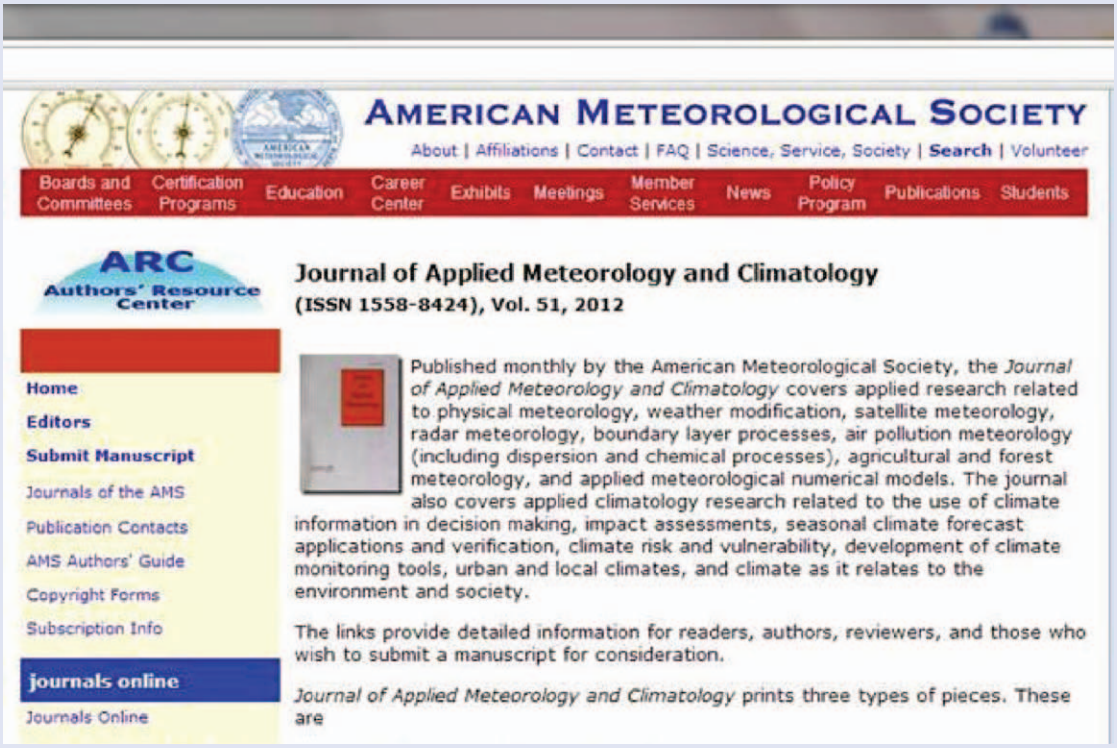
Abstract

Predictive skills of retrospective seasonal climate forecasts tailored to Philippine Rice production data at national, regional and provincial levels investigated using precipitation hind casts from uncoupled general circulation model (GCM) and two coupled GCMs, as well as using antecedent observations of tropical Pacific sea surface temperatures, warm water volume and zonal winds (WWV and ZW). Contrasting cross-validated predictive skills are found between the "dry" January -June and "rainy" July-December crop-production seasons. For the dry season, both irrigated and rain fed rice production are shown to depend strongly on rainfall in the previous October to December. Furthermore, rice-crop hind casts based on the two coupled GCMs, or on the observed WWV and ZW, are each able to account for more than half the total variance of the dry-season national detrended rice production with about a six month lead time prior to the beginnings of the harvest season. At regional and provincial level, predictive skills are generally low.

The relationship is found to be more complex for rainy season rice production. Area harvested correlates positively with rainfall during the preceding dry season, whereas the yield has positive and negative correlations with rainfall in June – September and in October- December of the harvested year respectively; tropical cyclone activity is shown to be contributing factor in the latter three-month season. Retrospective forecasts based on the WWV and ZW are able to account for almost half of the variance of detrended rice production data in Luzon with a few months lead time prior to the beginnings of the rainy season.



Completed Projects:

Foreign-assisted Projects:

Strengthening of Flood Forecasting and Warning System for Dam Operation (FFWSDO) - JICA -TCP 2010-2012

The JICA Technical Cooperation Project for the Strengthening of Flood Forecasting and Warning System for Dam Operation started in October 2009 with the aim of strengthening the flood forecasting and warning activities that will cover the entire river basin thru capacity building of agencies concerned. PAGASA was the implementing agency with the National Power Corporation (NPC) and National Irrigation Administration (NIA) as cooperating agencies. Project activities were based on the Project Design Matrix (PDM) that was mutually agreed by all the concerned agencies. The PDM was updated after a series of discussions between the Mid-Term Review Team and Counterpart agencies on the narrative summary, indicators and inputs/outputs of the project, agreeing on the supplemental activities and deliverable outputs to be undertaken that would further enhance the Project purpose. Project areas were the six dams in Luzon, namely the Ambuklao, Binga, San Roque, Angat, Pantabangan, and Magat.

Upon commencement of the Project, the Joint Coordination Committee (JCC) was formed with the following central government agencies: PAGASA, NPC, NIA, Department of Public Works and Highways-FCSEC), National Water Resources Board (NWRB), Office of Civil Defense (OCD) and National Economic Development Authority (NEDA) for monitoring and discussion of the issues concerning the Project. In addition, the Joint Operation and Management Committee (JOMC), which was established in 1989 as the platform entity that oversees the operation and management FFWS/FFWSDO, was also attached to the Project.

In order to carry-out the activities of the Project, four (4) working groups (WG) were organized to conform with the target outputs highlighted in the PDM and each was headed by the respective Experts from JICA: Organization and System, Meteorology and Hydrology, Flood Modeling and Equipment and Planning and O&M. Counterpart personnel from PAGASA, NPC and NIA were designated to work closely with the Experts to ensure the attainment of the Project objectives of conducting activities in the collection, processing, management and sharing of meteorological/hydrological records, operation and maintenance of FFWS/FFWSDO equipment and strengthening of the flood forecasting and warning capability on dam operation taking a basin wide approach.

The WGs performed various Project activities assisted and facilitated by the Consultant Team members, which include meetings with the C/Ps and the Joint Coordination Committee (JCC) meetings to present the project updates, data collection and river surveys which served as inputs in the development of the Dam Inflow and Dam Downstream Forecasting Model and Hydrological Database. In order to familiarize the hydrologists of PAGASA, MPC and NIA with these hydro models, flood drills were carried out at the dam site. This

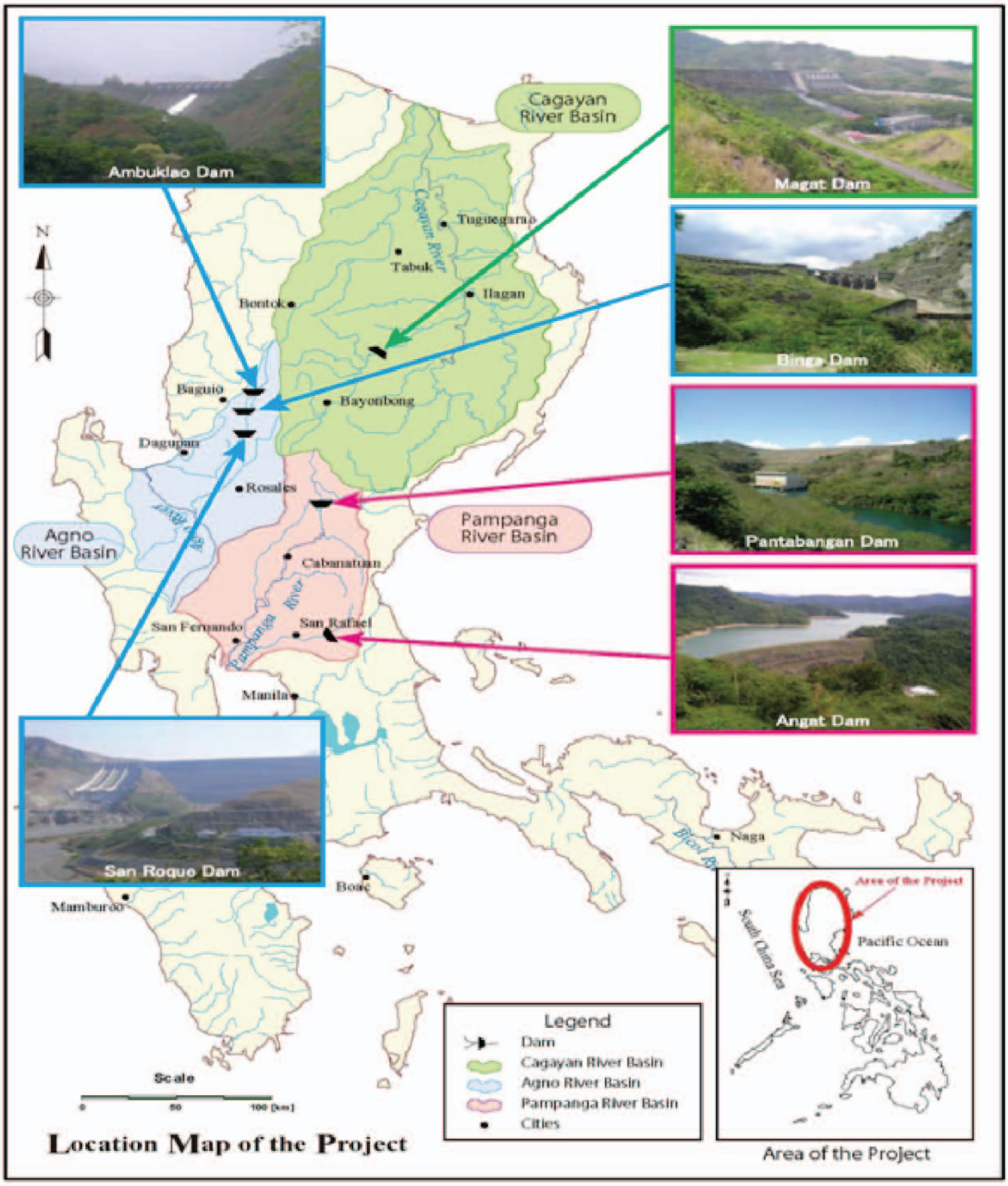
At Angat FFWSDO, Norzagaray, Bulacan

At Main Operation
Center-Flood Forecasting
and Warning, WFFC Building

activity also strengthened the coordination among the agencies concerned with the Local Government Units (LGUs) downstream of the dams due to their involvement, e.g. hosting of the consultation meetings, active participation in the coordination and dissemination of Forms that were used during the drill. One LGU from Nueva Ecija even conducted an actual rescue and evacuation as their supplemental activity for the drill.

During the conduct of discussions with the Joint Terminal Evaluation Team in July 2012, the Philippines and Japanese sides agreed to grant the request of the counterpart agencies for the conduct of inundation analysis in the Pampanga River Basin. The PDM was again revised to include this new activity and subsequently, a Working Group on Inundation Analysis was organized with the counterpart staff from PAGASA, NIA, and NPC. One of the outputs of the WG was the development of a conceptual model that could be used for river (1-D) and flood inundation (2-D) for the flood-prone area.

The Project was finally completed in November 2012 and this was culminated by the conduct of the Final Seminar last October 16, 2012. Said seminar was attended by key personnel from the DOST Undersecretary for Scientific and Technological Services Prof. Fortunato T. Dela Peña, JICA Chief Representative Mr. Takahiro Sasaki, Agham Party List Representative Congressman Angelo Palmones, Counterpart personnel from PAGASA, NPC, NIA and representatives from related agencies like the MMDA-EFCOS and other funding agencies like the Asian Development Bank and AusAID.



As an expression of their appreciation for making significant and strong contribution to the overall management of its activities, JICA Philippine Office led by the Chief Representative, Mr. Takahiro Sasaki, presented a Recognition Award to PAGASA, the first Filipino recipient of this award. The unrelenting commitment of PAGASA has paved the way for the successful implementation of JICA's forged partnership with the Philippines, particularly in the field of disaster management and preparedness.

Coinciding with the final year for the Project was the celebration of the 40 years of flood forecasting and warning system in the Philippines. Dr. Susan R. Espinueva, Chief of the Hydrometeorology Division, provided a presentation on the early stage of the development of FFWS and the succeeding events that led to its advancement, articulating on the technical and financial assistance of the Government of Japan, the challenges faced by PAGASA in the operation and maintenance aspect of the FFWS/ FFWSDO equipment as well as the milestones and continuing activities for the expansion of FFWS in the Philippines. The presence of Mr. Juanito F. Lirios, one of the Pensionado Scholars who was sent to become an expert in hydrology to the prestigious Imperial College of London in 1954, has made the Final Seminar really memorable.

Mr. Lirios, then an aspiring Hydrometeorologist would one day become the future "Architech" of Philippine Flood Forecasting.

The completion of the Project has paved the way for the numerous accomplishments that would greatly benefit not only the agencies concerned with FFWS but most especially the people living the downstream communities of the dams. Notable among these accomplishments was the comprehensive review and revision of manuals s which will be utilized by the responsible agencies concerned to effectively manage the reservoirs, particularly in the conduct of spillway operation, the provision of equipment to enhance data collection, operation and maintenance of equipment and the dam inflow forecasting model which can be operationalized and utilized by PAGASA, NPC and NIA.

Establishment of Early Warning and Response System for Disaster Mitigation in Metro Manila. KOICA funded

Establishment of an early warning and response system within the Marikina-Pasig River Basin. Provision of scientific and automated method for gauging the rainfall at the Pasig-Marikina River Basin and monitoring water levels at the selected points along the river basin which can help in the forecasting of the river's water level. The project installed a total of 17 rain gauge (RG) and 16 water level gauge (WLG) for Metro Manila. The system is operational first quarter of 2013.

MDGF 1656: Strengthening the Philippines Institutional Capacity to Adapt to Climate Change Spanish Grant & UNDP

To assist the Philippine Government to address the threats of climate change the MDG-F 1656 Joint Programme (JP) was launched with support from the Spanish Government by capacitating its major actors of which PAGASA is one. The JP was designed to strategically pursue the following three (3) outcomes in addressing climate change impacts at the national and local levels:

1. Climate risk reduction (CRR) mainstreamed into key national and selected local development plans and processes;
2. Enhanced national and local capacity to develop, manage and administer projects addressing climate change risks; and
3. Coping mechanisms improved through pilot adaptation project.

Guided by these three target outcomes, the JP aims to;

- To determine vulnerability of critical sectors of the Philippines to climate change;
- To strengthen the country's adaptive capacity by enhancing the planning, programming and implementation capacities of key stakeholders; and
- To undertake five adaptations demonstration projects to develop/test systems for potential up-scaling and replication.

Overall, the project contributed to increasing the level of PAGASA capabilities in terms of infrastructure and human resource. Training programs raised the agency capabilities in generating high resolution regional climate projections using new downscaling techniques developed by CSIRO. The acquisition of cluster computing facilities cut the 10 months running time to 2 months. PAGASA has enhanced its capacity to develop detailed regional climate information from data that developed countries, such as the UK, CSIRO are equipped to supply. Climate scenarios generated by PAGASA in 43 ++ provinces in 2020 and 2050 are widely used in the planning activities of national government agencies (NGA's).

PAGASA participated in various forums on the application of the climate scenarios in climate proofing plans and programs of various NGA's and LGU's. Trainors' training proved to be an effective means to introduce and strengthen the knowledge of PAGASA personnel, particularly those in the field stations, in climate change and scenario analysis and enable them to understand how to generate climate scenarios, and share their knowledge to the people at the countryside. The pool of lecturers that were trained would also be more accessible to provide orientation/briefing to their constituents. The programme was able to develop a common platform of knowledge into training materials that could then be adapted to local condition by trainers. Trainers can make presentation more local by adding local climate data and local experience. The automatic weather stations installed in the four project sites has benefitted local government units in monitoring rainfall which can be translated as early warning system for the community. The AWS are already used in the weather-based insurance index being implemented by International Labour Organization (ILO) and Philippine Crop Insurance Corporation (PCIC). The application of the AWS is already used in the weather-based insurance index being implemented by International Labor Organization (ILO) and Philippine Crop Insurance Corporation (PCIC). Certified daily rainfall from the AWS will be used by PCIC in case monitored of breach of index or there is potential for payouts for claims.

DA/DENR/PAGASA - Philippine Climate Change Adaptation Project-Phase 1 (PhilCCAP-1)/World Bank

Component 3: Enhanced Provision of Scientific Information for Climate Risk Management

1. This component aims to improve access of end-users, especially in the agriculture and natural resources sectors, to more reliable scientific information that would enable more rapid and accurate decision making for climate risk management. Specifically, it will provide the weather and climate information needed to design each adaptation intervention in other components of the project. Through the demonstration of this approach it is hoped that such strategies could be scaled up and used for other projects and activities. A specific output would be the preparation of a report that would be issued by PAGASA to the CCC on a semi-annual basis which would provide assessments of climate and weather conditions/forecasts in the medium and longer term. This would be an important input to Government's overall climate adaptation planning, work programming and risk management strategies.

2. Sub-component 3.2: Strengthening institutional capacity for effective climate risk management. Institutional capacity would be strengthened in PAGASA and other organizations as necessary, to provide the information described above as well as more broadly to capture, and analyze data, including through modeling, to better understand climate change trends over different timescales and to make this information available for practical use by policy makers, project managers at national and sub-national levels, and the general public. In cooperation with DA, Climate Field Schools will also be supported and communication networks strengthened to disseminate scientific climate information.

Locally-Assisted projects

Completion of the project "Development of Hybrid Weather Monitoring System and Production of Weather and Rain Automated Stations" – DOST-ASTI-PAGASA

Conduct of Seminar-workshop on the use of AWS and ARG data for disaster preparedness in the following areas:

Ilocoss Sur and Abra, Bengued

in Bantayan Cebu on December 28, 2012

La Trinidad, Benguet on September 20, 2012

In La Trinidad the Seminar workshop on the use Automatic Weather station (AWS) data was done simultaneously with the Inauguration of the SMART co-location project in collaboration with SMART Telecommunication Company.

In Apayao on November 22, 2012

Ifugao on November 20, 2012

In Mariveles, Bataan on November 15-16, 2012

Every year, the Philippines experiences strong typhoons with heavy rains and flooding during the monsoon season. This natural phenomenon has claimed many lives and damaged millions worth of properties, crops and livestocks over the years. In order to prevent or minimize damage caused by this natural phenomenon, obtaining timely and accurate data is the key to disaster prevention and mitigation. To prepare for such calamities, the project will deploy the network for Automated Water Stations (AWS) and Automated Rain Stations in different strategic locations across the country to complement PAGASA's weather forecasting system.

The project developed and deployed a network of AWSs and automated rain stations, which will be made redundant, throughout the Philippines to monitor real time weather changes occuring in specific areas or localities. Figure 4 and 5 deployed AWS and ARG.

The major components of the network system consist of the following:

1. Network of AWS and automated rain stations. These monitoring stations are equipped with different sensors capable of measuring the following weather parameters:
   a. Automated Weather Stations (AWS)
      - Wind speed & direction
      - Air temperature
      - Air humidity
      - Air pressure
      - Rain amount, duration, and intensity
   b. Rain monitoring stations
      - Rain amount, duration, and intensity

2. The systems network communications;
   The network communication uses the GSM/ GPRS as the primary communication line in transmiting real time data from the remote stations to the central server. The satellite communication however is used, whenever the primary communication is down.

3. The central server station is the master control for the network station. It receives, stores and provides data information from the remote monitoring stations to PAGASA. The data gathered from the remote monitoring stations will be made accessible to PAGASA and other concerned agencies for interpretation and analysis.

The Systems diagram:

II. The major activities of the project include the following:

1. Production of AWS and rain stations - Both AWS and rain monitoring stations will be equipped with ASTI's GSM Data Acquisition Terminal (GDAT) for data logging and real time transmission to the centralserver via cellular network or thru a satellite link as needed. The stand alone AWS and automated rainmonitoring stations will be made of high grade materials and will consist of reliable sensors, solar panelsand electronic data transmitters.

2. Development of the central server station software for data and network management

3. Research and Development to be conducted on the following:
   3.1 Satellite communications – To enable the satellite communication link to the network to ensure continuous transmission of data.

   3.2 Power control charger – Maximize solar power output to attain longer power backup for the remote stations

4. Deployment and Installation of the network system - The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) played a major role in the deployment and installation of the automated monitoring stations. PAGASA will be responsible for identifying and securing the project sites as well as facilitate the construction of installation structures for the automated stations. ASTI will install/ set up the automated sensor units.

Objectives:

To produce 80 automated weather stations (AWS) and 100 automated rain monitoring stations using local technologies resources;

- To deploy the AWS and rain monitoring system in key areas across the Philippines to complement PAGASA's weather forecasting facilities;

- To develop and incorporate satellite communication capability to the system as an alternative option for GSM/GPRS communication for timely and continuous weather information access; and To ensure reliable and continuous operation of the AWS and rain monitoring stations.

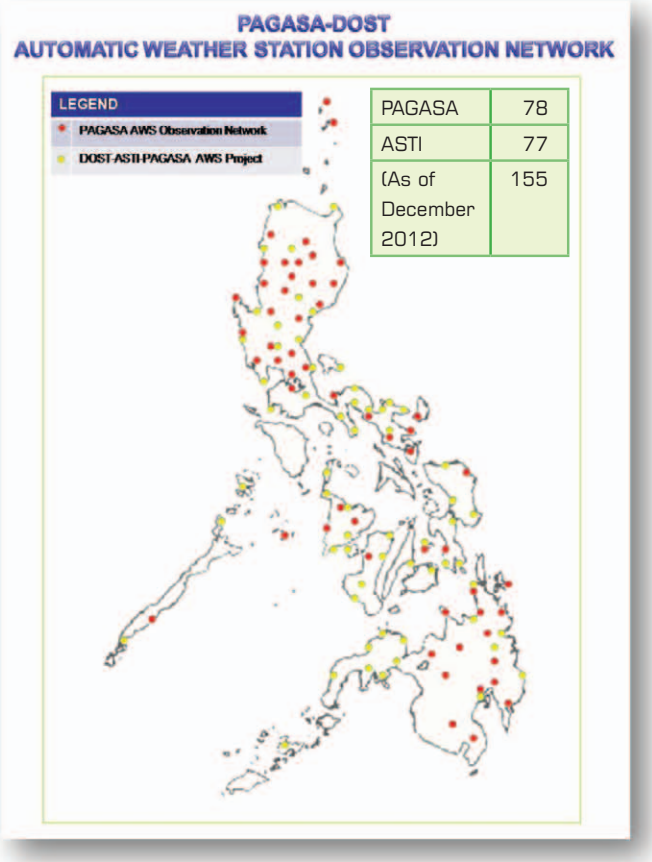


Fig 4: Deployed Automatic Weather Station (AWS)

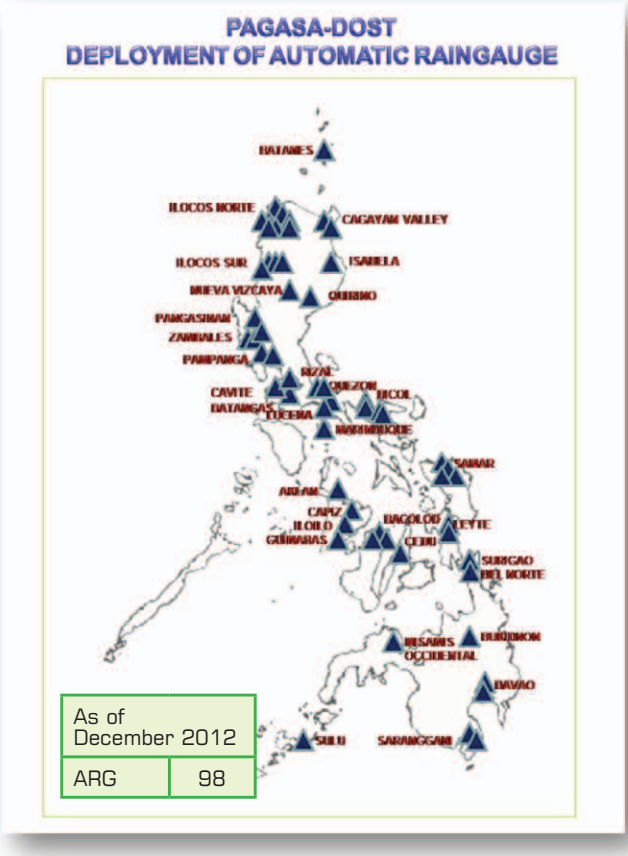


Fig 5: Deployed Automatic Raingauge (ARG)

The project completed the installation of 80 AWS and 100 ARG. Activities undertaken during the conducted of seminar workshop on the use AWS and ARG data for disaster preparedness to 42 provinces.

Establishment of National Meteorological and Climate Center (NMCC) DAP- GOP funded)

The project is consistent with the Millennium Development Goal (MDG) to eradicate extreme poverty and hunger including possible threat and impacts of weather and climate disaster; and is in line with the National 4-point Action Plan Preparedness. Better equipment and infrastructures contribute to better services in uplifting conditions, human development and national progress in line with the commitment made in the "Hyogo Framework of Action 2005-2015; "Building the Resilience of Nations and Communities to Disaster", with the overall goal of protecting the lives and properties of our countrymen from future disasters. The primary objective is to strengthen further the country's preparedness against meteorological and climate related hazards. The specific objectives are as follows:

- To establish the national meteorological and climate center;
- To conduct weather and climate modeling and prediction;
- To conduct research and /or case studies of disastrous hydro meteorological disasters;
- To foster greater awareness and understanding of various weather-climate and water related;
- To develop initial education and training program;
- To establish networks and cooperation among hydro meteorological and climate experts; and
- To strengthen collaboration efforts with international partners to share lessons and achievements. This will directly contribute to the further enhancement of and hydro meteorological climate-related disaster capacity within the country.

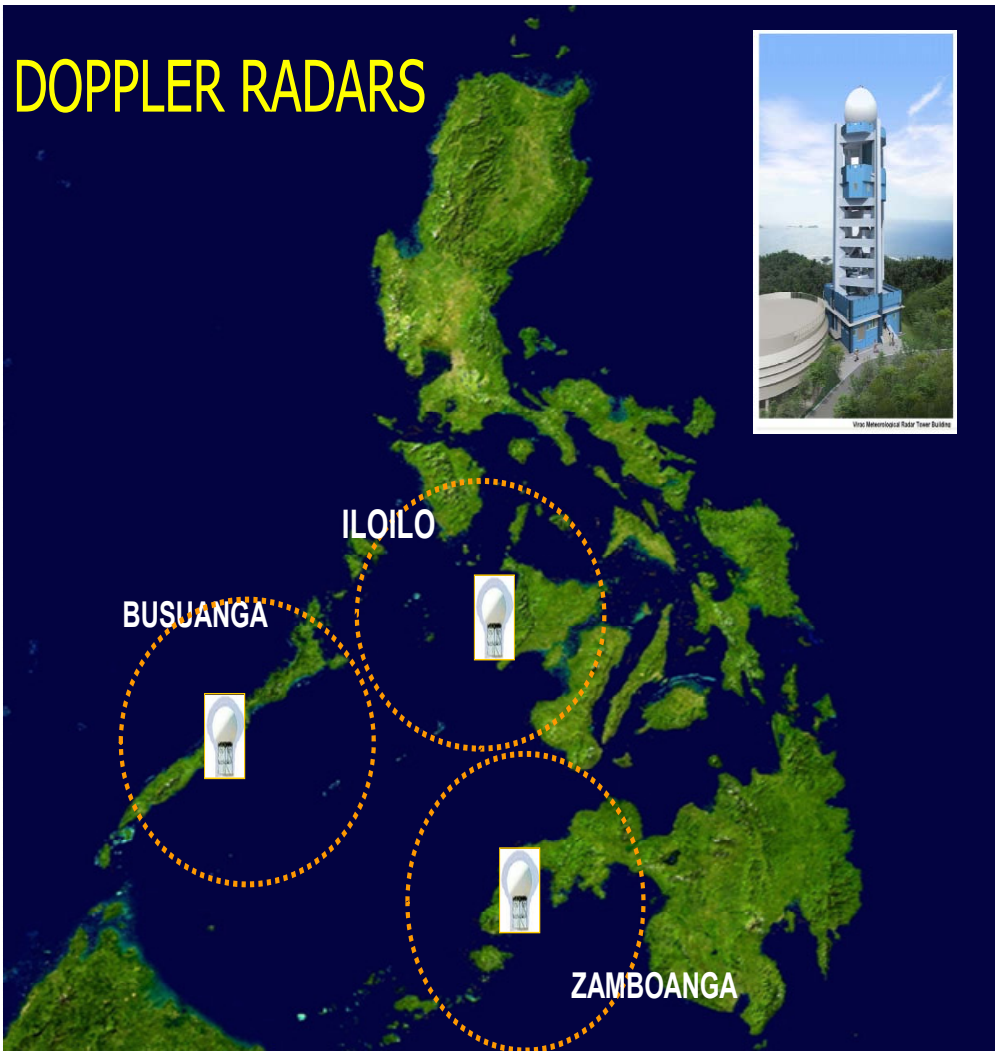


Fig 6: Additional Radar to be installed in Iloilo, Busuanga, Palawan and Zamboaga (DAP-GOP Funded)

Enhancement of Doppler Radar Network for National Weather Watch, Accurate forecasting and Flood Early Warning (DAP- GOP funded)

The project addresses number one strategy of the National 4-point Action Plan Preparedness, "Upgrading PAGASA and PHIVOLCS", that better equipment and better infrastructure contributes to better services necessary in uplifting the living conditions, human development and national progress. The project is consistent with the Millennium Development Goal (MDG) to eradicate extreme poverty and hunger including possible threat and impacts of weather and climate disaster. The main objectives of the project include the establishment of three (3) Doppler weather radar stations for western Philippine. This will involve the acquisition and installation of one (1) new S-band Dual Polarization Doppler Radar, the construction of buildings and towers in western parts of the country at Iloilo, Busuanga, Palawan and Zamboanga Peninsula and provision of associated operation and maintenance facilities.

The Doppler Radar stations to be established at the western seaboard will complete the coverage and monitoring of the country and will provide reliable and real-time data for the provisions of hourly tropical cyclone updates as well as to monitor thunderstorm and heavy rains in real time. The aviation, maritime and shipping, agriculture, health, defense, public weather services and environmental monitoring sectors will definitely benefit from the project.

On-Going Projects:

Foreign – Assisted Projects

Improvement of Flood Forecasting and Warning System for Magat Dam and Downstream Communities - Norwegian funding

The objectives of the project is to sustain the effective operation of the monitored major reservoirs in Angat, Pantabangan, Binga/Ambuklao/ San Roque complex and Magat, the project was proposed to upgrade the existing facilities for flood forecasting and warning. With an upgraded system, flood forecasts will be improved and loss of lives and damage to properties will be minimized in communities downstream of the dams. To update, finalization of technical specifications of the project was prepared and submitted to the funding agency.

Improvement of Metrological Radar System in the Philippines - 2009-2013 - JICA

Involves the acquisition and installation of equipment and facilities for three (3) Doppler radar systems, enhancement of knowledge and capacities of weather forecasters, development or improvement of forecasting techniques for rainfall, flashfloods and landslides and strengthening of warning dissemination and communication to improve the forecasting and warning systems of PAGASA for typhoons, monsoons and other weather disturbances. It aims to reduce loss of lives and damage to properties due to the occurrence of typhoons, monsoons and other weather disturbances in the country. The three (3) Doppler radar will be installed in Aparri, Guiuan, and Virac. The Virac Doppler was completed and inaugurated in May 2012, Aparri was completed and fully operational in December 2012, final acceptance and hand over of the project will in January 7, 2013. Guiuan is ongoing implementation and will be completed in 2013.

Applying Remote Sensing Technology in River Basin Management JAXA/ADB Technical Assistance project

The Asian Development Bank (ADB), in collaboration with Japan Aerospace Exploration Agency (JAXA), is formulating a regional capacity development technical assistance (TA) to support countries in Asia and the Pacific apply space based technologies (SBT) and information communication technology (ICT) for improved river basin management. Country level interest has been explored through ADB's existing sector partnership with the members countries, and the Philippines has been identified as pilot country for the following reasons:

The Philippines remains one of the most water-related disaster prone countries from 1988 to 2008, the number of people perished from water-related disaster is the fifth largest among the developing member countries;

Mitigating natural disaster is stressed in its Country Operations Business Plan (COBP); and The Philippines has strong ownership in developing structural; and non-structural measures to mitigate water-related disasters.

Satellite based rainfall data called Global Satellite Mapping for Precipitation (GSMaP) will be utilized to interpolate the ground based rainfall observation and apply the calibrated data to improve the quality of flood forecasting and/or prediction. Activities undertaken during the year, conducted inception workshop in November 2012, identification of rainfall gauging sites (field visits).

Enhancing the Forecasting and Warning Capabilities of PAGASA through Effective Utilization of Weather Data JICA-TCP

The significance of the project is to achieve further improvement of PAGASA's technical skill and capability in protecting the Philippines from natural disasters in general as well as effective and longer utilization of the meteorological radar systems, specialized technical training and technology transfer are vital and indispensable for PAGASA staff. Weather observation data in the upper level of the atmosphere are also vital information in the enhancement of forecasting and warning capabilities of PAGASA. Upper level data are necessary not only for purposes of aviation meteorology but also in the simulation of numerical models to come up with more accurate forecasts. Meteorological instruments such as vertical wind profilers are now popularly used in measuring upper air level data in place of the more expensive radiosonde facilities. Further, they provide information more frequently than radiosonde stations without increasing its expenses for power consumption.

More accurate weather information for natural disaster management is strengthened in terms of time and quality through human capacity development and the dissemination of weather

information among the stakeholders are more broadened. This Project is focused on improvement of meteorological information through development of human capacity of staff concerned with meteorological data processing, analysis and forecasting using computer-based technologies. The main objective of the Project is to improve meteorological information to be issued by PAGASA through upgrading the weather analysis capability of PAGASA under the support of Japanese experts on weather analysis, forecasting and maintenance of the modern meteorological instruments (weather radar, etc.). The project conducted a project cycle management seminar in November 22-23 2012.

Strengthening of Flood Forecasting and Warning System (FFWS) in the Bicol River Basins

Upgrading of the flood forecasting and warning system (FFWS) in order to provide timely and accurate flood forecasts and warnings through the rehabilitation of telemetering system, rainfall and water level monitoring equipment, restoration of the computer system and supply of spare parts and O&M equipment. It aims to minimize flood-related disasters in Bicol river basins.

To update, basic design report is being reviewed by the Ministry of Foreign Affairs of Japan (MOFA). Finalization of tender documents, procurement and installation is targeted in 2013.

Natural Disaster Preparedness and Mitigation Services

In accordance with its mandate and in the pursuit of its mission, PAGASA is always at the forefront together with other concerned agencies in formulating strategies to combat the effects of natural calamities. One proven strategy is the vigorous information and education campaign being pushed by the agency to promote awareness on natural hazards. PAGASA regularly conducts lectures on the different hazards its effects and characteristics. The STRIDE (Special Tropical Weather Disturbance Reconnaissance, Information

Flooded occurred at Maysilo, Malabon.

Water level at
Manggahan flood gate.

Dissemination and Damage Evaluation) Team, a quick response group of the Agency that performs activities explicitly expressed by the group's name, conducted field investigation and extended assistance in the mitigation of meteorological hazards and disaster reduction in areas affected by land falling tropical cyclone, tornadoes, store surge, etc. For the year, the STRIDE Team conducted flood investigation on the occurrence of Southwest Monsoon from August 06-09, 2012. "Habagat" in METRO MANILA FLOODING INCIDENT.

The team proceeded to Malabon City and Valenzuela City where there were reports of flooding in the areas. Flooded areas reported where in Tugatog and Hulong Dagat in Malabon including Metro Manila.

Along MH Del Pilar Street, Maysilo Malabon, a 6 inches deep flood was observed in the area up to the street going to Panghulo High School. In Polo, Valenzuela the group observed a knee-deep high flood along the Poblacion. Pictures below shows flooded areas due to HABAGAT.

Astronomical Services

As the official time keeper of the Philippines, PAGASA is responsible for maintaining and disseminating the Philippine Standard Time (PST). It operates a precise standard clock from which the setting of time pieces may be referred. Under normal conditions, the PAGASA Observatory broadcasts time signals every hour on the hour. For the year, a total of 9,408 time check requests through telephone, mostly in Metro Manila, were accommodated including synchronization of time for all TV stations in Metro Manila.

To promote Astronomy in the countryside, PAGASA conducted several activities such as Mobile planetarium, planetarium shows, stargazing and telescoping for 27,050 students and science teachers in various schools in Luzon which generated an income of P.P357, 225.00. Likewise, the agency disseminated 329 astronomical information packages to students and science teachers which also generated an income of P 23,282.00

Information Education and Communication (IEC) Campaign

A continuing activity of the agency aimed at increasing public awareness on natural hazards for proper implementation of appropriate mitigation measures. The main component of the IEC program is the consistent participation of its personnel as resource persons in seminars, workshops, training, fora, and other public gathering organized by LGUs, NGOs and other disaster-oriented organizations on related topics such as hydro-meteorological hazards, climate change, El Niño, La Niña, the agency's role in S&T and disaster preparedness and mitigation. Some 147,072 participants attended the different fora conducted in Metro Manila and in some provinces. These activities have brought PAGASA closer to the public and likewise enhanced the participants' level of awareness on disaster reduction. Likewise, a total of 36,716 information materials such as pamphlets, maps, posters and brochures were distributed to the public to help sustain the agency's IEC campaign. Strengthening ties with the media continues in support for a wider dissemination of information.

Local and International Linkages

Participation In The WMO Extraordinary session

Collaboration with local and international organizations is continuously and actively done in terms of exchanges of information on meteorology and related fields; technology transfer; and financial grants/support for the socio-economic programs.

(L-R): Ambassador Evan P. Garcia, Permanent Representative to the United Nations and other International Organizations in Geneva; Dr. Flaviana Hilario, Deputy Administrator, PAGASA; Ms. Marivil Valles of the Philippine Mission to the UN and other International Organizations in Geneva; First Secretary Elizabeth Te of the Philippine Mission to the UN and other International Organizations in Geneva; Dr. Nathaniel T. Servando, PAGASA Administrator and Permanent Representative to the World Meteorological Organization.

As part of its international commitments, particularly with UN agencies and the WMO, country representation was provided in international scientific fora.

The Philippine delegation actively participated in the Extraordinary Session of the World Meteorological Congress convened on 29 – 31 October 2012, and the Dialogue for Climate Services Users and Providers held on 26 – 27 October.

Philippines supports global climate efforts and shares activities on local climate services

At the Extraordinary Congress, PAGASA Administrator Nathaniel Servando expressed support to the full and effective implementation of the Global Framework for Climate Services (GFCS), noting that its objective is to strengthen the production, availability, delivery and application of science-based climate prediction and services. A successful Global Framework, he said, will enable better management of the risks of climate variability and change, and adaptation to its impacts at all levels.

Citing a recent study by the United Nations, Dr. Servando noted that the Philippines is the third most vulnerable country in the world in terms of disaster risk and natural hazards. Under the GFCS, priority shall be given to building the capacity of climate-vulnerable developing countries.

Dr. Servando further stressed the importance of capacity development in developing countries including the Philippines, as well as a clear funding mechanism for capacity development, in order to strengthen the capacity of National Meteorological and Hydrological Services (NMHSs) such as PAGASA in providing accurate and timely climate services to the communities.

At a side event organized by the Food and Agriculture Organization, PAGASA Deputy Administrator Flaviana Hilario briefed participants of the Dialogue for Climate Services Users and Providers on how climate information reaches farmers, fishermen and other sectors of the Philippines. Climate information is disseminated through PAGASA's regional centers, various government agencies, and media. PAGASA regularly conducts National Climate Forums to apprise various stakeholders on the expected climate for the next six months. PAGASA likewise conducts climate field schools which aim to develop locally-appropriate climate information tools and capacity and apply these at farms to mitigate the impacts of droughts, floods and typhoons. PAGASA further assists farmers by providing farm weather forecast and advisories, tropical cyclone warnings for agriculture, and ten-day regional agri-weather information. Dr. Hilario also shared the tools currently being applied by PAGASA assessing the linkages between climate change and food security.

Korea Meteorological Administration (KMA) International Workshop for Meteorological officials commemorating the World Meteorological Day

The workshop aims to inform the Senior Officials of WMO member countries (Asia, Southwest Pacific and Africa) and other local guests on the participation of KMA in WMO activities and its significant contributions, past, present and future cooperative projects with other national Meteorological and Hydrological Services. The six participating members, namely Lao PDR, Malaysia, Mongolia, Philippines, Sri Lanka and Tanzania were toured at the different facilities of KMA.

WM Day Celebration at KMA, South Korea

Korea Meteorological Administration (KMA) International Workshop for Meteorological Officials commemorating the World Meteorological Day, with the theme"KMA's Role as a Leader in the World Meteorological Community". Dr. Carina G. Lao, Asst. Weather Services Chief, PAGASA is with Ms. Mary Power of WMO (4th from left), KMA Administrator Dr. Seok Joon Cho (5th from left) and other invited guest presenters, KMA WM Day Celebration, 20-23 March 2012.

Lectures on the following topics were presented to some 1,000 attendees: Weather and Climate Services for Development Needs by Ms. Mary C. Power of WMO; PAGASA Products and Services Philippine Regional Training Centre (RTC) Activities and PAGASA Cooperative Projects with KMA by Dr. Carina G. Lao of PAGASA; Achievement of KMA and Future Plans from the Viewpoint Meteorological Society by KMA; Weather Industries from the Busines Sector; KMA and Scientific Communication from the University of Seoul; and KMA's Future Direction as A Meteorological Leader by Dr. Kenneth Crawford of USA.

PAGASA is a recipient and has paricipated in the different fellowships, scholarships, training and seminars on Observation, Information Communication, Weather Forecasts, Aviation Meteorological Services, Climate, Research and International Cooperation. For the International Cooperation, PAGASA has been granted three projects by the Government of Korea, thru KMA and KOICA, two in Early warning System and one in Communication System.

In behalf of PAGASA, Dr. Nathaniel T. Servando expressed his gratefulness for the full support provided by the Government of Korea and conveyed willingness to support ongoing snd future projects, and also for KMA's continued acceptance and accomodation of PAGASA Staff and Officials to Korea for capacity building and its other significant activities for the benefit of its neighbouring WMO member countries in issues on weather, climate and water.

International Workshop on Rapid Change Phenomena in Tropical Cyclones, Haikou City, Hainan Province, China, 5-9 November 2012

Dr. Carina G. Lao during her presentation on unusual movement of Typhoon PARMA (local name Pepeng) which occurred in September 2009, with Dr. Lianshou Chen of China Meteorological Administration and China Academy of Engineering in Beijing. Dr. Tetsuo Nakazawa of WMO in Geneva and Dr. Russsel Elsberry of the Department of Meteorology Graduate School of Engineering & Applied Sciences, Monterey, CA, were also participated the 5-day session presentation and workshop.

The Workshop aimed to improved the theoretical understanding and forecast capabilityof rapid change phenomena in tropical cyclones and also to stimulate future research work in this field. The Workshop covered a range of topics (observation,

Costa Rica

prediction, research and field programs, etc.) related to the usual behaviour of tropical cyclones. The 5-day Workshop activity was divided into five sessions. Each session was chaired by two chairpersons and assisted by a rapporteur, whose reports were used in drafting the Workshop outputs.

A side meeting was called by the WMO Representative (Dr. Tetsuo Naka zawa) on the project proposal for WWWRP/WMO R&D entitled High Resolution Numerical Prediction Typhoon Rainfall. The meeting was particpated in by ten persons from BoM-Australia, Naval Postgraduate School, University of Hawaii-Manoa, IMD-India, PAGASA, TMD-Thailand, CMA-Beijing, Shanghai Typhoon Institute (STI), and IAS-Beijing.

Before closure of the Workshop, Dr. Xiaotu Lei of STI, CMA and China Chair of Working Group on Meteorology of ESCAP WMO Typhoon Committee, invited each participant to submit reserach papers to the Tropical Cyclone Research and Review (ISSN2225-6035) for possible publication.

Taiwan

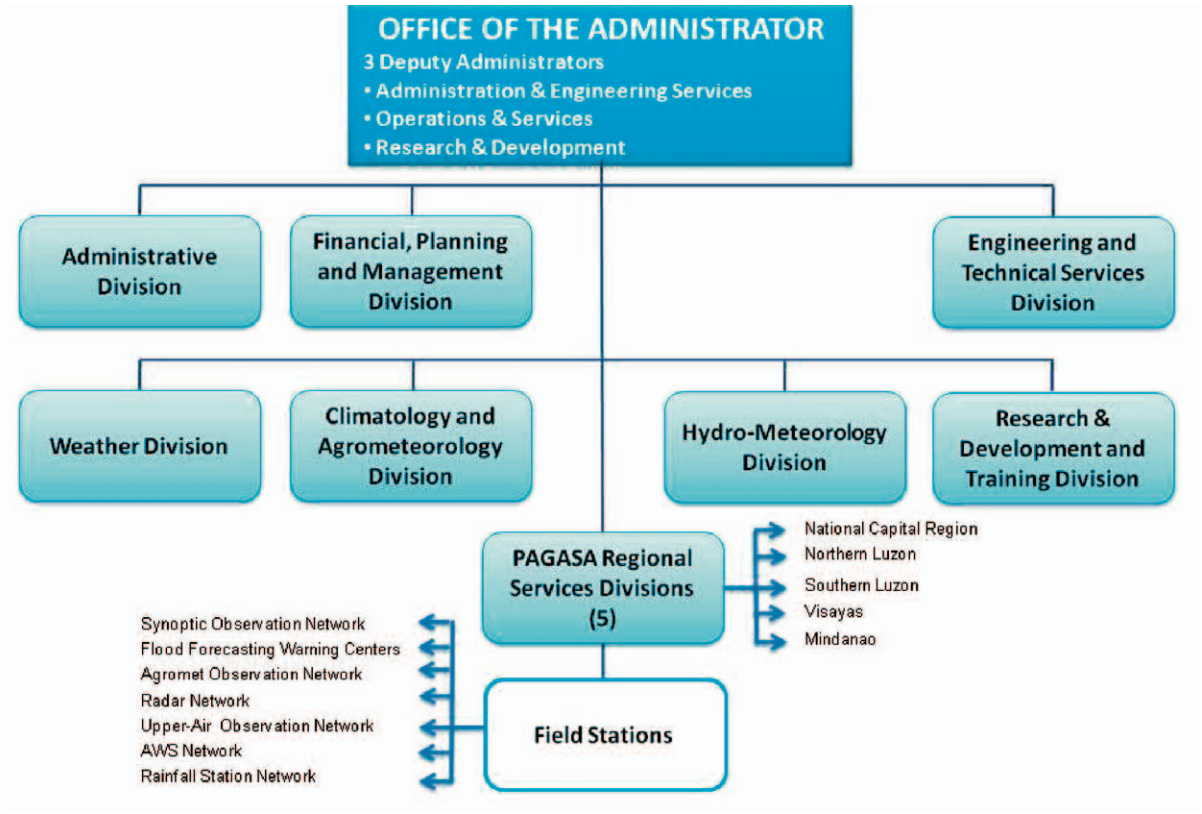
Organizational

- History
- Organization chart
- Human Resource Development
- Budget
- Manpower Resources

History

- **1865**
  Start of regular meteorological observations
- **1884**
  Officially a government agency under Spain
- **1901**
  The meteorological service was formally names as **Weather Bureau**
- **1972**
  Abolition of the Weather Bureau and the creation of the **PAGASA** under the DND (P.D.78)
- **1977**
  Addition of TMRDO and NNFO to the PAGASA (P.D. 1149)
- **1984**
  Transfer of the PAGASA to NSTA (E.O. 984)
- **1987**
  Reorganization of the NSTA to the present DOST (E.O. 128)

Organization Chart



Human Resource Development

For further advancement of its personnel the Agency has continued to develop its manpower resource through scholarship program and capacity building for effective and efficient delivery of S & T services.

Scholarship

PAGASA Scholarship program which aims to provide higher education and training opportunities to its staff. During the year, a four (4) total number of personnel avail of scholarship. All are pursuing Master's Degree Program at the University of the Philippines including 3 foreign fellows. The grant of fellowship to foreign nationals is a commitment of the Philippine Government to the WMO Voluntary Cooperation Program (VCP), as a member of the WMO.

Capacity Building

To further enhance the skills and upgrade the capabilities of its personnel in effectively carrying out its function, sixteen (16) specialized in-house training courses were conducted by the agency for a total of 626 PAGASA participants. Table 1 lists in-house training courses conducted by the agency. The courses range from weather observation, weather forecasting and other related phenomena, software development and values orientation. To establish essential linkages within the scientific community and other organization as well as promote exchanges of scientific and technical knowledge for improving and upgrading agency services, a total of 58 personnel attended local trainings and seminars while 99 officials and employees participated in international trainings and conferences. Table 2 list various training, seminars and conferences attended by PAGASSA officials and employees here and abroad.

Table 1: List of in-house trainings for 2012.

Name of Trainings	Duration	Total number of participants
1. Meteorologists Training Course	November 2011 to October 23, 2012	34 participants
2. Training/Workshop on the Actual Use of LIDAR in the Development of Site Multipliers	`	12 participants
3. Training Seminar on JMA/TCC One-Month Probabilistic Forecast	March 13-15,	15 participants
4. Training Seminar on Government Radio Operator's Communication (GROC) NLPRSD	March 21-24	33 participants
5. APEC Training Workshop on Quantitative Precipitation Estimation/Forecasting (QPE/QPF), Crowne Plaza Manila Galleria	March 27-30	22 foreign participants, 0 local participants
6. Orientation Seminar/Workshop on Operational Hydrology (Mindanao PRSD)	April 9-13,	30 participants
7. Workshop on the Development of Rainfall Warning System for Metro Manila	April 10-11	50 participants
8. Orientation Seminar/Workshop on Operational Hydrology (NL-PRSD	April 16-20	30 participants
9. 5-Day Orientation Seminar/Workshop on Operational Hydrology for NCR-PRSD	May 7-11	21 participants
10. 5-Day Orientation Seminar/Workshop on Operational Hydrology for VIS-PRSD		22 participants
11. 5-Day Orientation Seminar/Workshop on Operational Hydrology for MIN-PRSD		18 participants
12. Enhancing Climate Field School: Trainor's Training on Basic Meteorology and Agrometeorology (with CAD)	August 28-September 1	16 participants
13. Rainfall Warning System (RWS) Training/Workshop for Forecasters: Basic Doppler Radar Data Interpretation	December 11, 2012	35 participants
14. Supervisory Development Course - WFFC Bldg., - Amihan Conference Room - Puerto Princesa, Palawan - Amihan Conference Room - Amihan Conference Room - Amihan Conference Room	 April 17-19 April 23-25 May 6-10 June 6-8 June 20-22 July 4-6	 28 participants 27 participants 28 participant 20 participants 28 participants
15. Values Orientation Seminar - Baguio City - Subic, Zambales - Cebu City - Davao City - Legazpi City - Amihan Conference Room	 May 15-18 May 30-June 1 June 13-16 August 21-24, September 17-20 October 9-12	 24 participants 19 participants 24 participants 20 participants 20 participants 32 participants
	Sub Total	610 participants
On-going		
16. BS Meteorology SY 2012-13 (First Semester) under AGHAM Party List, Training Room,	started June 25, 2012	16 students
	Total	**626 participants**

Training Seminar on Goverment Radio Operator's Communication (GROC) NLRSD

5 Day Orientation Seminar/ Workshop on Operational Hydrology for Mindanao PRSD

Training Seminar on JMA/ TCC One-Month Probabilistic Forecast

Supervising Development Course (SDC)

Lecture on Satellite Techniques & Data Application – Dr. JC Comiso

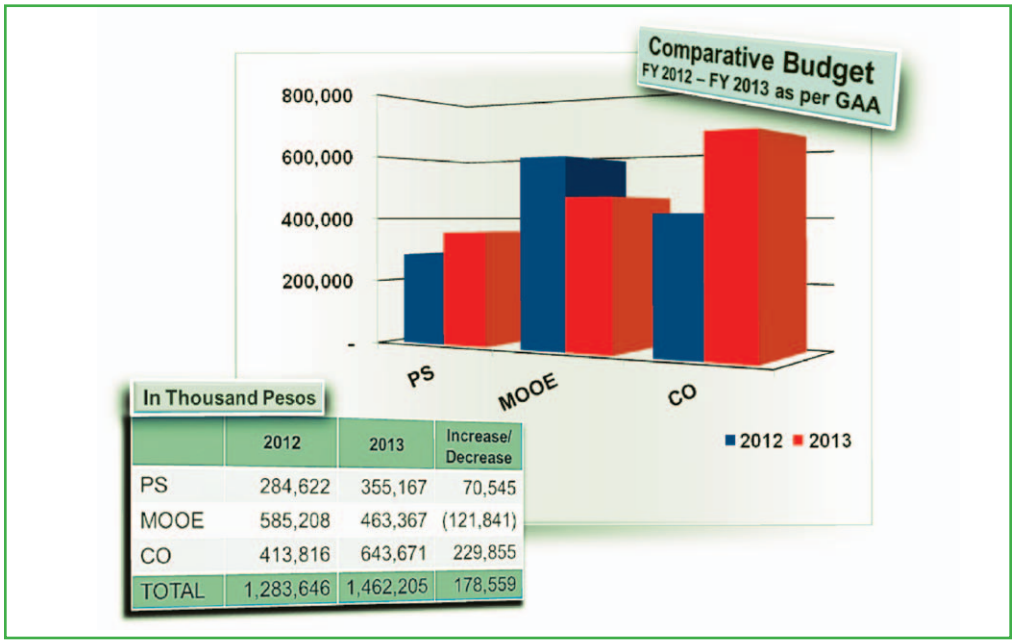
Table 2 list various training, seminars and conferences attended by PAGASA officials and employees abroad.

2012 Conduct of and Participation in Scientific & Technical Conferences & Meetings
44th Session of the Typhoon Committee, China, Feb. 6-11
UFRM Guidelines Drafting Meeting, China, Feb. 13-14
15th GEOSS Asia Pacific Symposium and the Associated 9th Asia Water Cycle Initiative (AWCI) International Coordination Group (ICG) Meeting, Tokyo, Japan, April 2-4
10th Meeting of the ASIA/PAC OPMET Management Risk Task Force(OPMET/MTF/IO) and the 2nd Meeting of the Meteorological Advisories and Warnings Implementation Task Force, Bangkok, Thailand, April 17-20
34th Meeting of the ASEAN Sub-Committee on Meteorology & Geophysics (SCMG), Siam Reap, Cambodia, April 24-26
4th Session of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology, Korea, May 23-31
2012 APEC Typhoon Symposium (2012 APTS) on Typhoon Prediction and Hazard Mitigation, Taipei, Taiwan, June 4-7
35th Session of the Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland, June 6-9
5th Council Meeting of the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) and First RIMES Ministers Conference, New Delhi, India, June 18-19
2012 1st APEC Research Center for Typhoon and Society (ACTS) Workshop on Advanced Technology for Reducing Public Health Impacts after Heavy Rains, Thailand, July 18-20
International Geological Congress, Brisbane, Australia, July 30-Aug. 10
4th International Disaster and Risk Conference, Davos, Switzerland, Aug. 26-30
9th Asian Water Cycle Initiative (AWCI) International Cooperation Group (ICG) Meeting and Workshop on Climate Change Adaptation, Japan, September 29-October 2
1st Meeting of the UNESCAP/WMO Typhoon Committee Working Group on Hydrology (WGH), Seoul, Korea, October 7-10
APEC Climate Symposium 2012, St. Petersburg, Russia, October 8-11
4th Southeast Asia Astronomy Network Meeting 2012 (SEAAN 2012), Bandung, Indonesia, October 10-11
World Meteorological Organization's (WMO) Technical Conference on Meteorological and Environmental Instruments and Methods of Observation, Brussels, Belgium, October 16-18
Dialogue on Climate Services Users and Providers: Towards Implementation of the Global Framework for Climate Services, Geneva, Switzerland, October 26-27
Extraordinary Session of the World Meteorological Organization Congress (Cg-Ext), Geneva, Switzerland, October 29-31
Korea Meteorological Agency-World Meteorological Organization (KMA-WMO) High-Profile Regional Satellite Training event, and the 3rd Asia-Oceania Meteorological Satellite User's Conference, Korea, October 4-12
PAGASA-Korea Astronomy and Space Science Institute (KASI) Cooperative Meeting and Science Tour, Daejeon, Korea, October 25-November 4
International Training Course on the Application of Meteorological Satellites in Disaster Mitigation and Environmental Studies, Beijing, China, October 22-November 2
Training workshop on Competence Assessment of Aviation Forecasters and Observers, Shefayim, Israel, October 29-November 2
Typhoon Committee Roving Seminar 2012, Korea, October 30-November 1
International Workshop on Rapid Change Phenomena in Tropical Cyclones, Haikou, China, November 5-9
1. Training Program on Flood Inundation Analysis, Tsukuba, Japan, November 12-22
4th Tropical Rainfall Measuring Mission (TRMM) and Global Precipitation Measurement (GPM) Mission International Science Conference, Tokyo, Japan, November 13-16
2012 2nd APEC Research Center for Typhoon and Society (ACTS) Workshop, Taipei, Taiwan, November 17-19
Climate Prediction Training Program 2012, Busan, Korea, November 19-30
Doha Climate Change Conference, Doha, Qatar, November 26-December 7
Training Seminar on Climate Analysis Information, Japan, November 26-30
7th Integrated Workshop on Effective Warning, Nanjing, China, November 26-30
2nd Monsoon Heavy Rainfall Workshop, Kuala Lumpur, Malaysia, December 10-12
Training Seminar on the Management of Meteorological Training Institutions, Langen, Germany, December 3-7

BUDGET

For 2012, the Agency was given a total allotment of PP1,283,646,000.00 including releases of continuing appropriations from previous years' budget, Grants-in-Aid, and funds from other sources for the implementation of its programs, projects and activities. Total expenditures amounted to P1,092,560,000.00 distributed among the different S&T functions of the agency.

PAGASA Comparative Budget for 2012 -2013 as per General Appropriation Act (GAA)



In Thousand Pesos

	2012	2013	Increase/ Decrease
PS	284,622	355,167	70,545
MOOE	585,208	463,367	(121,841)
CO	413,816	643,671	229,855
TOTAL	1,283,646	1,462,205	178,559

Financial Accomplishments / Utilization Rate
(FY 2012)

In Thousand Pesos

	Allotment Released	Obligations Incurred	Unobligated Balance	% of Utilization
CURRENT YEAR				
Personal Services	261,932	261,932	-	100%
MOOE	489,321	287,223	202,098	59%
Regular	*352,842*	*267,544*	*85,298*	*76%*
FAPs (VAT) *Fund 102*	*136,479*	*19,679*	*116,800*	*14%*
Capital Outlay	413,816	116,500	297,316	28%
Total, Current Year	1,165,069	665,655	499,414	57%
RLIP	22,690	21,669	1,021	96%
PRIOR YEAR's				
MOOE (regular)	17,076	15,687	1,389	92%
(FAPs – VAT)	187,667	13,302	174,365	7%
Capital Outlay	207,867	205,022	2,845	99%
Total, Prior Year's	412,610	234,011	178,599	57%
Special Purpose Funds	178,549	171,225	7,324	96%
GRAND TOTAL	1,778,918	1,092,560	686,358	61%

Manpower Resources

The agency total manpower for 2012 was 918 including Job Order (JO). Of these personnel, 4 were performing managerial functions, 586 were involved in technical activities and 196 were administrative and clerical staff. 289 or 32.8 % have degrees in technical fields including the natural and physical science, engineering and other related field, 592 or 67.2 % graduates of non-technical courses.

Personnel Distribution by Level of Education and S&T Functions as of December 2012

Reference: WARM BODIES and ACTUAL DEPLOYMENT as of DECEMBER 31, 2012

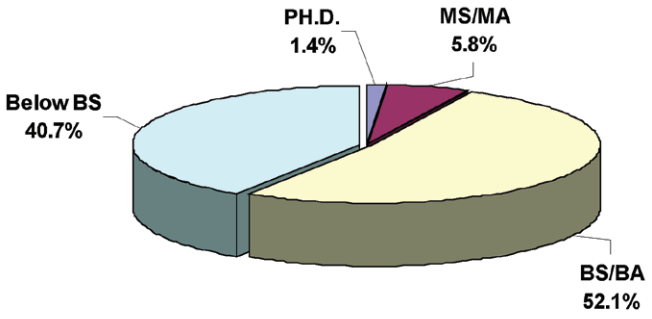
CATEGORY OF PERSONNEL	LEVEL OF EDUCATION				TOTAL
	Below BS	BS/BA	MS/MA	PhD	
S&T Service (STS)	255	295	29	7	586
Research and Development (R&D)	30	50	7	3	90
S&T Education and Training (STET)	3	5	1	0	9
General Administration and Support					
Service (GASS)	71	109	14	2	196
TOTAL	359	459	51	12	881

Personnel Distribution by Level of Education

Reference: WARM BODIES and ACTUAL DEPLOYMENT as of DECEMBER 31, 2012

Level of Education	No. of Personnel	%
PH.D.	12	1.4%
MS/MA	51	5.8%
BS/BA	459	52.1%
Below BS	359	40.7%
TOTAL	881	100%

Personnel Distribution by Level of Education



Personnel Distribution by Level of Position, Gender & Education

Reference: WARM BODIES and ACTUAL DEPLOYMENT as of DECEMBER 31, 2012

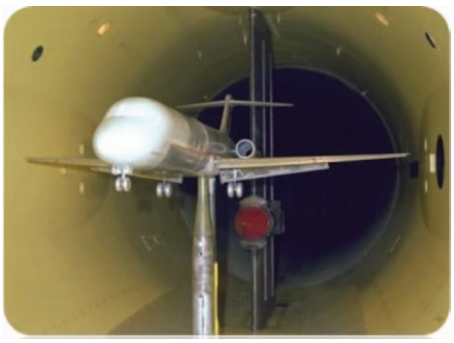
	Gender			Educational Attainment				
	Male	Female	Total	Phd	MS/MA	BS	Undergrad	Total
1. 3rd Level Officials	3	1	4	3	1	0	0	4
2. 2nd Level Officials and Employees	157	126	283	6	47	224	6	283
3. 1st Level Employees	365	229	594	3	3	235	353	594
Total	525	356	881	12	51	459	359	881

Programs and Projects for 2013

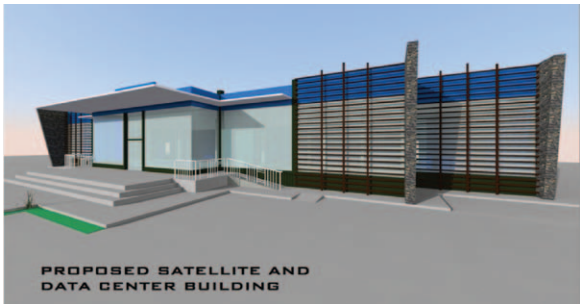
The following are set of priorities of PAGASA which are consistent with the DOST's vision and within the framework of the Philippine Development Plan 2011-2016, specifically, on climate change adaptation and disaster preparedness and hazard mitigation

ENHANCEMENT OF WEATHER FORECASTING CAPABILITIES

- Automated Data Integration, Analysis and Display System for Timely and Reliable Weather Information for Disaster Mitigation and Decision Support
  1. HydroMet Decision Support System (HDSS) Multi-sensor (radar, satellite, gauge network) precipitation measurement and multi-hour forecasting system designed for managing water resources and mitigating risk from heavy rain and flooding.
  2. Mesoscale Forecast Decision Support System Highly customized numerical weather prediction using the Weather Research and Forecast (WRF) model and the Uncoupled Surface Layer (USL) model
  3. Quantitative Precipitation Estimate (QPE) and Quantitative Precipitation Forecasting/ Nowcasting system (up to 4 hr forecast)
  4. Severe storm prediction system
  5. Integration of 9 radars by 2013
  6. Enhancing the forecasting and Warning Capabilities through Effective Utilization of Weather Data - JICA-TCP funded project
  7. Wind tunnel



  8. Satellite & Data Center Building (Satellite Antenna Farm)
  9. Farm Workstation's



- Doppler Weather Radar Program
  1. Operationalize 9 Doppler weather radars (7 GOP funded: Baguio, Baler, Subic, Hinatuan, Tagaytay, Mactan, Tampakan and Virac; 1 JICA radar: Aparri) – (for completion 95% coverage)
  2. Completion and operationalization of JICA radar at Guian
  3. Completion and operationalization of 4 additional radars (Zamboanga, Busuanga, Iloilo and Quezon, Palawan) (Iloilo Radar & Infra requirement for Zamboanga & Busuanga are funded out of Disbursement Acceleration Program (DAP) while Quezon, Palawan GAA funded.
  4. Radar data validation/calibration
  5. Mobile radar

- Rolling-out of Automated Weather Stations, Rain gauges, and Water level sensors
  1. Installation of 150 AWS, more WLS and ARG (in collaboration with ASTI and DOST ROs.)

2. Identified probable sites for AWS, RGs, and WLS
3. Perform data validation
4. Conduct IEC

- Warning system for Marine Navigation and Transport
  1. Procurement and Installation of 4 locally fabricated Meteorological Buoys (in coordination with ASTI).
  2. Identified and surveyed probable sites

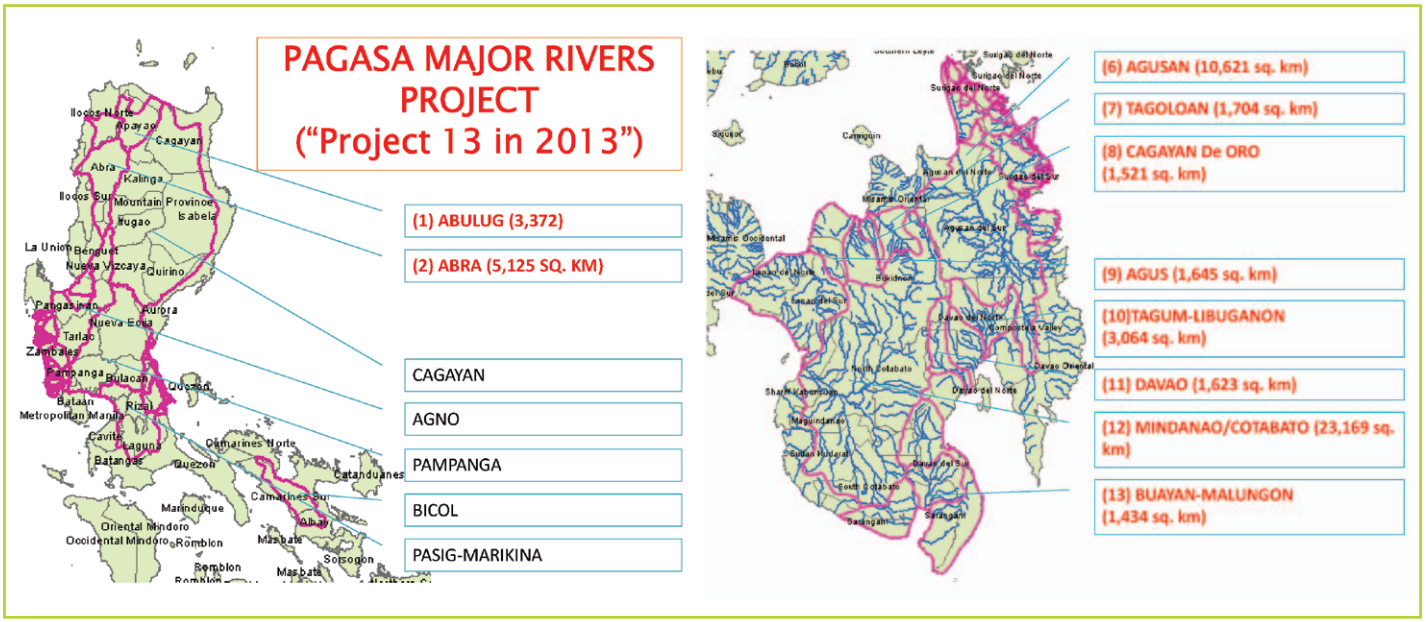
- Redundant Communication System
  1. Redundant Communication System
  2. PAGASA Unified Information System (PUMIS)
  3. VSAT Interconnectivity

HRDP- Improving capacities of PAGASA FORECASTING personnel

- increasing the pool of operational forecasters/hydrologists
- Ph. D/M. Sc graduates (Foreign Universities)
- Meteorologist Training Course
- Meteorological Technician Training Course-MTTC
- Hydrologist Training Course (20 new hydrologists)

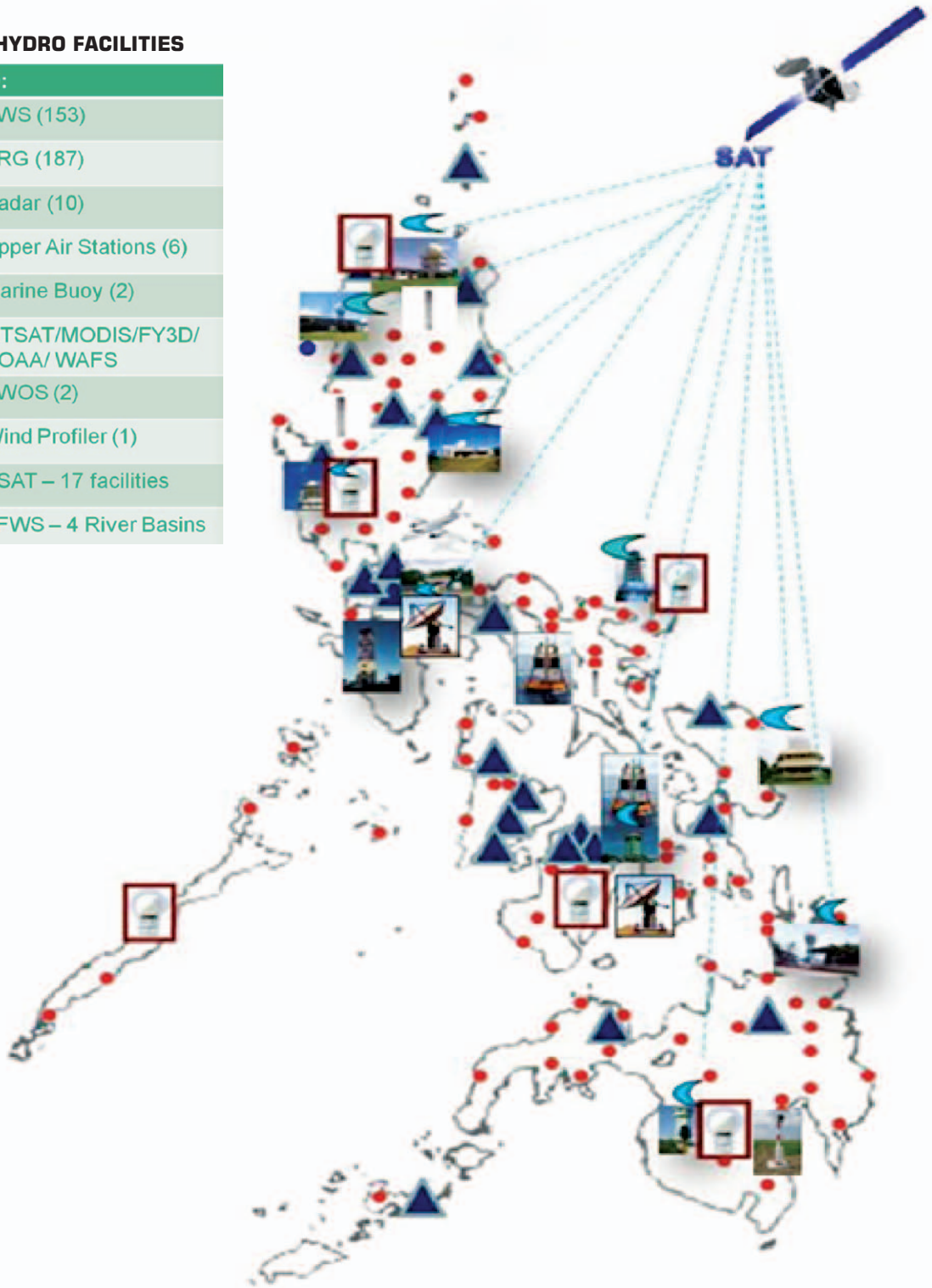
STRENGTHENING FLOOD MONITORING, FORECASTING AND WARNING SYSTEM

- Upgrading of the Cagayan River Basin telemetered FFWS
- Upgrading of the Bicol River Basin telemetered FFWS
- Installation of more WLS in 13 major River Basins (in collaboration with ASTI)
- Establishment of FFWS in major river basins in the country
- Survey of river systems



MET-HYDRO FACILITIES

LEGEND:	
	AWS (153)
	ARG (187)
	Radar (10)
	Upper Air Stations (6)
	Marine Buoy (2)
	MTSAT/MODIS/FY3D/ NOAA/ WAFS
	AWOS (2)
	Wind Profiler (1)
	VSAT – 17 facilities
	FFWS – 4 River Basins



PAGASA ICT Facilities & Services

Directory of Key Officials

NATHANIEL T. SERVANDO, Ph. D.
Administrator
9294865/4349040
dr_servando2002@yahoo.com
ntservando@hotmail.com

VICENTE B. MALANO, Ph. D.
Acting Deputy Administrator,
Office of the Deputy Administrator for Operations & Services
4345886/4348975
vmalano58@yahoo.com

CATALINO L. DAVIS, MPA
Acting Deputy Administrator,
Office of the Deputy Administrator
For Administration and Engineering Services
4342579/ 4343039
cl_davis1999@yahoo.com
January to June 2012

FLAVIANA D. HILARIO, Ph. D.
Acting Deputy Administrator,
Office of the Deputy Administrator
For Research & Development
4342537/ 9291953
fhilarioph@yahoo.com

SUSAN R. ESPINUEVA, Ph. D.
Chief, Hydro-Meteorology Division
9265060
shenry112293@yahoo.com

ROBERTO S. SAWI
Officer-In-Charge, Weather Division
9271541/ 9271335
r_sawi@hotmail.com

CYNTHIA P. CELEBRE, Ph. D.
Chief, Research & Development and Training Division
4342675/ 4349843
cpcelebre@yahoo.com

EDNA L. JUANILLO, MSc
Officer-In-Charge, Administrative Division
9291953/ 4340955
ejuanillo@yahoo.com
July to December 2012

ENGR. EDWIN F. MANRESA
Officer-In-Charge, Engineering and Technical Services Division
9286461
efmanresa@yahoo.com

SYLVIA N. DAVIS, MPA
Chief, Administrative Division
4364033/ 4343830
viaviang@yahoo.com
January to July 2012

LILIBETH B. GONZALES, CPA
Chief, Financial, Planning and Management Division /
OIC, Acting Deputy Administrator for Administrative
and Engineering Services
4342632/ 4341882
lillibet2k@yahoo.com
July to December 2012

ESPERANZA Q. CAYANAN, Ph.D
Officer-In-Charge
Climatological & Civil Agrometeorological Division – CAD
9291953 / 4340955
eocayanan@gmail.com
July to December 2012

PAGASA REGIONAL SERVICES DIVISIONS

ENGR. LEO L. BUÑAG
Officer-In-Charge Northern Luzon – PRSD
Capitol Site, Tuguegarao City, Cagayan 3500
(078) – 3041994
leo_bunag@yahoo.com

LANDRICO U. DALIDA, JR., Ph. D.
Chief, Southern Luzon – PRSD
Airport Cmpd. Legazpi City, Albay 4500
(052) – 4814471; (052) 8206726
jundalida2002@yahoo.com

ENGR. FREDOLINA D. BALDONADO
Officer-In-Charge, National Capital Region – PRSD
PAGASA Science Garden, Agham Road, Diliman, Quezon City
(02) 9275343
fredolina_baldonado@yahoo.com

ENGR. OSCAR C. TABADA
Officer-In-Charge, Visayas – PRSD
Airport Road, Pusok, Lapu-lapu City, Mactan Cebu
(032)-3404143; (032)- 3401868
oscartabada@yahoo.com

RICARDO A. MERCADO, MPA
Chief, Mindanao, PRSD
Juan Luna St. Cagayan de Oro City
(08822)- 745164
ric_mercado58@yahoo.com

Production Staff

Plans and Programs Development Unit (PPDU)

Nancy T. Lance

Ramon C. Agustin

Roque E. Adora

Cynthia R. Paltuob

Renely L. Basiño

DEPARTMENT OF SCIENCE & TECHNOLOGY
Philippine Atmospheric, Geophysical &
Astronomical Services Administration

PAGASA Bldg, Science Garden
Agham Road, Diliman Quezon City

Tel. Nos:
434-9040 / 927-9308

Fax. Nos:
929-4865 / 434-2696

Website:
www.pagasa.dot.gov.ph

Dial-A-Weather:
434-ULAN (8526)

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