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Asian Disaster Preparedness Center

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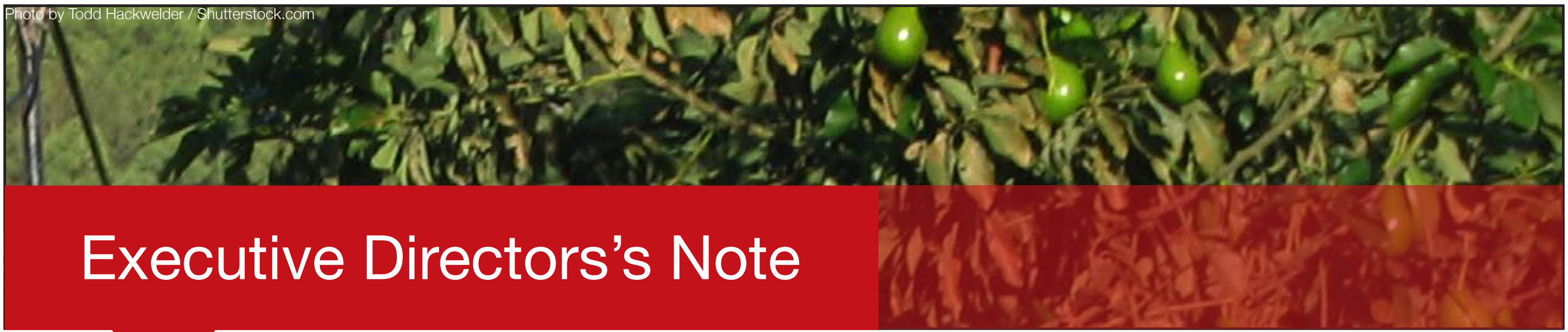
Asian Disaster Management News

Bringing **early warning** to communities

Building Resilience through Innovation and Partnerships



Executive Directors's Note

Dear Readers,

Welcome to our first issue of Asian Disaster Management News this year. With the Indian Ocean Tsunami's 10th anniversary fresh in our minds we should once again remind ourselves of the necessity of effective early warning systems in preparation to natural hazards. In such a disaster-prone region as the Asia-Pacific, the development of early warning systems is a crucial part of disaster preparedness. Effective early warning systems can safeguard human lives from hazards, whereas ineffective ones can turn hazards into disasters.

The strengthening of early warning systems in communities is a critical component on the global disaster risk reduction agenda. We look forward to consolidating the post-2015 Framework for Disaster Risk Reduction in a time when renewed attention towards early warning systems is needed in order to make the communities of the Asia-Pacific region safer.

Since the Indian Ocean Tsunami in 2004, Asian Disaster Preparedness Center has worked closely with international, governmental and non-governmental stakeholders in the Asia-Pacific region to integrate early warning systems into the overall disaster risk reduction frameworks of countries. Our collaboration with national hydro-meteorological services, national disaster management organizations, civil society, the private sector and individual communities has generated a number of lessons learned.

In this issue, we will showcase some of these interesting lessons and developments brought to you by us and our partners.

We hope you enjoy reading these reflections.

Shane Wright
Executive Director

About us

Asian Disaster Management News is published by Asian Disaster Preparedness Center, to serve as a channel of communication and source of information for disaster risk management practitioners and development workers in Asia-Pacific.

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Cover Photo by Atiq Kainan Ahmed

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Features

Changing landscape of early warning systems

Reflections on the Asia-Pacific region's developments, challenges and future pathways from a practitioner's perspective.

by Atiq Kainan Ahmed, ADPC

The recent extreme climatic events and subsequent disasters globally have demonstrated that the countries in the Asia-Pacific region are in a great need to strengthen their early warning systems to prepare for the changing patterns of natural hazards. The main concerns include delivering early warning to vulnerable communities that are affected by unprecedented extremes and their irregular thresholds of frequency, intensity and exposure. These irregular patterns are apparently becoming 'new normals' (NCDC 2011) of our time. Hence, the endeavor to enhance building resilient communities through effective provisioning of early warning systems remains to be a continued effort, which responds to a need that is greater than ever before.

The term *early warning system* (EWS) is defined by the United Nations Office for Disaster Reduction (UNISDR) as "the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss (UNISDR 2006)." Early warning systems are a means to save lives and protect development gains. Community-based early warning systems (CEWS) aim at local management of risk by allowing community members themselves to protect their lives, assets and livelihoods. As stated by the International Federation of Red Cross and Red Crescent Societies: "Early action, covering all time scales, is essential. It is an investment in the future, and has been proven effective at attenuating the effects of disasters (IFRC 2012)."

In the past few years, we have seen extensive development in early warning systems in the Asia-Pacific region. A substantial amount of resources has been devoted to the development of regional and national multi-hazard observation, detection and prediction systems. National hydro-meteorological services, national disaster management organizations, civil society entities and local communities are strengthening their cooperation in order to improve early warning systems.

Reflecting on this growth of early warning systems and the wide array of lessons learned, this article provides an analysis of some notable achievements as well as the intrinsic gaps or challenges in this development. It provides a critical look into the changing landscape of early warning systems in the Asia-Pacific region from a practitioner's perspective.

Four 'streams' in early warning systems

Since the devastating Indian Ocean Tsunami in 2004, a suit of other mega hazards has jeopardized the Asia-Pacific region: floods in China, India, Pakistan, and Thailand; tropical storms in Bangladesh, Myanmar, and the Philippines; and the tsunami in Japan. Also hazards of slow onset such as droughts have had a subtle but substantive impact in many countries.

However, disaster risk reduction (DRR) has taken important steps forward and we find that the recent improvements in early warning systems have also supported development at various other fronts. To chart these developments, we can cluster them into four different streams vis-à-vis popular vocabularies: upstream, downstream, side stream and temporal stream. In recent times, these four streams in early warning systems have been popular in communications, informal discussions and sporadic writings among practitioners. The streams and vocabularies are now becoming new practicing vocabularies among early warning system and disaster risk reduction practitioners and in some cases areas of development in a subtle way. Given the primacy of practitioners' lessons and these popularly evolved vocabularies, they are uniquely used in this paper as an analytical lens to chart the recent developments of early warning systems in the region. Before moving forward with the analysis, we will elaborate on the characteristics of these four streams below.

The *upstream* of early warning systems is often dominated by science-driven measures such as hazard detection systems, monitoring and observation, identification of thresholds for creating early warnings, and development of the warning information. This stream is often viewed as a 'techno-centric' domain.

The *downstream* is a common approach that starts from setting up provisions for communicating and disseminating as well as relaying and interpreting the early warning information. It extends to mobilizing people, institutions and communities to respond to early warning information in a systematic manner. This stream is predominantly characterized by the 'people-centric' elements of early warning systems where the issues of access, understanding, societal applications, procedural response and institutional engagement are critical factors.

The *side stream* of early warning systems has evolved more recently to answer to the need of growth in different sectors of the society. Sectoral applications of early warning systems and their integration into different economic and occupational areas remain important areas of development in many countries. Early warning information should be integrated into planning as well as response and risk management in key sectors such as agriculture, energy, health, transportation, and water. The side stream of early warning systems focuses on covering all vulnerable groups in society, both spatially and demographically, as well as taking into consideration special needs (e.g., early warning systems for persons with disability or different livelihood groups).

The changing climate is now dictating our future, increasing uncertainties, and affecting planning and decision-making. Among practitioners of disaster risk reduction, climate change adaptation and development, the new *temporal stream* of early warning systems is critical for understanding the future risks and how they can be managed by applying information as early as possible. Early warning systems are critical for charting the future scenarios and planning.

In order to identify the developments and challenges of early warning systems in the region we will look at the four streams more closely. *Tables 1–4* provide an analytical outline of these four streams in a synoptic manner, charting the developments and challenges in each of the streams separately. The information in these tables is derived from the work conducted by ADPC and its partners since the Indian Ocean Tsunami in 2004 and the documentation of early warning systems that has evolved over the decade. This attempt should be considered as an exhaustive exercise to interpret the recent developments and challenges in early warning systems in the region.

Photo by Patrick Foto / Shutterstock.com

Empowering communities *Community-based early warning systems aim at local management of risk by allowing community members themselves to protect their lives, assets and livelihoods.*

	Developments	Challenges
Upstream	• Detection capacity is increasing through installation of observation systems (e.g., radars, automated weather stations, sea level stations, satellite observation) • Data archiving, exchange and management systems are improving (e.g., CLIMSOFT, CLISYS, climate portals, GTS networks) • Capacity to detect and forecast coastal hazard early warning is increasing • Modeling and prediction capacity is improving for short-range forecast (through weather research and forecast) • Multi-hazard early warning systems are being developed • Expansion of the forecasts to wider areas as well as to new stakeholders and sectors with more accuracy is underway • The integration of early warning systems with the national disaster management offices and sectors is increasing • Regional collaborations (e.g., Typhoon Committee, Regional Specialized Meteorological Centers) are being extended	• The service-oriented approach that is being recommended by the World Meteorological Organization is still to be adopted by the countries • Lack of accurate forecast systems for long-lead, location-specific and user-appropriate information • Insufficient training and capacity development opportunities • Insufficient integration of the early warning systems with the national disaster management offices, media and different sectors • Standard operating procedures have not been sufficiently developed for upstream or are not adequately responding to the user needs • Lack of data-sharing and south–south knowledge-sharing • Lack of simplification of the early warning messages • Lack of reliable forecast validation processes • Lack of impact-based forecasts

	Developments	Challenges
Down-stream	• Local governments, NGOs, civil society organizations, and the private sector are increasingly incorporating early warning systems into disaster risk reduction and development programs • Local and national emergency operation centers as well as national disaster management information centers are being developed • Standard operating procedures are being developed at national and subnational levels • New tools are being designed to give better access to early warning systems • Public awareness and capacity to interpret early warning system messages is improving • Training and capacity building on early warning systems are increasingly available • End-to-end simulations are being adopted in many countries to test early warning systems and to find the intrinsic gaps • Dissemination channels are being tested to ensure early warnings are delivered around the clock • Location-specific forecasts have been made available • Needs are being regularly expressed to the national hydro-meteorological services by the users • World Meteorological Organization is supporting the service delivery mode and encouraging downstream applications • Applications have been developed for persons with diverse needs or disabilities • The use of different technologies (e.g., cell phones) and social media for early warning dissemination has been piloted	• Weak integration of early warning systems with the existing community-based disaster risk reduction and development programs • Insufficient connections between community-based early warning systems and scientific forecasts • Long-lead forecast products and more location-specific information are lacking (linked to upstream) • Scale and resolution of products applicable for communities are not adequately available • Impact-based forecasts are not sufficiently available • Limited capacity in communities to utilize the existing forecasting tools, interpret the scientific information, and disseminate early warnings around the clock • Standard operating procedures for early warnings at national and sub-national levels are not sufficiently available or functional • Sustained financial allocations are lacking • Missing provisions to propagate the piloted results and effectively replicate them • Limited opportunities for capacity building for downstream application of early warnings • Insufficient adoption of common alerting protocols • Insufficient measures for persons with diverse needs or disabilities • Standards needed for social media usage • Lack of user-friendly decision-making systems for early warning response • Sectoral integration as well as platforms and forums for discussion are limited • Insufficient education, advocacy and awareness programs on early warning

	Developments	Challenges
Side stream	• World Meteorological Organization is supporting the service delivery mode and encouraging different sectors to apply it to their work • The Global Framework of Climate Services (WMO 2011) for the four pilot sectors, namely agriculture, water, health and disaster, has been launched • Sectoral applications particularly in agriculture, marine, business, energy, health, transport, and tourism are being piloted in some countries • Development of sector-specific early warning systems and climate risk management plans • Increased adoption of disaster management legislation in favor of early warning systems in a number of countries and sectors • Development of sectoral application frameworks (e.g., agriculture, energy)	• The current efforts to implement the Global Framework of Climate Services for the four pilot sectors are not sufficient • Sectoral application frameworks are not sufficiently outlined • Application of climate forecast information in different sectors is limited • The number of programs on sectoral mainstreaming is limited and in some cases they have not been initiated • Guidance for sectoral application needs to be improved • Dialogue between forecasters and sectoral specialists is limited • Current practices for sharing of data and information between forecasters and sectors are not functioning well • Tools for sectoral application of early warning products are not well developed

	Developments	Challenges
Temporal stream	• Downscaling capacity and efforts are increasing • Data and ensembles are available for cross-comparison • Global Framework of Climate Services (WMO 2011) is underway • Regional and global centers are developing capacity building initiatives for climate downscaling and other topics • Portals on climate model results are being developed (e.g., Nepal Climate Data Portal, IPCC Data Distribution Centre, Bangladesh Climate Change Portal) • National hydro-meteorological services are collaborating with regional and international entities	• Interaction between climate change adaptation professionals and modelers is still limited • Lack of national efforts to implement the Global Framework of Climate Services • Adoption of climate forecast application frameworks is limited • Integration of early warning systems with the disaster risk reduction and climate change adaptation planning processes needs to be strengthened • Training and capacity building opportunities are limited • Lack of science–policy interactions for delivering better results • Impact-, exposure-, loss- and damage-based scenarios and tools are limited and not being adequately applied for future planning

Table 1–4. *An analysis of the developments and challenges in the different streams of early warning systems in the Asia-Pacific region during the past decade.*

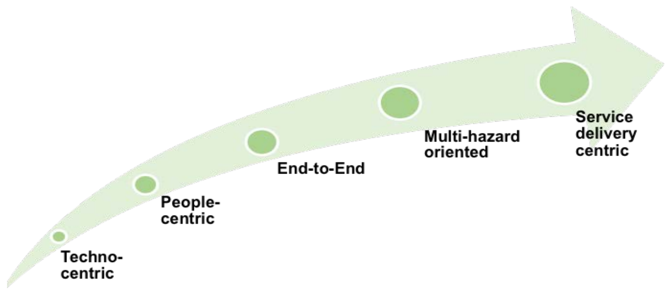

Figure 1. *Changing and moving focus of the early warning systems in the Asia-Pacific region.*

A subtle change in the early warning system paradigm

Almost two decades ago, the Early Warning Programme under the United Nations International Decade for Natural Disaster Reduction (IDNDR 1997) identified a set of guiding principles for effective early warning at different levels. Since then, the systems have developed drastically and new early warning systems have emerged. Recent experiences have helped develop more efficient ways to empower individuals, communities, nations, and regions to better prepare for the increasing number of natural hazards. The United Nations Economic and Social Commission for Asia and the Pacific in its Report on Regional Unmet Needs also highlighted the issue of climate change and stated that there is a need to broaden the horizon of early warning systems in the region (ESCAP 2011).

To respond to these renewed needs regionally, the early warning systems have grown from a 'techno-centric only' paradigm to a 'people-centric' one where the 'end-to-end' and 'multi-hazard' components and their procedural norms start to bind together. The development has moved ahead with a multi-hazard approach that can support the seamless integration of climate and risk information into the early warning systems at multiple scales ranging from the short range (0–3 days) to medium range (5–10 days), seasonal range (weeks to months), and long range (inter-annual and decadal scales). In recent times, needs and priorities have resulted in an endeavor where the issues and elements of science, institutions, inclusiveness and societal applications have started to blend together in order to strengthen early warning systems as a key development stream of disaster risk reduction. Encouraged by the World Meteorological Organization, a 'service-oriented approach' (WMO 2014) is currently expected to become the next pathway of early warning systems in the region.

This new global move lead by the World Meteorological Organization adopting a service delivery approach has already started to lead the early warning system agendas and planning horizons towards a service-oriented paradigm. The approach relies on a delivery-oriented mindset to the early warning system services, which should be making early warning information available and ensure the information is timely, reliable, dependable, usable, expandable, sustainable, responsive, authentic and credible. Future service-oriented actions should start from user engagement and developing partnerships; designing and developing services; providing service deliveries; and gradual evaluation and improvements. This process may comprise of a comprehensive provisioning of a) evaluation of user needs and decisions; b) linking service development and delivery to user needs; c) evaluation and monitoring of services, performance and outcomes; d) sustained improved service delivery; e) development of skills needed to sustain service delivery; and f) sharing of best practices and knowledge with others. (WMO 2014.)

In this changing landscape of early warning systems in the Asian countries, the developments may actually take multiple streams and stakeholders may continue to practice a combination of the approaches to build people-centric, multi-hazard, end-to-end and service-oriented early warning systems for any given context. But the key for success would rely on: a) continued proactive governance; b) mobilization of resources, and capacity development for delivering the services (from all four streams) to the countries; and finally c) making provisions for integration of early warning systems into the overall disaster risk reduction measures, which would be essential for keeping future harm away and moving ahead to build resilience at the center of all activities. In this endeavor, the greater success will come only when all of the streams of early warning system development are tied closely together to provide the services to the people in need. ■

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LET'S INCLUDE EVERYONE IN EARLY WARNING SYSTEMS

When a disaster hits the Asia-Pacific region, persons with disabilities are rarely the recipients of conventional early warning systems. Their mortality rate is twice that of people without disabilities.

by Betty Dion, Global Alliance on Accesible Technologies and Environments

PEOPLE WHO ARE DEAF OR HARD OF HEARING WILL NOT hear audible sirens or announcements. The blind or the visually impaired will not be able to read posted warnings, and people with cognitive or developmental disabilities may not receive any warnings at all. To ensure everyone is reached during a disaster, a variety of different formats of early warning dissemination should be used.

Over the past ten years, there has been substantial research and investments contributing greatly to the effectiveness of early warning systems. However, very little has been done to develop disability-inclusive early warnings in the Asia-Pacific region.

It is necessary to ensure that early warning systems reach persons with disabilities and comply with the United Nations Convention on the Rights of Persons with Disabilities. Early warnings must include both visual and audio formats in order to reach the entire community, and they need to be developed and tested on the field prior to disaster – with support from the disabled. It is necessary to ensure that early warning systems comply with the article on accessibility under the United Nations convention.

Guidelines on inclusive disaster risk reduction: focus on disabilities

ADPC is working with the Global Alliance on Accessible Technologies and Environments and the Asia-Pacific Broadcasting Union to develop a new guideline on inclusive disaster risk reduction with a focus on disabilities and disasters. Funded by ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness, the guideline will focus on proper warnings for the most vulnerable members of communities.

The *Guideline on Inclusive Disaster Risk Reduction: Disabilities and Disasters* will be a result of extensive research and consultations with persons with disabilities and the disaster risk reduction community as a whole. Including information on early warning solutions, communication and evacuation techniques, accessibility of the built environment, and strategies for working with the disabled community, the document will be released in a variety of formats in order to ensure access for everyone. ■

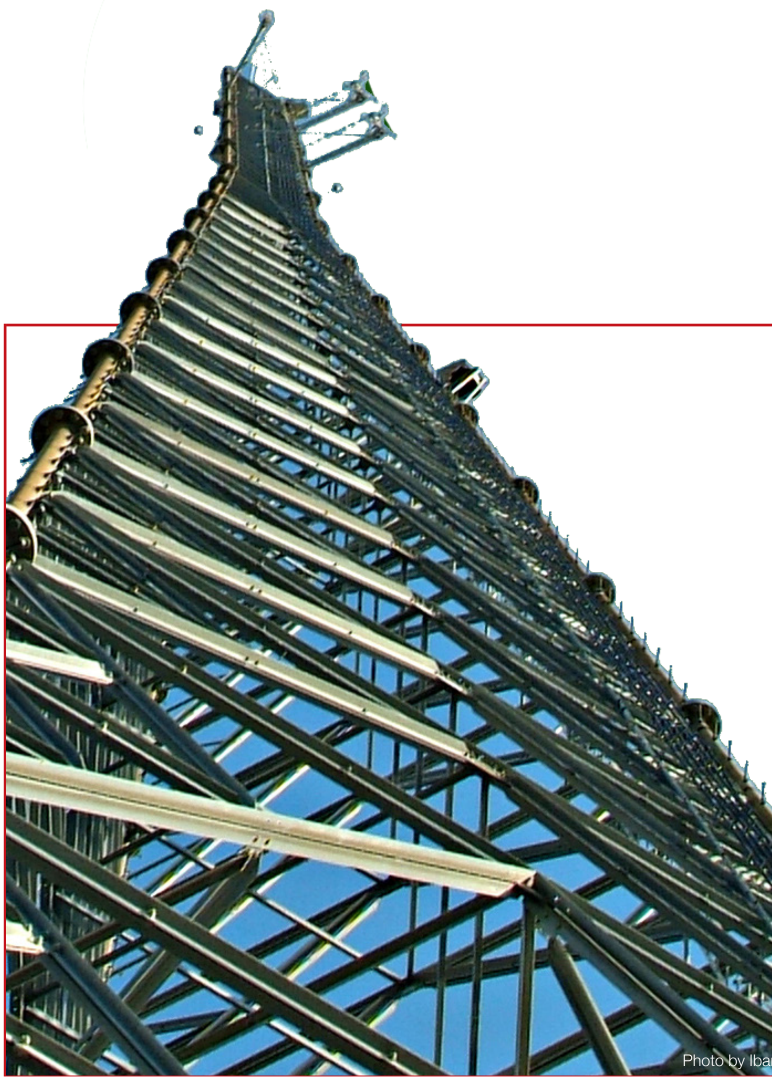


Photo by Iba

Warnings on disaster can be disseminated in a variety of different formats in order to effectively reach everyone.

VOLUNTEERS


Photo by baitong333 / Shutterstock.com

Volunteers can go door-to-door by motorcycles, auto rickshaws or bicycles to alert those who may not receive an early warning from other sources. Personal communication can be very effective in reaching people who are isolated in a community.

SIRENS


Photo by ADPC

The use of sirens that transmit sound and voice messages is the most effective method to warn people outdoors as soon as possible. With sirens, it is also possible to warn people in isolated areas such as beaches. Sirens reach populations that have limited access to other warning devices such as cell phones, corded telephones, television and radio.

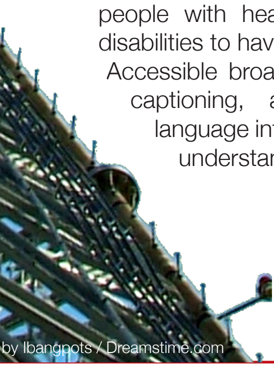
FLAGS


Photo by Stuart Miles / freedigitalphotos.net

Flags can be raised to indicate that an emergency warning has been issued. Flags in different colors can represent different disaster warning messages, but they only work if the community is educated on what each color represents.

RADIO & TELEVISION

Radio and television are extremely effective outlets when information – including disaster early warnings and updates – needs to be distributed to a wide area. Broadcasters must incorporate inclusive and accessible broadcasting in order for people with hearing-, vision- and other disabilities to have access to the warnings. Accessible broadcasting includes closed captioning, audio description, sign language interpretations and easy-to-understand content.


by Ibangnots / Dreamstime.com

ELECTRONIC SIGNS

Electronic signage systems can be very useful in providing information to people who are deaf and hard of hearing. These systems form an important visual medium to supplement audio systems, especially outdoors.

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URL: http://www.un.org/disabilities

2. UN Convention on the Rights of Persons with Disabilities, Article 9: Accessibility
URL: http://www.un.org/disabilities/default.asp?id=269

FLOOD EARLY WARNING SYSTEMS AS A CLIMATE RESILIENCE MEASURE IN INDONESIA

ADPC assists local officials in Semarang, Indonesia, to develop a flood forecasting and warning system ahead of future hydro-meteorological hazards.

by Gabrielle Iglesias, ADPC; Dwi Rahayuni and Aniessa Delima Sari, Mercy Corps Indonesia; and Feri Prihantoro, BINTARI Foundation

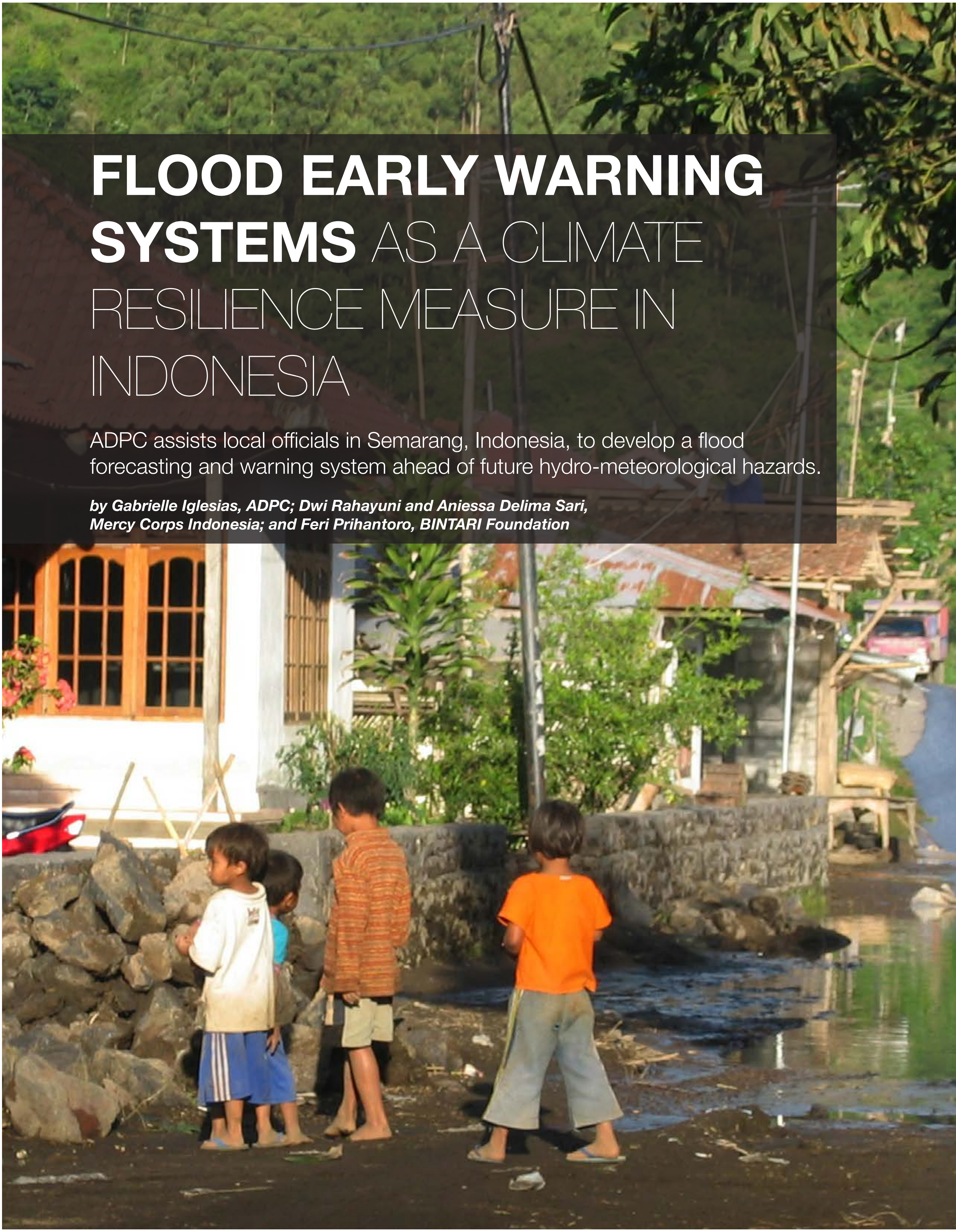

Photo by Todd Hackwelder / Shutterstock.com

HUMAN SETTLEMENTS CONTAIN DIFFERING CHARACTERISTICS that affect their disaster risk and resilience to the impacts of climate change. These include governance practices, demographic patterns, issues surrounding the vulnerability of the community's residents and the economy, and the physical layout and quality of the infrastructure. In Asia, it is not uncommon to find extreme concentration of housing and business establishments on areas that are at risk from flood waters, landslides, or other major hazards, which exacerbates the physical effects of disaster.

However, the impacts of climate change also change the risk profile of specific places, for example, projected sea level rise, changes in levels of precipitation and atmospheric temperature. This is a story about the disaster preparedness project of Semarang city in Indonesia, one of the country's prioritized actions for resilience. The project is an attempt to improve local capacities for climate resilience by investing in flood early warning systems.

The flood-prone Semarang city – risk profile

Semarang is the capital city of Central Java province. Located on the northern coast of Java island, the southern side is hilly and the northern coastal area has a relatively flat topography with 0–2 percent slope and elevation of less than 3.5 meters above mean sea level. The city's disaster profile includes exposure to tidal flooding and subsidence at the coast, and flash floods and landslides at the hilly areas. The areas inundated by tidal flood, in particular, have increased over time because of a significant increase in the height from 30–60 cm in the previous years to 50–100 cm. Furthermore, an assessment of Semarang city's vulnerability to climate change impacts projects a significant increase in precipitation intensity during the wet season, and as a result, flood risk will be higher in the future.

Together with five other districts, Semarang city is part of the Semarang metropolitan area that is identified as a national strategic area in Indonesia's *2030 National Spatial Plan* for its economic growth, social and cultural role, and other attributes. Almost one-third of the metropolitan area's population lives within Semarang, contributing to the city's annual population growth rate of approximately 1.4 percent and population density of 3,973 people per square kilometer. A large proportion of the population resides within the low-elevation coastal zone (less than 10 meters above sea level), where the average population density is estimated at 10,201 people per square kilometer in 2010 (Mulyana et al. 2013). This combination of socio-economic and geographic characteristics underlines the importance of climate resilience.

Semarang has four drainage systems and 21 drainage sub-systems. This project's focus is on the Bringin drainage sub-system that is vulnerable to flood disasters from both river overflow and tidal inundation. More than five sub-districts located within the sub-system experience flash flood, and two sub-districts among them are exposed to tidal flood. A flood in

2010 caused six deaths and over a hundred people injured.

Flood disaster timeline in Bringin catchment

Year	Recorded characteristics
2012	Heavy rainfall; Semarang-Kendal national road flooded; Mangkang Wetan and Mangunharjo sub-districts flooded; people evacuated; damage to two houses; slight economic disruption; flood depth up to 0.5 m
2010	Heavy rainfall throughout the Bringin catchment area; floods at Tugu district, six deaths, landslide along the river; Mangkang Wetan, Mangkan Kulon, and Mangunharjo sub-districts flooded from 0.3 to 0.5 m depth
1999	Flooded areas: 30 hectares of paddy fields and 15 hectares of fish pens
1998	Some overflowing at several points of the river; at Kelurahan Mangkang Kulon: 0.6 m depth, two hours duration
1990	Flooded area of 860 hectares; at Kelurahan Mangkang Wetan: 0.6 m depth, 48 hours duration; at Kelurahan Mangunharjo: 0.5 m depth, two hours duration

The city's climate change vulnerability assessment noted that although the city government is in the process of improving the city's drainage infrastructure, the effort will not be sufficient to cope with additional rainfall and sea level rise. In 2010, 51,000 households were located in flood-prone areas, and this number is projected to increase by 50 percent by 2050. The strategy also noted that Semarang city government revised its drainage master plan in 2010 but its implementation is hampered by budget constraints.

Based on this situation, the city's government developed a climate resilience strategy to define its prioritized actions for reducing vulnerability to climate change. Among other actions, the strategy prioritized flood disaster preparedness, with components for a flood early warning system, flood forecasting modeling, flood risk assessment, and community-level disaster preparedness.

Developing a flash flood early warning system

Semarang City is developing a flood early warning system for flash flood – at the upper catchment area – and tidal flood. For tidal flood, Indonesian Agency for Meteorology, Climatology and Geophysics (Badan Meteorologi, Klimatologi, dan Geofisika, [BMKG]) has monitoring equipment that uses satellite data to produce daily information about high and low tides. The project will establish the mechanism for delivering information of tidal flood from BMKG to the coastal communities to enable them to prepare themselves for the economic and health impacts.

ADPC's role is to provide technical review of the design of the flash flood early warning system and forecasting modeling, and to review the community-level training and preparedness strategy. The intervention described here covers the Bringin River area, one of the smaller and less-studied rivers in Semarang. It has seven at-risk sub-districts with a combined population of 83,535 in 2009, five of which are exposed to flash floods. In order to implement the project, several sets of actors were engaged to contribute to the project implementation. The main actors are: the local government department for disaster response (BPBD) who will maintain the community's capacities for disaster preparedness; the department for water resource management (PSDA) who will operate and maintain the flood early warning system; and the residents of seven sub-districts in the Bringin drainage sub-system at high risk to flooding.

In addition, a coordination mechanism was established to allow a wider group of stakeholders related to flood risk and climate change – such as a local university, community organizations, NGOs and other related government agencies at province- and national level – to contribute to the project based on their abilities and interests, and also promoting discussion of climate challenges and resilience measures.

The local government agencies involved are BAPPEDA (local planning board), BPBD (department for disaster response), PSDA (department for water resource management), DinKes (health agency), and DinSos (social welfare agency); the province and national agencies included are Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG), Indonesian Red Cross (PMI), BPBD Central Java Province, and the National Disaster Risk Reduction Board (BNPB); Diponegoro University located in Semarang, a local NGO called BINTARI specialized in development, and the local disaster response group (KSB) in sub-districts covered by the project.

Modeling the flood's characteristics

Bringin River's catchment area is located at Kecamatan Mijen and Kecamatan Ngaliyan, two districts of Semarang City. The river starts from Ungaran mountain in the south, flowing to the north and discharging into the Java Sea. The Bringin catchment has an area of 30.10 square kilometer that can be divided into two parts: an upstream region in the south consisting of very steep mountain slopes, and a relatively flat downstream region. Plantations and mixed gardens represent about 32 percent of land use, followed by residential use (21 %), yards (20 %), and forest (18 %). The other uses are relatively small in proportion.

The flooding problem is exacerbated by unregulated land usage upstream in order to build housing complexes. The reduction of the forested area at Bringin catchment area increases the water runoff, contributing to a rapidly increasing peak flow, and simultaneous reduction in groundwater percolation.

The warning lead-time for flash flood is relatively short, only hours

Community action *Participants in a small Indonesian community are briefed for a flood simulation exercise.*

or minutes, and depends on the community's location and the river flow characteristics. The early warning system will be able to deliver flood information and alerts to the community, whose members are expected to be able to evacuate themselves to the nearest flood shelter, which is safe from water inundation and provides them with access to water, food, and sanitation.

A specialized modeling team was created with members from the department for water resource management (PSDA), the Semarang office of the Meteorology, Climatology and Geophysics Service (BMKG), and the Faculty of Engineering of Diponegoro University. Their scope of work is to study the hydrological characteristics of the catchment area and the hydraulic characteristics of the river. Then they will generate the stream flow using computer modeling and analyze the flood routing in the river – including the movement of the flood wave, attenuation or reduction of the peak flow at the flood plain, and the discharge out of critical points along the river channel. Finally they will develop the model and formula to be used for flood forecasting.

The modeling for flood forecasting at Bringin River is meant to devise the formula to forecast the arrival time of floods, the peak discharge translation and attenuation from upstream to downstream reach, use the forecast to generate a warning, and improve the lead-time between the warning and flood arrival to give the at-risk communities more time to prepare themselves, protect their properties, and to evacuate to designated shelters. In brief, the analysis performed for this flash flood modeling consisted of three stages:

1) Modeling rainfall to discharge conversion using HEC-HMS software.

2) Modeling water level of each discharge point and development of rating curve using HEC-RAS software.

3) Analysis of flood forecasting function using a statistical approach. The available data has been analyzed, and design discharge has been generated for various return periods such as 5, 10, 25, 50 and 100 years.

The project has designs for monitoring equipment for flash floods, consisting of one automated rainfall recording station and three automated water level measuring stations installed in the drainage subsystem, as well as data processing equipment. Each device was designed and made by the University of Diponegoro, and will be turned over to the BKMG-Semarang office.

In 2014, the flood model calibration using the 2013 data – e.g., on precipitation and stream flow characteristics – was done and initial forecasting was conducted. The model will now be turned over to the department for water resource management (PSDA), as well as linked to the early warning system. The PSDA will have the responsibility to monitor rainfall, use the model to forecast floods, and manage the early warning system developed under this project. Through a coordination mechanism established by the local planning board (BAPPEDA), PSDA will deliver flood warning information to notify the department for disaster response (BPBD) as the government agency who is responsible for disaster risk management in Semarang City. BPBD is also responsible for local disaster response groups (KSBs) within the project site that have been organized and trained to disseminate the warning, prepare for floods, and respond to needs during a flood within the project. A standard operating procedure will be developed and finalized in 2014 on how the PSDA will deliver the warning information to KSBs by a combination of technologies including SMS, ham radio, and radio broadcast. KSBs, in turn, will forward this information to the community through the mosque's loudspeaker, alarms, and SMS.

Preparedness at community-level

The year 2012 saw the establishment of KSBs in five sub-districts in Ngaliyan district, which is exposed to flash floods. In 2013, a training module was developed on community-based disaster preparedness. The training has been implemented over several weekends, covering topics including basics of disaster risk management, community preparedness, how to recognize flood risk based on river level gauges, first aid, and evacuation strategy.

A series of flood simulation exercises are planned for each district to test each community's evacuation plan, and to practice the life-saving skills of the volunteer rescuers.

In addition, the communities have participated in a series of risk-mapping exercises and workshops to document their local knowledge over the flood characteristics in their respective areas, potential features of a communication and coordination system, possible evacuation routes, possible flood shelters from among the buildings in their community, methods of evacuation (foot, motorcycle, and car), and how they can protect their property. The project culminated in 2014 with the design of information, education and communication (IEC) materials to disseminate flood preparedness concepts and practice in the communities. ■

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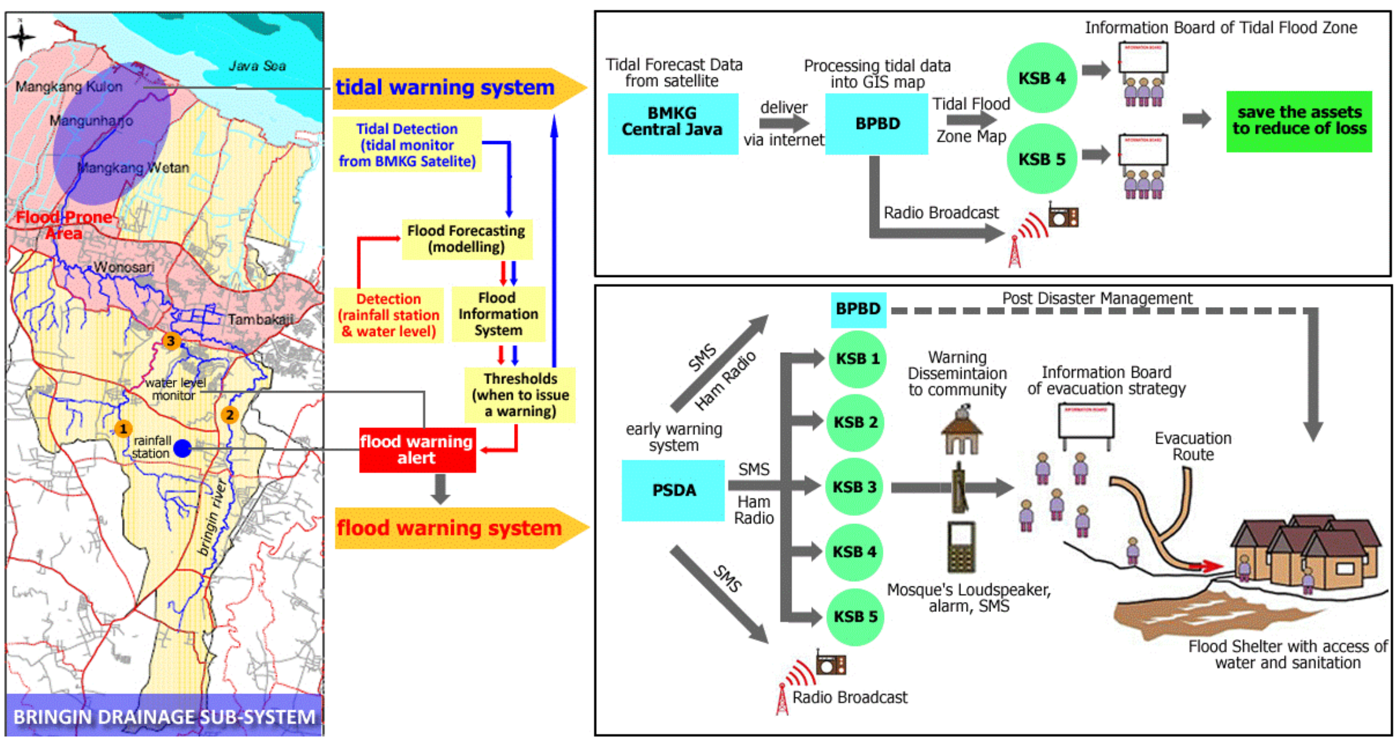
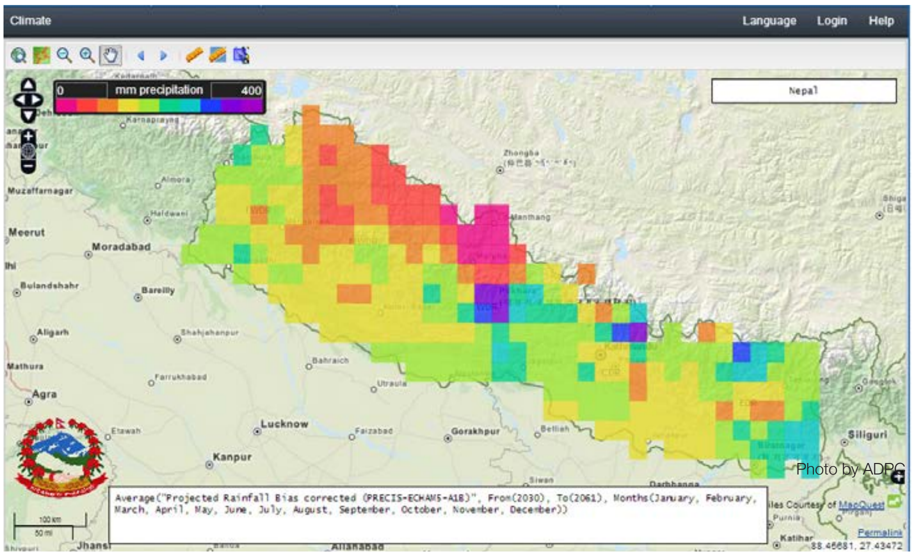


Communicating science to support action

Nepal Climate Data Portal provides open access to accurate and representative climate information, facilitating a huge step forward in awareness raising.

by Dr. Senaka Basnayake, ADPC; Saraju K. Baidya, Department of Hydrology and Meteorology of Nepal (DHM); Susantha Jayasinghe, ADPC; and Dr. Rishi R. Sharma, DHM



From data to action *Using the Nepal Climate Data Portal, policy makers can easily project the effects of climate change and identify vulnerabilities.*

Open access to a meteorological or climatological database is essential for impact and vulnerability assessments related to climate change and climate variability, especially in climate-sensitive sectors such as agriculture and food security, water resources, biodiversity, and health. Access to information is of utmost importance for sector-specific policymakers, planners, stakeholders, end-users and the general public to plan their routine works. Availability of climatic data has been identified as one of the most important elements under the United Nations Framework Convention on Climate Change and its subsequent Kyoto Protocol to combat unprecedented climate change.

In view of this, ADPC and Bjerknes Centre for Climate Research of Norway in association with the Faculty of Geo-Information Science and Earth Observation of the University of Twente in the Netherlands and The Energy and Resources Institute of India implemented a project called *Climate Data Digitization and Downscaling of Climate Change Projections in Nepal* under the program *Strengthening Capacity for Managing Climate Change* funded by Asian Development Bank. As one of the main outcomes of the project, ADPC worked in close collaboration with the Department of Hydrology and Meteorology of Nepal and the Nepali Tribhuvan University to launch Nepal Climate Data Portal in August 2012 as well as conducted technical and capacity building training courses for the local officials to ensure long-term sustainability of the initiative.

Improving response to major climatic events

Nepal Climate Data Portal facilitates the analysis of historical climate and meteorological data as well as future climate scenarios in different geographical settings using a publicly accessible web-based interface. The web portal has its own meteorological database that produces maps, time-series charts, and downloadable data. It uses simple language to represent arithmetic and statistical operations similar to a spreadsheet. The portal's intended audience includes research scientists, meteorologists, hydrologists, university students, decision-makers, and anyone who needs to understand past and projected weather and climate patterns in Nepal.

The portal provides climate forecasts that can help the country to respond to major climatic events. It also allows clients to purchase historical climate data that has been collected by the Department of Hydrology and Meteorology of Nepal over several decades.

Understanding the vulnerabilities and impacts of climate change and climate variability in different climate-sensitive sectors is crucial for managing weather and climate disaster risks. It is also important to take proactive adaptation measures for the changing climate. In Nepal, the current degree of vulnerability depends on physical, environmental, social, and economic aspects, and analysis of historical meteorological information on different temporal and spatial scales is of vital importance.

It is important to provide projected climate change scenarios using state-of-the-art dynamical downscaling tools such as PRECIS (Providing Regional Climates for Impacts Studies model), Regional Climate Model-4, and Weather Research and Forecasting Model at a high spatial resolution. This will allow scientists and researchers to quantify the potential changes in mean climate, which helps policy-makers, planners, and stakeholders to take proactive adaptation measures in the vulnerable sectors.

Comparing historical and projected climate information

On a technical level, there is a close alignment between the requirements of Nepal Climate Data Portal for historical climate data and projected future climate scenarios. The portal will provide users with an integrated platform to access climate data, and to compare historical and projected climate information.

It allows users also to view the data on an interactive map and generate information products including exporting the raw data. The portal produces various information products from the observed, gridded, and projected climate data to cater the needs of a variety of stakeholders. Technical experts and climate professionals prefer raw data for their own analysis while other professionals such as government officials, policymakers, and sector-specific planners require analyzed end-products such as maps and charts.

Climate data has been extensively used to assess the impacts of climate change and to identify the degree of vulnerability for climate change in climatic sensitive sectors. Therefore, researches, scientists, academics, sector-specific planners and policy-makers will certainly make use of Nepal Climate Data Portal for their routine works such as research and development; assessment of impacts and vulnerability in climate-sensitive sectors such as agriculture, water resources, energy, and health; as well as development of adaptation strategies for vulnerable sectors. The portal will also be useful when planning infrastructure as an adaptation measure as well as in contingency planning.

Upon the success of Nepal Climate Data Portal, ADPC has taken further steps to introduce similar types of climate data portals for Bangladesh, Myanmar, and Sri Lanka. With support from the Royal Norwegian Ministry of Foreign Affairs, ADPC has conducted a needs assessment in Myanmar with the Department of Meteorology and Hydrology to design a web portal with necessary features that would alleviate the department's climate services, and benefit researchers, scientists, academics, sector-specific planners, and policy-makers.■

Providing open access to historical meteorological and climatological data

Special features of Nepal Climate Data Portal:

- Performs a web-based calculating engine with its own database
- Facilitates the analysis of climatological, meteorological, geographical, and projection data using a publicly accessible web-based interface
- Produces maps, time-series charts and downloadable CSV data
- Allows additional climate data to be uploaded into the portal
- Raw observed meteorological and climatological time series accessible if data is purchased
- Information on pricing options as specified by the Department of Hydrology and Meteorology whose officials are responsible for pricing historical data. Users are able to purchase data directly from the portal and the payment can be made to the Department of Hydrology and Meteorology's office or at a bank.
- Nepal Climate Data Portal provides the following data types based on specific queries:
  - Pont (observed) and observed and projected gridded climate data
  - Maps visualizing gridded observed climatic variables (monthly/ seasonal/annual)
  - Time series plots of modeled climate parameters (present-day and future scenarios)

Visit Nepal Climate Data portal at: dhm.gov.np/dpc

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Photo by ADPC

Q&A

with Dr. Bhichit Rattakul

by Adam Yousri, ADPC

Since the Indian Ocean Tsunami in 2004, you have remained at the forefront of initiatives related to the development of early warning systems in Asia-Pacific. How can early warning systems support disaster risk reduction in the region?

It has been proved again and again that early warning systems can help with many disaster situations, especially with regard to hydro-meteorological hazards. Early warning systems are useful not only in response and evacuation but are also key in the risk planning processes. For instance, early warning systems have had a clear positive influence in coastal regions surrounding the Indian Ocean. The 2004 Indian Ocean Tsunami had a disastrous impact because at that time the early warning system for tsunamis was not yet developed in the region.

Early warning systems have also showed their significance in the 2011 floods in Thailand. Various hydrological monitoring equipment and sensors upstream in the Chao Phraya River motivated a response in the Bangkok metropolitan area long before floodwaters actually reached the city. Casualties would have been far greater had these early warning provisions not existed. Vietnam, which had similar types of flood monitoring equipment placed in various cross-sections of the Mekong River, was able to use the information to enact an effective risk management plan. Damages in the urban Mekong River Delta were far less than those in the Chao Phraya River Delta.

How have early warning systems changed and improved within the region?

The early warning systems have improved as a response to the 2004 tsunami and other recent hydro-meteorological hazards in the region. All in all, early warning system implementation has been much more common in all affected countries since the tsunami. With the addition of recent hazards, hydro-meteorological disasters have been seen as a serious and significant threat to the region. For this reason early warning systems are now a critical element in effective disaster risk management.

A key player in encouraging the development of early warning systems is the Typhoon Committee established by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization (WMO). There are various working groups in the Typhoon Committee focusing on meteorology, hydrology, and disaster risk reduction. ADPC collaborates with these regional entities providing inputs in the processes through research, program development, information exchange, and technological transfer. ADPC also implements needs-based projects on early warning systems in many countries within the region.

What is the role that ADPC plays in early warning?

ADPC plays an engaging role in the overall research, development and capacity building of early warning systems in Asia. Its emphasis is on building capacity in modeling severe weather conditions and developing end-to-end capacity of institutions and communities to respond to the early warning information in a more systematic way. ADPC's first significant input in early warning was during the Cyclone Nargis in Myanmar. It provided forecasting information almost four days in advance of Nargis' landing. More recently, ADPC has provided forecasts in collaboration with the Norwegian Meteorological Institute, Japan Meteorological Agency and the national hydro-meteorological services in the region.

ADPC believes that physical and social sciences need to be integrated. Early warning information must be transferred from the national level to local governments and nested into the social processes of communities. Scientific data is not always easily understandable to the common person, and ADPC builds the capacity to translate it into an easily understandable and actable form. Clear information allows communities to take action whether this action be evacuation or adaptation.

What can be done to further improve early warning systems?

The next challenge in improving early warning systems will be to increase collaboration between countries within the region. Countries can collaborate to identify model initiatives for hazard-specific early warning systems and work together to develop platforms for multi-hazard early warning systems. We need to propagate success stories within the region to demonstrate the efficacy of early warning systems in preventing future losses. Furthermore, sharing hydro-meteorological information between countries can provide a more complete picture of risks posed by natural hazards before they actually reach vulnerable communities.

Dr. Bhichit Rattakul serves as Special Advisor at ADPC. He is the former Governor of Bangkok and the former Minister of Science and Technology of Thailand.

Cambodia

BETTER EARLY WARNING AND COMPREHENSIVE RISK ASSESSMENTS

Floods and drought in Cambodia over the past years have led to huge losses in agricultural revenue – the main source of income for many households. **H.E. Mr. Ross Sovann** from the National Committee for Disaster Management wants to improve dissemination of early warnings and increase the involvement of communities in disaster risk reduction.

by Rishiraj Dutta, ADPC

CAMBODIA IS AT RISK OF HYDRO-METEOROLOGICAL HAZARDS THAT recently have culminated in disasters affecting large segments of the society. Floods and drought have impacted rural populations and created a need for major relief operations. Occasional climatic events such as Typhoon Ketsana in 2009 have only mounted the problem further.

His Excellency Mr. Ross Sovann, Deputy Secretary General of the National Committee for Disaster Management of Cambodia stresses the need to enhance capacity in disaster risk management against the prevailing hazards.

"Over the past decades, Cambodia has seen several regimes and gone through turbulent times. Now, we need to increase people's participation and their awareness of the changing environment as well as improve their capacity to deal with natural hazards," H.E. Sovann says.

A key step forward has been the establishment of the National Committee for Disaster Management and its technical arm, the National Emergency Coordination Center. In addition, Cambodia has adopted a systematic approach to disaster risk management at provincial, district and commune levels.

"We have seen improvement in the commitment to disaster risk management. However, gaps and threats still remain and **we need to strengthen the system and develop capacities to make the system more effective**, "

H.E. Mr. Ross Sovann states.

"We have seen improvement in the commitment to disaster risk management. However, gaps and threats still remain and we need to strengthen the system and develop capacities to make the system more effective," H.E. Sovann states.

In particular, he wants to improve the national early warning system that still lacks sufficient capacity to reach out to all provinces, districts and communes.

A need for comprehensive risk assessment

As part of Ketsana Emergency Reconstruction and Rehabilitation Project lead by the World Bank, ADPC

Photo by mrmichaelangelo / Shutterstock.com

“This is a time for working together to make Cambodia resilient to recurring disasters,”

says H.E. Mr. Ross Sovann, Deputy Secretary General of the National Committee for Disaster Management of Cambodia.

provides technical assistance in building the capacity of the Cambodian officials in disaster management by implementing initiatives on disaster management information systems, risk assessment and early warning systems. In addition, a handbook and guidelines on safer rural housing are soon going to be launched.

“The project helps us address the factors that restrict the effectiveness of disaster risk management in Cambodia. The country has conducted some risk assessments in the past but there is a need for a more comprehensive assessment and mapping of risks in all provinces and at all levels,” H.E. Sovann states.

“We need technical assistance in identifying the local risks and vulnerabilities as well as their impacts on different sectors and response programs,” he adds.

Establishing a disaster management information center

The National Committee for Disaster Management with technical support from ADPC currently develops a web portal to serve as an information hub on disaster management. In order to improve the dissemination of disaster management knowledge and facilitate effective decision-making, the country is also establishing a Disaster Management Information Center.

“We are planning to link the disaster management information center with a multi-hazard early warning system, a risk information and map database as well as relevant disaster management agencies,” H.E. Sovann explains.

“We will need a nodal system for continuous sharing of information through the disaster management information center. This would ensure that the provincial and local bodies will receive early warning and hazard information on a regular basis and with adequate guidance,” H.E. Sovann states. ■

Typhoon Haiyan, an extraordinary event?

A commentary on the complexities of early warning, disaster risk management and societal responses to the typhoon.

by Atiq Kainan Ahmed, ADPC; Ardito Kodijat, UNESCO; Mayfourth Luneta, Center for Disaster Preparedness, Philippines; and Krishna Krishnamurthy, World Food Programme

Photo by Richard Whitcombe / Shutterstock.com

In November 2013, typhoon Haiyan, known locally as typhoon *Yolanda*, severely affected the Philippines, a densely populated country of over ninety million people. It was an exceptionally powerful tropical cyclone – the strongest recorded at landfall and one of the strongest recorded in wind speeds. It was also the deadliest typhoon to affect the Philippines to-date, resulting in more than six thousand casualties in the Philippines alone.

The typhoon first made landfall at the Eastern Samar province with a wind speed of 235 km/h and gusts of up to 275 km/h. Rainfall of up to 30 millimeters per hour and a storm surge up to six meters high hit Leyte and the Samar islands. Many cities and towns faced widespread destruction, in some areas most of the houses were destroyed. Roads and pathways were blocked, airports and seaports were severely impaired, and heavy vessels were thrown considerable distances inland. The storm cut off water and power supplies, destroyed food stocks and other goods, left health facilities dysfunctional, and quickly exhausted medical supplies.

Causalities in the Samar and Leyte islands were caused not only by the high winds that stripped off almost every roof in the affected areas but also the "storm surge" that submerged coastal areas to the height of a two-story building. The surge swept away the port-city of Tacloban with such forces that it can be compared to a tsunami. Thousands of people were trapped under rubble and drowned or were hit by debris. The devastation was widespread across the Leyte and Samar Islands. Millions of Filipinos were affected, displaced or made homeless. The Philippines Government declared the typhoon as a national calamity.

The United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA), which coordinated the implementation of the Haiyan Action Plan (UN OCHA 2013), identified access to information in the affected communities as an urgent need in the response to the disaster. Survivors urgently needed information on available assistance and services. For those who were out of reach of direct assistance, the communication of lifesaving self-help information such as the self-treatment of diseases and techniques for water purification was crucial in saving lives. The restoration of the communications infrastructure was an urgent priority. Initial reports suggested that the damage to the communications infrastructure was extensive and that most local public information services were not functioning in the immediate aftermath of the typhoon. Electricity provision was severely limited, further affecting peoples' access to information given on radio and television. However, the international humanitarian response was scaled up significantly after considerable initial challenges caused by damaged or destroyed infrastructure. There were criticisms that things were not moving quickly enough. The criticisms were valid in many spheres.

The dimensions of the dilemma

When analyzing the event a year after its occurrence, several dimensions of dilemma emerge clearly. This article makes an attempt to reflect on the different dimensions and tries to understand the various hardships the event has created. Some of the dimensions are derived from the commentaries of various reports and others from dialogues with stakeholders. This analysis is useful for reviewing critical lessons learned from the unprecedented case of typhoon Haiyan including peoples' experiences of the early warning system and communication difficulties throughout the country. Post-disaster responses have started to emerge from various sources and narratives. Here we have made an attempt to outline some of the salient issues raised and interpreted by various stakeholders and the media in order to gain reflective lessons from the event and the way it was managed. We portray the dimensions of the dilemma in the following paragraphs.

Dimension 1: *Were all key components of the early warning system conducted correctly?*

The United Nations Office for Disaster Risk Reduction (UNISDR 2006) identifies four key components of a people-centric early warning system: risk knowledge; monitoring and warning service; dissemination and communication; and response capability (*see Figure 1)*. In the past few years, the Philippines has developed a relatively good typhoon detection system compared to other countries in the region.

The Philippine government's national hydro-meteorological service is known as the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). Under the Department of Science and Technology (DOST), PAGASA is responsible for monitoring, detecting, and managing typhoon early warning systems. The National Disaster Risk Reduction & Management Council in collaboration with the local authorities leads the typhoon warning dissemination and response sub-systems. The World Meteorological Organization in a recent Typhoon Committee event stated that the Philippines' national meteorological services issued regular wind speed and storm-surge warnings about typhoon Haiyan (WMO 2013). The Regional Specialized Meteorological Centre in Tokyo and other national hydro-meteorological services such as the China Meteorological Administration and National Hydro-Meteorological Service in Vietnam were also able to make a relatively accurate detection of the typhoon with good lead time. Hence, the detection of the storm functioned relatively well on some elements but not on all of the elements of the hazard.

The second component of the early warning system, namely monitoring and warning service, included the detection of typhoon Haiyan and worked relatively well. Risk knowledge was obtained through the existing global observation system and the regular observation of the storm, so the Philippines' early warning system connected well to the upstream component of the early warning system. But what risk knowledge existed downstream at the community and local government levels? This remains a dilemma. Even though warnings were issued by PAGASA/DOST well ahead of time and they described the forecasted magnitude of the typhoon, many communities at risk did not expect the typhoon to be so strong. Their risk perception, which was based on historical experience, did not match with the forecast.

One dilemma can be found in miscommunicating the characteristics of typhoon Haiyan to the community. For example, many people did not expect that the wind generated by the typhoon would lead to a surge in the sea-level. This lack of understanding of the phenomenon led to inappropriate responses to the warnings. In terms of response capability, there were not enough safe locations for people to evacuate to in response to the warning they received. Another dilemma is the localizing of risk knowledge and risk perception (British Red Cross 2013), and the dissemination and communication of risk. A major remaining challenge is to communicate risk in a manner that results in a fast and appropriate response by the public. A weak manifestation of response capacity by the communities at risk is still a problem. Hence, despite the timely detection of the typhoon, the other components of the early warning system did not connect in an effective way and this ultimately resulted in the failure of the early warning system to reduce risk.

Figure 1. *Four key components of a people-centric early warning system (UNISDR: 2006).*

Dimension 2: *Was there any linkage of Haiyan with climate change?*

An opinion article in The Japan Times (Dyer 2013) questions the linkage between typhoon Haiyan and climate change. It states that Haiyan may be an early warning of what is to come, not just to the Philippines, but for any coastal area in Asia. The science corroborates these concerns. The latest climate change assessment of the Intergovernmental Panel on Climate Change suggests that typhoons like Haiyan will become the norm, rather than a rarity in future climate conditions. This suggests that climate change would have increasingly adverse effects towards the formation of typhoons and their frequency.

Dimension 3: *Providing life-saving information and services in the immediate aftermath of a disaster*

A report by the United Nations Office for the Coordination of Humanitarian Affairs (2013) has commented on the importance of disseminating accurate information after a disaster. Affected communities are primary stakeholders of the humanitarian response and have a basic right to participate in decisions that affect their lives. They need to receive the information they need in order to make informed decisions following the immediate aftermath of a typhoon. Survivors urgently need information on available services, aid, and support when finding ways to communicate with each other during times of severely damaged telecommunications. Adequate information and capacity for two-way communication are essential prerequisites for resilience and recovery. Sufficient sources of information on assistance for the affected communities, community leaders (barangay councils), local government authorities, and community volunteers were not there in time in the aftermath of Haiyan.

Dimension 4: *Were the available shelters adequate to protect the people against the effects of Haiyan? What was the status of infrastructural preparedness?*

Many commentaries indicated that the shelters in the Haiyan-affected areas could not provide substantial protection against major typhoons. There are good examples of strong multipurpose cyclone shelters in the region, such as the ones on coastal Bangladesh. An early report in the Washington Post (Fisher 2013) commented on the causes for the lack of preparedness before Haiyan. The article mentions that “about 20 tropical cyclones hit the country every year, making it practically a routine” and the writer questions why the country was not prepared for this event. The arrival of typhoon Haiyan was not a surprise but stormproof shelters were destroyed and necessary relief efforts have failed to come together. The single most important factor, the article states, “may be that, quite simply, this storm was just too big; with winds well beyond 200 miles per hour and sea levels surging across coastal communities, no country could absorb it unharmed. But the Philippines seems to have been particularly ill-suited to deal with the crisis.” (Fisher 2013.)

Here there are two sides of dilemma exemplified. On one hand the Philippines’ unpreparedness may be related to the homes that are modestly constructed of wood and other light materials (Fisher 2013). On the other hand, the investments in building resilient infrastructure that could resist the effects of natural disasters had also remained insufficient (Fisher 2013). The Washington Post reported, “three days after the storm, the devastated city of Tacloban remained almost inaccessible; aid workers said it took six hours to make the 14-mile round trip ferrying supplies between the airport and the city center (Fisher 2013).” In many ways, the preparedness gap in the Philippines comes from the inability to access sufficient resources after a disaster due to a lack of resilient infrastructure and inadequate disaster response plans.

Dimension 5: *Deficient implementation and integration of community-based disaster risk reduction and climate change adaptation initiatives on the ground*

Community-based disaster risk reduction (CBDRR) and adaptation practices can help move communities from vulnerability to resilience and prepare them for worst case scenarios vis-à-vis extreme events. Integration of community-based disaster risk reduction and climate change adaptation processes into development strategies creates an enabling environment for a more resilient society, and we have seen good commitments in this regard in the Philippines.

The successful cases from San Francisco and the Camotes Islands

Photo by Richard Whitcombe / Shutterstock.com

Mainstreaming to avoid disaster *Mainstreaming disaster risk reduction and climate change adaptation in anticipation of future disaster scenarios may help to prevent tragic consequences of natural hazards in the future.*

are also good examples of integrating community-based disaster risk reduction and climate change adaptation into development process. However, this has remained deficient in many Haiyan-affected communities where the community-based disaster risk reduction and climate change adaptation initiatives were inadequate and not effectively integrated into the development processes prior to the typhoon.

Dimension 6: *Uneven economic growth and rapid urbanization cause varying vulnerabilities to hazards*

One of the commentaries in the Economist (2013) highlighted the inequalities in the socio-economic domain. It reported that the economic growth in the Philippines in recent times has been strong but the gains are not evenly spread (The Economist 2013). Leyte and Samar are among the poorest provinces in the Philippines and as many people lived in poor conditions in shanty towns by the shore during Haiyan, a large number of lives was lost. Issues related to power, politics and corruption created an intrinsic vulnerability to any extreme event. This dimension of the dilemma requires further research, but the connection between the uneven growth and the hazard impacts have started to become more and more apparent.

Dimension 7: *What was the impact on food security and livelihoods?*

Livelihoods, especially farming and fishing, were severely affected by typhoon Haiyan. According to a needs assessment (WFP & UN OCHA 2013) over half of fishing communities and almost one third of farming households reported complete destruction of their livelihoods. Strong winds and powerful storm surges resulted in the loss of rice and standing crops, such as coconuts and sugarcane – resulting in significant losses of income. Households were concerned that it would take up to eight months (on average) to recover from the typhoon, as a result of which they would miss the 2014 agricultural production season degrading their resilience capacity. For farmers who depend on coconut production for their income, the destruction of coconut plantations means that an alternative livelihood has to be identified as coconut trees take up to ten years to become productive again.

Typhoon Haiyan also had severe impacts on food security. In the immediate aftermath of the typhoon, food security remained a key concern for the affected population. As food assistance efforts were rapidly scaled up, the situation improved substantially within days, but some households still had difficulty in consuming adequate diets. Food assistance was a key source of food provisions – especially staple foods such as rice for the affected population.

According to an article in the Financial Times, "the UN Food and Agriculture Organization (FAO) estimates that typhoon Haiyan affected a third of the Philippines' rice growing areas, destroying almost a million metric tons of wet-season rice harvests – in a country where more than a quarter of the 95m population live below the poverty line (Landingin 2013)." FAO's forecast on the amount of rice production was 18 million metric tons instead of the originally expected 18.9 million prompting the government to increase rice imports to rebuild stocks (Landingin 2013).

Typhoon Haiyan left many farmers landless and heavily indebted, and the need for them was far more than simply fresh working capital for the next production cycle. They worried about paying their land rents and the loans that financed the purchase of seeds and fertilizers for the affected cropping season. The government has adopted a reconstruction program where money has been allocated to food aid and similar welfare as well as rebuilding and upgrading damaged houses, buildings and infrastructure to withstand the next natural disaster. (Landingin 2013.) However, the damaged livelihoods and recovery will still remain on the shoulders of the severely affected farmers.

Concluding thoughts

These above reflections on the multiple dimensions of typhoon Haiyan and the dilemma it caused prompts us to rethink major disasters. Big typhoons and extreme climatic events are more and more anticipated with the changing climate. These reflections indicate to us that the dilemma of preparedness or adaptation to extreme events such as Haiyan needs a more integrated and risk-informed disaster management system. We need to take an integrated approach towards risk management and at the same time we should think of 'unknown thresholds' (e.g., various unprecedented scenarios) and prepare ourselves for those scenarios. A comprehensive approach is needed to move ahead with an adaptive and integrated planning process. Mainstreaming disaster risk reduction and climate change adaptation into the development processes in order to prepare for future extremes is needed more than ever.■

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Alumni Testimonials

ADPC supports national hydro-meteorological services in the Asia-Pacific to disseminate improved and timely early warning information on natural hazards. ADPC's training workshops focus on numerical weather forecasting, climate scenarios, data visualization, as well as storm surge and ocean modeling. Read about how the participants have utilized their new skills in their day-to-day work.

by Susantha Jayasinghe, ADPC

Kyaw Lwin Oo
Deputy Director
Department of Meteorology and Hydrology, Myanmar

"After the training, we were able to provide a weather research and forecasting model output on our website. With the model, users can for example check the wind speed and direction as well as the amount of local rainfall.

The course enhanced the Department of Meteorology's capacity building efforts in numerical weather prediction, storm surge modeling as well as climate downscaling and data management.

I can now run a weather research and forecasting model with different physical parameterization schemes, and I'm also preparing a research paper and technical presentations on the topic. In addition, I can now run a program called 'RStudio' used for climate data management and application."

Shirley J. David
Senior Weather Specialist
Philippine Atmospheric, Geophysical and Astronomical Services Administration

"The training helped us understand what a weather research and forecasting model is and what it can do. It provided us with the know-how on the installation of the model as well as designing our domain efficiently in terms of the resources and visualization.

I was able to directly apply the training to the early warning systems in the Philippines by providing the necessary inputs to our rainfall warning system. In the near future, I plan to use the system to simulate interesting weather events that happened earlier in 2014.

The variation of topics presented during the training ranged from basic to the most advanced numerical weather prediction modeling and application."

Ajith Wijemannage
Meteorologist in Charge
Department of Meteorology, Sri Lanka

"We were able to rectify many problems at home after the workshop thanks to the guidance by the resource teams. Some of the skills we have applied at home include using localized mesoscale numerical models, which help us in numerical weather prediction – an area the Department of Meteorology is substantially lagging behind in.

We also learned a lot about early warning systems from the course. We were trained on how to install and run a weather research and forecasting model as well as a storm surge model. These skills helped us improve forecasting guidance and the quality of early warnings in Sri Lanka. We plan to use the storm surge model when there is a risk for a large cyclone.

In the future, we want to address some of the challenges facing our department including perfecting data assimilation techniques. This will allow us to use numerical weather prediction model outputs more effectively."

In Brief

Simulation tested readiness for coastal hazards in Myanmar

ADPC provided technical assistance in a unique end-to-end early warning simulation and drill in May 2014 in three pilot sites in Myanmar's Ayeyarwady region. The simulation was an opportunity to test the early warning system's readiness and improve it before the next disaster.

The simulation and demonstrative drills were conducted simultaneously in the coastal sites of Chauntha beach of Pathain, Thayetpinselk Village of Paypon, and Daw Nyein Village of the Paypon Township.

"End-to-end early warning simulations and drills are important features of public weather services and useful in order to see how coastal communities in Myanmar prepare using warnings and forecasts issued by the Department of Meteorology and Hydrology (DMH). This is a useful learning experience towards people-centric end-to-end early warning system in Myanmar," said Dr. Hrin Nei Thiam, Director General of DMH.

"From this simulation and drill exercises, people in the communities can learn a lot of practical and common sense elements for preparing themselves to manage coastal hazards in a more systematic way," stated U Than Soe, Head the Relief and Resettlement Department (RRD), Ayeyarwady Region.

Organized by the Department of Meteorology and Hydrology of Myanmar in collaboration with the Relief and Resettlement Department, and respective General Administrative Department (GAD) representations, the village drills were participated by about 1,200 people with several external organizations and media agencies observing. ■

Photo by ADPC

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