6. Philippines

6.1 Background

The Philippines is an archipelago consisting of 7,100 islands located between the South China Sea and the Pacific Ocean, on the Southeast Asian continental shelf. It lies on the western rim of the Pacific and is part of the circum-Pacific seismic belt. It stretches more than 1,800 km from north to south and 1,046 km from east to west at its widest extent.

Because of its geographical location, the Philippines is exposed to a variety of hazards ranging from typhoons, storms, floods, tsunamis, earthquakes, volcanic eruption, landslides and droughts.

Typhoons

Annually, an average of 30 typhoons occur in the north-western Pacific Ocean, of which, 19 enter the Philippines Area of Responsibility, causing immense damage to life and property. The typhoons occur mainly between July and November.

Storm surges

The irregular coastlines and the numerous typhoons make the Philippines vulnerable to storm surges. High tides coinciding with a storm intensify the surge. Factors contributing to the height of storm surges are a concave coastline that prevents the rising water from moving laterally, a fast moving storm that does not allow time for the water to spread, and shallow coastal waters. Environmental degradation, such as destruction of mangroves, coral reefs and other forms of natural breakwater; siltation of river deltas and bays; and shoreline reclamation also increases the occurrence of the storm surge hazard.

Floods

Heavy rains accompanying typhoons usually cause extensive floods. Areas most prone to floods are Eastern Mindanao, Northern Samar, Central Luzon and the Bicol region. Flooding in Metro Manila occurs because it is lower than sea level and has inadequate drainage systems.

6.2 Institutional Arrangement for Early Warning

With the annual occurrence of disasters, windstorms and flooding, the Philippine Government has given priority to a well-defined disaster management system. Presidential Decree 1566 dated 1978, otherwise known as the Philippine Disaster Management Act, laid the foundation for government action before, during and after a disaster. The Philippine Calamities and Disaster Preparedness Plan (CDPP) articulates a hazard warning system that includes the procedure and linkages among the disaster agencies (Figure 6.1) to ensure a well organized and coordinated dissemination and response to warnings.

The CDPP has identified the responsibilities of governmental and non-governmental agencies for the detection of hazards, preparation of hazard warning, dissemination and management of warning, and operational response to warning. The National Disaster Coordinating Council, composed of different government agencies, has organized task units, one of which is responsible for generating hazard warning. Another task unit is responsible for communicating the warning to the lower level coordinating councils, which will disseminate the warning to the affected community. The diagram (Figure 6.2) illustrates the organizational structure of a disaster coordinating council. This structure is duplicated at all levels from the national level down to the village level.

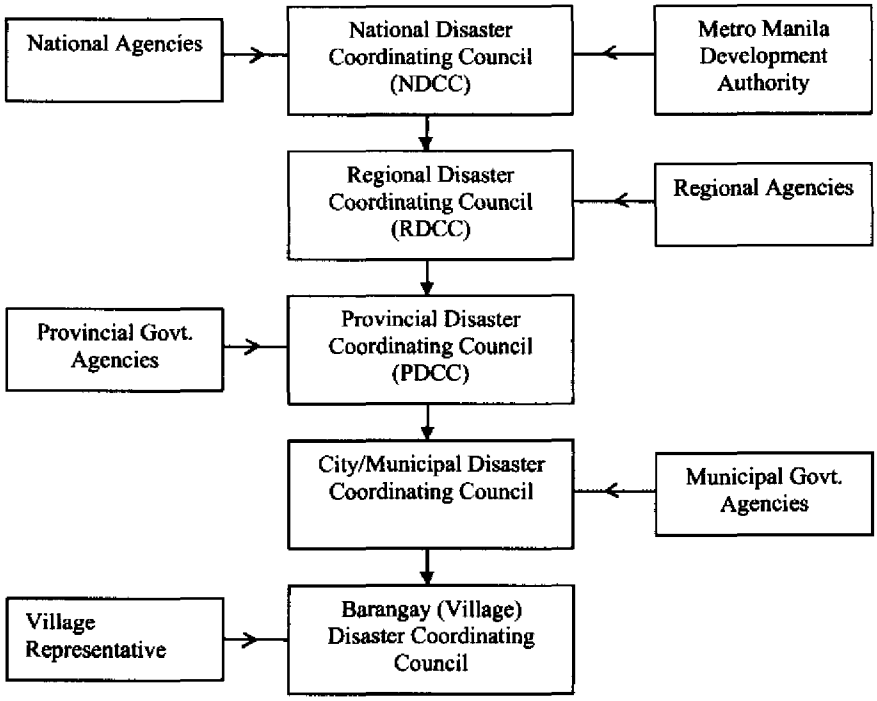


Figure 6.1 Linkages of disaster agencies involved in the dissemination of and response to warnings in the Philippines

6.3 Hazard Detection

6.3.1 Severe Weather Detection

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA, the Philippine weather bureau) has over 60 synoptic stations that send daily weather data to the central forecasting office in Metropolitan Manila. Observational data are sent to the central forecasting office through single side band radio communications, telephone, and e-mail wherever applicable.

Although the international standard requires six hourly observations, the weather data are transmitted on a three-hourly basis. The six-hourly observation is sent to other countries in Asia to help the countries prepare their weather forecast. The same data set is also sent to

the Regional Specialized Meteorological Center in Tokyo and other countries using the WMO Global Tele-Communications System (GTS).

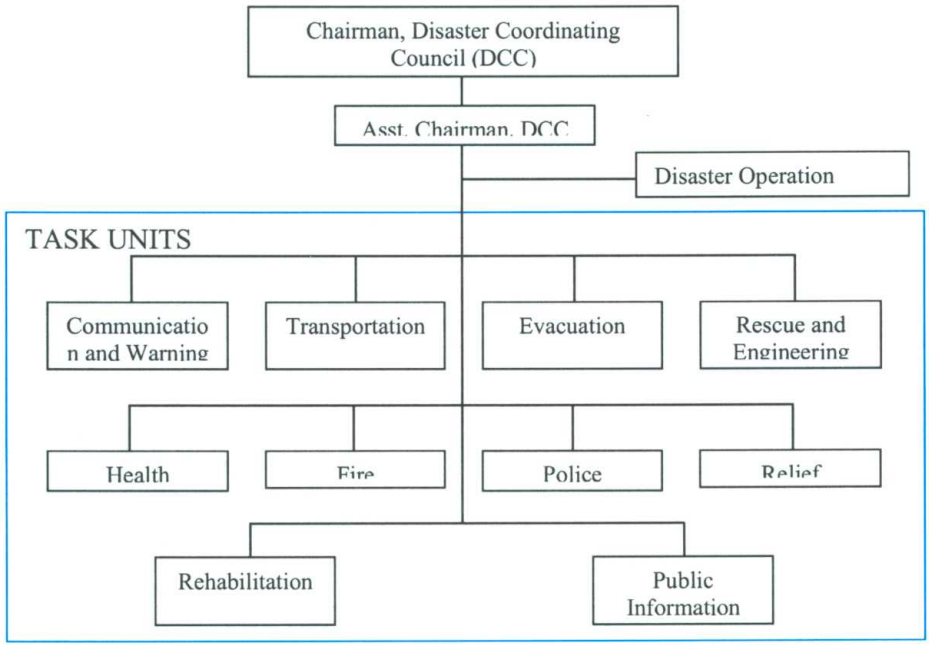


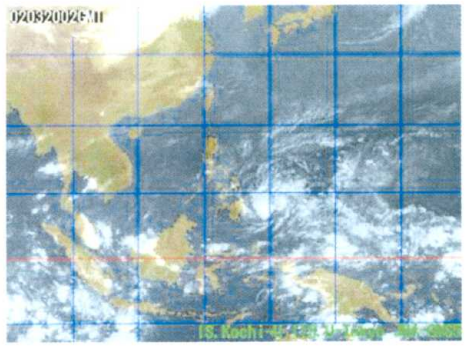
Figure 6.2 Organizational structure of a disaster coordinating council in the Philippines

The basic tool for weather forecasting is the weather map. This map depicts the distribution patterns of atmospheric pressure, wind, temperature and humidity at different levels of the atmosphere. In addition, PAGASA gets satellite imagery through the Japanese satellite GMS-5, which sends hourly photographs of the weather situation (Figure 6.3). Weather radars located along the length of the archipelago also provide cloud coverage. The weather map, satellite imagery and the result of numerical weather predictions using a global spectral model are analyzed and the results are translated into a weather forecast.

6.4 Hazard Warning

6.4.1 Tropical Cyclone

Figure 6.3 Satellite image from the Japanese Geo-stationary Meteorological Satellite (GMS-5)



PAGASA issues the following warning depending on the level of threat:

Weather Advisory: General information on the presence of a cyclone in the general area of the western Pacific (or South China Sea). The cyclone at this stage does not pose a threat within three days of issuance. The weather advisory is issued once a day at 3:30 p.m. except for the first advisory, which may be issued anytime when a severe weather system is detected.

Severe Weather Bulletin: Tropical Cyclone Alert. The alert stage indicates that a tropical cyclone poses a threat to a part of the country. The bulletin provides more detailed information about the cyclone including location, movement and intensity as well as a 24-hour forecast. The bulletin also gives advice to the public to undertake the appropriate safety measures and to continue monitoring development. The tropical cyclone alert is issued twice a day at 11:00 a.m. and 11:00 p.m.

Severe Weather Bulletin: Tropical Cyclone Warning. The warning is issued when there is real and immediate danger to a part or parts of the country from a cyclone. At this stage, public storm signals are raised (refer Annex 7). The warning is issued four times a day: 5:00 a.m., 11:00 a.m., 5:00 p.m. and 11:00 p.m.

6.4.2 Flood Forecasting and Warning

PAGASA monitors the flood situation in major urban areas and the four main river basins of the country. The Flood Forecasting Branch that produces the flood forecasts and warnings undertakes the hydrological warning for:

- Pampanga, Agno, Bicol and Cagayan river basins
- Major dams, namely, Binga, Ambuklao, Angat, Pantabangan, and Magat
- Pasig-Marikina-Laguna Lake complex system.

Flood forecasting consists of the following steps:

Monitoring and data collection: Data from rain gauges, water level and discharge rate are collected at regular intervals and sent to the Central Flood Forecasting

a) Office. In the case of dam monitoring, some of the rainfall and river gauges data are telemetered to the central office.
b) Analysis: Flood-forecasting models tested for each river basin and dam sites are used to analyse the flood situation.
c) Preparation of flood forecast and warning: Appropriate warnings as well as the corresponding precautionary measures are incorporated in the flood bulletin.

There are three categories of flood bulletin:

- Flood outlook: Information on current hydrological situation that is intended to alert the residents within the vicinity of a river basin with potential deterioration in the river condition (e.g. gradual and continuous rise in the water level).

- Flood advisory: Informs the public of an imminent flood situation. The advisory is issued when the hydrological condition deteriorates further or when the condition improves but the public is still advised to be cautious. A flood advisory contains recommended actions to be taken by the public.

- Flood warning: Issued when flooding is predicted to occur within 24 hours. The warning category is maintained as long as the affected areas are inundated and the

attendant dangers are present. Samples of flood warning for different situations are attached as Annex 8A and B. Flood warnings are also issued when gates are opened in flood mitigation projects like the Mangahan Floodway in Marikina-Pasig-Laguna Lake complex or in the various dams in Luzon, namely, Agno, Ambuklao, Magat, and Pantabangan Dams.

6.5 Warning Dissemination

Severe weather warning is disseminated from the PAGASA Central Forecasting Office (Figure 6.4). The media is the most direct channel through which a warning reaches the public.

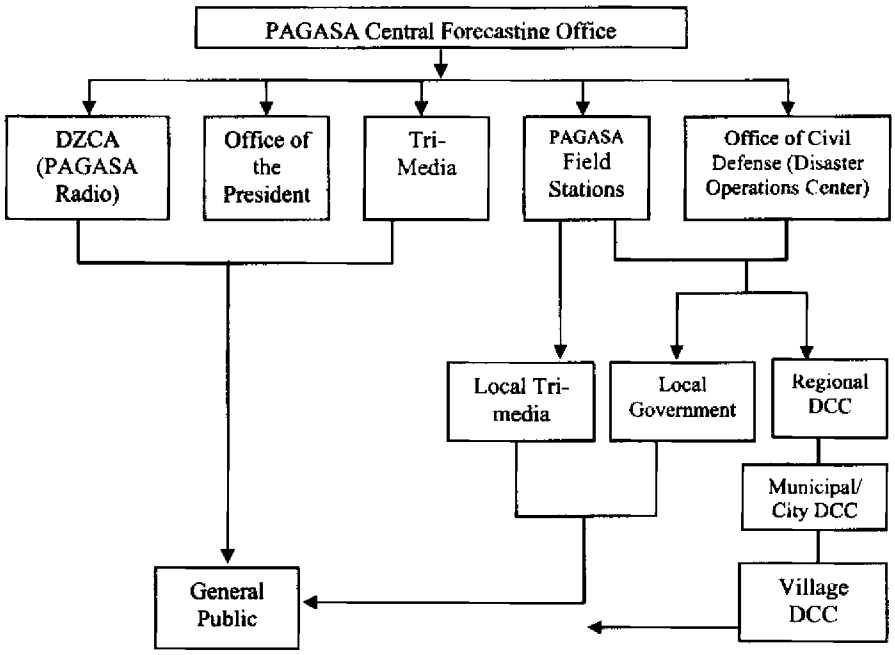


Figure 6.4 Severe weather warning dissemination schemes in the Philippines

The PAGASA FFB (Flood Forecasting Branch) Operation Center has a multi-pronged dissemination scheme for flood bulletins (Figure 6.5). The concerned public receives flood information directly from PAGASA or through national and local broadcasts, disaster coordinating councils, and regional warning centers and dam offices.

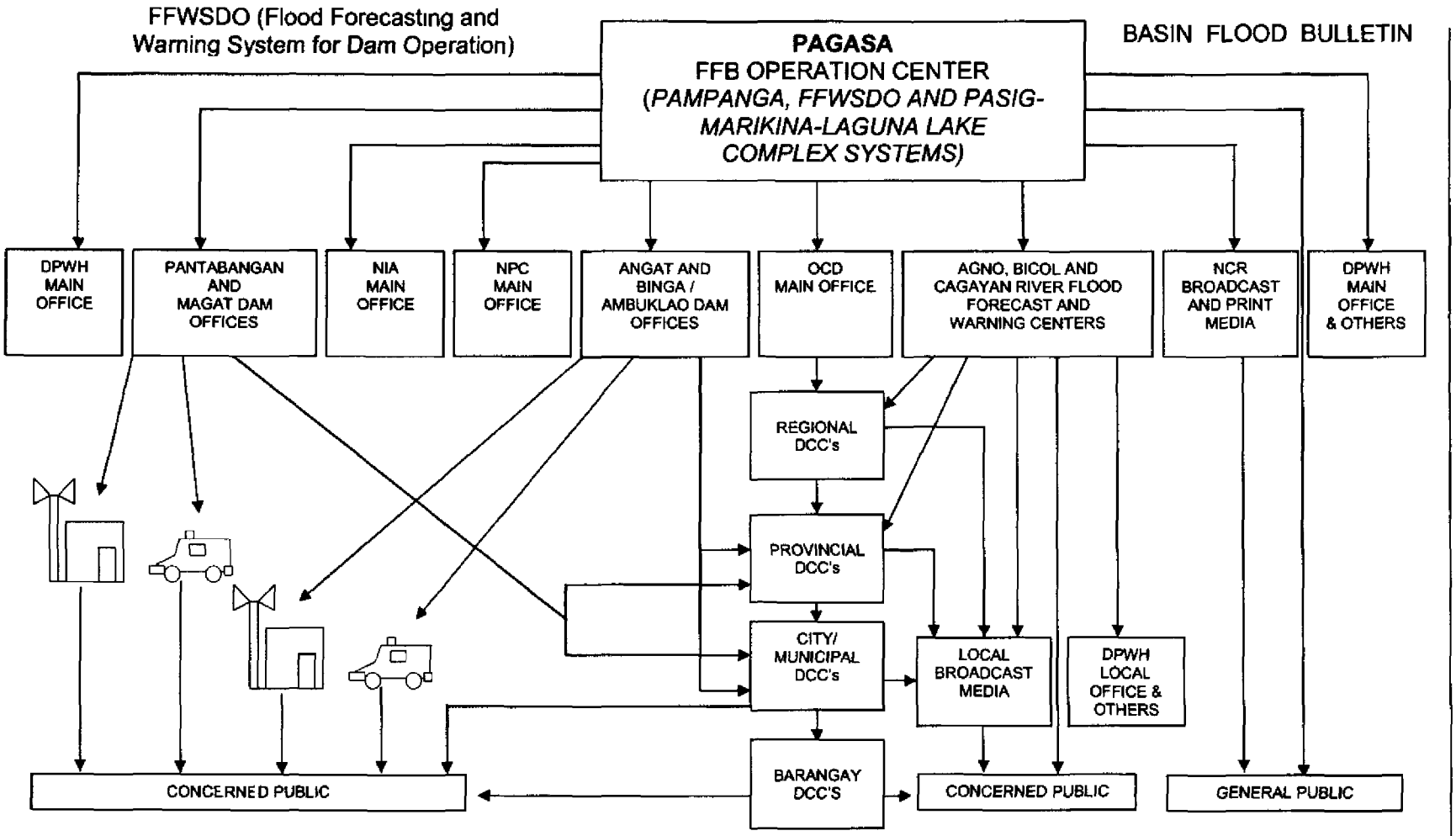


Figure 6.5 FFWSDO and basin flood bulletins dissemination scheme in the Philippines

6.6 Community Response

Two communities in the island of Luzon (Figure 6.6) are featured below to show hazard warning dissemination at the local level and the communities' responses to the warning.

6.6.1 Sitio Kinalumbacan, Barangay Capalong, Real, Quezon Province

Sitio Kinalumbacan faces the Pacific Ocean and hence is vulnerable to strong winds brought by typhoons. Every year, the area is affected by wind-driven surges from the sea. Most of the time, the houses are flooded whenever a typhoon batters the area. Because of its location, Real is affected by the northeast monsoon that occurs from October to January. A typhoon that occurs during the northeast monsoon season is more devastating than that occurring out of season. While a modern bungalow (Figure 6.7a) can be occasionally observed in Real, a typical barangay house is often made from weaker materials (Figure 6.7b).

Figure 6.6 Location of communities visited in the Philippines: (a) Sitio Kinalumbacan, Quezon Province (b) San Manuel, Pangasinan Province

Warning and dissemination

Typhoon warnings come from three sources:

- PAGASA weather station at Infanta, the town next to Real
- Radio broadcast
- Disaster Coordinating Council

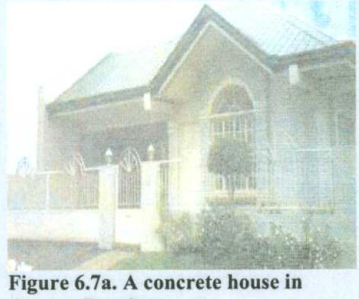


Figure 6.7a. A concrete house in Quezon Province

In addition to the warning received from any or all of the above sources, the community uses indigenous knowledge to determine whether the place will be hit directly by a typhoon or by the monsoon. The community knows how to associate the type of wind with a typhoon and the monsoon. It uses indigenous indicators that include leaves falling off trees and sea wave height, to indicate whether the typhoon is approaching or not.

Figure 6.7b. A hut in Quezon Province

When a typhoon is anticipated to affect the area and warning is received, the municipal Mayor personally goes around the community to make announcements and advise the people to evacuate. Assisted by the municipal police, the mayor boards a truck and broadcasts the warning using a megaphone.

Community preparedness response

There are no community meetings or discussions that present the meaning of typhoon signals. Neither are the community members informed of appropriate actions that need to be taken when the typhoon strikes. Instead, the communities' actions are dictated by their indigenous knowledge and practices that have been passed on from generations.

The community preparedness action in the wake of a typhoon striking the community include:

- Preparing sufficient food stock to transport to evacuation centers.
- Strengthening or buttressing the weak portion of the house to prevent its collapse from the typhoon
- Ensuring refuge in safer places like municipal halls or schools. The trucks that are used to broadcast warnings also transfer people to the designated evacuation centers.

Some preparedness actions are associated with superstitious beliefs, such as tying sharp objects on the roof of the house to break the wind or weaken the typhoon. It is believed that the sharp object induces lightning and the ensuing thunder. It is thought that when this happens, the typhoon weakens and the rain stops.

6.6.2 San Manuel Town, Pangasinan Province

San Manuel (Figure 6.6b), which is located downstream of the biggest clay core dam in Asia, San Roque Dam, Pangasinan, Central Philippines, experiences annual flooding from the release of water in Binga Dam, located upstream of the Agno River. The provincial and the municipal disaster coordinating councils have worked jointly to produce flood vulnerability maps of the municipalities downstream of the river. These maps are used for response purposes and to prepare disaster preparedness plans.

A warning system has been set up for the province of Pangasinan, allowing the local disaster coordinating councils to inform the people and authorities of the release of water and the expected rise of river water. Evacuation centers have also been identified and people have been informed of the nearest evacuation centers. Community members are prepared to handle annual flooding from their past experiences. They have boats tied to their houses, ready for navigation through floodwaters.