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The Philippines' Typhoon Alley: The Historic *Bagyos* of the Philippines and Their Impact

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Abstrak

Setiap tahun Filipina dilanda hampir selusin badai tropis. Badai yang dibarengi turunnya hujan lebat ini menyebabkan kerusakan berat dan merenggut kehidupan warga Filipina. Selama kurun satu tahun, badai tropis ini mengalami proses beberapa tahap di atas permukaan laut sebelum melintasi daratan. Beberapa wilayah di Filipina rentan terhadap badai topis dan taifun ini. Sementara wilayah lain tidak begitu parah terkena dampak dan potensi kerusakannya. Terkait perubahan iklim, badai yang sangat kuat dalam bentuk super taifun menjadi sedikit lumrah. Tulisan ini bertutur tentang bagaimana pembentukan badai tropis yang berlangsung setiap tahunnya di wilayah Pasifik Barat dan dampaknya bagi kehidupan warga. Tulisan ini juga mengaitkan data historis tentang badai ini di Filipina, termasuk badai super Yolanda yang dideskripsikan sebagai badai terkuat pernah melintas di permukaan bumi.

Kata kunci: Badai tropis, taifun, rehabilitasi, rekonstruksi.

Introduction: Nomenclature of Tropical Cyclones

One of the characteristics of the Philippine environment is the frequent occurrence of tropical cyclones. The archipelago is visited by an average of 22 cyclones in a year. For many Filipinos the occurrence of storms especially after a long drought brings relief to farmers. The accompanying rains bring life to parched surroundings. To farmers especially those cultivating rain-fed fields' storms are beneficial. Aside from sustaining life, tropical cyclones are bringers of death. Excessive rains cause rivers to overflow and wash away homes, crops and livestock. Every year, hundreds of Filipinos die as a result of floods and landslides. Since the occurrence of tropical cyclones is a constant feature of the Philippines, people can only adjust to its power.

Tropical cyclones are areas of low barometric pressure which cause a movement of air and accompanied by large amounts of moisture which come from the surrounding bodies of water. The movement of the air is swirls in a counter clockwise direction as cyclones formed in the northern hemisphere spin in this direction while those that form in the southern hemisphere spin in the clockwise direction. The differences in the spinning direction are attributed to the earth's magnetic field.

Tropical cyclones in the Philippines are called *bagyos* or *baguios*.[1] Foreign terms for these tropical disturbances are *tifones, temporales, tormentas and tempestos* in Spanish. The English terms include typhoons and storms. Sometimes the West Indian uses the term "huracanes" or hurricanes. Spanish documents also use the Tagalog term *baguio*, making it part of the Spanish vocabulary *(PNA, Calamidades* Publicas, 1845-1898, Bundle 2, SDS 15087).

There are technical terms for the tropical cyclones. The beginnings of a cyclone are a low pressure area (LPA). Based on the standards of the Philippine Atmospheric, Geophysical and Astronomical Service Administration (PAGASA) when a low pressure area develops swirling winds that reach 35 to 55 kilometers per hour, it becomes a tropical depression. As the tropical depression gains strength with speeds reaching 60 kilometers per hour, it is now classified as a tropical storm. The disturbance officially becomes a typhoon when the wind speed reaches 120 kilometers an hour.

The word "typhoon" or "*tifon*" in Spanish originates from the Chinese *dai feng* or the Japanese *tai fu* which both means "great wind." The word typhoon is the term given to this strong disturbance in the North Pacific area west of the International Date Line. In the Carribean and North Atlantic area these disturbances are called hurricanes- from the word "*huracan*" which was the god of the rain, storm and fire of the ancient Mayas. The term cyclones apply to the disturbances in the South Pacific, Indian Ocean and the Atlantic area. A super typhoon is the highest and most powerful level of tropical cyclones in the Philippines. According to the U.S. Joint Typhoon Warning Center, the typhoon is a cyclone whose surface wind speed reaches at least 240 kilometers an hour.[2]

The Creation and Behavior of Tropical Cyclones in the Philippines

Tropical cyclones usually develop over warm water and near the equator. These tropical disturbances feed from the water vapor which is abundant in the oceans and seas. When the sun warms up the earth's surface water evaporates into the atmosphere and condenses into water droplets. A great amount

1 This is different from Baguio from which the city of Baguio in Northern Luzon was named. The city was named from bagiw which was a term for a local moss in the area.

2 The US Joint Typhoon Warning Center uses the Saffir-Simpson wind scale to classify hurricanes and typhoons. It classifies storms into five categories. A Category 1 storm must have sustained winds of 74 to 95 miles per hour (119-153 kilometers per hour); a category 2 has winds between 96 to 110 miles per hour (119-153 kilometers per hour); a category 3 has winds from 111 to 129 miles per hour (178 to 208 kilometers per hour); category 4 has sustained winds of 130 to 156 kilometers per hour (209 to 251 kilometers per hour. The most severe category, the category 5 has winds in excess of 157 miles per hour (252 kilometers per hour) A tropical storm, according to the Saffir-Simpson Scale has sustained winds of 39 to 78 miles per hour (63 to 118 kilometers per hour) while a tropical depression has winds of less than 38 miles per hour (62 kilometers per hour) . See Williams, Jack (May 17, 2005). "Hurricane scale invented to communicate storm danger". USA Today. Retrieved 2007-02-25.

of heat energy which is locked up in the water vapor is released through condensation. Usually the ocean temperature of 26.5 centigrade (79.7 degrees Fahrenheit) or more is necessary for the formation of a tropical disturbance. The warm waters are needed to maintain a warm core that supplies the energy for the cyclone. Tropical cyclones also form within 500 kilometers (300 miles) of the earth's equator but with the rise of ocean temperatures because of El Niño phenomenon, tropical storms may now form at higher latitudes.

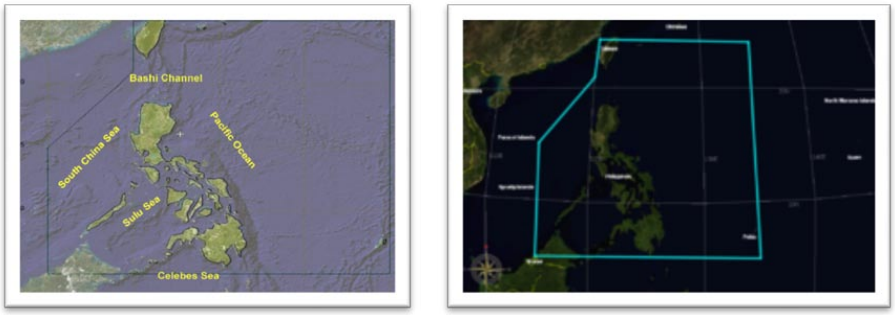
The process of forming and sustaining a tropical cyclone requires a great amount of energy. According to Pagasa, an average-sized typhoon will get an energy supply in one day all the energy released by 40,000 hydrogen bombs. The typhoon will dissipate once the supply of water vapor is cut off. This happens when a typhoon from the ocean passes over land. But while it is still over water the typhoon would be at its strongest. When it moves over mountains the effect of the topography retards the air strength. The relationship of tropical cyclones and large bodies of water shows that cyclones like typhoons are closely related to the oceans.

Along with the heating of the bodies of water within the Western Pacific the increase in water vapor results in the instability of the lower atmosphere. The interaction between the air and the ocean happens at the surface of the seas. This interface however is not a rigid boundary between the fluid and gaseous envelopes of the earth. Rather it is a transfer station of matter and energy when the heat helps turn the water into water vapor.

Another factor which gives rise to the formation of tropical cyclones is the high humidity which is provided by the warm ocean waters. While these conditions are necessary for cyclone formation, they do not necessarily mean that such a weather disturbance will form. What could just form maybe just a mass of clouds or a front zone where winds from the north and south may converge. However when a sufficient vortex is formed, a tropical disturbance may develop. It becomes organized with the formation of an "eye" which is actually a region of calmness inside a storm. The winds of a cyclone are the strongest near the eye or vortex.

Filipino meteorologists study cyclones in an area called the Philippine Area of Responsibility (PAR). The area is actually bigger than the territory of the Philippines and it is bounded by the following coordinates: 25°N - 120°E, 25°N - 135°E, 5°N - 135°E, 5°N - 115°E, 15°N - 115°E and 21°N - 120°E.

Picture 1. The Philippine Area of Responsibility (PAR)



Source: Philippine Atmospheric, Geophysical and Astronomical Services Administration hereinafter referred to as PAGASA.

Tropical cyclones in the Western Pacific Ocean follow three common tracks: The first is a straight track which is a general westward path that affects the Philippines, Taiwan and Vietnam. The second track is the parabolic track in which the tropical disturbance recurves to the north, affecting eastern Philippines, eastern China, Taiwan, Korea and Japan. The last common track is when the tropical cyclone follows a northward track. The storm moves in a northerly direction and affects only small islands. A few storms originate in the South China Sea and the Western Pacific and move eastward.

Most tropical cyclones make landfall or passed near extreme Northern Luzon during the June –October period. Cyclones especially typhoons would make landfall at Central and Northern Luzon during July and August. The Visayas and Southern Luzon would be passed by the cyclone around September to October. Some storms would make landfall in eastern Mindanao. Often this happens at the latter part of the year during November and December. The occurrence of tropical cyclones in southern Mindanao and Sulu is considered rare.

On an annual time scale the month with the least tropical disturbance reaching the Philippines would be in the month of May. This steadily increases through June and July and the month of August having the most typhoons in a year. The activity falls off significantly in October. The most active typhoon season was in 1993 when the Philippine Area of Responsibility was visited by a record 36 tropical cyclones.

Nearly a third of the world's tropical cyclones form in the Western Pacific, making the region one of the most active on earth. Tropical cyclones were formed all year round. Historically, the year 1964 was the most active year in the formation of tropical cyclones in the Pacific. During that year, 39

cyclones of tropical storm strength were formed. In 2010, only 14 cyclones of tropical strength were formed in the Pacific of which seven became typhoons. The year 1993 was the highest year for cyclone strikes for the Philippines with nineteen tropical cyclones passing through the islands. In contrast, in 1958 there was only one tropical storm visited the archipelago (Rodgers, Adler and Pierce, 2000).

Tropical disturbances in the Pacific form all year in the northwestern Pacific Ocean. This corresponds to the area just northeast of the Philippines. The month with the least number of cyclones formed is in February. This number then steadily increases through June and spiking through July to October and September, becoming the most active month for the cyclone formation. The activity falls off in November. The most affected areas were northern and Central Luzon and Eastern Visayas. Here, at least 30% of the annual rainfall comes from tropical cyclones while in the southern islands less than 10% receive their annual rainfall from tropical cyclones.

Tropical cyclones become stronger when they are fed with moisture from the seasonal winds called monsoons. The country experiences two monsoon seasons: the northeast monsoon locally called the *amihan*. It usually occurs from October to February, originates from the Northeast Asia. The other monsoon is the southwest monsoon, known locally as the *habagat* and it blows from the late of May to October. This monsoon brings moisture coming from the Indian Ocean and the southern West Philippine Sea. As a tropical cyclone approaches the Philippines it sucks in the monsoon and its accompanying moisture releasing great volumes of rain. The tropical cyclone weakens when it encounters a mountain range but it may recover once it reaches water.

Naming of Storms

The naming of tropical storms was adopted in the 20th century. Female names were used in the 1950s. The Philippines has its own naming system which was adopted in 1963. Local female names were given once the storm with an international name has entered the Philippine Area of Responsibility. The naming was assigned in alphabetical order. In January 2000, the World Meteorological Organization began assigning names to storms from a list given by 14 Asian countries with each country getting two three a year. Unlike the American, Philippine systems storm names were not people's names but names of things, like flowers, goods and animals. These names were not given in alphabetical order by the country that nominated that name. Since January 2000, forecasters at PAGASA continued the tradition of giving local names to tropical cyclones once these enters the PAR. Presently the PAGASA provides the local name and the international name. For example super typhoon *Haiyan* was given the local name Yolanda. In Chinese, Haiyan means "petrel".

Names of cyclones can be reused or renamed several times but some names were replaced or cannot be used again because of the scale of destruction they created. Among them were *Dading* (Winnie, 1964), *Pitang* (Georgia, 1970), *Titang* (Kate, 1970), *Yoling* (Patsy, 1970), *Sening* (Joan, 1970), *Wening* (Elaine, 1974), *Didang* (Olga, 1976), *Atang* (Olive, 1978), *Undang* (Agnes, 1984), *Herming* (Betty, 1987), *Sisang* (Nina, 1987), *Unsang* (Ruby, 1988), *Uring*, (Thelma, 1991), *Rosing* (Angela, 1995), *Loleng* (Babs, 1998), *Unding* (Muifa, 2004), *Violeta* (Merbok, 2004), Winnie (2004), *Milenyo* (Xangsane, 2006), *Reming* (Durian, 2006), *Cosme* (Halong, 2008), *Frank* (Fengshen, 2008), *Ondoy* (Ketsana, 2009), Pepeng (Parma, 2009), *Bebeng* (Aere, 2011), *Mina* (Nanmandol, 2011), Sendong (Washi, 2011), *Pablo* (Bopha, 2012), *Santi* (Utor, 2013) and *Yolanda* (Haiyan, 2013) (Pagasa.gov.ph).

Intensity

The Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) have its own classification for tropical cyclones. The lowest category is that of a tropical depression which a weak low pressure disturbance is with a definite surface circulation having maximum wind speed of up to 63 kilometers per hour (kph) or approximately less than 25 miles per hour (mph). It has one or more closed isobars and it is most common in the equatorial regions or inter tropical convergence zones and less frequent in the trades. A tropical storm is a moderate tropical cyclone with a maximum wind speed of 64 to 118 per hour (25 to 75 mph) and with closed isobars while a typhoon is an intense tropical cyclone with a maximum wind speed exceeding 118 kilometers per hour.

Other countries have different standards for tropical cyclones. The Japan Meteorological Agency (JMA) defines a tropical depression as a tropical system that has wind speeds not exceeding 33 knots (38 mph or 61 kph); a tropical storm has a sustained wind speed that exceeds 34 knots (39 mph/63 kph). When the tropical cyclone exceeds winds of 64 knots (74 mph/119 kph) it is now a considered a typhoon which is the highest on its scale. The Hong Kong Observatory has three classifications for typhoons: a typhoon has wind speeds of 64 to 79 knots (73-119 mph/118-149 kph); a severe typhoon has wind speeds of at least 80 knots (92 mph/150 kph) while the highest form of typhoon is the super typhoon which has a wind speed of at least 100 knots (120 mph/190 kph). The United States Joint Typhoon Warning Center (JTWC) unofficially classifies typhoons with wind speeds of at least 130 knots (150 mph/241 kph) which is the equivalent of strong category 4 storms in the Saffir-Simpson Scale as super typhoons.

Tropical cyclones have a life cycle that has four stages. First of this stage is the formative stage in which the tropical cyclone form in waves and in

shear lines of pre-existing disturbances and winds usually below the typhoon force. The second stage is the immature stage in which there a deepening stage of the cyclone until the lowest central pressure and maximum wind intensity is reached. This intensification usually does not always take place since some tropical cyclones are known to die down even if it has not reached winds of typhoon force. The third stage is the mature stage in which the area of circulation expands while the surface pressure no longer falls and there is no increase in the maximum wind speed which may last for a week. The final stage is the decaying stage in which the cyclone dissipates. The dissipation happens when the cyclone encounters friction with land masses and lack of moisture as it moves over continents or when it meets colder and drier air when they go towards the North Pole.

The Effects of Tropical Cyclones Winds

The primary effect of a tropical cyclone is the strong wind. Tropical cyclones are at their strongest near the center or the "eye." The formation of the "eye" is actually the vortex of the cyclone and a formation of a well-developed "eye" shows the maturity of the storm. The intensity of the cyclone is measured by the speed of the wind as it approaches an area. PAGASA releases cyclone warnings in the form of Public Storm Warning Signals (PSWS). If an area goes under Public Storm Signal (PSWS) No. 1, a tropical cyclone will affect the locality and winds of 30 to 60 kph or intermittent rains may be expected 36 hours. When a tropical cyclone develops very close to the locality a shorter lead time of the occurrence will be specified in the warning bulletin.

Under PSWS No. 1 twigs and branches of small trees may be broken and some banana plants may be tilted or downed. Some houses made of very light material like nipa and cogon maybe partially unroofed.[3] Light damage is expected by exposed communities. Rice crops however may suffer significant damage when the plants are at their flowering stage. When their locality goes under PSWS No. 1, the signal may be upgraded if the cyclone is getting stronger or moving closer. The waves on coastal waters may gradually develop and become bigger and higher. Fishermen and sailors are advised against going out to sea especially if their sea craft is small. People are advised to listen to the latest severe weather bulletins every six hours. Businesses however may be carried out unless floods occur. Disaster preparedness is activated to alert status.

3 Nipa refers to palm leaves obtained from swamp palms which are commonly used for roofings as well as walls in homes in Philippine rural villages. Cogon on the other hand, is a type of grass that is used for roofing material.

Picture 2. Depiction of a place under Public Storm Signal No. 1

Source: pagasa.dost.gov.ph

In PSWS No. 2, winds of up to 60 kilometers per hour are expected within the next 24 hours. Like in PSWS No. 1, the tropical cyclone will affect the locality and winds greater than 60 up to 100 kph will be expected in at least 24 hours. Under PSWS No. 1, coconut trees may be tilted and others may be broken. Banana plants may be downed.[4] Rice and corn plants will be adversely affected and large number of houses with nipa and cogon roofs may be partially or totally unroofed. Some old galvanized iron roofings may be peeled off. In general, there will be light and moderate damage to exposed communities.

When an area comes under PSWS No. 2, sea and coastal waters will be dangerous to small sea craft. Special attention should be given to the latest position, the direction, movement and intensity of the cyclone as it moves towards the locality. The general public is advised against travelling by sea and is cautioned to avoid unnecessary risks. Properties must be secured before the signal is upgraded and disaster preparedness agencies are now in action to alert their communities.

4 There are references to Philippine agricultural products such as rice, corn and coconuts since the rural countryside produces these goods.

Picture 3. Depiction of a place under Public Storm Signal No. 1

Source: pagasa.dost.gov.ph

In an area placed under PSWS No. 3, winds of 100 kilometers per hour are expected in the next 18 hours. Many coconut trees may be broken or destroyed and almost all banana plants may be downed and a number of trees may be uprooted. Rice and corn crops may suffer heavy losses. Majority of houses built of light materials like cogon and nipa may be unroofed or destroyed. There may be considerable damage to structures of light and medium construction. There may be widespread disruption of electrical power and communication services. In general, moderate to heavy damage is expected especially in the agricultural and industrial sectors.

The tropical disturbance of PSWS No. 3 strength is dangerous to the affected and threatened communities. The sea and coastal waters will be very dangerous to all kinds of sea crafts. Travel will be very risky by air or by sea and people are advised to seek shelter in strong buildings, evacuate low-lying areas and stay away from the coasts as the seas may swell. They are similarly advised to stay away from river banks as the rivers may overflow because of heavy rains.

When the eye of the tropical disturbance passes over the locality there will be a sudden occurrence of fair weather immediately after the very bad weather with intense winds coming generally from the north. People are advised not to venture away from the safe shelter because after one to two hours, the worst weather will resume with very strong winds coming this

time from the south. Classes in all levels should be suspended and children should stay within the safety of strong buildings. The disaster preparedness and response agencies and organizations are in action with appropriate response to the actual emergency.

Picture 4. An artist's depiction of an area under PSWS No. 3

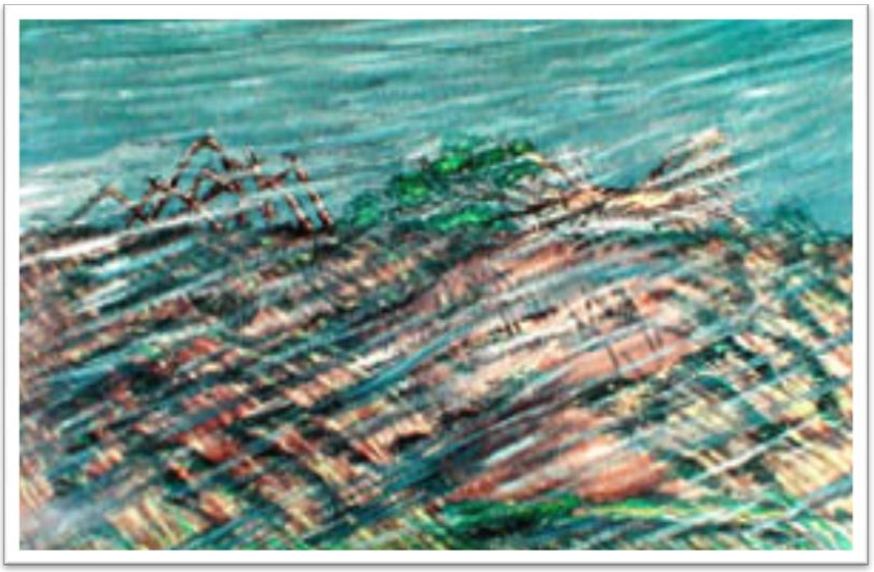
Source: pagasa.dost.gov.ph

Under the highest alert signal, PSWS No. 4, winds in excess of 185 kilometers per hour are expected within the next 12 hours. Here the very intense typhoon will affect the locality and very strong winds of more than 185 kph may be expected in at least 12 hours. The effect of an area under PSWS No. 4 is that coconut plantations may suffer from extensive damage. Many large trees may be uprooted. Rice and corn plantations may suffer severe losses. Most residential and institutional buildings of mixed construction may be severely damaged. Electrical power distribution and communication facilities may be severely disrupted. In the overall the damage to affected communities can be very heavy.

For people coming under PSWS No.4 the situation is potentially destructive to the community and all travel and outdoor activities should be cancelled. Evacuation to safer shelters should have been completed at this time but it will be too late under this situation. Areas coming under PSWS No. 4 are likely to be hit directly by the eye of the typhoon. As the eye of the typhoon approaches, the weather will continuously worsen with the winds increasing to their strongest coming from the north. Then there will

be a sudden improvement of the weather with light winds which is actually a lull. This means the eye of the typhoon is over the locality. The improved weather may last for one to two hours depending on the diameter of the eye and the ground speed of the typhoon. As the eye moves out of the locality the worst weather experienced before the lull resumes. This time the very strong winds will come generally from the south. The disaster coordinating councils and other disaster response organizations are now fully responding to emergencies and in full readiness to respond to the possible calamity.

Picture 5. An artist's depiction of an area under PSWS No. 4



Source: pagasa.dost.gov.ph

As the cyclone approaches an area and gains strength, the storm signals are upgraded. On the other hand, when a cyclone leaves an area or weakens, storm signals are lowered. As for suspension of classes, classes in the preschool level are cancelled whenever there is a PSWS No. 1; Elementary and High School classes are suspended whenever PSWS No. 2 is raised; all classes for colleges and universities are suspended whenever PSWS No. 3 and 4 are raised.

Rains, Floods, and Storm Surges

Along with winds, heavy rainfall is expected with the approach of a cyclone. Since cyclones develop over bodies of water, a strong typhoon will dump

several inches of rainwater. The wettest tropical cyclone was recorded in Baguio City during July 14-18, 1911. The cyclone dumped 2,210 millimeters or 87 inches of rain during a 15 hour period. The source of the moisture was not just the cyclone itself but the accompanying monsoon.

Tropical cyclones account for 30% of the rainfall in the Philippines. The rest is attributed to the monsoons. A tropical cyclone did not need to be especially powerful to cause massive destruction. A well-placed cyclone can draw in moisture from the monsoon that will cause massive flooding. One example was tropical cyclone *Ibiang* (Winnie). *Ibiang* was just a tropical depression with a wind speed of 55 kph on August 18, 1997, but sucked in the southwest monsoon causing massive flooding in Central and Northern Luzon. A total of 810,105 people were affected by the typhoon and 53,654 persons had to be evacuated to higher grounds. Preliminary damage was reported at 60 million pesos. Aside from damage due to floods, heavy rains may cause landslides in mountainous areas, blocking roads and burying entire villages. One such incident was the landslides in Compostela Valley in 2011 from tropical storm Sendong. The denudation of the surrounding forests and gold mining activities increased the risk of landslides as the roots of the trees which hold down the soil are uprooted.

A tropical cyclone does not need to make a landfall to cause heavy rains and massive flooding. Typhoon *Heling* (Abe) caused heavy rains in the Philippines and Taiwan on August 1990 without making landfall before hitting China on September 2. During the same year, Typhoon *Loleng* (Dot) caused floods in northern Luzon and killing four people without making landfall in the Philippines during September 3 to 11, 1990. Heavy rains cause flashfloods in low-lying areas. Small rivers and streams become raging torrents. Numerous deaths caused by drowning and landslides were caused by oversaturated mountainsides. Billions of pesos were lost in typhoon and monsoon-caused floods. In the onslaught of *Ondoy*/Ketsana, the storm which induced the southwest monsoon dumped more than 180 millimeters of rain in a 9 to 12 hour period. This would be more than a month's worth of rain that was dumped in a single day. Around 200 people were reported killed as a result of massive flooding.

The rate of absorption of the soil was only 40 to 60 millimeters in six hours before flooding can occur. The excess of this amount will result in flooding. During the onslaught of *Ondoy* floods were reported in Camarines Norte, Metro Manila, Bulacan, Batangas, Laguna, and Rizal reported widespread and very heavy flooding with moderate to low flooding occurring in the provinces of Zambales, Pampanga, Bataan, Cavite and Quezon. Ondoy's rainfall turned out to be of a flash flood type and was very unanticipated and unprepared for, which led to many deaths and extensive destruction of property.

One of the worst storms that caused massive destruction was Typhoon *Diding* (Yunya) during June 11-17, 1991. The typhoon made landfall at Dingalan Bay in Aurora Province as a category 1 storm with maximum winds of 120 kilometers per hour. It exited as a weak tropical storm a day later. The storm washed down volcanic ash ejected by Mount Pinatubo which had just erupted downing power lines, burying hundreds of houses to their second floor level. Since the volcano had just erupted, it literally rained mud on June 11 and 12, 1991. Oversaturation of the ground with water will cause landslides in elevated areas. Mountainous areas especially the Cordillera region, Eastern Mindanao, Compostela Valley and Mindoro will be vulnerable in a typhoon that draws in excessive moisture.

During the onslaught of Typhoon *Pedro* (Nesat) on September 27, 2011, the typhoon had a sustained wind-speed of 105 kph but it attracted the southwest monsoon. Within a few hours caused waist-deep waters in downtown Manila. The floods were not just caused by the heavy rain but by a storm surge as waters of Manila Bay were blown inland, damaging and flooding most buildings facing the bay. Anecdotal accounts about floods show the very rapid rate of flooding caused by the rain and the storm surge:

> "*The residents of Manila had no other choice but to wade through waist-deep floodwaters, dodging branches and flying debris as the typhoon sent surging waves as tall as palm trees over seawalls completely submerging neighborhoods. By the evening of September 27, at least 7 people were reported to be killed and most of them in metropolitan Manila, a place already battered by heavy monsoonal rains. A motorcyclist in the city reported that "It's flooded everywhere. We don't have a place to go for shelter. Even my motorcycle got filled with water". He was one of the thousands stranded by fast-rising flood in the city. Hospital generators were flooded and the building had no power once the typhoon arrived. Soldiers and police in trucks moved thousands of residents, most importantly the women and the children away from the Baseco shanty town after many houses were washed away in the surge and floodwaters brought by Nesat. The storm surge destroyed the seawall of Roxas Boulevard and caused flooding inside the hotels facing Manila Bay*. (Hjranski, Hrvoje, "*Typhoon Nesat Swamps Cities, 7 Die*," (Hearst Communications, 27 September 2011)

Since cyclones are areas of low pressure, such low pressure causes bodies of water to rise. With the accompanying winds, a wave or surge is created. Several surges are created as the waves pile up over one another. In Tacloban a surge as high as 30 feet was reported during the onslaught of super typhoon Yolanda in November 6, 2014 that the residents had to climb trees and move to the upper floors of their homes to avoid the incoming water from the sea. Most of the casualties caused by the super typhoon were caused in Tacloban

City. The surge was so sudden that the residents believed that a tsunami had hit the city.

Storms Mentioned in Philippine History

A Spanish Jesuit priest Manuel Selga, S.J. compiled a history of storms and typhoons in the Philippines. Selga was the last Spanish Director of the Manila Observatory who served between 1926 to 1946. His work Catalogue of Typhoons (published 1935) used terms such as storms, depression and typhoons. He compiled information from old historical accounts among were 533 disturbances classified as typhoons. (Schumacher, p. 112)

An addenda to the work is a Chart of Remarkable Typhoons in the Philippines 1902-1934) which is an abridged enumeration of typhoons and storms as described by old chroniclers or described by contemporary documents. The earliest description of a typhoon came from Ibn Batuta. The catalogue was structured monthly providing every month a list of typhoons. He quoted a part of Natural History of the Visayas, written by Fr. Ignacio Alcina who was assigned in the Visayas. Describing what a typhoon was in the 17th century he wrote:

> *"The Indians of this area call baguio to this type of hurricane, which in other part and in the East Indies are called typhoons. And all this means a very strong tempest. There used to be in these islands so numerous and so strong that neither Virgil in his Eneid (sic), nor Ovidius in his Ponto, nor any other poet that I have read reaches by one thousand miles to describe their rigors or their strength. We see them very often and we suffer so much, that even after experiencing them it seems impossible to believe. To say it briefly, when one of those baguíos runs (usually one of two every year), neither the trees are safe in the center of the mountains, nor the animals in the caves, nor the men in their houses, nor the beasts i*n *their middens, nor even the worms in their dens...'.* (AMN Ms. 478)

Describing a typhoon which hit Luzon on November 1-3, 1893, Selga wrote:

> "*A typhoon appeared to the SE of Manila and partially filled up, entering the Archipelago, continuing westward as a depression'.* On the other hand there are very vivid and detailed reports, such as that from November 1, 1742*: 'in a manuscript dated 1743 and written in Manila, we read the following account: "On All Saints' Day of the last year, 1742, we experienced such a storm, as never before had been seen in Manila. It caused the greatest destruction to the churches and houses of the Society of Jesus. In our church, some arches were damaged. The big window of the choir with its frame was forced in; the rain rushed in and the church was so full of water that mass could not be said on some of the altars the next day. The corridors of many houses were destroyed, and in a word, there is scarcely a roof in Manila that is not damaged'.*

The analysis of these reports shows the intensity of the tropical cyclone. The reports in the second half of the 19th century have become very detailed and sometimes accompanied by instrumental data. The main reason for this was the establishment of the Manila Observatory in 1865. The observatory was founded by Fr. Frederico Faura who was an innovative meteorologist who used instruments to predict the weather. Under his supervision a Secchi Meteograph was installed. The predictions by Fr. Faura were very accurate in predicting typhoons sealing the reputation of the Observatory. The need to establish a weather observatory has practical applications not just for knowing science. The occurrence of tropical cyclones presents a risk to life and property. Prediction of behavior of these weather disturbances would mean between the difference between life and death.

The role of the observatory became very significant that the Spanish government designated as the official institution for the observation of weather in the Philippines. Secondary stations were established in various parts of Luzon. Fr. Faura also designed an aneroid barometer. Another of his innovations a weather gauge became a household article. Eventually the Observatory branched out to seismology and astronomy. Before his death a 19-inch refracting microscope telescope was installed.

The Observatory also had a publication entitled *Boletin del Observatorio de Manila* which was in demand in Asia in the late 19th century. The Observatory exchanged information with the other observatories run by Jesuits in Hong Kong, Shanghai and Japan which gave a more complete picture about the tropical disturbance. In one account about a typhoon which originated in the Philippines:

> *'A typhoon appeared in the China Sea NW of Luzon, moved to WNW and entered the continent NE of Hong Kong'. Similarly, for September, 9-16, 1891, it is quoted as: 'Appearing NE of Luzon, the typhoon, moving in a WNW direction, approached S Formosa and recurved to the NE; then it followed the coast of Japan bordering the Japan Sea and finally crossed Hokkaido to the ENE'* (East North East).

Selga also used secondary sources among which were the Piddington maps and the History of the Philippines by Rev. Father Pedro Murillo. The Piddington maps are included in a classic book titled *The sailors handbook for the law of storms* and written by Henry Piddington (1876). Selga was the first person to use the term "cyclone" to refer to the tropical weather phenomenon we now call hurricanes or typhoons. He was the president of the Marine Courts at Calcutta in the mid-19th century. The *History of Philippines* (Murillo, 1749) was written by a Jesuits and provides a comprehensive Account of the Jesuits activities in the Archipelago during the period 1616-1716. Baldwin,

M.P., L.J. Gray, T.J. Dunkerton, K. Hamilton, P.H. Haynes, W.J. Randel, J.R. Holton, M.J. Alexander, I. Hirota, T. Horinouchi, D.B.A. Jones.

The Deadliest Storms in the Philippines

The deadliest tropical cyclone on record to hit the Philippines was believed during September 1881. Known as the Haiphong typhoon, the disturbance hit Central Luzon was estimated to have killed up to 20,000 people as it passed over the country September 27, 1881. On October 22, 1882, a typhoon hit the Manila area destroying hundreds of houses. A list from the Tribunal *de Naturales* showed that even sturdy houses made of stone with roofs made of galvanized iron were not safe and houses of light materials like those made from nipa and wood will certainly not survive from winds of more than 200 kilometers per hour (de Viana, pp. 225-229).

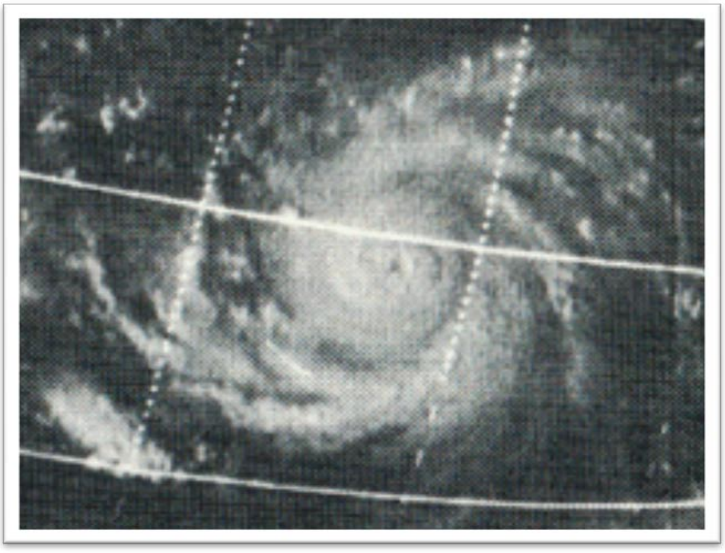
A report about the effect of the typhoon in Manila was replete with terms like *piedra rota la delantera* (stone removed, washed out), *hierro galvanizado remangzado* (galvanized roof torn off), *el balconage* roto (balcony destroyed), piedra destrosada (stone destroyed), *hierro galvanizada tombada* y destrosada (turned over and destroyed) etc. dominated the report. (Philippine National Archives, *Varias Provincias*, Binondo)

In analyzing the term such as *piedra rota*, the report explicitly said that even sturdy houses made of stone were destroyed. The material of the houses needs to be examined. The houses built of stone at that time were made of adobe or volcanic tuffa which is widely available in the Philippines. Adobe stone is just compacted volcanic ash. The houses at that time had no steel reinforcement.

In 1897 a powerful storm made landfall on the islands of Samar and Leyte with strong winds and a "deadly tidal wave." This "tidal wave" was unmistakably a storm surge caused by the storm blowing great volumes of water inland. The hurricane hit the capital Tacloban and left the town in less than half an hour a mass of ruins. Reports at the time estimated that the storm –"one of the worst disasters reported from the Southern Ocean in many years" –had killed more than 6,000 local residents and 400 Europeans. The report appeared in the issue of the *New York Times* on November 28, 1897. The hurricane actually hit the two islands more than a month earlier and the news did not reach the US press until that time. Only one building in Tacloban survived the storm. There was also uncertainty over the exact death toll. A former government official Raphael Lotilla cites a study of the 1897 typhoon carried out at the time by officials from the Observatory of Manila. The study estimates the number of dead to be roughly 1,300, far fewer than U.S. newspapers reported.

In 1912 powerful storm caused widespread devastation in the Central Visayan region. The landfall in the Central Visayas on November 29, 1912 directly hit Tacloban. The exact death toll from the typhoon was unclear. The *Washington Herald* reported that "probably half of the population of Tacloban and that of Capiz that more than 20,000 had died. But a report on the same day by the *New York Times* put the death toll far lower at slightly more than 300. This was similar to a report by a police official who said that the death toll in Typhoon *Yolanda* at 10,000 dead. As of December 13, 2013 the death toll from the typhoon according to the Christian Science Monitor was 6,009 with 1,779 still missing. The actual number of fatalities was placed at newspaper nevertheless acknowledged that the damage to the telegraph lines no estimate of possible number of fatalities or of the property losses can be made. Before typhoon *Yolanda*, one of the most remembered typhoon was Typhoon *Yoling* (International name Patsy)

Picture 6. Typhoon Patsy (*Yoling)*

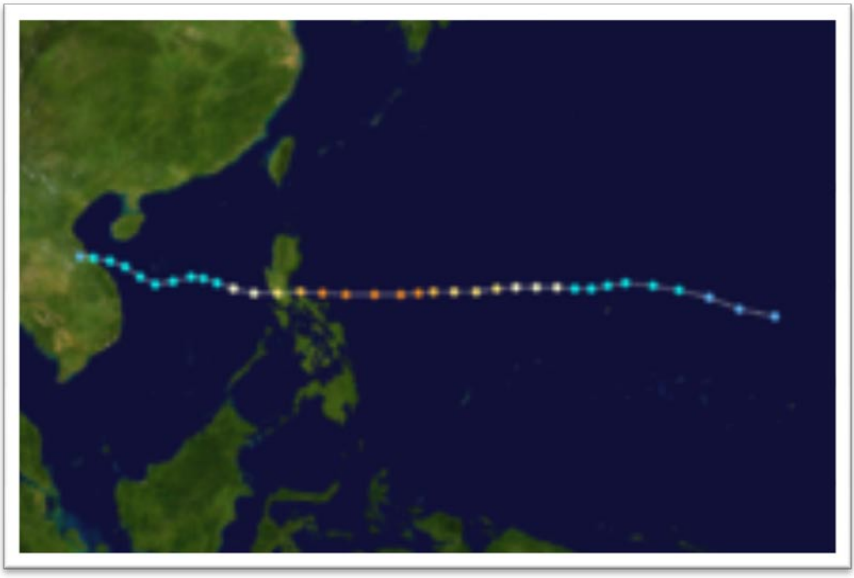


Source: US Navy photograph

Yoling began as s tropical disturbance south southeast of Wake Island on November 10, 1970. It weakened into a tropical depression designated as 27W (from its location at latitude 27, Western Pacific). The strong high pressure area forced it to move westward and upon reaching an area north of Saipan on November 24 it became a tropical storm and was given the international name Patsy. As it moved westward it grew in intensity and reached typhoon strength at 200 miles northwest of Guam on November 16, 1970. Its winds

peaked 250 kilometers per hour (155 mph). The typhoon slightly weakened to 210 kph with an atmospheric pressure of 918 millibar as the Philippine landmass blocked the air flow of the typhoon. At this strength, it was still destructive as it slammed into Casiguran, Aurora on November 19 and its eye passed over Manila. The typhoon continued to move westward into the South China Sea and struck Vietnam as a tropical storm with winds of 70 kph and dissipated on November 22.

Picture 7. Path of Typhoon *Yoling*



Source: Japan Meteorological Agency

Typhoon *Yoling* caused massive flooding in Luzon. The storm surge created by the typhoon caused the Laguna Lake to overflow and the flooding of Luzon's Central Plain caused the waters to join the waters of the lake. The official damage caused by the typhoon was US$80 million ($403 million in 2005). The official death toll was placed at 241. More deaths were reported in Vietnam but the official dead and missing may never be known because of the Vietnam War which was raging at the time. Yoling was said to be the deadliest cyclone to hit Manila since the establishment of the Philippine Observatory before Tropical Storm Ondoy (Ketsana) in 2009 and Typhoon Yolanda in 2013.

The following is a list of deadliest and costliest tropical storms to hit the Philippines

Name of Cyclone	Date of Impact	Areas Affected	Death Toll	Property Damage	Remarks
September 1881 typhoon	1881, September 27	Central Visayas	20,000	Unknown	Hurricane science.org.
October 1897 Typhoon	1897, October 7	Central Visayas	1,500	Unknown	Selga
Bopha/*Pablo* 2012	2012, December 2–9	Northern Mindanao, Southern Visayas	1,901	42.2 billion/1.04 billion	Ndrmcc.gov.ph
1867 Typhoon	1867, September 22	Luzon	1,800	Unknown	Boletin del Observatorio de Manila, January 1868
Ike/*Nitang* 1984	1984, September 3–6	Visayas, Northern Mindanao	1,492	4.1 billion	Pagasa.com
Fengshen/ *Frank* 2008	2008, June 20–23	Panay, Central Visayas	1,410	13.5 billion/301 million	Inquirer.net/typhoon frank
Durian/*Reming* 2006	2006, November 29-December 1		1,399	Metro Manila, Bicol Region	Associated Press, "Powerful Typhoon Durian lashes eastern Philippines" December 1, 2009
Winnie/*Ibiang*2004 Tropical depression	2004, November 27–30	Visayas/ Luzon	1,593	678.7million/14.6 million	Typhoon2000.ph/stormarchives.2004\retired
Parma/*Pepeng*	October 2 – 10, 2009	Northern Luzon		27.3 billion/608 million	GMA News, 100,000 recommended evacuated, October 2009
Nesat,/*Pedring*2011	September 26 – 28, 2011	Luzon	85	15 billion/333 million	Joint Typhoon Warning Advisory 301800 Xinhua News Agency, Typhoon Leaves 31 Dead, 28 September 2011

Ketsana /*Ondoy*	September 25 – 27, 2009	Luzon	484	11 billion/244 million	Flood blamed on record rainfall". Manila Bulletin. 2009-09-28. Retrieved 2009-12-09. Pagasa/Ndrmmcc
Mike/*Ruping*	November 10 – 14, 1990	Northern Mindana, Visayas, Palawan	748	10.8 billion/241 million	Reuters, "Typhoon leaves 235 Dead in Philippines, "New Straits Times, November 14, 1990.
Angela/*Rosing*	October 30 – November 4, 1995	Luzon, Metro Manila	936	10.8 billion/241 million	Pagasa.com.
Flo/*Kadiang*	October 2 – 6, 1993	Over water		8.75 billion/195 million	Meteogroup.typhoon2000.com
Megi/*Juan*	October 18 – 21, 2010	Luzon	26	8.32 billion/193 million	Pagasa/Ndrmcc.com
Haiyan/ *Yolanda*	2013, November 7–8	Central Visayas, Palawan	6,241	35.5 billion/809 million	Typhoon Haiyan RW updates, UN Office of Humanitarian Affairs , December 2013

Super Typhoon *Yolanda*

Yolanda/Haiyan began as a region of low pressure off Pohnpei in the Federated States of Micronesia on November 2, 2013 and became a storm the following day. The increase of intensity was caused by the warm waters of the area. It passed over Palau on November 6 and entered the Philippine Area of Responsibility on the same day. It made landfall on Guiuan, Eastern Samar on November 8. As it hit land Yolanda struck with maximum sustained winds of 314 kilometers per hour (195 mph). The winds were so strong that some residents thought that a tornado accompanied the typhoon. The storm easily tore out galvanized iron roofs and destroyed wooden structures. Ships at sea and those docked near the shore were also washed into the land.

As the super typhoon roared inland it created a storm surge up to 30 feet high that the residents thought that they were hit by a tsunami. Yolanda created five other landfalls in Tolosa, Leyte; at Daanbantayan, Cebu; Bantayan, Cebu; Concepcion, Iloilo and Busuanga, Palawan. In these areas it left a wide path of destruction. By November 9, the super typhoon left the Philippine Area of Responsibility. On November 11, President Benigno Aquino III declared a State of National Emergency.

Yolanda affected five political regions of the Philippines; Southern Luzon (Region IV-A [Mindoro, Marinduque, Romblon, Palawan provinces], Region IV-B [Cavite, Laguna, Batangas, Rizal, Quezon], Region V (Camarines Norte, Camarines Sur, Albay, Catanduanes, Sorsogon, Masbate], Region VI [Iloilo, Antique, Aklan, Capiz, Negros Occidental and Guimaras]; Region VII (Cebu, Bohol, Negros Oriental and Siquijor]; Region VIII [Eastern Samar, Northern Samar, Samar, Leyte, Southern Leyte and Biliran Province]; Region XI [Compostela Valley, Davao Oriental, Davao del Norte, Davao del Sur] and Region XIII (Caraga Region [Agusan Del Norte, Agusan del Sur, Surigao del Norte, Surigao del Sur, Dinagat Islands]).

Of these regions Region VIII especially the provinces of Eastern Samar, Leyte, Southern Leyte and Samar bore the brunt of the super typhoon. The northern parts of Palawan, Cebu, Iloilo and Aklan also bore severe damage. The city of Tacloban and the area facing the Pacific Ocean were swamped by the storm surge and a few structures were left standing. A total of 3,424,593 families or 16,078,181 persons were affected by the super typhoon; 6, 201 persons were confirmed killed, 28,626 were injured and 1,785 persons were still missing.

The calamity also displaced 890,895 families or 4,095,280 persons. It caused a humanitarian crisis with the destruction thousands of homes. People resorted to rampant looting of stores, groceries, hardware supply shops and damaged and undamaged structures. Security guards, police personnel and home and store owners were helpless in stemming the looters as they ransacked

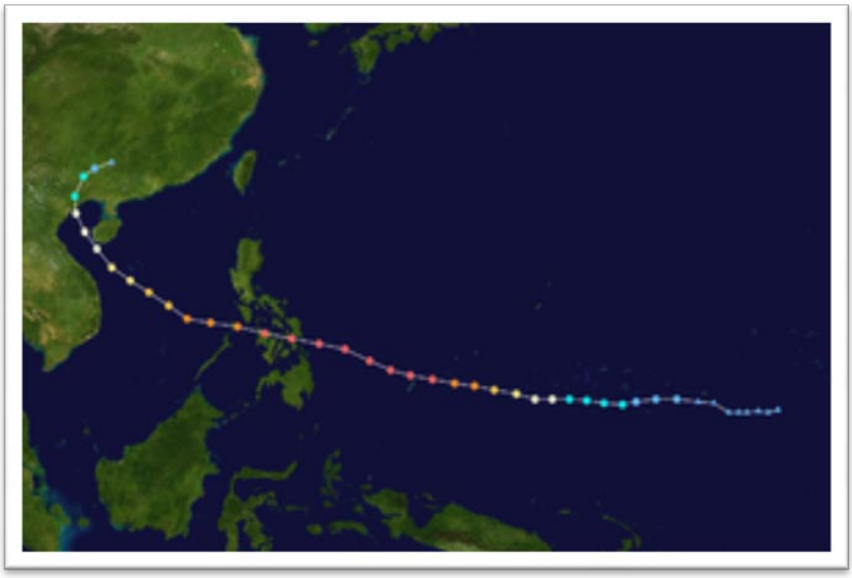
warehouses and shops. There is also the threat of waterborne diseases as toilet facilities were destroyed and there were still bodies being found up to two months after the super typhoon. The displacement of inhabitants caused a migration to other areas as far as Manila. People scrambled to get the next available flight or trip out of the region. For those who remained, the government and private groups set up tent cities and later the hastily-constructed bunk houses. As schools were destroyed, classes were suspended for a month and later many students moved to schools in provinces like Cebu and some of them migrated to Manila to continue their studies.

Damage to infrastructure as a result of super typhoon *Yolanda* was estimated at 19,599,379,136.11 pesos. (US$ 44,5440,434.92) The Tacloban airport was temporarily put out of commission but its main terminal was totally destroyed. The ports remained unusable and were reopened only to accommodate rescue and relief vessels. Facilities for the supply of potable water were also damaged. Water supply was sufficient as of November 15. In Busuanga, Palawan water supply remained functional but Coron started rationing for potable water. In Roxas, Capiz, the local water district resumed operations as of November 15 but the water supply remained limited. Forty per cent of the water districts in Antique were functional and 70% were functional in Iloilo.

The super typhoon destroyed or damaged 1,959 electrical transmission facilities as hundreds of transmission towers and poles were toppled along with the main transmission lines. The Department of Energy gave a grim assessment that it would take a year to fully restore electricity in the affected areas. As of January 4, 2014 electrical power was restored to 56 barangays or villages or 1,243 households in Tacloban City. This number comprises only 3.46% of the total number of households in the city. Damage to agriculture from the super typhoon was estimated at 20,262,118,716.06 pesos(US$46,0502,698.09). The affected areas in Region VIII were dependent on coconut farming and it will take several years for the industry to recover.

Typhoon *Yolanda*/Haiyan was the world's deadliest storm in recent memory. It was the strongest typhoon ever recorded to make landfalls anywhere in the world based on its wind speed of 315 kph (195 mph). *Yolanda/Haiyan* was a Category 5 typhoon and it exceeded hurricane *Katrina* which had a wind speed of 280 kph (175 mph). The scale of destruction was unprecedented in the country's history. All in all damage to both infrastructure and agriculture was estimated 39,821,497,852.17. ($90,5034,042.09). Because of the immediate need to provide relief to the affected inhabitants, President Aquino appealed for international aid. The affected regions will continue to bear the scars of the destruction of Yolanda for years to come. (Simbahayan Data)

Picture 8. Path of Typhoon *Yolanda*/Haiyan (Japan Meteorological Agency)



Victims of super typhoon *Yolanda* line up to get their relief supplies in Tacloban City. (UST Simbahayan)

Concluding Remarks

The occurrence of tropical cyclones in the form of tropical depressions, storms and typhoons is a permanent feature of the Philippine environment. The Philippines lies in the typhoon belt and the occurrence of tropical cyclones is a yearly occurrence. The location of the country's typhoon alley varies depending on the time of the year from the early months of the year, to June or July this avenue of storms that will be on the north of the country such as extreme northern Luzon and northern Luzon area. In the latter part of the year, the typhoon alley moves south and on occasion hitting Mindanao. This behavior is due to climatic conditions.

Severe storms are part of the collective memory of the Filipinos. Some were remembered in folklore such as the Darangen of the Maranaos in Mindanao. This lengthy recitation of a folk tale mentions about the existence of a land called Bumbaran. Bumbaran was said to be a prosperous city until it was destroyed by a powerful typhoon. The inhabitants of the city were said to have disrespected Islamic preachers who had arrived to introduce Islam in the area. (Castillo and Buenaventura, p. 38) The preachers cursed the inhabitants and brought the typhoon as a punishment. Among the Tagalogs of Luzon

there was a mention of the *unos* Luzon which happened because the people did not pay the proper offerings to the ancestral spirits.

In the historical records, there were few occasions in which tropical cyclones and bad weather changed the course of history. In 1748 patache *Santo Domingo* was dispatched to the Marianas. The vessel carrying immigrants to the Marianas was forced back to the Philippines because of bad weather and it was wrecked at Homonhon. There were no survivors from the shipwreck and since then the plan to repopulate the Marianas with indios from the Philippines was stopped. (PNA, Marianas, *Memoria*, 1758, ff. 94-95)

One of the near-disasters of World War II was a typhoon which occurred in December 1944 and affected the Central Visayan region. A relatively average typhoon named Cobra, churned in the Western Pacific Ocean. At the time, the US Navy Task Force 38 consisting of 86 ships was covering operations for the Philippines. Wrong information about the location of the typhoon caused the commander, Admiral William Halsey to sail directly into the disturbance. It resulted in the loss of 790 men, two ships sunk and damage to 26 others.[5] Admiral Halsey was relieved of command. The casualties from the typhoon was considered the largest casualties the history of the US Navy caused by a tropical cyclone. The aftermath of Typhoon Cobra, also remembered as Halsey's Typhoon, led to the establishment of the Joint Typhoon Warning Center (JTWC) whose data are being used by the U.S. Navy and the U.S. Air Force.

The main cause of death is drowning from the resulting floods and storm surges. Unfortunately, this is due to the lack of adequate preparation and the stoic attitude of Filipinos of what may come, will come. Another shortcoming of the Filipinos was the lack of historical memory. Despite historical documentation, the warnings of history remained unheeded. For many people storms like Yolanda was one of those storms that they could ride out.

The number of casualties in the eastern Visayan typhoon alley was greater than in any other region of the Philippines because the area is more densely populated. Furthermore, the coasts which are vulnerable to storm surges have large concentrations of people. Compared to the other typhoon alleys like the Batanes and some parts of northern Luzon, these areas have less inhabitants. In the Batanes the inhabitants live on the hillsides rather than on the coasts. The houses are more spread out unlike those in the Visayas. Furthermore, the inhabitants developed a type of architecture which made an

5 Among these were *the USS Hull* (capsized and sank), *USS Monaghan* (capsized and sunk) and *USS Spence* (capsized and sunk). Twenty-six other ships were *USS Cowpens*, *USS Monterey*, *USS Langley*, *USS San Jacinto USS Altamaha*, *USS Anzio*, *USS Nehenta*, *USS Cape Esperance*, *USS Kwajelaien*, *USS Iowa*, *USS Baltimore*, *USS Dewey*, *USS Alwyin*, *USS Buchanan*, *USS Dyson*, *USS Hickox*, *USS Maddox*, *USS Benham*, *USS Donaldson*, *USS Melvin R. Nawman*, *USS Tabberer*, *USS Waterman*, *USS Jicarilla* and the *USS Shasta*

ivatan (a native of the Batanes) house highly resistant to typhoons. This type of architecture was introduced by the Spaniards in the 17th century (Hornedo, p. 62).

The frequent occurrence of typhoons in certain areas affected the economy of the typhoon alleys. In Northern Luzon, the Ilocano inhabitants of Northwestern Luzon whose land experiences extremes of drought and very rainy seasons, agriculture in that region is not as productive compared to the eastern part of Luzon. In the Visayan typhoon alley in the provinces of Eastern Samar, Samar, Leyte, Southern Leyte and Biliran which comprise Region 8 is the third poorest region in the Philippines after the Autonomous Region of Muslim Mindanao (ARMM) and Region XII which comprises the provinces of South Cotabato, Cotabato, Sultan Kudarat and Sarangani. The incidence of poverty among families in 2012 is 37.2% compared to 36.2% in 2009 and 33.3% in 2006. According to the National Statistical Coordination Board, one out of three families in Eastern Visayas is poor (NSCB Fact Sheet, p. 1).

The poverty among Eastern Visayans is expected to remain for a long time since a large part of the region (about 49%) of agricultural land is dependent on coconut farming. It will take years before it will recover from the effects of *Yolanda*. Areas planted to rice, corn and root crops may recover in a year. While fishing communities may recover as soon as they rebuild their fishing boats. The poverty caused by the dismal economic opportunity and the frequent natural disasters caused a diaspora among the people of Eastern Visayas. These people of the typhoon alleys are inclined to migrate to other areas. According to figures from the Philippine Statistics Authority, many people from the Eastern Visayas come to cities like Manila to find work. Being poor, many of them are functionally illiterate.[6] According to the Philippine Statistical Authority Eastern Visayas has the lowest literacy rate in Central Philippines. Many of the migrants end up as menial laborers. Many became victims of human trafficking and sexual exploitation It was feared that one of the long term effects of Yolanda would be an upsurge of human trafficking especially of child trafficking (Sevastupulo Demitri, p. 1.).

These are acts of desperation by the parents who could not take care of their children and the opportunism by unscrupulous individuals to take advantage of the plight of typhoon victims. Many become victims of human trafficking the destruction of facilities in the typhoon alley especially in the Visayas forced many inhabitants to migrate elsewhere for education, health care and work (Catholic News.org.international/asia.story.php).

The occurrence of more and more powerful storms will be expected as the world experiences global warming. A study of the United Nations shows

6 According to the Philippine Statistical Authority, Eastern Visayas which comprise the islands of Samar and Leyte, has the lowest functional literacy rate (76.7%) in the Central Philippines region as of 2003. See, www.census.ph.gov.

that the Philippines had more than its share of natural calamities placing it at no. 3 on countries that would be likely to be struck by a typhoon or an earthquake. A study by the NOAA reveals that one degree increase in sea water temperature will increase the possibility of more storms and stronger ones. Philippine authorities and people in general can only adjust to these conditions through adequate preparation. As one goes around Manila there are markers placed in strategic places where floods are likely to occur. Disaster teams and measures on how to respond whenever a typhoon and storm have been placed in the minds of people.

The best thing to deal with more powerful typhoons is to prepare for it. In one of its publications, the National Disaster Risk Reduction Management Council (NDRRMC) stated that the Philippines are frequently subjected to various types of hazards and it has been observed to be increasing throughout the years. Its geographical location and physical environment make it vulnerable to natural hazards such as tropical cyclones, floods, extreme rainfall, thunderstorm, storm surges, strong winds, tornado and others. Every year, these hazards bring havoc to life and property, seriously disrupt the agriculture-based economy and disturb the lives of millions of Filipino families. The occurrence of typhoons gives the basis for planning in the future. The Philippine government NDRRMC and the Department of Science and Technology began identifying and mapping areas that would be prone to storm surges, floods and landslides. These include areas directly facing the open ocean like in Eastern Samar and Mindanao; mountainous areas such as the Cordillera and Compostela Valley region; the low-lying areas at the plains and river banks. Plans have been made to relocate facilities and population centers. There are plans to relocate the Tacloban Airport which directly faces the Pacific Ocean to a more secure area in the town of Palo. That plan was shot down however by local politics (Interaksyon.com).[7] Here, politics including friction between political parties as well as personalities may play a role in the speed (or delay) for disaster preparation, mitigation and rehabilitation. There is already conflict between political authorities on the priorities regarding which areas should be rehabilitated first.

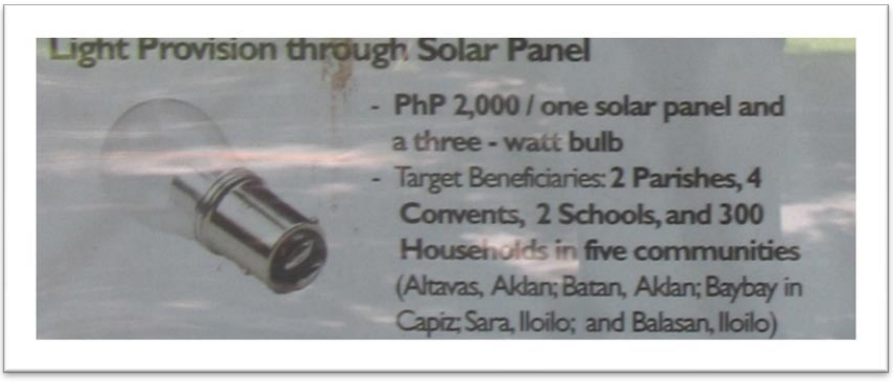
For the inhabitants of Leyte and Samar, people were advised against establishing their residences in areas that would be prone to storm surges and floods. In other areas like cities like Manila, markers were installed signifying if the flood warranted evacuation. Rivers and drainage systems were dredged periodically to allow the smooth passage of rainwater. People are informed what to do in the incidence of floods while local governments were given the authority to declare suspension of work and of classes independent of the announcement of the Philippine weather bureau especially in the incidence

7 "*Tao Nga Di Mailipat, Airport pa? Tacloban mayor rebuffs Gov's Proposal to Transfer Airport*," Interaksyon.com. article. March 27, 2014.

of heavy rains in their localities. Evacuation routes and places for evacuees were already identified and food or emergency supplies and equipment were always ready.

The occurrences of typhoons also provided an opportunity to try out new technologies especially in the rehabilitation of the affected areas. The wooden boats of fishermen who lost their property during typhoons were will be replaced with boats made of fiberglass. The use of fiberglass will help conserve the forests as fewer trees would be cut down to build new boats. As of June 2014, more than 500 fiberglass boats were constructed and distributed to fishermen's families affected by super typhoon *Yolanda* (Simbahayan Data). The funding for the new boats came from voluntary donations and funneled through non-governmental organizations. Another innovation would be the use of solar panels especially in area where electricity was yet to be restored. A community development group based in the University of Santo Tomas (UST) named Simbahayan said that every P 2,000 (US$45) donation will provide for one solar panel and one three-watt bulb.[8] This would light up one family home. To minimize the use of high voltage lighting light bulbs using light emitting diode (LED) technology was used. These types of bulbs were utilized using either electricity from solar panels or electricity from the grid.

An illustration of a three-watt bulb powered by solar power (UST Simbahayan)

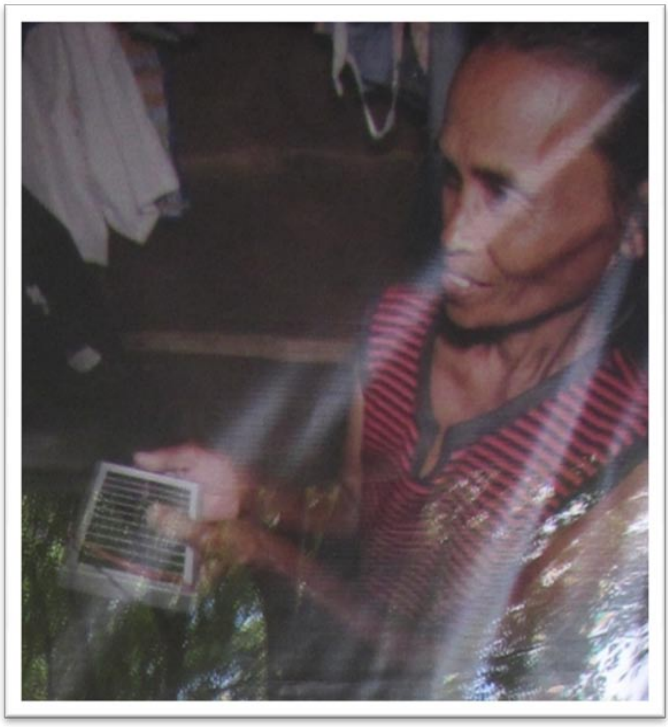


8 Simbahayan's area of operations is in the Western Visayas targeting the towns of Altavas and Batan, in Aklan province and Sara and Balasan in Iloilo.

Psychological counseling being conducted by volunteers of Simbahayan with the super typhoon victims. (UST Simbahayan)

Aside from physical reconstruction and livelihood restoration, there is a need to conduct psychological counseling among disaster victims. Psychological trauma is one of the effects of tragedies that are not paid enough attention. The effect of such trauma can be felt in the long term. Often children suffer from traumatic experiences especially if they lose a family member from the disaster. Government and private groups and agencies conduct psychological counseling to the affected individuals to help them move on with their lives after their tragic experience.

A resident receiving a solar panel from the Simbahayan volunteers. (UST Simbahayan)

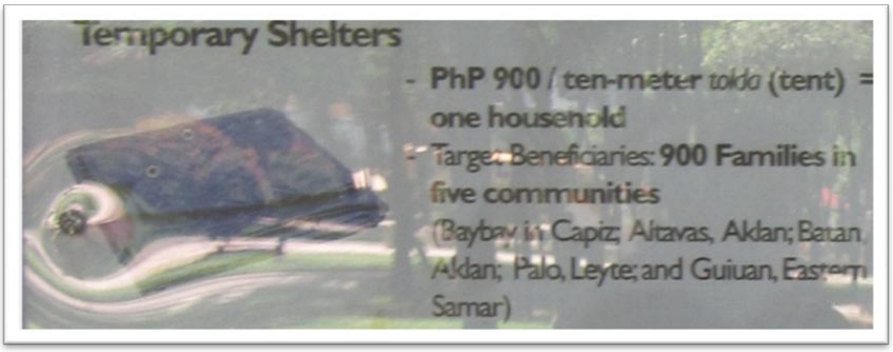


Student volunteers teaching residents how to use the solar panels. (UST Simbahayan)

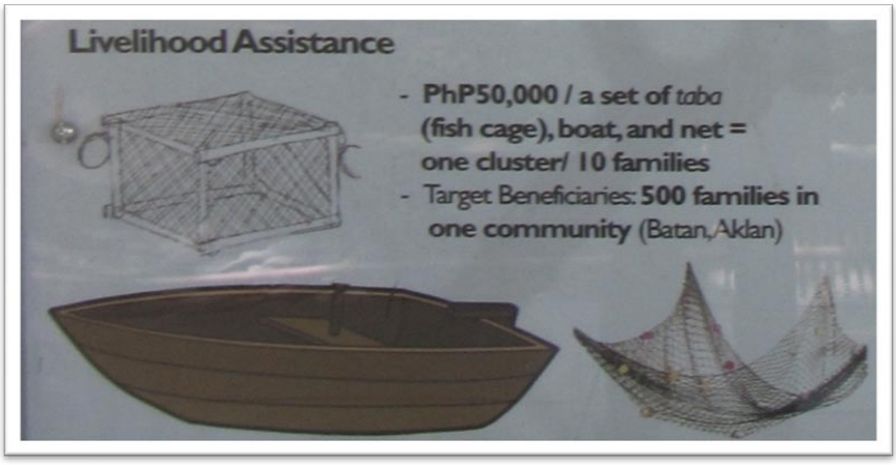
Since the recovery efforts will last for several months, government and private organizations will have to raise funds for a longer period to allow the affected regions to recover. Thus, there are many efforts done by private and government groups to continue to solicit assistance several months after the occurrence of the super typhoon.

The immediate need for families rendered homeless by the Super typhoon is the erection of temporary shelters which are actually tents.

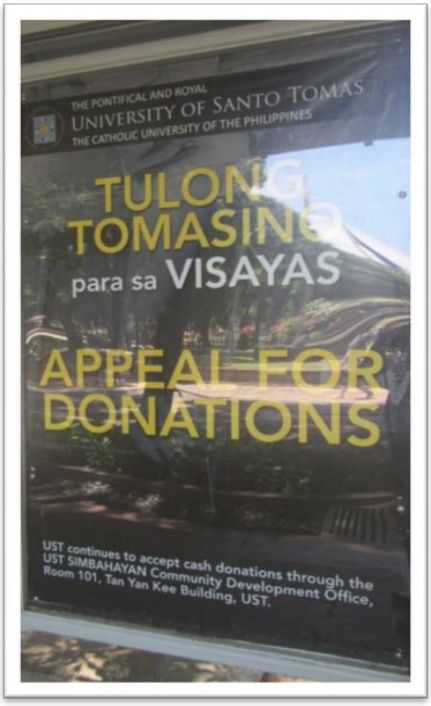
These shelters need to be replaced later by bunk houses. (UST Simbahayan)



There is also a need to restore the livelihood of the victims' families According to Simbahayan the amount of 50,000 pesos (US$ 1136.36) is necessary to furnish a fish cage, a boat and net. (UST Simbahayan)



A poster from the UST Simbahayan appealing for donations. Collection for cash and goods is still on going months after the disaster (UST Simbahayan)



A marathon organized by UST Simbahayan for the benefit of the victims of Super typhoon Yolanda. (UST Simbahayan)

The final step towards disaster preparedness is to educate people and their local officials to be diligent at all times. The attitude of the people of "*bahala na*" or whatever will be, will be, should be replaced by a culture of preparedness. When people undertake the adequate preparations, extreme heavy casualties and property destruction will be avoided and a better quality of life can be ensured. ●

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