

The Philippines modified its Tropical Cyclone Warning System

Historical Background

As an archipelago in Western North Pacific, the Philippines is exposed to tropical cyclones of varying intensity and impacts at an average frequency of 20 tropical cyclones a year. To mitigate or reduce the damages caused by this disastrous phenomenon, the Philippine Weather Bureau, the national meteorological-hydrological service now known as Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), established the Tropical Cyclone Warning System (TCWS).

In 1950's, the TCWS involved 10 warning levels: Public Storm Warning Signal (PSWS)# 1 to PSWS #10. Basically, the warning system was designed for mariners at sea. Visual storm warning signs in the form of cones and cylinders are hoisted prominently on masts in ports. Night signals are in the form of red and white lamps. In 1970's, the number of warning levels was reduced from 10 to three (3) using the three WMO tropical cyclone category as basis. The warning levels then are: PSWS #1: max winds <63 kph for Tropical Depression; PSWS #2: max winds 64 -117 kph for Tropical Storm; and PSWS #3: max winds >118 kph for Typhoon. In 1997, there was motion to upgrade the warning levels to four (4) for the reason that the number of warning signals is inadequate for strong typhoons. Hence, the signals used was PSWS #1 to PSWS # 4 with the addition of time element: PSWS # 1: Winds 30-60 kph -expected in at least 36 hrs; PSWS # 2: Winds >60-100 kph -expected in at least 24 hrs; PSWS # 3: Winds >100-185 kph -expected in at least 18 hrs; and PSWS # 4: Winds >185 kph -expected in at least 12 hrs. Some changes such as addition of meteorological conditions, impacts of the winds and precautionary measures were made later in 2010.

Modification of TCWS in 2015

The idea of modifying the TCWS came about after the devastating effect of the very strong Typhoon Haiyan in central Philippines on November 8, 2013. TY Haiyan caused more than 6,300 casualties and PhP89.6 billion damages. Stakeholders claimed that the warning level, Public Storm Warning Signal (PSWS) No. 4 issued by PAGASA was inadequate for strong typhoon such that there is a need to review the warning system. Assessment reports by different organizations support the idea, hence PAGASA reviewed the TCWS. After a long discussion, brainstorming among forecasters, experts and stakeholders, the modified TCWS was finally crafted. Finally, the modified Tropical Cyclone Warning System (TCWS) was launched for operational use starting May 2015.

There are two main modifications or changes in the TCWS: 1) the adoption of 5 classifications or categories of tropical cyclones (Table 1), and 2) the expansion of warning level to from 4 to 5 (Table 2). Table 1 shows the updated tropical cyclone classification adopted by PAGASA. The first four classification (TD, TS, STS, TY) was based on the classification of tropical cyclones being used in the warning systems intended for international users and exchanges among the Typhoon Committee Members (Chapter 4, WMO Typhoon Committee Operational Manual, Meteorological Component, 2015 Ed.). The fifth classification, Super Typhoon (STY) was added to emphasize the strength and impact of a very destructive typhoon of more than 220 kph maximum sustained winds.

Table 1. Updated Tropical Cyclone Classification

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

Table 2 describes the modified Public Storm Warning Levels which is now expanded from 4 levels to 5. Public Storm Warning Signal No. 5 (PSWS #5) was added to correspond to the warning for a Super Typhoon. Aside from the addition of PSWS#5, changes in the range of wind strength of warning levels are also made. It was noted that in the old system, the range of PSWS#3 is very wide (101-185kph = 85) compared to PSWS#1 (30kph) and PSWS#2 (40kph). In the new system, the range only varies from 30kph (PSWS#1) to 60kph (PSWS#2).

Table 2. Modified Public Storm Warning Levels

PSWS	LEAD TIME* (hrs)	WINDS (KPH)	IMPACTS OF THE WIND
#1	36	30 - 60	No damage to very light damage
#2	24	61-120	Light to moderate damage
#3	18	121-170	Moderate to heavy damage
#4	12	171-220	Heavy to very heavy damage
#5	12	more than 220	Very heavy to widespread damage

*Lead time is only applicable for 1st issuance.

The modified TCWS not only focus on the range of wind strength but most importantly on the impacts of the wind to structures and vegetation.

PSWS	Open Sea Condition	Damage to Structure	Damage to Vegetation
 <p>1</p> <p>Winds: 30-60 kph may be expected in at least 36 hrs</p>	<p>Wave Height: 1.25-4.0 meters</p>	<ul style="list-style-type: none"> • Very light or no damage to high risk structures, • Light to medium and low risk structures • Slight damage to some houses of very light materials or makeshift structures in exposed communities. 	<ul style="list-style-type: none"> • Some banana plants are tilted, a few downed and leaves are generally damaged • Twigs of small trees may be broken. • Rice crops, however, may suffer significant damage when it is in its flowering stage. 
PSWS	Open Sea Condition	Damage to Structure	Damage to Vegetation
 <p>2</p> <p>Winds: 61 -120kph may be expected in at least 24 hrs</p>	<p>Wave Height: 4.1-14.0 m Storm surge possible at coastal areas</p>	<ul style="list-style-type: none"> • Light to Moderate damage to high risk structures; • Very light to light damage to medium-risk structures; • No damage to very light damage to low risk structures • Unshielded, old dilapidated schoolhouses, shanties, and structures of light materials are partially damaged or unroofed. • Some old galvanized iron (G.I.) roofs may be peeled /blown off. • Some wooden, old electric posts are tilted or downed. 	<ul style="list-style-type: none"> • Most banana plants, a few mango trees, ipil-ipil and similar trees are downed or broken • Some coconut trees may be tilted with few others broken • Rice and corn may be adversely affected • Considerable damage to shrubbery and trees with some heavy-foliaged trees blown down. 

PSWS	Open Sea Condition	Damage to Structure	Damage to Vegetation
<p>3</p>  <p>121 -170 kph may be expected in at least 18 hrs</p>	<p>Wave Height: > 14.0 meters</p> <p>Storm surge possible at coastal areas</p>	<ul style="list-style-type: none"> • Heavy damage to high-risk structures; • Moderate damage to medium-risk structures; • Light damage to low-risk structures • Increasing damage to old, dilapidated residential structures and houses of light materials (up to 50% in a community) • Houses of medium strength materials (old, timber or mixed timber-CHB structures, usually with G.I. roofings), some warehouses or bodega-type structures are unroofed, 	<ul style="list-style-type: none"> • Almost all banana plants are downed, some big trees (acacia, mango, etc.) are broken or uprooted, • Dwarf-type or hybrid coconut trees are tilted or downed • Considerable damage to shrubbery and trees with heavy foliage blown off; some large trees blown down. 
<p>4</p>  <p>Winds: 171-220 kph may be expected in at least 12 hours</p>	<p>Wave Height: more than 14.0 meters</p> <p>Storm surge 2-3m possible at coastal areas</p>	<ul style="list-style-type: none"> • Very heavy damage to high-risk structures • Heavy damage to medium risk structures; • Moderate damage to low-risk structures • Considerable damage to structures of light materials (up to 75% are totally and partially destroyed); complete roof structure failures. • Many houses of medium-built materials are unroofed, some with collapsed walls; extensive damage to doors and windows • A few houses of first-class materials are partially damaged • All signs/billboards are blown down. 	<ul style="list-style-type: none"> • There is almost total damage to banana plantation, • Most mango trees, ipil-ipil and similar types of large trees are downed or broken. • Coconut plantation may suffer extensive damage. • Rice and corn plantation may suffer severe losses. 

PSWS	Open Sea Condition	Damage to Structure	Damage to Vegetation
 <p>5</p> <p>Winds: >220 kph may be expected in 12 hours. A Super Typhoon will affect the locality.</p>	<p>Wave Height: more than 14.0 m</p> <p>Storm surge more than 3 meters possible at coastal areas</p>	<ul style="list-style-type: none"> • Widespread damage to high-risk structures • Very heavy damage to medium-risk structures • Heavy damage to low-risk structures; • Almost total damage to structures of light in highly exposed coastal areas. • Complete roof failure on many residences and industrial buildings. Severe and extensive window and door damage • Most residential and institutional buildings of mixed construction may be severely damaged. • Electrical power distribution and communication services severely disrupted. • All signs/billboards blown down. 	<ul style="list-style-type: none"> • Total damage to banana plantation • Most tall trees are broken, uprooted or defoliated; • Coconut trees are stooped, broken or uprooted. • Few plants and trees survived 

Reference: Leoncio A. Amadore, “Comprehensive Risk Assessment of Physical, Social and Economic Impacts of Tropical Cyclones”, Part V, Typhoon Damage Scale. National Research Council of the Philippines (NRCP) Project.

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