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Operations and Services
Tropical Cyclone Weather Services Program, NWSPD 10-6

TROPICAL CYCLONE DEFINITIONS

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***SUMMARY OF REVISIONS*:** This directive supersedes NWS Instruction 10-604 dated June 9, 2010. The following revisions were made to this directive:

Deleted definitions for Tropical Storm/Hurricane Wind Watches and Warnings

Updated description for Short Term Forecast (NOW)

Updated definitions for tropical storm and hurricane watches/warnings

Signed June 1, 2011

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Water, and Weather Services

DEFINITIONS

Dissipated. Used when the circulation is no longer closed.

Dissipating. Used for weakening tropical depressions which contain minimal and diminishing deep convection with no expectation for recovery.

Extratropical Cyclone. A cyclone (of any intensity) for which the primary energy source is baroclinic (i.e., results from the temperature contrast between warm and cold air masses).

Eye Wall. An organized band of cumulonimbus clouds immediately surrounding the center of the tropical cyclone.

Gale Warning. A warning of 1-minute sustained surface winds in the range 34 knots (39 mph) to 47 knots (54 mph) inclusive, either predicted or occurring not directly associated with tropical cyclones.

High Wind Warning. The high winds described here exclude those directly associated with severe local storms. A high wind warning is required when either of the following occur or are expected to occur in the near term:

- Sustained surface wind speeds (1-minute average) of 35 knots (40 mph) or greater lasting for 1 hour or longer, or

- Sustained winds or gusts of 50 knots (58 mph) or greater for any duration.

Hurricane. A tropical cyclone in which the maximum 1-minute sustained surface wind is 64 knots (74 mph) or greater.

Hurricane/Typhoon Eye. The relatively calm center of the tropical cyclone which is more than half surrounded by an eye wall.

Hurricane/Typhoon Season. The part of the year having a relatively high incidence of tropical cyclones. In the Atlantic, Caribbean, and Gulf of Mexico, and central North Pacific, the hurricane season is the period from June 1 through November 30; in the eastern Pacific, May 15 through November 30. In the western North Pacific, the typhoon season is from July 1 to December 15. Tropical cyclones can occur year-round in any basin.

Hurricane/Typhoon Warning for the Atlantic, Eastern Pacific, Central Pacific, and Western North Pacific hurricane basins . An announcement that sustained winds of 64 knots (74 mph or 119 km/hr) or higher are expected within the specified area. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane warning is issued 36 hours in advance of the anticipated onset of tropical storm force winds (24 hours for the Western North Pacific).

Hurricane/Typhoon Watch for the Atlantic, Eastern Pacific, Central Pacific, and Western North Pacific hurricane basins. An announcement that sustained winds of 64 knots (74 mph or 119 km/hr) or higher are possible within the specified area. Because hurricane preparedness activities become

difficult once winds reach tropical storm force, the hurricane watch is issued 48 hours in advance of the anticipated onset of tropical storm force winds.

Major Hurricane. A hurricane which reaches Category 3 (sustained winds greater than 110 mph) on the Saffir/Simpson Hurricane Wind Scale.

Maximum Sustained Surface Wind. When applied to a particular weather system, refers to the highest one-minute average wind (at an elevation of 10 meters with an unobstructed exposure) associated with that weather system at a particular point in time.

Mean Sea Level (MSL). The arithmetic mean of hourly water elevations observed over a specific 19-year tidal epoch.

Mean Low Water (MLW). The arithmetic mean of the low water heights observed over a specific 19-year tidal epoch.

Mean Lower Low Water (MLLW). The arithmetic mean of the lower low water heights of a mixed tide observed over a specific 19-year tidal epoch. Only the lower low water of each pair of low waters, or the only low water of a tidal day is included in the mean.

National Hurricane Operations Plan (NHOP). The NHOP is issued annually by the Federal Coordinator for Meteorological Services and Supporting Research. It documents interdepartmental agreements relating to tropical cyclone observing, warning, and forecasting services. National Hurricane Center (NHC), Central Pacific Hurricane Center (CPHC), and the JTWC serve as the principal offices in coordinating the day-to-day activities of the NWS in support of the Plan in their region of responsibility.

Post-tropical cyclone. This generic term describes a cyclone that no longer possesses sufficient tropical characteristics to be considered a tropical cyclone. Post-tropical cyclones can continue carrying heavy rains and high winds. Note that former tropical cyclones that have become fully extratropical, as well as remnant lows, are two specific classes of post-tropical cyclones.

Remnant Low. A class of post-tropical cyclone that no longer possesses the convective organization required of a tropical cyclone and has maximum sustained winds of less than 34 kt. The term is most commonly applied to the nearly deep-convection-free swirls of stratocumulus in the eastern North Pacific.

Saffir/Simpson Hurricane Wind Scale (SSHWS). A scale on a 1 to 5 categorization based on the hurricane's intensity at the indicated time. The scale provides examples of the type of damages and impacts associated with winds of the indicated intensity. In general, damage rises by a factor of four for every category increase. The maximum sustained surface wind peak (peak 1-minute wind at the standard meteorological observation height of 10 m [33 ft] over unobstructed exposure) associated with the cyclone is the determining factor in the scale. (Note that sustained winds can be stronger in hilly or mountain terrain compared with that experienced over flat terrain).

This scale can be used in public hurricane releases and in discussions with the media to describe the

hurricane's intensity at the indicated time.

Saffir/Simpson Hurricane Wind Scale (SSHWS) – (for use in Atlantic and North East Pacific basins.)

ONE Sustained winds 74-95 mph. (64-82 kts or 119-153 km/hr.) Very dangerous winds will produce some damage. People, livestock, and pets struck by flying or falling debris could be injured or killed. Older (mainly pre-1994 construction) mobile homes could be destroyed, especially if they are not anchored properly as they tend to shift or roll off their foundations. Newer mobile homes that are anchored properly can sustain damage involving the removal of shingle or metal roof coverings, and loss of vinyl siding, as well as damage to carports, sunrooms, or lanais. Some poorly constructed frame homes can experience major damage, involving loss of the roof covering and damage to gable ends as well as the removal of porch coverings and awnings. Unprotected windows may break if struck by flying debris. Masonry chimneys can be toppled. Well-constructed frame homes could have damage to roof shingles, vinyl siding, soffit panels, and gutters. Failure of aluminum, screened-in, swimming pool enclosures can occur. Some apartment building and shopping center roof coverings could be partially removed. Industrial buildings can lose roofing and siding especially from windward corners, rakes, and eaves. Failures to overhead doors and unprotected windows will be common. Windows in high-rise buildings can be broken by flying debris. Falling and broken glass will pose a significant danger even after the storm. There will be occasional damage to commercial signage, fences, and canopies. Large branches of trees will snap and shallow rooted trees can be toppled. Extensive damage to power lines and poles will likely result in power outages that could last a few to several days. Hurricane Dolly (2008) is an example of a hurricane that brought Category 1 winds and impacts to South Padre Island, Texas.

TWO Sustained winds 96-110 mph. (83-95 kts 154-177 km/hr.) Extremely dangerous winds will cause extensive damage. There is a substantial risk of injury or death to people, livestock, and pets due to flying and falling debris. Older (mainly pre-1994 construction) mobile homes have a very high chance of being destroyed and the flying debris generated can shred nearby mobile homes. Newer mobile homes can also be destroyed. Poorly constructed frame homes have a high chance of having their roof structures removed especially if they are not anchored properly. Unprotected windows will have a high probability of being broken by flying debris. Well-constructed frame homes could sustain major roof and siding damage. Failure of aluminum, screened-in, swimming pool enclosures will be common. There will be a substantial percentage of roof and siding damage to apartment buildings and industrial buildings. Unreinforced masonry walls can collapse. Windows in high-rise buildings can be broken by flying debris. Falling and broken glass will pose a significant danger even after the storm. Commercial signage, fences, and canopies will be damaged and often destroyed. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks. Potable water could become scarce as filtration

systems begin to fail. Hurricane Frances (2004) is an example of a hurricane that brought Category 2 winds and impacts to coastal portions of Port St. Lucie, Florida with Category 1 conditions experienced elsewhere in the city.

THREE Sustained winds 111-130 mph. (96-113 kts or 154-177 km/hr.) Devastating damage will occur. There is a high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. Most newer mobile homes will sustain severe damage with potential for complete roof failure and wall collapse. Poorly constructed frame homes can be destroyed by the removal of the roof and exterior walls. Unprotected windows will be broken by flying debris. Well-built frame homes can experience major damage involving the removal of roof decking and gable ends. There will be a high percentage of roof covering and siding damage to apartment buildings and industrial buildings. Isolated structural damage to wood or steel framing can occur. Complete failure of older metal buildings is possible, and older unreinforced masonry buildings can collapse. Numerous windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Most commercial signage, fences, and canopies will be destroyed. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to a few weeks after the storm passes. Hurricane Ivan (2004) is an example of a hurricane that brought Category 3 winds and impacts to coastal portions of Gulf Shores, Alabama with Category 2 conditions experienced elsewhere in this city.

FOUR Sustained winds 131-155 mph. (114-135 kts or 210-249 km/hr.) Catastrophic damage will occur. There is a very high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. A high percentage of newer mobile homes also will be destroyed. Poorly constructed homes can sustain complete collapse of all walls as well as the loss of the roof structure. Well-built homes also can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Extensive damage to roof coverings, windows, and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will break most unprotected windows and penetrate some protected windows. There will be a high percentage of structural damage to the top floors of apartment buildings. Steel frames in older industrial buildings can collapse. There will be a high percentage of collapse to older unreinforced masonry buildings. Most windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months. Hurricane Charley (2004) is an example of a hurricane that brought Category 4 winds and impacts to coastal portions of Punta Gorda, Florida with Category 3 conditions experienced

elsewhere in the city.

FIVE Sustained winds greater than 155 mph. (135 kts or 249 km/hr.) Catastrophic damage will occur. People, livestock, and pets are at very high risk of injury or death from flying or falling debris, even if indoors in mobile homes or framed homes. Almost complete destruction of all mobile homes will occur, regardless of age or construction. A high percentage of frame homes will be destroyed, with total roof failure and wall collapse. Extensive damage to roof covers, windows, and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will occur to nearly all unprotected windows and many protected windows. Significant damage to wood roof commercial buildings will occur due to loss of roof sheathing. Complete collapse of many older metal buildings can occur. Most unreinforced masonry walls will fail which can lead to the collapse of the buildings. A high percentage of industrial buildings and low-rise apartment buildings will be destroyed. Nearly all windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Nearly all trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months. Hurricane Andrew (1992) is an example of a hurricane that brought Category 5 winds and impacts to coastal portions of Cutler Ridge, Florida with Category 4 conditions experienced elsewhere in south Miami-Dade County.

Note: A "major" hurricane is one classified as a Category 3 or higher.

Saffir/Simpson Hurricane Wind Scale (SSHWS) - (for use in Central Pacific basin.)

ONE Sustained winds 74-95 mph. (64-82 kt or 119-153 km/hr.) Damaging winds are expected. Some damage to building structures could occur, primarily to unanchored structures (such as school portables). Some damage is likely to poorly constructed signs. Loose outdoor items will become projectiles, causing additional damage. Persons struck by windborne debris risk injury and possible death. Numerous large branches of healthy trees will snap. Some trees will be uprooted, especially where the ground is saturated. Many areas will experience power outages with some downed power poles. Hurricane Iwa (passing just northwest of Kauai in 1982) and Hurricane Dot (landfall on Kauai in 1959) are examples of Category One hurricanes that directly impacted Hawaii.

TWO Sustained winds 96-110 mph. (83-95 kt or 154-177 km/hr.) Very strong winds will produce widespread damage. Some roofing material, door, and window damage of buildings will occur. Considerable damage to unanchored structures and poorly constructed signs is likely. A number of glass windows in high rise buildings will be dislodged and become airborne. Loose outdoor items will become projectiles, causing additional damage. Persons struck by windborne

debris risk injury and possible death. Numerous large branches will break. Many trees will be uprooted or snapped. Extensive damage to power lines and poles will likely result in widespread power outages that could last a few to several days. There is no record of a Category Two hurricane directly impacting Hawaii. Elsewhere in the United States, Hurricane Erin (1995, 100 mph at landfall in northwest Florida) and Hurricane Isabel (2003, 105 mph at landfall in North Carolina) are examples of Category Two hurricanes at landfall.

THREE Sustained winds 111-130 mph. (96-113 kt or 154-177 km/hr.) Dangerous winds will cause extensive damage. Some structural damage to houses and buildings will occur with a minor amount of wall failures. Unanchored structures and poorly constructed signs are destroyed. Many windows in high rise buildings will be dislodged and become airborne. Persons struck by windborne debris risk injury and possible death. Many trees will be snapped or uprooted and block numerous roads. Near total power loss is expected with outages that could last from several days to weeks. There is no record of a Category Three hurricane directly impacting Hawaii. Elsewhere in the United States, Hurricane Rita (2005, 115 mph landfall in east Texas/Louisiana) and Hurricane Jeanne (2004, 120 mph landfall in southeast Florida) are examples of Category Three hurricanes at landfall.

FOUR Sustained winds 131-155 mph. (114-135 kt or 210-249 km/hr.) Extremely dangerous winds causing devastating damage are expected. Some wall failures with some complete roof structure failures on houses will occur. All signs are blown down. Complete destruction of unanchored structures. Extensive damage to doors and windows is likely. Numerous windows in high rise buildings will be dislodged and become airborne. Windborne debris will cause extensive damage and persons struck by the wind-blown debris will be injured or killed. Most trees will be snapped or uprooted. Fallen trees could cut off residential areas for days to weeks. Electricity will be unavailable for weeks after the hurricane passes. Hurricane Iniki, which made landfall on Kauai in 1992, is an example of a Category Four hurricane at landfall in Hawaii.

FIVE Sustained winds greater than 155 mph. (135 kt or 249 km/hr.) Catastrophic damage is expected. Complete roof failure on many residences and industrial buildings will occur. Some complete building failures with small buildings blown over or away are likely. All signs blown down. Complete destruction of unanchored structures. Severe and extensive window and door damage will occur. Nearly all windows in high rise buildings will be dislodged and become airborne. Severe injury or death is likely for persons struck by wind-blown debris. Nearly all trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. There is no record of a Category Five hurricane directly impacting Hawaii. Elsewhere in the United States, Hurricane Camille (1969, 190 mph at landfall in Mississippi) and Hurricane Andrew (1992, 165 mph at landfall in Southeast Florida) are examples of Category Five hurricanes at landfall.

Note: A "major" hurricane is one classified as a Category 3 or higher.

Modified Saffir-Simpson Hurricane Scale (SSHS) for the Western North Pacific.

For Tropical Depression and Tropical Storm:

Category A — Maximum sustained Wind (MSW): 30-49 mph (26-43 kt) and peak gusts 40-64 mph (33-56 kt)

Typical Damage - Damage done to only the flimsiest lean-to type structures. Unsecured light signs blown down. Minor damage to banana trees and near-coastal agriculture, primarily from salt spray. Some small dead limbs, ripe coconuts, and dead palm fronds blown down from trees. Some fragile and tender green leaves blown from trees such as papaya and fleshy broad leaf plants.

Coastal Inundation and Wave Action - On windward coasts, sea level rise of less than 2 feet (0.7 m) above normal in open bays and inlets due to storm surge and wind driven waves; breaking waves inside bays can reach 2-3 feet (0.7 - 1.0 m); less than 1 ft (0.3 m) over reefs. Rough surf at reef margin with moderately strong along-shore currents (rip currents) inside reefs.

Category B — MSW: 50 - 73 mph (44-63 kt) and peak gusts 65-94 mph (57-81 kt)

Typical Damage - Minor damage to buildings of light material; major damage to huts made of thatch or loosely attached corrugated sheet metal or plywood. Unattached corrugated sheet metal and plywood may become airborne. Wooden signs not supported with guy wires are blown down. Moderate damage to banana trees, papaya trees, and most fleshy crops. Large dead limbs, ripe coconuts, many dead palm fronds, some green leaves, and small branches are blown from trees.

Coastal Inundation and Wave Action - On windward coasts, sea level rise of 2-4 ft (0.7-1.2 m) above normal in open bays and inlets due to storm surge and wind-driven waves; breaking waves inside bays can reach 4-6 ft (1.2-1.8 m); 1-2 ft (0.3-0.7 m) over reefs. Very rough surf at reef margin with strong along-shore currents (rip currents) inside reefs.

For Typhoon:

ONE — MSW: 74-95 mph (64-82 kt) and peak gusts 95-120 mph (82-105 kt)

Typical Damage - Corrugated metal and plywood stripped from poorly constructed or termite-infested structures and may become airborne. A few wooden, non-reinforced power poles tilted, and some rotten power poles broken and their attached lines down. Some damage to poorly constructed, loosely

attached signs. Major damage to banana trees, papaya trees, and fleshy crops. Some young trees downed when the ground is saturated. Some palm fronds crimped and bent back through the crown of coconut palms; a few palm fronds torn from the crowns of most types of palm trees; many ripe coconuts blown from coconut palms. Less than 10 percent defoliation of shrubbery and trees; up to 10 percent defoliation of tangantangan. Some small tree limbs downed, especially from large bushy and frail trees such as mango, African tulip, poinciana, etc. Overall damage can be classified as minimal.

Coastal Inundation and Wave Action - On windward coasts, sea level rise of 4-6 ft (1.2-1.8 m) above normal in open bays and inlets due to storm surge and wind-driven waves; breaking waves inside bays can reach 5-7 ft (1.5-2.1 m) above normal; 2-3 ft (0.6-1.0 m) additional water across reef. Wind-driven waves may inundate low-lying coastal roads where reefs are narrow. Minor pier damage. Some small craft in exposed anchorages break moorings.

TWO — MSW: 96-110 mph (83-95 kt) and peak gusts 121-139 mph (106-121 kt)

Typical Damage - Several rotten wooden power poles snapped and many non-reinforced wooden power poles tilted. Some secondary power lines downed. Damage to wooden and tin roofs, and doors and windows of termite-infested or rotted wooden structures, but no major damage to well-constructed wooden, sheet metal, or concrete buildings. Considerable damage to structures made of light materials. Major damage to poorly constructed, attached signs. Exposed banana trees and papaya trees totally destroyed; 10-20 percent defoliation of trees and shrubbery; up to 30 percent defoliation of tangantangan. Light damage to sugar cane and bamboo. Many palm fronds crimped and bent through the crown of coconut palms and several green fronds ripped from palm trees. Some green coconuts blown from trees. Some trees blown down, especially shallow rooted ones such as small acacia, mango and breadfruit when the ground becomes saturated. Overall damage can be classified as moderate.

Coastal Inundation and Wave Action - On windward coasts, sea level rise of 6-8 ft (1.8-2.4 m) above normal in open bays and inlets due to storm surge and wind-driven waves; breaking waves inside bays can reach 7-9 ft (2.1-2.7 m) above normal; water is about 3-5 ft (1.0-1.5 m) above normal across reef flats. Wind-driven waves will inundate low-lying coastal roads below 4 ft (1.2 m) on windward locations where reefs are narrow. Some erosion of beach areas, some moderate pier damage, and some large boats torn from moorings.

THREE — MSW: 111-130 mph (96-113 kt) and peak gusts 140-165 mph (122-144 kt)

Typical damage - A few non-reinforced hollow-spun concrete power poles broken or tilted and many non reinforced wooden power poles broken or blown down;

many secondary power lines downed. Practically all poorly constructed signs blown down and some stand-alone steel-framed signs bent over. Some roof, window, and door damage to well-built, wooden and metal residences and utility buildings. Extensive damage to wooden structures weakened by termite infestation, wet-and-dry wood rot, and corroded roof straps (hurricane clips). Non-reinforced cinder block walls blown down. Many mobile homes and buildings made of light materials destroyed. Some glass failure due to flying debris, but only minimal glass failure due to pressure forces associated with extreme gusts. Some unsecured construction cranes blown down. Air is full of light projectiles and debris. Major damage to shrubbery and trees; up to 50 percent of palm fronds bent or blown off; numerous ripe and many green coconuts blown off coconut palms; crowns blown off of a few palm trees. Moderate damage to sugar cane and bamboo. Some large trees (palm trees), blown down when the ground becomes saturated; 30-50 percent defoliation of most trees and shrubs; up to 70 percent defoliation of tangantangan. Some very exposed panax, tangantangan, and oleander bent over. Overall damage can be classified as extensive.

Coastal Inundation and Wave Action - On windward coasts, sea level rise of 8-12 ft (2.4-3.7 m) above normal in open bays and inlets due to storm surge and wind-driven waves; breaking waves inside bays can reach 11-14 ft (3.3-4.2 m) above normal; water is about 5-8 ft (1.5-2.4 m) above normal across reef flats. Wind-driven waves will inundate low-lying coastal roads below 7 ft (2.1 m) of elevation on windward locations where reefs are narrow. Considerable beach erosion. Many large boats and some large ships torn from moorings.

FOUR MSW: 131-155 mph (114-135 kt) and peak gusts 166-197 mph (145-171 kt)

Typical Damage - Some reinforced hollow-spun concrete and many reinforced wooden power poles blown down; numerous secondary and a few primary power lines downed. Extensive damage to non-concrete roofs; complete failure of many roof structures, window frames and doors, especially unprotected, non-reinforced ones; many well-built wooden and metal structures severely damaged or destroyed. Considerable glass failures due to flying debris and explosive pressure forces created by extreme wind gusts. Weakly reinforced cinder block walls blown down. Complete disintegration of mobile homes and other structures of lighter materials.

Most small and medium-sized steel-framed signs bent over or blown down. Some secured construction cranes and gantry cranes blown down. Some fuel storage tanks may rupture. Air is full of large projectiles and debris. Shrubs and trees 50-90 percent defoliated; up to 100 percent of tangantangan defoliated. Up to 75 percent of palm fronds bent, twisted, or blown off; many crowns stripped from palm trees. Numerous green and virtually all ripe coconuts blown from trees. Severe damage to sugar cane and bamboo. Many large trees blown down (palms,

breadfruit, monkeypod, mango, acacia, and Australian pine.) Considerable bark and some pulp removed from trees; most standing trees are void of all but the largest branches (severely pruned), with remaining branches stubby in appearance; numerous trunks and branches are sandblasted. Patches of panax, tangantangan, and oleander bent over or flattened. Overall damage can be classified as extreme.

Coastal Inundation and Wave Action - On windward coasts, sea level rise of 12-18 ft (3.7-5.5 m) above normal in open bays and inlets due to storm surge and wind-driven waves; breaking waves inside bays can reach 15-24 ft (4.5-7.3 m) above normal; water is about 8-12 ft (2.4-3.7 m) above normal across reef flats. Wind-driven waves will inundate coastal areas below 12 ft (3.7 m) elevation. Large boulders carried inland with waves. Severe beach erosion. Severe damage to port facilities including some loading derricks and gantry cranes. Most ships torn from moorings.

FIVE MSW: 156-194 mph (136-170 kt) and peak gusts 198-246 mph (172-216 kt)

Typical Damage - Severe damage to some solid concrete power poles, to numerous reinforced hollow-spun concrete power poles, to many steel towers, and to virtually all wooden poles; all secondary power lines and most primary power lines downed. Total failure of non-concrete reinforced roofs. Extensive or total destruction to non-concrete residences and industrial buildings. Some structural damage to concrete structures, especially from large debris, such as cars, large appliances, etc. Extensive glass failure due to impact of flying debris and explosive pressure forces during extreme gusts. Many well-constructed storm shutters ripped from structures. Some fuel storage tanks rupture. Nearly all construction cranes blown down. Air full of very large and heavy projectiles and debris. Shrubs and trees up to 100 percent defoliated; numerous large trees blown down. Up to 100 percent of palm fronds bent, twisted, or blown off; numerous crowns blown from palm trees; virtually all coconuts blown from trees. Most bark and considerable pulp removed from trees. Most standing trees are void of all but the largest branches, which are very stubby in appearance and severely sandblasted. Overall damage can be classified as catastrophic.

Coastal Inundation and Wave Action - On windward coasts, sea level rise of 18 to 30 + ft (5.5 - 9.2 + m) above normal in open bays and inlets due to storm surge and wind-driven waves; breaking waves inside bays can be >30 ft (9.2 m) above normal; water is about 12-20 + ft (3.7-6.1 + m) above normal across reef flats. Serious inundation likely for windward coastal areas below 18 ft (5.5 m) elevation. Very large boulders carried inland with waves. Extensive beach erosion. Extensive damage to port facilities including most loading derricks and gantry cranes. Virtually all ships, regardless of size, torn from moorings.

Short Term Forecast (NOW). WFOs may issue these forecasts to provide the public with detailed information about the evolution (timing and duration) of meteorological parameters (rain bands,

winds, etc.) associated with a tropical cyclone within their geographic area of responsibility.

Storm Surge. An abnormal rise in sea level accompanying a tropical cyclone or other intense storm and whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the storm. Storm surge is usually estimated by subtracting the normal or astronomical tide from the observed storm tide.

Storm Tide. The water level rise resulting from the astronomical tide combined with the storm surge.

Storm Warning. A warning of 1-minute sustained surface winds of 48 to 63 knots (55 to 73 mph) or greater, either predicted or occurring, not directly associated with tropical cyclones.

Subtropical Cyclone. A non-frontal low pressure system that has characteristics of both tropical and extratropical cyclones. This system is typically an upper-level cold low with circulation extending to the surface layer and maximum sustained winds generally occurring at a radius of about 100 miles or more from the center. In comparison to tropical cyclones, such systems have a relatively broad zone of maximum winds that is located farther from the center, and typically have a less symmetric wind field and distribution of convection.

Subtropical Depression. A subtropical cyclone in which the maximum 1-minute sustained surface wind is 33 knots (38 mph) or less.

Subtropical Storm. A subtropical cyclone in which the maximum 1-minute sustained surface wind is 34 knots (39 mph) or more.

Super Typhoon. Typhoon having maximum sustained winds of 130 knots (150 mph) or greater.

Tropical Cyclone. A warm-core, non-frontal synoptic-scale cyclone, originating over tropical or subtropical waters with organized deep convection and a closed surface wind circulation about a well-defined center.

Tropical Depression. A tropical cyclone in which the maximum 1-minute sustained surface wind is 33 knots (38 mph) or less.

Tropical Disturbance. A discrete tropical weather system of apparently organized convection--generally 100 to 300 mi in diameter--originating in the tropics or subtropics, having a nonfrontal migratory character and maintaining its identity for 24 hours or more. It may or may not be associated with a detectable perturbation of the wind field.

Tropical Storm. A tropical cyclone in which the maximum 1-minute sustained surface wind ranges from 34 to 63 knots (39 to 73 mph) inclusive.

Tropical Storm Warning for the Atlantic, Eastern Pacific, Central Pacific, and Western North Pacific Hurricane basins . An announcement that sustained winds of 34 to 63 knots (39 to 73 mph or 63 to 118 km/hr) are expected within the specified area within 36 hours (24 hours for the Western

North Pacific).

Tropical Storm Watch for the Atlantic, Eastern Pacific, Central Pacific, and Western North Pacific Hurricane basins. An announcement that sustained winds of 34 to 63 knots (39 to 73 mph or 63 to 118 km/hr) are possible within the specified area within 48 hours.

Tropical Wave (formerly known as inverted trough). A trough or cyclonic curvature maximum in the trade wind easterlies. The wave may reach maximum amplitude in the lower middle troposphere or may be the reflection of an upper tropospheric cold low or an equatorward extension of a mid-latitude trough.

Typhoon. A tropical cyclone in which the maximum 1-minute sustained surface wind is 64 knots (74 mph) or greater which forms in the northwestern Pacific Ocean.

Wind Radii. Found in the forecast advisory/products, wind radii is the largest radii of that wind speed found in that quadrant. Quadrants are defined as NE (0-90), SE (90-180), SW (180-270), and NW (270-0). As an example, given maximum 34 knot radii to 150 nm at 0 degrees, 90 at 120 degrees, and 40 nm at 260 degrees, the following line would be carried in the forecast/advisory: 150NE 90SE 40SW 150NW.