



# eSafety Trainer Bulletin

## HURRICANE INFORMATION

Every citizen living in coastal regions from New England to Texas is susceptible to potential property damage and life threatening conditions created by the weather. Why should we pay strong attention to these storms? History teaches us a lesson.



In the Atlantic region, there have been at least three storms to kill more than 10,000 people. **Hurricane Mitch** during the 1998 Atlantic hurricane season caused severe flooding and mudslides in Honduras, killing about 18,000 people and changing the landscape enough that entirely new maps of the country were needed. **The Galveston Hurricane of 1900**, which made landfall at Galveston, Texas as an estimated Category 4 storm, killed 8,000 to 12,000 people, and remains the deadliest natural disaster in the history of the United States. The deadliest Atlantic storm on record was **the Great Hurricane of 1780**, which killed about 22,000 people in the Antilles.

Before modern technology, forecasting was a difficult task. Now, high-speed computers and sophisticated simulation software allow forecasters to produce computer models that forecast tropical cyclone tracks based on the future position and strength of high and low pressure systems. But while track forecasts have become more accurate than 20 years ago, scientists say they are less skillful at predicting the intensity of tropical cyclones. They attribute the lack of improvement in intensity forecasting to the complexity of tropical systems and an incomplete understanding of factors that affect their development.

Having a good understanding of Storm characteristics, forecasting terms, and the definitions used by forecasters will benefit you and help you make the proper decisions as a storm is predicted to approach your area. The following is some helpful information to assist you in this process.

ATLANTIC HURRICANE NAMES			Hurricane Season: June 1 through November 30
<b>2012</b> Alberto Beryl Chris Debby Ernesto Florence Gordon Helene Isaac Joyce Kirk Leslie Michael Nadine Oscar Patty Rafael Sandy Tony Valerie William	<b>2013</b> Andrea Barry Chantal Dorian Erin Fernand Gabrielle Humberto Ingrid Jerry Karen Lorenzo Melissa Nestor Olga Pablo Rebekah Sebastien Tanya Van Wendy	<b>2014</b> Arthur Bertha Cristobal Dolly Edouard Fay Gonzalo Hanna Isaias Josephine Kyle Laura Marco Nana Omar Paulette Rene Sally Teddy Vicky Wilfred	<p style="text-align: center;"><b><u>HURRICANE WATCH</u></b></p> <p style="text-align: center;"><b>Hurricane Conditions Pose A Threat to your area within 24 to 36 Hours</b></p> <p style="text-align: center;">Early evacuation may be necessary when a watch is issued. Otherwise you should review hurricane safety procedures and make preparations. Listen to NOAA Weather Radio, commercial radio and television stations for the latest information and instructions for your location.</p> <p style="text-align: center;"><b><u>HURRICANE WARNING</u></b></p> <p style="text-align: center;"><b>Hurricane Conditions are expected in your area within 24 Hours</b></p> <p style="text-align: center;">Areas subject to storm surge or tides should be evacuated as well as areas which could be isolated by flood waters. Follow the instructions of local officials.</p>



# eSafety Trainer Bulletin

## SAFFIR-SIMPSON SCALE

Scale Number (Category)	Sustained Winds (MPH)	Sustained Winds (Knots)	Damage Expected	Storm Surge Expected	Central Pressure (mb)	Damage Level (Overall)
Tropical Depression (TD)	<39	<34				
Tropical Storm (TS)	39 – 73	34 – 63				
1	74 – 95	64 – 82	Minimal: Unanchored Mobile Homes, vegetation and Signs.			Minimal
2	96 – 110	83 – 95	Moderate: All Mobile Homes, roofs, small craft, and flooding			Moderate
3	111 - 130	96 – 112	Extensive: Small buildings, low-lying roads cut off.			Extensive
4	131 – 155	113 – 135	Extreme: Roofs destroyed, trees down, roads cut off, mobile homes destroyed, low lying coastal areas flooded.			Extreme
5	More than 155	More than 135	Catastrophic: Most buildings destroyed. Vegetation destroyed. Major roads cut off. Homes flooded.			Catastrophic

## THE SAFFIR-SIMPSON HURRICANE SCALE

The Saffir-Simpson Hurricane Scale is a 1-5 rating based on the hurricane's present intensity. This is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. **Wind speed is the determining factor in the scale**, as storm surge values are highly dependent on the slope of the continental shelf and the shape of the coastline, in the landfall region. Note that all winds are using the U.S. 1-minute average.

### Category One Hurricane:

**Winds 74-95 mph. Storm surge generally 4-5 ft above normal.** No real damage to building structures is expected. Damage should be primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs may be seen. Also, some coastal road flooding and minor pier damage is expected.

### Category Two Hurricane:

**Winds 96-110 mph. Storm surge generally 6-8 feet above normal.** Expect some roofing material, door, and window damage of buildings. Considerable damage to shrubbery and trees with some trees blown down as well as considerable damage to mobile homes, poorly constructed signs, and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of the hurricane center. Small craft in unprotected anchorages break moorings.

### Category Three Hurricane:

**Winds 111-130 mph. Storm surge generally 9-12 ft above normal.** Some structural damage to small residences and utility buildings with a minor amount of curtain wall failures is expected. Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs may be destroyed. Low-lying escape routes are cut by rising

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water 3-5 hours before arrival of the center of the hurricane. Flooding near the coast destroys smaller structures with larger structures damaged by battering from floating debris. Terrain continuously lower than 5 ft above mean sea level may be flooded inland 8 miles or more. Evacuation of low-lying residences within several blocks of the shoreline may be required.

## Category Four Hurricane:

**Winds 131-155 mph. Storm surge generally 13-18 ft above normal.** More extensive curtain wall failures with some complete roof structure failures on small residences may be seen. Shrubs, trees, and all signs may be blown down. Complete destruction of mobile homes is possible. Extensive damage to doors and windows that are not protected is possible. Low-lying escape routes may be cut by rising water 3-5 hours before arrival of the center of the hurricane. Major damage to lower floors of structures near the shore will occur. Terrain lower than 10 ft above sea level may be flooded requiring massive evacuation of residential areas as far inland as 6 miles.

## Category Five Hurricane:

**Winds greater than 155 mph. Storm surge generally greater than 18 ft above normal.** Great potential for complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water 3-5 hours before arrival of the center of the hurricane. Major damage to lower floors of all structures located less than 15 ft above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5-10 miles of the shoreline may be required. Only 3 Category 5 Hurricanes have made landfall in the United States since records began: **The Labor Day Hurricane of 1935**, **Hurricane Camille (1969)**, and **Hurricane Andrew** in August, 1992. The **1935 Labor Day Hurricane** struck the Florida Keys with a minimum pressure of 892 mb--the lowest pressure ever observed in the United States.

### General Effects of Wind on Buildings:

- Building failures are generally caused by:
  - Higher winds than the building is constructed to withstand.
  - Breaching of openings (windows and doors)
  - Poor construction
    - Improper construction techniques
    - Poor material selection
  - Flying debris from other items or structures
- Building Damage caused by:
  - Wind Speed
  - Storm Surge
  - Inland Rainfall
- Wind loads are influenced by:
  - Site Location (Topography - surrounding terrain, open areas, forested areas, etc)
  - Height of building
  - Configuration of building
- Roof Shape plays a significant role:
  - Hip roofs generally perform better in high winds
  - Gable end roofs require extensive detail to transfer lateral loads acting on the gable end





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- o Steeply pitched roofs perform better than flat roofs due to uplifting being reduced.

## Additional Notes:

- Post disaster investigations have shown that wind damaged building failures are due to a component or segment of roofing being blown off.
  - o This allows wind and rain to rapidly enter the building, causing further damage to the roof system.
  - o An opening on the windward side of the building may also allow wind entering the building to add uplifting force (Positive Pressure) to the building system. This in conjunction with the negative pressures exerted on the exterior of the building will cause a complete failure of the structure.
- Cyclic loading on buildings also causes failures.
  - o Winds are generally unsteady; blowing hard, letting up, and going hard again. This variation in pressures causes structures to pulsate and eventually fail.
- Windborne debris may become missiles and cause considerable damage.
- Trees and other falling objects also great damage to structures.

## DEFINITIONS

It is important to become familiar with the terms used to identify a Hurricane hazard. It is important to tune into NOAA Weather Radio, commercial radio, or your local television station for more information. Additional information may be available from National News and Weather broadcasters.

**Tropical Depression** - An organized system of clouds and thunderstorms with a defined surface circulation and maximum sustained winds of 38 MPH or less. Sustained winds are defined as the one-minute average wind measures at 33 ft. above the surface.

**Tropical Storm** - An organized system of strong thunderstorms with a defined surface circulation and maximum sustained winds of 39 – 73 MPH.

**Hurricane** - An intense tropical weather system of strong thunderstorms with a well defined surface circulation of maximum sustained winds of 74 MPH or higher.

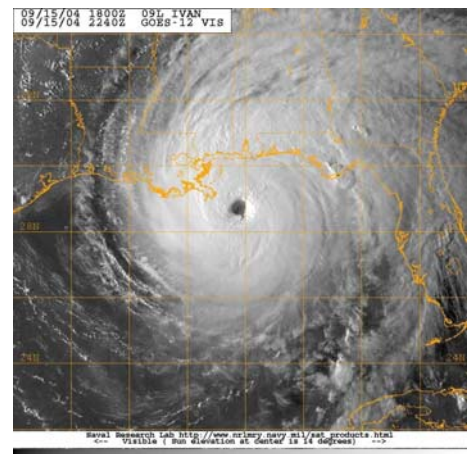
**Storm Surge** - A dome of water pushed onshore by hurricane and tropical storm winds. Storm surges can reach 25 ft high and be 50 to 1000 miles wide.

**Storm Tide** - A combination of storm surge and normal tide. If there is a predicted 15 ft. storm surge combined with a 2 ft. normal high tide over the mean sea level, a 17 ft. storm tide is created.

**Hurricane/Tropical Storm Watch** - Hurricane or tropical storm conditions re possible in the specified area, usually within 36 hours.

**Hurricane/Tropical Storm Warning** - Hurricane or tropical storm conditions are expected in the specified area within 24 hours.

**Short Term Watches and Warnings** - These warnings provide detailed information about specific hurricane related threats such as flash floods or tornados.



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