Saffir-Simpson Hurricane Scale

SAFFIR-SIMPSON HURRICANE SCALE		
Category	Wind speed	Storm surge
	mph (km/h)	ft (m)
5	≥156 (≥250)	>18 (>5.5)
4	131–155 (210–249)	13–18 (4.0–5.5)
3	111–130 (178–209)	9–12 (2.7–3.7)
2	96–110 (154–177)	6–8 (1.8–2.4)
1	74–95 (119–153)	4–5 (1.2–1.5)

The Saffir-Simpson Hurricane Scale is a classification used for most Western Hemisphere tropical cyclones that exceed the intensities of tropical depressions and tropical storms, and thereby become hurricanes. The scale divides hurricanes into five categories distinguished by the intensities of their sustained winds. In order to be classified as a hurricane, a tropical cyclone must have maximum sustained winds of at least 74 mph (33 m/s; 64 kt; 119 km/h). The highest classification in the scale, Category 5, is reserved for storms with winds exceeding 155 mph (69 m/s; 136 kt; 249 km/h).

The classifications are intended primarily for use in measuring the potential damage and flooding a hurricane will cause upon landfall, although they have been criticized as being too simple. Officially, the Saffir-Simpson Hurricane Scale is used only to describe hurricanes forming in the Atlantic Ocean and northern Pacific Ocean east of the International Date Line. Other areas use different classification scales to label these storms, which are called "cyclones" or "typhoons", depending on the area.

HISTORY

The scale was developed in 1971 by civil engineer Herbert Saffir and meteorologist Bob Simpson, who at the time was director of the U.S. National Hurricane Center (NHC).[1] The scale was introduced to the general public in 1973,[2] and saw widespread use after Neil Frank replaced Simpson at the helm of the NHC in 1974.[3]

The initial scale was developed by Saffir, a structural engineer, who in 1969 went on commission for the United Nations to study low-cost housing in hurricane-prone areas.[4] While performing the study, Saffir realized there was no simple scale for describing the likely effects of a hurricane. Mirroring the utility of the Richter magnitude scale in describing earthquakes, he devised a 1–5 scale based on wind speed that showed expected damage to structures. Saffir gave the scale to the NHC, and Simpson added the effects of storm surge and flooding. The scale does not take into account rainfall or location, which means a Category 2 hurricane which hits a major city will likely do far more damage than a Category 5 hurricane that hits a rural area.[5]

CATEGORIES

The scale separates hurricanes into five different categories based on wind, central barometric pressure, and storm surge. The U.S. National Hurricane Center classifies hurricanes of Category 3 and above as major hurricanes. Most weather agencies use the definition for sustained winds recommended by the World Meteorological Organization (WMO), which specifies measuring winds at a height of 33 ft (10 m) for 10 minutes, and then taking the average. By contrast, the U.S. National Weather Service defines sustained winds as average winds over a period of one minute, measured at the same 33 ft (10 m) height.[6][7] Central pressure values are approximate. Intensity of example hurricanes is from both the time of landfall and the maximum intensity.[8] The five categories are, in order of increasing intensity:

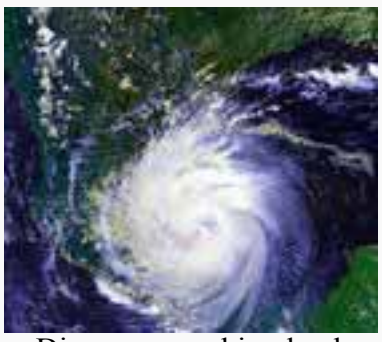
CATEGORY 1

Category 1			
Sustained winds	33–42 m/s	64–82 kt	 Gaston at landfall
	119–153 km/h	74–95 mph	
Storm surge	1.2–1.5 m	4–5 ft	
Central pressure	980–989 mbar	28.94 inHg	

Category 1 storms usually cause no significant damage to building structures; however, they can tip over unanchored mobile homes, as well as uproot or snap trees. Poorly attached roof shingles or tiles can blow off. Also, they produce some coastal flooding, as well as minor pier damage.[8]

Examples of storms of this intensity include: Hurricane Alice (1954), Danny (1985), Jerry (1989), Ismael (1995), Gaston (2004), Humberto (2007), and Hurricane Boris (2008).

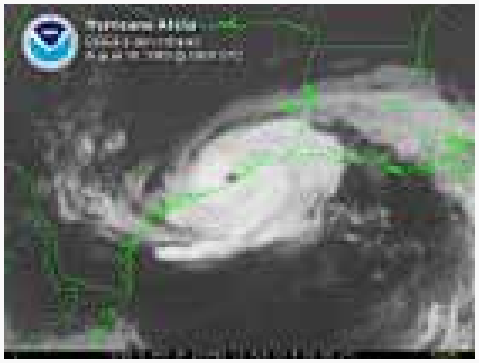
CATEGORY 2

Category 2			
Sustained winds	43–49 m/s	83–95 kt	 Diana approaching land
	154–177 km/h	96–110 mph	
Storm surge	1.8–2.4 m	6–8 ft	
Central pressure	965–979 mbar	28.50–28.91 in Hg	

Storms of this intensity damage some roofing material, and also produce damage to poorly constructed doors and windows. Considerable damage is caused to vegetation, poorly constructed signs, and piers. Mobile homes, whether anchored or not, are usually badly damaged, and many manufactured homes also suffer structural damage. Also, small craft in unprotected anchorages may break their moorings.[8]

Hurricanes that peaked at Category 2 intensity, and made landfall while still in that category include Carol (1954), Diana (1990), Erin (1995), Hurricane Marty, Hurricane Juan (2003), and Hurricane Dolly (2008).

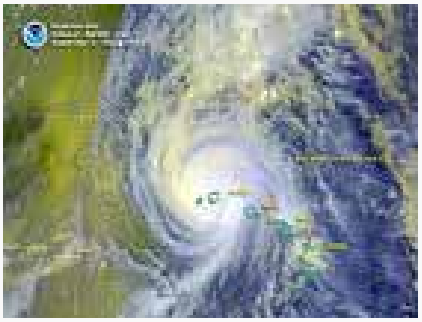
CATEGORY 3

Category 3			
Sustained winds	50–58 m/s	96–113 kt	 Alicia approaching Texas
	178–209 km/h	111–130 mph	
Storm surge	2.7–3.7 m	9–12 ft	
Central pressure	945–964 mbar	27.91–28.47 inHg	

Tropical cyclones of this intensity and higher receive the name of major hurricanes when located in the Atlantic or Eastern Pacific basins. These storms can cause some structural damage to small residences and utility buildings, particularly those of wood frame or manufactured materials with minor curtainwall failures. Buildings that lack a solid foundation, such as mobile homes, are usually destroyed, and gable-end roofs are peeled off. Manufactured homes usually sustain very heavy and irreparable damage. Flooding near the coast destroys smaller structures, while larger structures are hit by floating debris. Additionally, terrain may be flooded well inland.[8]

Examples of storms of this intensity include Hurricane Alma (1966), Alicia (1983), Fran (1996), Isidore (2002), Jeanne (2004), Katrina (2005), and Lane (2006).

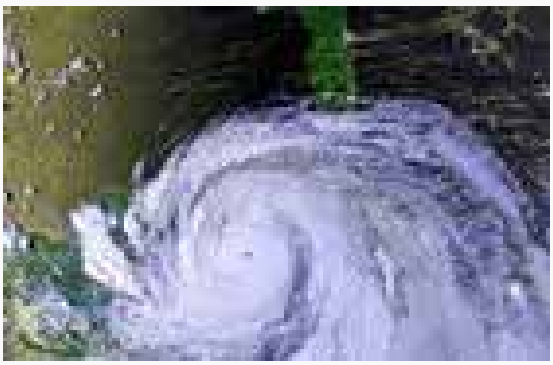
CATEGORY 4

Category 4			
Sustained winds	59–69 m/s	114–135 kt	 Iniki over the Hawaiian Islands
	210–249 km/h	131–155 mph	
Storm surge	4.0–5.5 m	13–18 ft	
Central pressure	920–944 mbar	27.17–27.88 inHg	

Category 4 hurricanes tend to produce more extensive curtainwall failures, with some complete roof structural failure on small residences. Heavy, irreparable damage and near complete destruction of gas station canopies and other wide span overhang type structures are also common. Mobile and manufactured homes are leveled. These hurricanes cause major erosion of beach areas and terrain may be flooded well inland as well.[8]

Hurricanes of this intensity are extremely dangerous to populated areas. The Galveston Hurricane of 1900, the deadliest natural disaster to hit the United States, would be classified as Category 4 if it occurred today. Other examples of storms at this intensity are Hazel (1954), Carmen (1974), Iniki (1992), Luis (1995), Iris (2001), and Charley (2004).

CATEGORY 5

Category 5			
Sustained winds	≥70 m/s	≥136 kt	 Gilbert near peak intensity
	≥250 km/h	≥156 mph	
Storm surge	≥5.5 m	≥19 ft	
Central pressure	<920 mbar	<27.17 inHg	

Category 5 is the highest category a tropical cyclone can obtain in the Saffir-Simpson scale. These storms cause complete roof failure on many residences and industrial buildings, and some complete building failures with small utility buildings blown over or away. Collapse of many wide-span roofs and walls, especially those with no interior supports, is common. Very heavy and irreparable damage to many wood frame structures and total destruction to mobile/manufactured homes is prevalent. Only a few types of structures are capable of surviving intact, and only if located at least three to five miles (four to eight km) inland. They include office, condominium and apartment buildings and hotels that are of solid concrete or steel frame construction, public multi-story concrete parking garages, and residences that are made of either reinforced brick or concrete/cement block and have hipped roofs with slopes of no less than 35 degrees from horizontal and no overhangs of any kind, and if the windows are either made of hurricane resistant safety glass or covered with shutters.[8]

The storm's flooding causes major damage to the lower floors of all structures near the shoreline, and many coastal structures can be completely flattened or washed away by the storm surge. Storm surge damage can occur up to four city blocks inland, with flooding, depending on terrain, reaching six to seven blocks inland. Massive evacuation of residential areas may be required if the hurricane threatens populated areas.[8]

Storms of this intensity can be extremely damaging. Historical examples that reached the Category 5 status and made landfall as such include the Labor Day Hurricane of 1935, the 1959 Mexico Hurricane, Camille in 1969, Gilbert in 1988, Andrew in 1992, Hurricane Mitch in 1998, Wilma in 2005, and Dean and Felix in 2007.

References

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[2] Staff writer (May 9, 1973). "'73 Hurricanes to be Graded". The Associated Press. Retrieved on 2007-12-08.
[3] Debi Iacovelli (July 2001). "The Saffir/Simpson Hurricane Scale: An Interview with Dr. Robert Simpson". South Florida Sun-Sentinel. Retrieved on 2006-09-10.
[4] Associated Press (2001-08-13). "Hurricanes shaped life of scale inventor Saffir". Retrieved on 2007-12-21.
[5] Ker Than (2005-10-20). "Wilma's Rage Suggests New Hurricane Categories Needed", LiveScience. Retrieved on 2005-10-20.
[6] Tropical Cyclone Weather Services Program (June 1, 2006). "Tropical cyclone definitions" (PDF). National Weather Service. Retrieved on 2006-11-30.
[7] Federal Emergency Management Agency (2004). "Hurricane Glossary of Terms". Retrieved on 2006-03-24. Accessed through the Wayback Machine.
[8] National Hurricane Center (2006). "Saffir-Simpson Hurricane Scale Information". National Oceanic and Atmospheric Administration. Retrieved on 2007-02-25.