

The Major Hurricanes of 2005: a Few Facts

Compiled by Gaye S. Farris

The following is a compilation of storm terminology, categories, and names as well as the meteorological history, damage, and paths of Hurricanes Dennis, Katrina, Rita, and Wilma. This information is taken, except where noted, from the Web site and archives of the National Hurricane Center (NHC), a part of the National Oceanic and Atmospheric Administration's National Weather Service (NWS). Greater details are available at www.nhc.noaa.gov. These facts are presented here to provide the reader background for the articles in this volume describing the storm science of the U.S. Geological Survey, which works with the NWS during hurricanes by providing real-time river stage data used by NWS to forecast river floods.

Hurricanes, Typhoons, and Cyclones

A cyclone is an atmospheric closed circulation that rotates counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. A tropical cyclone is a generic name for warm-core, nonfrontal, large-scale, low-pressure cyclones originating over tropical or subtropical waters, with organized deep convection (thunderstorm activity) and a closed surface wind circulation around a well-defined center.

Tropical cyclones include tropical depressions (winds less than 39 mi/hour or 63 km/hour) and tropical storms (39–73 mi/hour or 63–117 km/hour), which receive a name. When tropical cyclone winds reach 74 mi/hour (119 km/hour), they are called one of the following, depending on location:

- **hurricanes** in the North Atlantic Ocean, the Northeast Pacific Ocean east of the International Dateline, or the South Pacific Ocean east of longitude 160° E
- **typhoons** in the Northwest Pacific Ocean west of the International Date Line
- **severe tropical cyclones** in the Southwest Pacific Ocean west of longitude 160° E or Southeast Indian Ocean east of longitude 90° E
- **severe cyclonic storms** in the North Indian Ocean
- **tropical cyclones** in the Southwest Indian Ocean

Atlantic hurricanes take place in the Atlantic Ocean, Caribbean Sea, and the Gulf of Mexico. The Atlantic hurricane season is from June 1 to November 30.

Hurricane Categories

The National Weather Service uses the **Saffir-Simpson Hurricane Scale**, a 1–5 rating based on wind intensity calculated at the U.S. 1-minute average at about 33 ft (10 m).

- **Category 1 hurricane:** Winds 74–95 mi/hour (119–153 km/hour)
- **Category 2 hurricane:** Winds 96–110 mi/hour (154–177 km/hour)
- **Category 3 hurricane:** Winds 111–130 mi/hour (178–209 km/hour)
- **Category 4 hurricane:** Winds 131–155 mi/hour (210–249 km/hour)
- **Category 5 hurricane:** Winds greater than 155 mi/hour (249 km/hour)

The Saffir-Simpson Hurricane Scale is based on wind rather than storm surge values because surge depends on the slope of the Continental Shelf and coastline shape. **Storm surge** is an abnormal rise in sea level accompanying an intense storm, and its 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. It is usually estimated by subtracting the normal or astronomic high tide from the observed storm tide.

Hurricane and Storm Names

In 2005 there were 31 tropical cyclones during the Atlantic hurricane season, 27 of them named:

Tropical Storm Arlene
Tropical Storm Bret
Hurricane Cindy (redesignated as a hurricane in the postseason reanalysis)
Hurricane Dennis
Hurricane Emily
Tropical Storm Franklin
Tropical Storm Gert
Tropical Storm Harvey
Hurricane Irene

Tropical Depression Ten
Tropical Storm Jose
Hurricane Katrina
Tropical Storm Lee
Tropical Storm Maria
Hurricane Nate
Hurricane Ophelia
Hurricane Philippe
Hurricane Rita
Tropical Depression Nineteen
Hurricane Stan
Subtropical Storm (this unnamed subtropical cyclone was identified during NHC's postseason reanalysis)
Tropical Storm Tammy
Subtropical Depression Twenty-two
Hurricane Vince
Hurricane Wilma
Tropical Storm Alpha
Hurricane Beta
Tropical Storm Gamma
Tropical Storm Delta
Hurricane Epsilon
Tropical Storm Zeta

Significant Atlantic Hurricanes of 2005

This report deals with the U.S. Geological Survey (USGS) response to the 2005 hurricanes named Dennis, Katrina, Rita, and Wilma. The USGS responded to other storms during 2005, but these four were unusually large and severe. “Best track” maps (figs. 1–4) are provided to indicate a tropical cyclone’s location and intensity over its lifetime. They are, according to the NHC, subjectively “smoothed” representations based on poststorm assessment of all available data.

Hurricane Dennis (July 4–13)

began as a tropical depression July 4 over the southern Windward Islands, intensifying to a category 4 hurricane and eventually making landfall July 10 as a category 3 on Santa Rosa Island, Fla., where it produced a storm surge of 6–7 ft (1.8–2.1 m) above normal tide levels. Dennis caused nine known tornadoes in Florida and one in Georgia. Dennis is responsible for 42 deaths (3 in the United States) and was indirectly responsible for 12 more deaths in Florida (for example, automobile accidents, falls). Estimated U.S. insured and uninsured property damage was \$2.23 billion.

Hurricane Katrina (August 23–30), one of the most intense, largest, costliest, and deadliest hurricanes to hit the United States, was a tropical depression on August 23 when it was over the southeastern Bahamas. It reached hurricane force August 25 and made landfall as a category 1 on the southeastern coast of Florida. It moved west-southwestward over the Everglades, weakened to a tropical storm, and then entered the southeastern Gulf of Mexico on August 26, where it became a category 3. Katrina strengthened to a category 5 on August 28 and attained its peak intensity south of the Mississippi River. It made landfall as a high-level category 3 on August 29 near Buras, La., at the mouth of the river. Its final landfall was at the mouth of the Pearl River at the Louisiana and Mississippi border on August 29, still as a category 3.

Storm surge data were difficult to measure because of the failures of tide gages and the fact that many buildings were destroyed. The NHC cites Federal Emergency Management Agency data indicating that the storm surge was about 24–28 ft (7.3–8.5 m) along the Mississippi coast across a 20-mi (32-km) swath centered around Bay St. Louis and was 17–22 ft (5.1–6.7 m) from Gulfport to Pascagoula. The surge appears to have penetrated at least 6 mi (9.7 km) inland of the Mississippi coast and 12 mi (19 km) along bays and rivers. The storm surge was 8–15 ft (2.4–4.6 m) along coastal Alabama. Data from NOAA’s National Data Buoy Center (NDBC) regarding buoy 42040, several miles south of Dauphin Island, Ala., reported a wave height of 30 ft (9 m) on August 29 and later 55 ft (16.8 m) on that same day, equaling the largest significant wave height ever measured by an NDBC buoy.

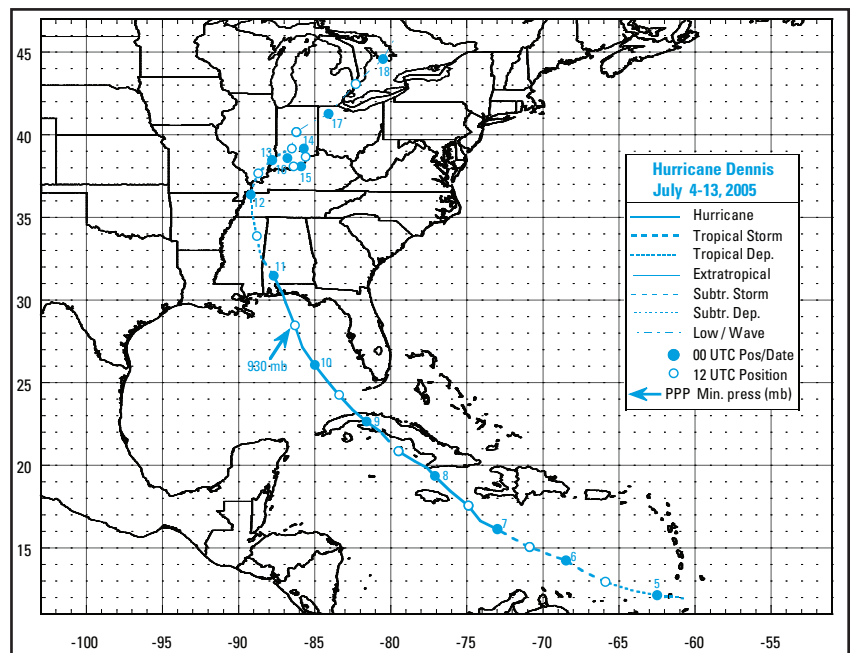


Figure 1. Track of Hurricane Dennis.

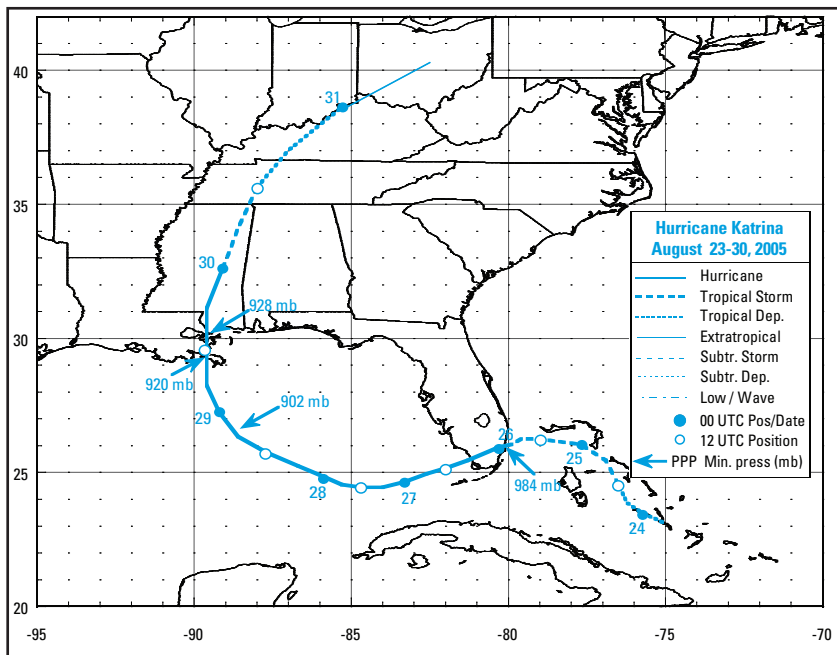


Figure 2. Track of Hurricane Katrina.

As the level of Lake Pontchartrain, La., rose, water was pushed into communities along its northeastern shore, from Slidell to Mandeville. The levees and floodwalls of New Orleans were overtopped and breached, and some failed. Water was also pushed up the Mississippi River-Gulf Outlet (American Society of Civil Engineers, 2007), the Intracoastal Waterway, the Inner Harbor Navigation Canal (Industrial Canal), the 17th Street Canal, and the London Avenue Outfall canal. About 80 percent of New Orleans was flooded to varying depth of up to 20 ft (6 m) within a day of landfall.

Katrina produced 43 reported tornadoes: 1 in the Florida Keys, 20 in Georgia (a record for 1 day in August, and 1 of them causing a fatality), 11 in Alabama, and 11 in Mississippi.

State health departments estimate that about 2,000 deaths gulfwide were caused by Katrina, with most occurring in Louisiana. So far, Katrina is the third deadliest known hurricane, surpassed in fatalities by hurricanes in 1900 in Galveston, Tex. (8,000), and in 1928 in Lake Okeechobee, Fla. (2,500).

Thousands of citizens are still living in trailers or have evacuated to other areas and have not returned as of this writing. Thousands of homes and businesses in the New Orleans area and on the Mississippi coast were destroyed. The U.S. insured and uninsured losses are estimated to be at least \$80 billion.

Hurricane Rita (September 18–26) slammed into the Gulf Coast just about 3 weeks after Hurricane Katrina had hit. Rita was a tropical depression in the Turks and Caicos on September 18 and later that day became a tropical storm. By September 20 it was a hurricane off the coast of Key West, Fla. Gaining strength, Rita proceeded westward into the southeastern Gulf of Mexico as a category 3 on September 21 and eventually a category 5, reaching its peak intensity south-southeast of the mouth of the Mississippi River. Rita weakened to a category 4 on September 22 and a category 3 on September 24, when it made landfall in southwestern Louisiana, just west of Johnsons Bayou and east of Sabine Pass at the Texas-Louisiana border.

Because many structures in southwest Louisiana were destroyed by Rita and many gages failed hours before the storm, storm surge analysis has been difficult. Unofficial visual observations of high-water marks and debris lines in Cameron suggest a storm surge of 15 ft (4.6 m) and higher. Surge up the Calcasieu River caused flooding in portions of the Lake Charles area, reaching Interstate 10, about 25 mi (40 km) from the coast. Flood waters in downtown Lake Charles were as deep as 6 ft (1.8 m) or so in some places. Flooding to the east in Vermilion, Iberia, and St. Mary Parishes was visually estimated to be 8–12 ft (2.4–3.7 m). Rita also produced storm surge in southeastern

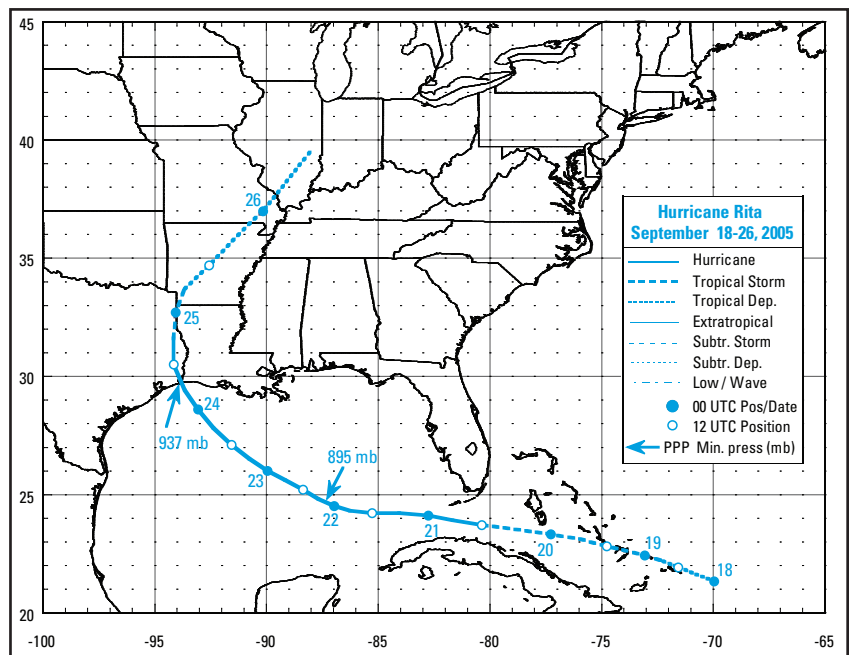


Figure 3. Track of Hurricane Rita.

Louisiana of 4–7 ft (1.2–2.1 m) in areas previously flooded by Katrina. Additionally, Rita had earlier produced a storm surge in the Florida Keys of 4–5 ft (1.2–1.5 m) in some areas. At least 90 tornadoes were associated with Rita in Alabama, Mississippi, Louisiana, and Arkansas.

Rita triggered the largest evacuation in U.S. history, with the media reporting more than 2 million evacuees from Texas and a smaller number from Louisiana. Seven deaths were directly attributed to Rita and at least 55 indirectly (for example, heat exhaustion, bus accident, carbon monoxide poisoning). Entire communities were devastated in Louisiana, including Holly Beach, Cameron, Creole, and Grand Cheniere. Estimated U.S. damage was \$10 billion.

Hurricane Wilma (October 15–25) was a tropical depression October 15 east-southeast of Grand Cayman and became a tropical storm October 17. On October 18 Wilma became a hurricane and by October 19 was a category 5. It headed to the Yucatan Peninsula of Mexico as a category 4 and made landfall on the island of Cozumel on October 21. On October 22 the hurricane moved northward, crossing the extreme northeastern Yucatan Peninsula. On October 23 Wilma moved into the southern Gulf of Mexico and made landfall in southwestern Florida near Cape Romano as a category 3. It crossed Florida as a category 2 and intensified once more to a category 3. On October 25 Wilma eventually lost strength over the western Atlantic

Coastal areas of Florida reported 4–8 ft (1.2–2.4 m) of storm surge, but higher surges may have occurred over uninhabited areas of southwestern Florida, south of where Wilma made landfall. The storm devastated areas of the northeastern Yucatan Peninsula and damaged areas of southern

Florida. It was a category 5 hurricane at peak intensity and is the strongest Atlantic tropical cyclone on record, with a minimum pressure of 882 millibars. (Meteorologists use a metric unit for pressure called a millibar, and the average pressure at sea level is 1,013.25 millibars; University of Illinois, 1997.)

Wilma produced 10 tornadoes over Florida and was responsible for 23 deaths: 12 in Haiti, 1 in Jamaica, 4 in Mexico, 5 in Florida, and 1 in the Bahamas. It caused the largest disruption to electrical service ever experienced in Florida and caused more than \$20.6 billion in insured and uninsured damage, making Wilma the third costliest hurricane in U.S. history after Katrina and Andrew (in 1992).

Conclusion

Given this meteorological history of the major hurricanes of 2005 and their associated damage, the reader is invited to explore the science behind the hurricane research of the U.S. Geological Survey.

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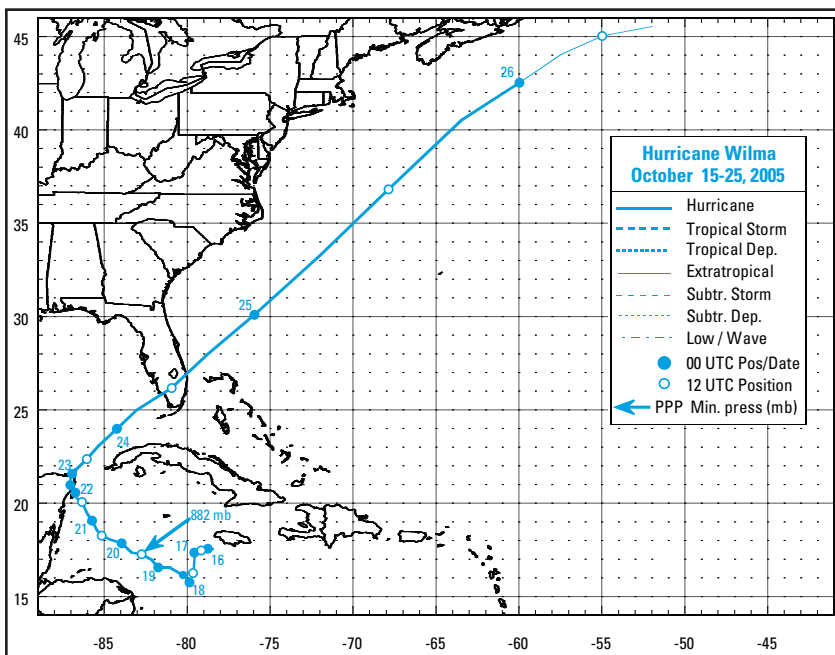


Figure 4. Track of Hurricane Wilma.