

## = Meteorological history of Hurricane Katrina =

The meteorological history of Hurricane Katrina , an extremely destructive Category 5 hurricane , began on August 23 , 2005 when it originated as Tropical Depression Twelve near the Bahamas . The next day , the tropical depression strengthened to a tropical storm , and was named Katrina ; it proceeded to make landfall on the southern tip of the U.S. state of Florida as a minimal hurricane .

In passing across Florida , Katrina did not attain any more strength but did manage to maintain hurricane status . After passing over Florida , the warm waters of the Gulf of Mexico allowed it to rapidly intensify to the sixth strongest Atlantic hurricane in recorded history . Afterward , Katrina made landfall as a Category 3 storm near Buras @-@ Triumph , Louisiana , and once more near the Mississippi / Louisiana border . Katrina progressed northward through the central United States and finally dissipated near the Great Lakes on August 31 , when it was absorbed by a cold front .

## = = Formation = =

Tropical Depression Twelve formed over the southeastern Bahamas at 5 : 00 p.m. EDT ( 2100 UTC ) on August 23 , 2005 , partially from the remains of Tropical Depression Ten , which had dissipated due to the effects of a nearby upper tropospheric trough . While the normal standards for numbering tropical depressions in the Atlantic indicate that the old name / number is retained when a depression dissipates and regenerates , satellite data indicated that a second tropical wave combined with Tropical Depression Ten north of Puerto Rico to form a new , much more advanced system , which was then designated as Tropical Depression Twelve . Simultaneously , the trough in the upper troposphere weakened , causing the wind shear in the area to relax , thereby allowing the new tropical depression to develop . In a later re @-@ analysis , it was determined that the low @-@ level circulation of Ten had completely detached and dissipated , with only the remnant mid @-@ level circulation moving on and merging with the aforementioned second tropical wave . As a result , the criteria for keeping the same name and identity were not met .

## = = First landfall = =

As the atmospheric conditions surrounding Tropical Depression Twelve were favorable for tropical development , the system began to intensify and was upgraded to Tropical Storm Katrina on the morning of August 24 . A burst of convection allowed Katrina to become the fifth hurricane of the 2005 season on August 25 , only two hours before it made landfall around 6 : 30 p.m. EST ( 2230 UTC ) between Hallandale Beach and Aventura , Florida . Katrina struck the peninsula with 80 mph ( 130 km / h ) winds , and had a well @-@ defined eye on NEXRAD weather radar , which remained intact throughout its passage over Florida . Parts of the Florida Keys experienced tropical storm winds throughout August 26 , with the Dry Tortugas briefly experiencing hurricane @-@ force winds .

## = = Gulf of Mexico = =

The initial National Hurricane Center forecasts predicted that Katrina would begin turning northward after landfall , eventually to hit the Florida Panhandle approximately three to four days later . Katrina , however , continued a westerly and west @-@ southwesterly track , which eventually shifted the forecast track westward to New Orleans .

Immediately after the storm entered the Gulf of Mexico , the low wind shear , good upper @-@ level outflow , and the warm sea surface temperatures of the Gulf Loop Current caused Katrina to intensify rapidly . On August 27 , the storm was upgraded to Category 3 intensity , becoming the third major hurricane of the season . An eyewall replacement cycle disrupted the intensification of maximum winds for about 18 hours , but almost doubled the radius of the storm . A second period of rapid intensification started by 7 : 00 p.m. CDT on August 27 , and by 12 : 40 a.m. CDT on August 28 , Katrina was upgraded to a Category 4 hurricane with maximum sustained winds of 145 mph (

233 km / h ) . It became a Category 5 ( the first in the Gulf of Mexico since Hurricane Allen 25 years prior ) storm by 7 : 00 a.m. CDT , twelve hours after the beginning of the second round of rapid intensification , and reached its peak intensity at 1 : 00 p.m. CDT with maximum sustained winds of 175 mph ( 280 km / h ) , gusts of 215 mph ( 344 km / h ) and a central pressure of 902 mbar ( 26 @. @ 64 inHg ) . The minimum pressure made Katrina , at the time , the fourth most intense Atlantic hurricane on record ( Hurricanes Rita and Wilma would later surpass Katrina that same year ) . As the hurricane approached New Orleans , the Weather Forecast Office in Slidell , Louisiana issued two strongly worded warnings of the storm 's danger .

By the afternoon of August 28 , the storm was large enough that some areas of the Gulf Coast were already experiencing tropical storm @-@ force winds . The center of Katrina was about 180 statute miles ( 290 km ) from the mouth of the Mississippi River , but tropical storm @-@ force winds extended 230 mi ( 370 km ) from the center of the storm , and hurricane @-@ force winds extended about 105 miles ( 170 km ) away . Overnight on August 29 , and into the morning of the next day , Katrina quickly weakened ( in terms of maximum sustained winds ) as it began to enter another eyewall replacement cycle . The inner eyewall deteriorated before an outer eyewall had fully formed , playing an important role in the weakening . In 18 hours , the hurricane 's maximum sustained winds decreased from 170 mph ( 280 km / h ) to 125 mph ( 205 km / h ) . However , storm surge remained high at landfall because large waves greater than 30 feet ( 9 @. @ 1 m ) in height were generated beforehand ( with a buoy recording a 55 ft / 16 @. @ 7 m wave at sea ) , when Katrina was at Categories 4 and 5 on the Saffir @-@ Simpson Hurricane Scale . The waves then combined with the storm surge of the large Category 3 hurricane .

= = Second and third landfalls = =

Katrina made its second landfall at 6 : 10 a.m. CDT on August 29 as a Category 3 hurricane with sustained winds of 125 mph ( 205 km / h ) near Buras @-@ Triumph , Louisiana . Because Katrina had just weakened from Category 4 and due to the shape of the coastline , sustained Category 4 winds likely existed on land while the eye was over water . At landfall , hurricane @-@ force winds extended 120 miles ( 190 km ) from the center , the storm 's pressure was 920 mbar ( 27 @. @ 17 inHg ) , and its forward speed was 15 mph ( 24 km / h ) . As it made its way up the eastern Louisiana coastline , most communities in Plaquemines , St. Bernard Parish , and Slidell in St. Tammany Parish were severely damaged by storm surge and the strong winds of the eyewall , which also grazed eastern New Orleans , causing in excess of \$ 1 billion worth of damage to the city ( see Effect of Hurricane Katrina on New Orleans ) .

Original estimates indicated that Katrina had made this landfall as a Category 4 hurricane , with 135 mph ( 220 km / h ) winds ; however , as indicated above , the storm weakened just before landfall to Category 3 intensity . The reasons for this weakening are not completely known yet ; while the eye @-@ wall replacement cycle played a part , slightly increasing shear , dropping sea @-@ surface temperatures , dry air on the western semicircle of the storm and interaction with the continental landmass also may have played a role in weakening the cyclone . This follows the trend of previous strong cyclones in the Gulf of Mexico : all cyclones with minimum central pressures of 973 mbar ( 28 @. @ 73 inHg ) or less have weakened over the 12 hours before making landfall in the Gulf Coast of the United States .

A few hours later , after weakening slightly , Katrina made its third landfall near the Louisiana ? Mississippi border with 120 mph ( 195 km / h ) sustained winds and 928 mbar ( 27 @. @ 37 inHg ) pressure , still at Category 3 intensity . Its minimum pressure at its second landfall was 920 mbar ( 27 @. @ 17 inHg ) , making Katrina the third strongest hurricane on record to make landfall on the United States , behind Hurricane Camille 's 909 mbar ( 26 @. @ 85 inHg ) reading in 1969 , and the 1935 Labor Day Hurricane 's 892 mbar ( 26 @. @ 35 inHg ) record .

Because the storm was so large , highly destructive eye @-@ wall winds and the strong northeastern quadrant of the storm pushed record storm surges onshore , smashing the entire Mississippi Gulf Coast , including towns in Mississippi such as Waveland , Bay St. Louis , Pass Christian , Long Beach , Gulfport , Biloxi , Ocean Springs , Gautier and Pascagoula , and , in

Alabama , Bayou La Batre . The surges peaked at 28 feet ( 8 @. @ 5 m ) in Bay St. Louis , Mississippi , and at 13 feet ( 4 @. @ 0 m ) as far away as Mobile , Alabama , which saw its highest storm surge since 1917 . Storm surge was particularly high due to the hydrology of the region , the hurricane 's extreme size , and the fact that it weakened only shortly before landfall . As Katrina moved inland diagonally over Mississippi , high winds cut a swath of damage that affected almost the entire state .

= = Demise = =

Katrina maintained hurricane strength well into Mississippi , but weakened thereafter , losing hurricane strength more than 150 miles ( 240 km ) inland , near Meridian , Mississippi . It was downgraded to a tropical depression near Clarksville , Tennessee and broke in half . One half continued to race northward , affecting the Central United States along its path , and was last distinguishable in the eastern Great Lakes region on August 31 . On August 31 , Katrina was absorbed by a frontal boundary and became a powerful extratropical low , causing 1 @. @ 97 ? 6 @. @ 69 inches ( 50 ? 170 mm ) of rain in 12 hours , as well as gale @-@ force wind gusts from 31 to 61 mph ( 50 to 98 km / h ) in southeastern Quebec and northern New Brunswick . In the region of Saguenay and Côte @-@ Nord , rain caused breakdowns and failure in roads . The Côte @-@ Nord region was isolated from the rest of Quebec for at least 1 week . The other half of Katrina broke off in the eastern part of the Appalachians , primarily leading to a significant tornado outbreak in the area from central Georgia to central Pennsylvania , killing two people and causing millions of dollars in additional damage .

At 11 : 00 p.m. EDT on August 31 , the center of the remnant low of what was Katrina had been completely absorbed by a frontal boundary in southeastern Canada , with no discernible circulation .