= Hurricane Kyle (2002) =

Hurricane Kyle was the fifth longest @-@ lived Atlantic tropical or subtropical cyclone on record . The eleventh named storm and third hurricane of the 2002 Atlantic hurricane season , Kyle developed as a subtropical cyclone on September 20 to the east @-@ southeast of Bermuda . Looping westward , it transitioned into a tropical cyclone and became a hurricane on September 25 . For the next two weeks , Kyle tracked generally westward , oscillating in strength several times because of fluctuations in environmental conditions . On October 11 , the cyclone turned northeastward and made landfalls near Charleston , South Carolina , and Long Beach , North Carolina , at tropical storm status . After lasting as a cyclone for 22 days , Kyle dissipated on October 12 as it was absorbed by an approaching cold front .

The hurricane brought light precipitation to Bermuda , but no significant damage was reported there . Moderate rainfall accompanied its two landfalls in the United States , causing localized flash flooding and road closures . Floodwaters forced the evacuation of a nursing home and several mobile homes in South Carolina . Kyle spawned at least four tornadoes , the costliest of which struck Georgetown , South Carolina ; it damaged 106 buildings and destroyed seven others , causing eight injuries . Overall damage totaled about $ 5 million (2002 USD , $ 6 @.@ 58 million 2016 USD) , and no direct deaths were reported . However , the remnants of Kyle contributed to one indirect death in the British Isles .

= = Meteorological history = =

A cold front stalled and began weakening to the southeast of Bermuda on September 15 , spawning a low @-@ pressure area by September 18 . A stationary wind circulation developed around the low by September 19 , aided by a trough aloft to its west . Convection developed into narrow banding features far from the center , and the overall structure gradually consolidated . It is estimated that the system developed into a subtropical depression late on September 20 , about 490 miles southeast of Bermuda ; it was classified subtropical because of the large distance between the convection and the center , uncharacteristic of purely tropical systems . The cyclone tracked northward within the weak steering flow between an upper @-@ level low to its south and a trough to its north . Strengthening gradually , the depression attained subtropical storm status early on September 21 , and as such was named Kyle by the National Hurricane Center .

After being named , Kyle tracked north @-@ northeastward before gradually executing a clockwise loop . Initially , the circulation center remained partly exposed to the south and west of the deep convection . On September 22 , the convection increased around the center as the system developed a warm thermal core , and as a result it was reclassified as a fully tropical cyclone . A building anticyclone to the northwest turned Kyle to the southwest . After the storm briefly weakened , previously moderate wind shear began decreasing , which allowed convection to deepen and the outflow over the cyclone to improve . Tracking over progressively warmer waters , Kyle began developing a banding eye feature late on September 24 . Slow strengthening continued , and the storm attained hurricane status at 1200 UTC on September 25 . The next day , Kyle reached peak winds of 85 mph (130 km / h) about 490 miles east @-@ southeast of Bermuda .

After maintaining its peak intensity for about 24 hours , Kyle began weakening on September 27 as increased upper @-@ level shear restricted outflow and distorted the convection envelope ; drier air also contributed to the weakening . On September 28 , after turning west @-@ northwestward , the hurricane weakened to tropical storm status , and by the next day the center had become devoid of deep convection . A trough passing to its north and a developing ridge to its west left the storm nearly stationary for several days . The weakening rate of Kyle was temporarily halted when thunderstorms redeveloped on September 29 and again early the next day , though late on September 30 the storm weakened to tropical depression status . The circulation had become elongated from northeast to southwest . The northeastern portion became associated with the approaching frontal zone , and was briefly monitored for signs of development . However , the southwestern portion redeveloped convection and became the dominant circulation .

Remaining a tropical depression for about 18 hours , Kyle re @-@ intensified to tropical storm status on October 1 , after redeveloping some thunderstorms southeast of the center . Despite unfavorable wind shear , the convection became better organized , developing into rain bands and wrapping into the mid @-@ level circulation of the storm . Late on October 2 , Kyle developed an eye feature in the center of the storm , and the winds increased to about 65 mph (105 km / h) ; operationally it was forecast to regain hurricane status . However , the storm encountered further wind shear , which left the center exposed from the convection by early on October 4 . Convection became intermittent and separated from the circulation , and Kyle again weakened to tropical depression status on October 5 . By then , the storm had begun a steady west @-@ northwest motion , which was followed by a slow turn to the north @-@ northeast . On October 6 , a decrease in wind shear allowed the cyclone to again reach tropical storm status , about 295 miles (475 km) west @-@ northwest of Bermuda . Around the same time , the system was located in an area of weak steering currents ; a ridge was to its northeast and southwest , an upper @-@ level low was to its east @-@ southeast , and a broad trough was to its northwest . By October 7 , it began a slow southwestward motion around a ridge to its west . The circulation became elongated as dry air limited convection , and after shear increased on October 8 , Kyle weakened to tropical depression status .

By early on October 9 , the depression consisted of a circulation center without any of the associated deep convection that is one of the prerequisites of being a tropical cyclone . Several hurricane forecast models predicted Kyle to weaken until dissipation . After 24 hours without significant convection , thunderstorms reformed to the southeast of the center on October 10 as the depression entered an area of warmer water temperatures . Environmental conditions became more favorable , with weakening wind shear and decreasing dry air . The depression continued tracking around a ridge , turning to the west and west @-@ northwest toward the coast of Florida . Convection increased markedly early on October 11 as it turned northward ahead of an approaching cold front , and Kyle regained tropical storm status about 35 miles (60 km) east of the border between Florida and Georgia .

After re @-@ attaining tropical storm status , Kyle turned more to the northeast and parallel to the coastline , making landfall near McClellanville , South Carolina as a minimal tropical storm . The storm briefly moved over open waters before again making landfall near Long Beach , North Carolina late on October 11 . By early on October 12 , the storm had weakened to tropical depression status . At the time of it moving ashore , there was a separate non @-@ tropical low to the northeast of the depression , and shear had greatly increased , which made re @-@ intensification unlikely . However , convection redeveloped baroclinically with the approaching cold front , and Kyle attained tropical storm status for the fifth time over the eastern Pamlico Sound . The restrengthening was short @-@ lived , as the wind field expanded while the convection transitioned into that of a frontal band . After emerging into the western Atlantic Ocean , Tropical Storm Kyle merged with a cold front late on October 12 . The remnants of Kyle continued eastward , executing a loop on October 14 before turning northeastward and impacting the Azores on October 17 . The next day , the remnants of Kyle were absorbed by an extratropical cyclone to its northwest , which continued northeastward and moved near the British Isles on October 23 .

= = Preparations = =

Because of uncertainties in its track , the government of Bermuda posted a tropical storm watch for the island on September 30 ; it was discontinued the following day .

As Kyle approached the coast of Florida , a tropical storm watch was issued between Cocoa Beach , Florida and Brunswick , Georgia , and later was extended northward to Edisto Beach , South Carolina . Early on October 11 , a tropical storm warning was put in place between Brunswick , Georgia and Cape Fear , North Carolina , which was later amended to include the Pamlico Sound and the coastline through Surf City , North Carolina . Prior to it making landfall , the National Weather Service office in Wilmington , North Carolina issued a flood watch for much of the coastline that was ultimately affected ; in South Carolina , a flood warning was issued for the counties of

Florence , Williamsburg , and Georgetown . States of emergencies were declared for ten South Carolina counties .

= = Impact = =

On Bermuda , the combination of the storm and a cold front to its north produced 2 @.@ 19 inches (55 @.@ 6 mm) of rainfall in the first two days of October , which was about half of the monthly rainfall total .

While passing near the northeast coast of Florida , Kyle produced a storm surge of 1 @.@ 31 feet (0 @.@ 4 m) in Fernandina Beach . Winds were light , with gusts peaking at 32 mph (52 km / h) in St. Augustine , and precipitation reached 2 @.@ 05 inches (52 mm) in Fernandina Beach . Along the Georgia coastline , the storm dropped moderate rainfall that peaked at 5 @.@ 35 inches (136 mm) at Hunter Army Airfield . Most of the precipitation fell in a 12 ? hour period , which flooded roads and low @-@ lying areas ; several roads were closed , and numerous vehicles stalled in the floodwaters .

Moderate rainfall from Kyle in South Carolina peaked at 6 @.@ 35 inches (161 mm) in Edisto Beach , with the precipitation resulting in minor urban flooding . In and around St. Stephen , flooding reached several feet in depth in roads and buildings ; there , a nursing home had to be evacuated because of flooding . High waters in Manning severely damaged 17 mobile homes , forcing about 50 people to move to shelters . Ten car accidents were reported in Florence . The tropical storm spawned an F2 tornado in Georgetown that remained on the ground for about 1 @.@ 25 miles (2 km) . At its peak strength , the tornado overturned five mobile homes and a car . The tornado destroyed seven homes and damaged 106 buildings , 28 severely . Eight people were injured by the tornado .

In North Carolina , above @-@ normal tides caused minor beach erosion . Rainfall near the coastline reached 5 @.@ 6 inches (142 mm) in Greenville . Moisture from the storm led to increased rainfall further inland , peaking at 8 @.@ 72 inches (221 mm) in Butner . Raleigh @-@ Durham recorded a two @-@ day rainfall total of 5 @.@ 79 inches (147 mm) , which was the highest two @-@ day total at the station since Hurricane Floyd in 1999 . Heavy rainfall caused flash flooding in Martin County , where several roads were closed . Moderate winds were reported in the state , with gusts peaking at 49 mph (79 km / h) on Bald Head Island . The storm spawned at least three tornadoes in the state , including an F2 twister near Pantego that damaged two houses and a farm .

Moisture from Kyle extended into the Mid @-@ Atlantic states and southern New York . The precipitation alleviated rainfall deficits throughout the region . Overall damage amounted to about $ 5 million (2002 USD , $ 6 @.@ 58 million 2016 USD) . While no deaths were reported directly from Kyle , its remnants contributed to one death in stormy seas off the British Isles .

= = Records = =

Lasting for a total of 22 days , Hurricane Kyle was operationally considered the third longest @-@ lived tropical cyclone in the Atlantic basin ; Kyle was behind Hurricane Ginger in the 1971 season with 27 @.@ 25 days and Hurricane Inga in the 1969 season with 24 @.@ 75 days . However , an update to the Atlantic hurricane best track in 2004 led to the San Ciriaco Hurricane of 1899 to be re @-@ analyzed as the longest @-@ lived Atlantic tropical cyclone on record , and as a result Kyle was dropped to the fourth longest @-@ lived . In September 2012 , Hurricane Nadine surpassed Kyle as the fourth longest @-@ lived cyclone at 22 @.@ 25 days , dropping Kyle to fifth longest @-@ lived . Kyle was the only Atlantic tropical cyclone on record to attain tropical storm status on five occasions .