

= Hurricane Emily ( 1993 ) =

Hurricane Emily in 1993 caused record flooding in the Outer Banks of North Carolina while remaining just offshore . The fifth named storm and first hurricane of the year 's hurricane season , Emily developed from a tropical wave northeast of the Lesser Antilles on August 22 . It moved northwestward and strengthened into a tropical storm on August 25 , after becoming nearly stationary southeast of Bermuda . Emily then curved to the southwest but quickly resumed its northwest trajectory while strengthening into a hurricane . Late on August 31 , the hurricane reached peak winds of 115 mph ( 185 km / h ) on its approach to North Carolina . Although part of the eye passed over Hatteras Island in the Outer Banks , its absolute center remained 23 mi ( 37 km / h ) offshore . Gradually weakening , the hurricane swerved away from the coast toward the northeast and later east . Emily stalled again , this time northeast of Bermuda , and dissipated on September 6 to the southeast of Newfoundland .

The threat of Emily prompted hurricane warnings for much of the North Carolina coast and northward through Delaware . A mandatory evacuation for Ocracoke and Hatteras islands displaced 160 @, @ 000 people during the busy Labor Day weekend ; the loss in tourism revenue amounted to \$ 10 million ( 1993 USD ) . About 1 @, @ 600 residents on these islands rode out the storm in their homes , and emergency officials stayed behind . Most of the evacuees went to hotels or stayed with friends or relatives , causing an increase in business across southeastern Virginia , where effects were minimal . Due to uncertainty in forecasting Emily 's path , there were also evacuations from the coasts of Virginia , Maryland , Delaware , and Fire Island in New York .

While bypassing the Outer Banks , Emily produced strong winds that coincided with high tides during a full moon , causing severe flooding along the Pamlico Sound . In Buxton , the floods left behind water marks as high as 10 @. @ 54 ft ( 3 @. @ 21 m ) , and the entire villages of Avon and Hatteras were inundated . The storm downed thousands of trees and wrecked 553 homes ? 168 of which completely destroyed ? leaving a quarter of the Cape Hatteras population homeless . Structural damage in North Carolina was estimated at \$ 35 million . Along the coasts of North Carolina and Virginia , three swimmers drowned as a result of Emily .

= = Meteorological history = =

Hurricane Emily originated from an African tropical wave that passed through the Cape Verde Islands on August 17 , 1993 . The wave traversed the tropical Atlantic and developed a closed cyclonic circulation five days later about 800 miles ( 1 @, @ 300 km ) east @- @ northeast of Puerto Rico , when the National Hurricane Center ( NHC ) classified it as a tropical depression . Moving northwestward , the depression remained poorly organized for several days , with an ill @- @ defined circulation center and sporadic thunderstorms , in part due to unfavorable wind shear from an upper @- @ level low to its north . On August 25 , the depression became nearly stationary in response to weakening steering currents . As the upper environment turned less hostile to development , a reconnaissance aircraft found unusually high sustained winds ? an indication that the cyclone had quickly strengthened into a strong tropical storm . The NHC named the storm Emily and upgraded it to a hurricane the following day , based on reports of 75 mph ( 120 km / h ) winds from a second reconnaissance mission .

Upon becoming a hurricane , Emily was centered roughly 1 @, @ 000 mi ( 1 @, @ 600 km ) east of the Florida peninsula , passing well south of Bermuda . A ridge of high pressure began to mature to its north , forcing the hurricane westward on August 27 . Emily 's winds vacillated between tropical storm and hurricane force over the course of the day , although the cyclone resumed its strengthening by August 28 upon developing favorable upper @- @ level outflow . Traversing warm sea surface temperatures , the hurricane continued to improve in appearance on satellite images , and the barometric pressure within its eye steadily decreased . Emily retraced toward the northwest on August 29 , when a shortwave trough eroded the southern periphery of the contiguous ridge . The NHC expressed uncertainty in forecasting Emily 's track , stating that South Carolina , North Carolina , and Mid @- @ Atlantic states were at risk of a direct hit from the hurricane . As high

pressure re @-@ established itself off the North Carolina coast , Emily briefly turned west @-@ northwestward on August 30 before initiating a prolonged curve toward the north . By that time , the NHC forecast Emily to remain offshore , though one tropical cyclone forecast model projected that the hurricane would move inland .

Early on August 31 , a reconnaissance flight indicated that Emily had become a Category 2 hurricane on the Saffir ? Simpson scale , and further intensification was expected because of warm waters . Later that day , reconnaissance reported that Emily had achieved a peak intensity of 115 mph ( 185 km / h ) , a Category 3 major hurricane ; the aircraft also observed flight @-@ level winds of 152 mph ( 245 km / h ) . At its peak , the center of the hurricane was located 23 mi ( 37 km ) east of Hatteras Island while turning northward . Its eye measured 45 mi ( 75 km ) in diameter , and a portion moved over Hatteras and the Pamlico Sound , constituting a direct hit but not a landfall . After affecting the Outer Banks , Emily continued around the large high @-@ pressure area , turning northeastward into an area with cooler ocean temperatures . The eye nonetheless remained distinct , and Emily maintained much of its intensity through September 2 . Later that day , the hurricane turned sharply eastward in response to a trough nearby . Wind shear over the region increased , weakening Emily as its eye feature quickly dissipated . Emily turned to the southeast and diminished to a tropical storm on September 3 , about 500 mi ( 800 km ) northeast of Bermuda , with a significant deterioration of the convection . Once again becoming nearly stationary , Emily further weakened to a tropical depression late on September 4 , after only a small area of thunderstorms remained near the center . It accelerated toward the northeast and became extratropical on September 6 , dissipating shortly thereafter .

= = Preparations = =

The NHC forecasts for Emily were generally accurate . On August 29 , two days before the storm 's closest approach , the NHC issued a hurricane watch from Cape Romain , South Carolina , to Fenwick Island , Delaware , including the Albemarle and Pamlico sounds of North Carolina as well as the Chesapeake Bay south of the Patuxent River . The next day , the watch was discontinued south of Little River , South Carolina . A hurricane warning was issued from Bogue Inlet to the border of North Carolina and Virginia on August 30 , and was extended a day later to Cape Henlopen , Delaware . The watches and warnings were canceled as Emily turned out to sea .

During the week when Emily approached shore , the North Carolina government was scheduled to have a two @-@ day emergency management exercise involving a hurricane strike ; the storm caused the exercise to be postponed . On August 29 , a voluntary evacuation was issued for the Outer Banks , and within 36 hours of the storm 's approach , a mandatory evacuation was issued for Ocracoke and Hatteras Island . A total of 160 @, @ 000 people ( mostly tourists ) evacuated from the Outer Banks , representing about 90 % of the population there . The evacuation was completed within 12 hours , expedited by highway patrol and making U.S. Route 158 and the Wright Memorial Bridge only one direction , away from the coast . About 1 @, @ 000 residents on Hatteras Island and another 600 on Ocracoke rode out the storm in their homes . The United States Coast Guard evacuated personnel to the mainland , leaving behind a skeleton crew to maintain their facilities . The National Park Service closed the campground on Ocracoke two days before the storm . Several towns in southeastern North Carolina were also evacuated , and schools closed across the region .

Because of the uncertainty in forecasting when and if Emily would make its northeast turn , Virginia Governor Douglas Wilder declared a state of emergency and put the National Guard on alert . In Virginia Beach , residents of seaside homes and low @-@ lying areas were recommended to evacuate , while a mandatory evacuation was ordered for Tangier Island in the Chesapeake Bay . Residents in mobile homes and on campgrounds were also advised to seek shelter . At least 750 people left their homes , 711 of whom resided in storm shelters . The Norfolk International Airport was closed for 13 hours , and rail service was suspended . To the north , officials in Ocean City , Maryland , declared a phase @-@ one emergency ahead of the storm ; beaches were closed , and tourists were recommended to leave . About 100 @, @ 000 people evacuated from the coast of Maryland ; 3 @, @ 600 stayed in storm shelters . In Delaware , 892 people used storm shelters after

voluntarily evacuating . Beaches in New Jersey closed due to threatening waves . About 20 @, @ 000 people also evacuated from Fire Island , New York . Across the Atlantic coast , 33 emergency shelters were opened in response to Emily , though most evacuees instead relied on hotels or the homes of friends and relatives to ride out the storm .

The Federal Emergency Management Agency ( FEMA ) assisted in coordinating preparations for Emily . The United States Department of Defense sent power equipment , previously used during the Great Flood of 1993 , to Fort Bragg , while the United States Department of Agriculture stockpiled food in risk zones . Power companies deliberately shut off the power in the Outer Banks to reduce damage to the system and mitigate the risk of electrocutions . At Naval Station Norfolk , 28 ships sailed out to sea to ride out the storm ; aircraft were evacuated , and nonessential personnel were sent home . The North Carolina government announced ahead of the storm that it would not create a State Disaster Fund , instead relying on private relief organizations such as the American Red Cross and the Salvation Army . The state 's park service pre @-@ positioned 60 members with chainsaws to help clear downed trees . Because Emily hit during the busy Labor Day weekend , the tourism industry suffered about \$ 10 million in business losses . Many of the evacuees relocated to southeastern Virginia , which saw greatly increased business during the weekend .

= = Impact = =

= = = North Carolina = = =

As Emily approached the Outer Banks of North Carolina , Diamond Shoal Light off Cape Hatteras recorded 2 @-@ minute sustained winds of 99 mph ( 159 km / h ) , along with gusts of 147 mph ( 237 km / h ) . Closer to shore , surface winds reached 115 mph ( 185 km / h ) in the Pamlico Sound . The National Weather Service in Buxton reported sustained winds of 60 mph ( 96 km / h ) , with gusts to 98 mph ( 158 km / h ) , before the wind recording instrument failed due to water intrusion . A reliable but unofficial wind station at a commercial building reported a gust of 107 mph ( 172 km / h ) . These high winds lasted for several hours due to the storm 's slow movement . There were two possible tornadoes in the Outer Banks region . On the south side of Hatteras Island , the storm coincided with high tides , producing a peak storm surge of 10 @. @ 2 ft ( 3 @. @ 1 m ) in Buxton . Large waves caused moderate beach erosion , comparable to that of a winter storm . The heaviest rainfall related to Emily occurred over the Outer Banks , where a peak total of 7 @. @ 51 in ( 191 mm ) was recorded in Buxton . Minimal rain fell farther inland , with only 1 @. @ 00 in ( 25 mm ) reported at Gum Neck in mainland Tyrrell County .

Overall damage from the storm was lighter than expected , largely confined to the barrier islands of Dare and Hyde counties . Severe flooding from the storm affected a 17 mi ( 27 km ) stretch of the Hatteras Island . Coinciding with high tides during a full moon , the hurricane 's winds pushed water from the Pamlico Sound to the south , lowering levels along the mainland and inundating the barrier islands ; surge flooding was minor on the ocean side . At Frisco and Hatteras , water levels along the Pamlico Sound reached 8 @. @ 5 ft ( 2 @. @ 6 m ) above normal ? their highest in the 20th century , surpassing those in Hurricane Gloria eight years prior . These water levels may have been the highest in the region since the 1899 San Ciriaco hurricane . In Buxton , the waters rose 3 to 4 ft ( 0 @. @ 9 to 1 m ) per hour at one point , leaving behind flood marks as high as 10 @. @ 54 ft ( 3 @. @ 21 m ) . The entire villages of Avon and Hatteras were inundated . Only the highest dunes along the Cape Hatteras National Seashore remained dry , and a section of dunes just north of Buxton was nearly breached . The waters ? 1 to 2 ft ( 0 @. @ 3 to 0 @. @ 6 m ) higher than the predicted 100 @-@ year flood ? broke through windows and entered houses ; some residents who did not exit their homes had to ride out the storm in their attics to escape the flooding . Officials at the Dare County Emergency Operations Center evacuated due to intrusion of floodwaters . The Cape Hatteras National Weather Service office was flooded for the first time since its inception in 1957 , and sustained damage to its rain chart and an antenna . Many boats in marinas were

wrecked , and hundreds of cars floated away from parking lots or streets ; flooded police cars had their emergency lights activated after the wires were damaged . Farther south , impact from the storm was limited on Ocracoke Island .

Emily 's winds destroyed several roofs and knocked down thousands of trees and power lines , with many signs and sheds damaged . All towns south of the Bonner Bridge were without power , affecting at least 1 @, @ 500 people , and Buxton lost water supply after the main water line was damaged . The combination of strong winds and floods left 553 homes uninhabitable in the Outer Banks , with 168 houses completely destroyed , including three that were washed away . Six of the destroyed homes were owned by the Coast Guard . The heaviest damage was largely in older homes or structures not up to code . About 25 % of the Hatteras population was left homeless . The Cape Hatteras School sustained about \$ 3 @. @ 1 million in damage , after flooding 4 ft ( 1 @. @ 2 m ) deep destroyed computers and textbooks . Tidal floods , sand , and debris forced authorities to close Highway 12 . Traffic lights along the route were damaged , and downed trees blocked the road in two areas . Sinkholes , some the size of three cars , developed along the route . Throughout North Carolina , damage from the storm was estimated at \$ 35 million , mostly on Hatteras Island and chiefly to the south of Avon . Rough surf killed two people in Nags Head , despite the beach being closed to swimming , and one person suffered injuries while escaping a flooded home .

= = = Elsewhere = = =

Outside of North Carolina , Emily produced gusts of 37 mph ( 59 km ) at the Chesapeake Bay Bridge ? Tunnel . To the north of the storm , Ocean City , Maryland , measured 2 @. @ 80 in ( 71 mm ) of precipitation . Above @- @ normal tides were reported as far south as Charleston , South Carolina ; high tides also spread farther north , with a storm surge of 1 @. @ 2 ft ( 0 @. @ 37 m ) at the Chesapeake Bay Bridge ? Tunnel and 0 @. @ 6 ft ( 0 @. @ 18 m ) in Lewes , Delaware .

High waves caused beach erosion northward through Virginia . At Virginia Beach , the waves led to minor flooding along the Sandbridge section ; rough surf and a strong undertow drowned one swimmer there . The storm triggered statewide power outages that affected about 5 @, @ 000 residents , as well as the Hampton Roads Bridge ? Tunnel . In Newport News , lightning set a roof on fire in the Lee Hall section of the city . Emily 's light rains in the area were not enough to break a prolonged drought that plagued Virginia . Rough seas and high tides later caused coastal flooding along Fire Island in New York .

= = Aftermath = =

As Emily 's winds eased over land , various assessment teams left Fort Bragg , North Carolina , to determine the extent of damage . FEMA informed the North Carolina congressional delegation about the storm 's threat to their constituents . The agency later received compliments for their timely preparations for storm @- @ related operations . All airports on the Outer Banks were reopened by September 1 . In response to the extensive scale of the power outages , power companies flew a helicopter over the region to assess the damage . The power was expected to be out for two weeks . Six emergency vehicles were sent to Dare County to provide drinking water .

On September 3 , Governor Jim Hunt declared a state of disaster for North Carolina , while President Bill Clinton declared Dare County a disaster area a week later . This allowed residents there to apply for federal assistance , as well as local governments to request aid to rebuild public buildings . Operating out of Avon , FEMA distributed about \$ 1 million in housing assistance to 444 people and provided \$ 400 @, @ 000 in individual grants to 153 applicants . The Small Business Administration received 812 applications for small business loans .

Shelters closed by September 1 and residents returned to their homes , although Hatteras Island remained off @- @ limits to everyone but emergency workers for several days . Unemployment across Hatteras rose in the wake of the damage to local businesses , and many restaurants lost product when their refrigerators failed during the power outages . Residents piled debris from their damaged homes on roads , primarily Highway 12 , and workers responded by clearing the debris .

The highway was speedily reopened and repaired at a cost of around \$ 1 million . Within two weeks of the storm , businesses resumed as cleaning work was under way , and the island was reopened to tourists . Clean up operations in the region lasted weeks to months . In the three months after the storm , saltwater intrusion into the Cape Hatteras water supply boosted chlorine levels from 40 milligrams ( 0 .0014 ounces ) to 280 milligrams ( 0 .01 ounces ) per liter ; it took another three months for the chlorine to decrease to normal concentrations . Around 50 homeowners affected by Emily raised their houses to prevent a recurrence , partially funded by flood insurance payments .