= Hurricane Karen (2001) =

Hurricane Karen was a hurricane of non @-@ tropical origin that formed in October of the 2001 Atlantic hurricane season . It developed out of the interaction between a cold front and an upper level trough on October 10 located to the south of Bermuda , and quickly strengthened as an extratropical storm . The storm passed near Bermuda on October 12 , producing hurricane @-@ force winds on the island . It then organized , becoming a subtropical cyclone on the 12th and a tropical cyclone on the 13th . Karen strengthened to reach 80 mph (130 km / h) winds as a Category 1 hurricane on the Saffir @-@ Simpson Hurricane Scale , and after weakening over cooler waters , it made landfall on Nova Scotia as a tropical storm . It quickly became extratropical .

On Bermuda , winds from the precursor extratropical storm produced moderate damage , primarily to power lines and marine interests . Over 2 / 3 of the island 's power subscribers were left without power during the worst of the storm , and several boats sank or ran aground from the high winds . Damage on Bermuda totaled to over $ 1 @.@ 4 million (2001 USD ; $ 1 @.@ 7 million 2008 USD) . In Atlantic Canada , Tropical Storm Karen produced light winds and rain , but caused minimal damage .

= = Meteorological history = =

A cold front stalled a couple hundred miles southeast of Bermuda on October 10 . During that day , a strong upper @-@ level trough moved southeastward off the southeast coast of the United States . Due to several factors , including upward motion and strong diffluence ? the rate at which a fluid moves ? the area became baroclinically unstable . This caused the interaction between the trough and the front to develop into an extratropical low about 345 miles (555 km) southeast of Bermuda on October 11 . The low moved quickly northward , then northwestward , strengthening quickly due to the instability of the atmosphere . Late on October 11 , the system slowed , and the upper @-@ level circulation became aligned with the low @-@ level circulation . The extratropical storm began to develop tropical characteristics late on October 11 , including surface temperatures warmer than the surrounding environment , and vertical wind characteristics of a tropical cyclone . Based on its organization , the system developed into Subtropical Storm One early on October 12 while located about 35 miles (55 km) south of Bermuda .

While passing to the south of Bermuda , the subtropical storm maintained winds of 70 mph (110 km / h) , with wind gusts on the island surpassing 100 mph (160 km / h) . After becoming dissociated from the Westerlies , the system turned northward , and began to develop convection over the center . In addition , the frontal characteristics of the subtropical storm continually weakened . On October 13 , based on an Advanced Microwave Sounding Unit observation that stated that a warm core was present throughout the system , the National Hurricane Center designated the system as a tropical storm , and gave it the name Karen . At this point , Karen was located 200 miles (320 km) north of Bermuda . Karen slowly strengthened over the warm waters of the Gulf Stream , and the storm intensified to a hurricane later on October 13 . Convection continued to develop , and organized into a ring around the eye as Karen reached its peak intensity of 80 mph (130 km / h) on October 14 while located about 400 miles (640 km) south of Halifax , Nova Scotia .

Karen quickly weakened as it moved over cooler waters , and late on October 14 it degenerated back into a tropical storm as it accelerated northward . Convection gradually decreased , and Karen made landfall on southwestern Nova Scotia with winds of 45 mph (70 km / h) on October 15 . Karen retained its tropical characteristics during and after making landfall , based on a research flight out of Halifax intended to study the early stages of extratropical transition . The flight reported arced bands and a warm @-@ core system transitioning into a more typical mid @-@ latitude system . Under the influence of a mid @-@ latitude system , the storm turned sharply to the northeast , and after losing the remaining of its convection it became extratropical shortly after landfall . Continuing northward , the remnant low quickly weakened , and dissipated as it was absorbed by a larger extratropical storm over the Gulf of Saint Lawrence .

= = Preparations = =

On October 10 , as the precursor extratropical storm was forming , the Bermuda Weather Service issued a gale and later a storm warning for the island , expecting winds of 50 to 60 mph (60 to 95 km / h) . Several radio interviews and television stations issued information on the expected storm . Many residents believed they were insufficiently warned , though it is acknowledged that emergency managers and citizens pay less attention to gale warnings then they do for tropical cyclone warnings . On October 12 , as the storm was passing to the south of the island , officials closed all schools and government offices . Many private businesses closed as well .

At the time of Karen 's landfall , gale warnings were issued for coastal waters , while inland wind warnings were in effect for Cape Breton . In addition , heavy rainfall warnings were issued for large portions of Nova Scotia including Halifax , southeastern New Brunswick , Fundy National Park , and Prince Edward Island .

= = Impact = =

= = = Bermuda = = =

While passing to the south of the island , the tight pressure gradient between the precursor extratropical storm and high pressures resulted in strong winds on the island , including sustained winds of hurricane status at Fort George . Gusts on the island officially peaked at 100 mph (161 km / h) at Devonshire . A cruise ship anchored at harbor reported a wind gust of 118 mph (190 km / h) , though it could have been caused by a downdraft . The storm also dropped moderate rainfall of just over 3 inches (76 mm) , resulting in minor flooding of streets . Because the storm developed quickly , wave @-@ induced beach erosion was minor .

The strong winds left considerable tree and powerline damage . At the worst of the storm , 23 @,@ 000 of the island 's 30 @,@ 000 power subscribers were without electricity . Damage to power lines totaled to $ 385 @,@ 000 (2001 USD , $ 468 @,@ 700 2008 USD) . The strong winds also caused considerable damage to vegetation . Three cruise ships weathered the storm at Saint George Harbour , where the powerful winds ripped out a post and snapped a mooring line , leaving a ship drifting in the harbor . One crew member was minorly injured . Over a dozen boats broke free from their moorings , resulting in them running aground or sinking . In all , 87 boats were affected to some degree , with marine damage totaling to about $ 665 @,@ 000 (2001 USD , $ 809 @,@ 600 2008 USD) . The winds also caused minor damage to 175 properties on the island , primarily to houses . Damage to houses amounted to about $ 425 @,@ 000 (2001 USD , $ 517 @,@ 400 2008 USD) . Overall damage was moderate , totaling to about $ 1 @.@ 4 million (2001 USD , $ 1 @.@ 7 million 2008 USD) . No fatalities were reported , though a few storm @-@ related injuries occurred .

= = = Canada = = =

Tropical Storm Karen produced light to moderate winds across Atlantic Canada , peaking at 47 mph (76 km / h) with a gust of 64 mph (103 km / h) in Cape George in Antigonish County , Nova Scotia , along with a 26 mph (42 km / h) report in Charlottetown , Prince Edward Island . Rainbands in the storm dropped light rainfall of up to 1 @.@ 8 inches (46 mm) in Yarmouth , Nova Scotia and 1 @.@ 4 inches (35 mm) in Saint John , New Brunswick , most of which fell in a short amount of time . Skewed to the left side of the transitioning storm , the rainfall was beneficial for the drought @-@ stricken areas of Nova Scotia and New Brunswick . Due to the fast @-@ moving nature of the storm , though , most areas reported only around half an inch of rain . A buoy in Halifax Harbour reported wave heights of up to 16 @.@ 7 feet (5 @.@ 1 m) , causing breaking waves at docks white caps along the ocean . Damage in Canada was minor due to the storm , limited to an uprooted tree in New Glasgow , Nova Scotia and several other trees with damaged branches . There were no

injuries or fatalities in Canada .