

= 1978 Atlantic hurricane season =

The 1978 Atlantic hurricane season was the last Atlantic hurricane season to use an all female naming list . The hurricane season officially began on June 1 , and ended on November 30 . It was an above average season due to a subsiding El Niño . The first storm , a subtropical storm , developed unusually early ? on January 18 ? and dissipated five days later without causing any damage . At the end of July and early August , short lived Tropical Storm Amelia caused extensive flooding in Texas after dropping as much as 48 in ( 1 @, @ 200 mm ) of rain . There were 33 deaths and \$ 110 million ( 1978 USD ) in damage . Tropical Storm Bess and Hurricane Cora resulted in only minor land impacts , while the latter was attributed to one fatality .

Later in August , Tropical Storm Debra produced widespread effects , though damage was also relatively minor . Hurricane Ella became the northernmost Category 4 hurricane while located at 38 ° N , and lashed the East Coast of the United States and Atlantic Canada with gusty winds and rip currents . Hurricanes Flossie and Kendra as well as Tropical Storms Hope , Irma , and Juliet caused minimal land impacts as a tropical cyclone . However , the precursor to Hurricane Kendra caused flooding in Puerto Rico . Hurricane Greta brought strong winds , high tides , and flooding to Central America , particularly Belize and Honduras . Greta resulted in about \$ 25 million in damage and at least five fatalities . Overall , the storms of this season collectively caused \$ 191 million in damage and 42 fatalities . Hurricane Greta crossed into the eastern pacific and was renamed Olivia .

= = Season summary = =

The Atlantic hurricane season officially began on June 1 , 1978 . Although 24 tropical cyclones developed , only twelve of them reached tropical storm intensity , which is slightly above the 1966 @-@ 2009 average of 11 @. @ 3 named storms per season . Of the twelve tropical storms , five of them strengthened into a hurricane , which is slightly below the 1966 @-@ 2009 average of 6 @. @ 2 . Two of the five hurricane became major hurricanes , which is Category 3 or greater on the Saffir ? Simpson hurricane wind scale . Three tropical storms and two hurricanes made landfall during the season and caused at least 41 fatalities and \$ 135 million . Additionally , the precursor to Hurricane Kendra brought flooding to Puerto Rico , with \$ 6 million in damage and one death . The season officially ended on November 30 , 1978 .

Tropical cyclogenesis began very early , with the development of a subtropical storm on January 18 . It dissipated about five days later . However , the next tropical cyclone , an unnumbered depression , did not develop until June 21 . In July , there were two systems , including an unnumbered tropical depression and Tropical Storm Amelia . Seven tropical cyclones formed in August , including Tropical Depression Four and tropical storms Bess and Debra and hurricanes Cora and Ella . There were also seven system in September ? tropical depressions Eight , Nine , and Twelve , Tropical Storm Hope , and hurricanes Flossie and Greta . During the month of October , there were five tropical cyclones , with two unnumbered tropical depressions , tropical storms Irma and Juliet , and Hurricane Kendra . There was another unnumbered tropical depression in November , which dissipated on November 5 .

The season 's activity was reflected with an accumulated cyclone energy ( ACE ) rating of 63 . ACE is , broadly speaking , a measure of the power of the hurricane multiplied by the length of time it existed , so storms that last a long time , as well as particularly strong hurricanes , have high ACEs . It is only calculated for full advisories on tropical systems at or exceeding 39 mph ( 63 km / h ) , which is tropical storm strength .

= = Storms = =

= = = Subtropical Storm One = = =

In the middle of January , an upper @-@ level trough in the westerlies spawned a surface low

pressure area to the east @-@ northeast of the Lesser Antilles to the south of the subtropical ridge . Isolated from the detrimental effects of the westerlies , it was initially non @-@ tropical in nature and intensified through a baroclinic energy source , or one that derives energy from the interaction of cold and warm air . Convection increased slightly despite cool sea surface temperatures of around 75 ° F ( 24 ° C ) . At 1200 UTC on January 18 , it organized into a subtropical depression about 1 @, @ 725 mi ( 2 @, @ 776 km ) east @-@ northeast of Puerto Rico while moving in a general westward track , which it would maintain for much of its duration . The National Hurricane Center ( NHC ) initiated Dvorak classifications on the cyclone at 0000 UTC on January 19 , assessing a Dvorak number of T2.5 , suggesting both tropical and subtropical characteristics . On the same day , the pressure gradient between the storm and the ridge produced gale force winds . By early on January 20 , the storm maintained minimal convection near its center , with its primary rainband revolved cyclonically around its well @-@ defined center . Later that day , the storm strengthened into a subtropical storm and attained peak winds of 45 mph ( 72 km / h ) , supported by both ship and Hurricane Hunters reports .

Late on January 21 , the outer rainbands to the south and east of the center began diminishing , which began a weakening trend after the storm maintained peak winds for about 36 hours . At around that time , the cyclone was moving west @-@ southwestward , and within 72 hours was forecast by one hurricane forecast model to be located over Hispaniola . By midday on January 22 , the winds decreased to below gale force after the convection dissipated near the center . Subsequently it turned more to the west away from land , and by January 23 the circulation degenerated into a remnant trough about 185 mi ( 298 km ) north of the Lesser Antilles . The storm was one of six tropical or subtropical cyclones on record in the month of January , and one of four to have formed in the month .

= = = Tropical Storm Amelia = = =

A tropical wave emerged into the Atlantic Ocean from the west coast of Africa on July 19 . The wave did not develop significantly while crossing the Atlantic Ocean and Caribbean Sea . The disturbance then entered an area of the Gulf of Mexico that was conducive to tropical cyclogenesis and became a tropical depression while located about 30 mi ( 48 km ) south of Brownsville , Texas on July 30 . Despite its proximity to land , the depression strengthened into Tropical Storm Amelia on July 31 and peaked with winds of 50 mph ( 80 km / h ) . Around that time , Amelia made landfall near Port Isabel , Texas . Later on July 31 , the storm weakened to a tropical depression and dissipated early the following day .

Amelia affected the Texas coast for two days , causing several shipping incidents and minor damage in Corpus Christi and South Padre Island . While active , there were no deaths linked to the storm . However , the biggest impact from the storm followed its dissipation , when its remnants contributed to record rainfall totals over the state . The state , already suffering from a previous drought , believed that the rain would help alleviate the conditions . However , the dry ground aided the flooding from the storm . The rainfall caused several rivers and creeks to flood , especially around the Texas Hill Country and northern Texas , leading to severe damage . Overall , Amelia caused 33 fatalities with an estimated \$ 110 million in damages .

= = = Tropical Storm Bess = = =

A low pressure area developed in Georgia along a dissipating cold front on August 1 . The system detached from the cold front and drifted southwestward , reaching northeastern Gulf of Mexico on August 3 . Satellite imagery , buoys , and reconnaissance aircraft flights indicated that by August 5 , the system likely acquired a closed circulation . Thus , the National Hurricane Center estimated that a tropical depression developed in the central Gulf of Mexico at 1200 UTC that day . On August 6 , a reconnaissance flight into the depression resulted in an upgrade to Tropical Storm Bess , while located about 250 mi ( 400 km ) southeast of Brownsville , Texas . The storm had initially headed west @-@ southwestward at 8 mph ( 13 km / h ) , before moving southwestward at nearly the same

speed .

At 1200 UTC on August 7 , Bess attained its minimum barometric pressure of 1 @, @ 005 mbar ( 29 @. @ 7 inHg ) . Thereafter , Bess began to turn nearly due southward under the influence of a high pressure area over southern Texas . Later on August 7 , the storm reached its maximum sustained winds of 50 mph ( 80 km / h ) . Early on August 8 , Bess made landfall near Nautla , Veracruz , at the same intensity and then rapidly dissipated inland . In Tuxpan , Veracruz and Tampico , Tamaulipas , sustained winds reached only 29 mph ( 47 km / h ) . The storm also produced heavy rainfall , peaking at 12 @. @ 04 in ( 306 mm ) in La Estrella . However , no flooding occurred and no damage or fatalities were reported .

= = = Hurricane Cora = = =

A disturbance exited the west coast of Africa on August 4 and developed into a tropical depression about three days later , while located well east of the Lesser Antilles . On August 8 , the depression strengthened into Tropical Storm Cora . The storm moved at an unusually high forward speed for a cyclone in the Atlantic Ocean in August , and intensified into a hurricane later that day . The hurricane was upgraded into a hurricane based solely on satellite photography , the second time this occurred . Early on August 9 , it peaked with winds of 90 mph ( 140 km / h ) . Around 0000 UTC the next day , Cora weakened to a tropical storm while west @-@ southwestward . The storm made landfall on Grenada on August 11 , while weakening to a tropical depression . Cora weakened further to a tropical depression , before losing its circulation and degenerating into a tropical wave on August 12 . The remnant crossed over Central America into the Pacific Ocean , where it regenerated into Hurricane Kristy .

Cora was an unusual cyclone , maintaining an unusually low latitude in the Atlantic in August at high speeds . While passing through the Lesser Antilles , gusty winds and light rainfall in Barbados and Saint Lucia . In the latter , a person died after stepping on a high tension power line that was downed in Castries . Approximately two to four percent of trees on the island were toppled . Cora was also responsible for altering weather conditions in Presque Isle , Maine , allowing for a takeoff of the historical flight of the Double Eagle II hot air balloon .

= = = Tropical Storm Debra = = =

A low @-@ pressure area that developed over southeast Florida and an area of convection near the Yucatán Peninsula merged and resulted in the formation of a tropical depression over the southern Gulf of Mexico on August 26 . Tacking west @-@ northwestward around a high pressure ridge , the depression gradually intensified began and was upgraded to Tropical Storm Debra on August 28 . Debra turned to the north and reached its peak intensity of 60 mph ( 97 km / h ) on August 29 , shortly before making landfall in southwestern Louisiana . It was a disorganized storm , with most of the convection located to the east of the center . The system weakened rapidly and dissipated over Arkansas on August 29 , though its remnants continued into the Ohio Valley .

One person died while attempting to evacuate an oil rig to the south of Cameron , Louisiana . Damage caused by Debra was considered minimal . In Louisiana , rainfall peaked at 10 @. @ 81 in ( 275 mm ) in Freshwater Bayou . However , no flooding was reported . Wind impacts were light and mainly limited to down trees and damage to roofs in Lake Charles and New Orleans . The storm spawned several tornadoes in Arkansas , Mississippi , Louisiana , Tennessee , and Texas . In Mississippi , a tornado in Crystal Springs destroyed three mobile homes and a house , killing one person and seriously injuring another .

= = = Hurricane Ella = = =

A cold front spawned a tropical disturbance near Bermuda , which became a tropical depression on August 30 . The depression strengthened , and by early on August 31 , it was upgraded to Tropical Storm Ella . Ship reports indicated that Ella became a hurricane later that day . Further significant

intensification occurred , and the storm reached a preliminary peak intensity of 125 mph ( 201 km / h ) . A short @-@ wave trough over the Eastern United States caused Ella to decelerate and turn north . Simultaneously , dry air diminished convection on September 2 , which in turn resulted in weakening . Eventually , another trough forced Ella to re @-@ curve northeastward , thereby remaining well offshore the East Coast of the United States .

The storm then re @-@ intensified and by 1200 UTC on September 4 , Ella peaked as a Category 4 hurricane with winds of 140 mph ( 230 km / h ) . Thereafter , Ella rapidly weakened as it passed offshore Atlantic Canada , before being absorbed by an extratropical storm while located more than 700 mi ( 1 @,@ 100 km ) northeast of St. John 's on September 5 . Ella threatened to pass within 50 mi ( 80 km ) of North Carolina . Because of this , a hurricane watch being issued for the Outer Banks of North Carolina during Labor Day Weekend , resulting in a significant drop in tourism occurred . However , because the storm veered northeastward , little effects other than 5 to 9 ft ( 1 @.@ 5 to 2 @.@ 7 m ) waves , minor beach erosion , and light winds in coastal portions of North Carolina . In Newfoundland , Ella produced rainfall amounts reaching 2 @.@ 39 in ( 61 mm ) and wind gusts up to 71 mph ( 114 km / h ) .

== = Hurricane Flossie == =

A tropical wave passed westward across Dakar , Senegal on August 31 and entered the Atlantic Ocean later that day . Convection markedly increased over the next few days and by 0000 UTC on September 4 , the wave developed into a tropical depression while located about midway between Africa and the Lesser Antilles . Later that day , the Hong Kong Merchant reported tropical storm force winds , thus the depression was upgraded to Tropical Storm Flossie . It initially tracked northwestward at 23 mph ( 37 km / h ) and minimal strengthening occurred , possibly due to rapid forward speeds . On September 5 , the storm curved westward , until turning north on September 7 . A high pressure area transitioned into a trough , causing Flossie to re @-@ curve northeastward and generating strong upper @-@ level winds .

On September 8 , Flossie was downgraded to a tropical depression . After the trough began weakening , favorable conditions returned , allowing Flossie to re @-@ strengthen into a tropical storm on September 10 . Flossie then decelerated and became nearly stationary on September 12 . Around that time , the storm was upgraded to a hurricane . Further intensification continued , and Flossie peaked with winds of 100 mph ( 160 km / h ) early on September 13 . The storm began turned nearly due northward and began weakening . Flossie accelerated to the northeast and eventually transitioned into an extratropical cyclone while 700 miles ( 1 @,@ 100 km ) north of the Azores on September 15 . The strong extratropical cyclone brought winds as high as 104 mph ( 167 km / h ) to Fair Isle , Great Britain .

== = Hurricane Greta == =

A tropical wave developed into a tropical depression near Trinidad on September 13 . By the following day , the depression strengthened into Tropical Storm Greta . It headed westward to west @-@ northwestward across the Caribbean Sea and slowly intensified , becoming a hurricane on September 16 . The rate of intensification increased as Greta was approaching the northwestern Caribbean Sea . Greta briefly peaked as a Category 4 hurricane with maximum sustained winds of 130 mph ( 210 km / h ) and a minimum barometric pressure of 947 mbar ( 28 @.@ 0 inHg ) , while brushing northeastern Honduras . Although the storm remained offshore , land interaction caused significant weakening . On September 19 , Greta made landfall in Stann Creek District , Belize with winds of 110 mph ( 180 km / h ) . The storm rapidly weakened inland over Central America , but survived its passage and eventually became Hurricane Olivia in the Eastern Pacific Ocean .

Early in its duration , Greta produced heavy rainfall in the Netherlands Antilles . With a similar path to Hurricane Fifi four years prior , Greta threatened to reproduce the devastating effects of the catastrophic storm ; however , damage and loss of life was significantly less than feared . In Honduras , about 1 @,@ 200 homes were damaged , about half of which in towns along the

coastline . The storm damaged about 75 % of the houses on Roatán along the offshore Bay Islands , and there was one death in the country . In the Belize Barrier Reef , Greta downed trees and produced high waves , while on the mainland , there was minimal flooding despite a high storm surge . In Dangriga where it made landfall , the hurricane damaged or destroyed 125 houses and the primary hospital . In Belize City , a tornado flipped over a truck and damaged four houses . Damage in Belize was estimated at \$ 25 million , and there were four deaths .

== Tropical Storm Hope ==

A mid @-@ tropospheric low pressure area developed over the Southeastern United States on September 10 . The system developed into a subtropical depression early on September 12 , while located about 75 mi ( 121 km ) east of St. Augustine , Florida . Over the next few days , the depression tracked east @-@ northeastward to eastward . While strengthening into a subtropical storm on September 15 , it passed just north of Bermuda , but produced only 1 @.@ 07 in ( 27 mm ) of rain on the island . The storm then made a brief dip to the east @-@ southeast , before resuming its east @-@ northeastward course on September 16 . Beginning on the following day , satellite imagery indicated that the system was acquiring tropical characteristics . As a result , it was reclassified as Tropical Storm Hope at 0600 UTC on September 17 .

Because Hope remained out of range of reconnaissance aircraft flights , the National Hurricane Center relied on ships and satellite estimates . After becoming a tropical cyclone , Hope began to accelerate while slowly intensifying . Satellite estimates at 1200 UTC on September 19 indicated that the storm attained its peak intensity with maximum sustained winds of 65 mph ( 105 km / h ) and a minimum pressure of 987 mbar ( 29 @.@ 1 inHg ) , recorded by the S.S. Banglar Mann . While located hundreds of miles north of the Azores on September 20 , the storm turned northward and began crossing into sea surface temperatures of 68 ° F ( 20 ° C ) . By 1200 UTC on September 21 , Hope transitioned into an extratropical cyclone and was absorbed by another extratropical storm while situated about 220 mi ( 350 km ) south of Reykjavík , Iceland .

== Tropical Storm Irma ==

The origins of Tropical Storm Irma were from a subtropical depression that formed about 500 mi ( 800 km ) south of the Azores on October 2 . During the next two days , thunderstorm activity gradually increased around the circulation center as the storm drifted northward . On October 2 , the storm had taken the appearance of a tropical storm on satellite photographs , and upper @-@ level anticyclonic flow over the center of the storm was evident on satellite time @-@ lapse movies . By the afternoon of October 4 , the system had acquired the characteristics of a tropical storm and was named Irma ; gale @-@ force winds extended 150 mi ( 240 km ) from the center of circulation .

Six hours after being named , Irma reached its peak intensity of 50 mph ( 80 km / h ) . On October 5 , Irma turned towards the north @-@ northeast and passed about midway between the central and western Azores . Shortly thereafter , Irma became less organized , and that evening was absorbed into an approaching cold front , about 450 mi ( 720 km ) northeast of the Azores . Although Irma passed near parts of the western and central Azores with gale @-@ force winds in some areas , no reports of damage or casualties caused by Irma were received . Several nearby ships reported winds around 46 mph ( 74 km / h ) . It was noted that heavy rains may have occurred on some of the mountainous islands as Irma passed .

== Tropical Storm Juliet ==

A weak tropical wave emerged into the Atlantic Ocean from the west coast of Africa on September 30 . The wave moved west @-@ northwestward and was centered well east of the Leeward Islands on October 6 , when satellite imagery indicated that deep convection became much more concentrated . The following day , ship reports noted that a closed circulation was developing . The system was classified as a tropical depression beginning at 1800 UTC on October 7 , while located

about 600 mi ( 970 km ) east of Puerto Rico . Around midday on October 8 , the depression strengthened into Tropical Storm Juliet .

After peaking with maximum sustained winds of 50 mph ( 80 km / h ) and a minimum barometric pressure of 1 @, @ 006 mbar ( 29 @. @ 7 inHg ) early on October 9 , Juliet passed north of Puerto Rico . The storm brought light rainfall to the island , peaking at 4 @. @ 51 in ( 115 mm ) at Toro Negro Plant . The storm then accelerated and curved northwestward , northward , and then northeastward . On October 11 , Juliet merged with a frontal zone , while located west @- @ southwest of Bermuda . Later that day , the remnants moved across the island and produced up to 3 in ( 76 mm ) of rainfall .

= = = Hurricane Kendra = = =

In late October , a tropical wave and an area of disturbed weather combined in the northwestern Caribbean , before crossing Puerto Rico . The system moved northwest and by late on October 28 , it became a tropical depression while located about 80 miles ( 130 km ) north of Mayaguana in The Bahamas . Early on the following day , it strengthened into Tropical Storm Kendra . The storm quickly intensified while moving either north or north @- @ northwestward and became a hurricane late on October 29 . After peaking with winds of 80 mph ( 130 km / h ) on October 30 , Kendra weakened significantly to a 50 mph ( 80 km / h ) tropical storm in only 12 hours . Kendra continued north @- @ northeastward or northeastward , before being absorbed by an extratropical cyclone while located west @- @ northwest of Bermuda early on November 1 .

The precursor system dropped rainfall across much of southern Puerto Rico was at least 7 in ( 180 mm ) , with a peak at 20 @. @ 43 in ( 519 mm ) in Pico del Este . Mudslides and flooding from the heavy precipitation left many roads impassable , washed out or collapsed several bridges , and caused considerable damage to agriculture , especially livestock . Additionally , one fatality occurred and 1 @, @ 710 families fled their homes for shelters . Damage in Puerto Rico reached \$ 6 million . A high @- @ pressure area and Kendra combined produced strong winds and abnormally high tides along the East Coast of the United States , though no damage was reported .

= = = Other storms = = =

In addition to the 12 other tropical cyclones , there were several tropical depressions that developed during the season . The first of which formed over the central Gulf of Mexico on June 21 . The depression moved northeastward toward Florida and strengthened slightly . It dissipated by late on June 22 . Another tropical depression developed about 175 mi ( 282 km ) southwest of Porto Novo , Cape Verde on July 10 . The system moved generally westward and intensified into a strong tropical depression , before dissipating two days later . Tropical Depression Four formed about 465 mi ( 748 km ) east of Barbados on August 7 . It tracked westward without significantly intensifying , and passed through the Windward Islands over Bequia on the following day . The depression continued westward and passed near Aruba on August 9 . It eventually traversed the Caribbean Sea , and made landfall to the south of Bluefields , Nicaragua on August 11 . The depression dissipated shortly thereafter .

A tropical depression formed in the central Gulf of Mexico on August 9 . The storm moved northward and struck southeastern Plaquemines Parish , Louisiana before dissipating the next day . By August 30 , another depression developed in the north @- @ central Gulf of Mexico . The system tracked generally eastward and avoided landfall . It dissipated around midday on September 1 . Tropical Depression Eight developed over western Senegal around 1200 UTC on September 3 . The depression initially headed west @- @ southwestward and soon entered the Atlantic Ocean . Between late on September 4 and early on September 5 , the system passed south of Cape Verde . Later that day , the storm began curving west @- @ northwestward . By early on September 7 , it was heading northwestward and then turned to the north @- @ northwest the next day . The depression moved northward between September 9 and September 10 , before re @- @ curving to the northeast . It dissipated about 440 mi ( 710 km ) of Flores Island in the Azores around midday on

September 11 .

At 1200 UTC on September 8 , Tropical Depression Nine developed over the west @-@ central Gulf of Mexico . Moving generally westward , the depression made landfall south of La Pesca , Tamaulipas , around midday on September 10 . The system rapidly weakened inland and dissipated later that day . Another tropical depression formed over western Senegal on September 18 . It moved westward across the Atlantic Ocean before curving west @-@ northwestward about three days later . On September 25 , the depression moved northwestward and then northward by September 28 . It dissipated about 550 mi ( 890 km ) east @-@ northeast of Bermuda at 1200 UTC the following day . The next tropical depression developed in the Gulf of Mexico just offshore Campeche on September 21 . Moving west @-@ northwestward , the depression made landfall near Tampico on September 23 , shortly before dissipating .

A tropical depression formed at 1200 UTC on October 13 , while located about 55 mi ( 89 km ) north of Corvo Island in the Azores . The depression initially moved south @-@ southwestward , before curving southwestward by the following day . It then turned west @-@ northwestward on October 15 . Late the next day , the depression turned abruptly northward . The system dissipated about 500 mi ( 800 km ) west @-@ northwest of Flores Island . The next tropical depression developed at 1200 UTC on October 26 , while located about 490 mi ( 790 km ) south @-@ southwest of the southernmost islands of Cape Verde . It moved generally westward and dissipated about halfway between the Lesser Antilles and the west coast of Africa on October 29 . The final tropical depression of the season formed about 265 mi ( 426 km ) northeast of North Abaco in the Bahamas on November 3 . Moving north @-@ northeastward , the depression turned northeastward by the next day . It dissipated about 275 mi ( 443 km ) east of Virginia Beach , Virginia on November 5 .

= = Storm names = =

The following names were used for named storms that formed in the north Atlantic basin in 1978 . Storms were named Amelia , Bess , Cora , Flossie , Hope , Irma and Juliet for the first time in 1978 . This was the last year that only female names were used for Atlantic hurricanes . The name Greta was retired after the 1978 season . Names that were not assigned are marked in gray .

= = Season effects = =

This is a table of the storms in 1978 and their landfall ( s ) , if any . Deaths in parentheses are additional and indirect ( an example of an indirect death would be a traffic accident ) , but are still storm @-@ related . Damage and deaths include totals while the storm was extratropical or a wave or low .