

**MAJOR STORMS & FLOODS
OF
WESTERN NORTH CAROLINA**

The 1940 and other floods in WNC

- Posted by [Rob Neufeld](#) on July 30, 2012 at 10:59am in [Local History](#)
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Floods commit unpredictable acts of violence and renewal

by Rob Neufeld

The local story of 18-year-old Kathleen Lipe's survival of the 1916 flood, as her father and others had been swept away, speaks of the awful power of the French Broad River and its tributaries. In Biltmore, water had risen fifteen feet in one hour.

Another horror

On May 28, 1973, David Wayne Woody stepped out of his home in Fowler's Trailer Park in Skyland and saw Robertson Creek rising. As a precaution, he took his two-year old son, Christopher, by the hand; and his nine-month old daughter, Shannon, in his arms to seek refuge in Clay Ledford's brick house.

On the way, Woody looked back and saw a four-foot high tidal wave heading toward him. Apparently, a dam constructed on the Brookwood Golf Course had given way. Woody hurried his family into Jason Roberts' trailer, but there was no safety there. The water tumbled and shoved the trailer for a mile, splitting it in half; and killing the inhabitants. Woody's own trailer remained unmoved.

Brief history of floods

The flood of 1916 is the worst on record in western North Carolina, but that is only for a specific area. The flood of August 30, 1940 was the worst one to ever pass through Canton and Enka, local residents recall.

A.J. L. Moritz, technical vice president of American Enka, stated, "in Hominy Valley the water came considerably higher than during any previously known flood in a history of over one hundred years."

Moritz proudly reported in the October 1940 issue of "The Enka Voice" that after the flood inundated the rayon factory's basements and ground floors, employees got the operation going full throttle in two weeks. "Close to a thousand machines had to be taken apart, cleaned, and again put in working order. All equipment, like spools, racks, etc., had to be individually cleaned."

Tragic deaths and heroic rescues are only part of the story of floods. Damage to railroads, bridges, and industries; scattered lumber; broken water mains and threatened water supplies; displaced residents; mud slides; and ruined crops also figure in the periodical outbursts.

And then there are the freakish and comical outcomes.

Hankie Enkie Sr. penned a humorous reflection on the 1940 flood in "The Enka Voice" in which Moritz's morale booster had appeared. He reported that employees played a game of "pinch-and-run" with items that had floated out of people's offices. "Personally," he noted, "I found me three pairs of good socks among Mr. (C. C.) Vanderhooven's (the company president's) collection of unmentionables with which he dazzles his monthly audiences in the gym."

Societal reactions to floods vary. Before industrialization, floods did less damage and restored the soil for crops. In our urban world, insurance companies step in—as they did in January 1974 with the passage of a federal law requiring municipalities to enforce flood plain management if they wanted to receive other benefits, such as mortgages for public buildings.

Big floods in WNC history

Fourth week of August, 1796

The first decade of the 1800s—changing course of Swannanoa River in Beverly Hills

August 28, 1852

February 22, 1891

May 20, 1901—particularly the French Broad River in Madison and Buncombe counties

July 11, 1905—French Broad River and Hominy Creek

July 16, 1916—French Broad and Swannanoa Rivers

August 15, 1928—east Buncombe and McDowell County

August 30, 1940—Haywood County, west Buncombe, Marshall, and Tuckaseegee River

August 14, 1946—east Buncombe, McDowell County, and Canton

May 28, 1973—Haywood County, south Buncombe, and Hiwassee River

September 8 and 17, 2004—Haywood County

PHOTO CAPTION

Three men stand in the doorway of Carolina Power & Light's Avery Street station Company during the flood of August 15, 1928. Photo courtesy N.C. Collection, Pack Memorial Library

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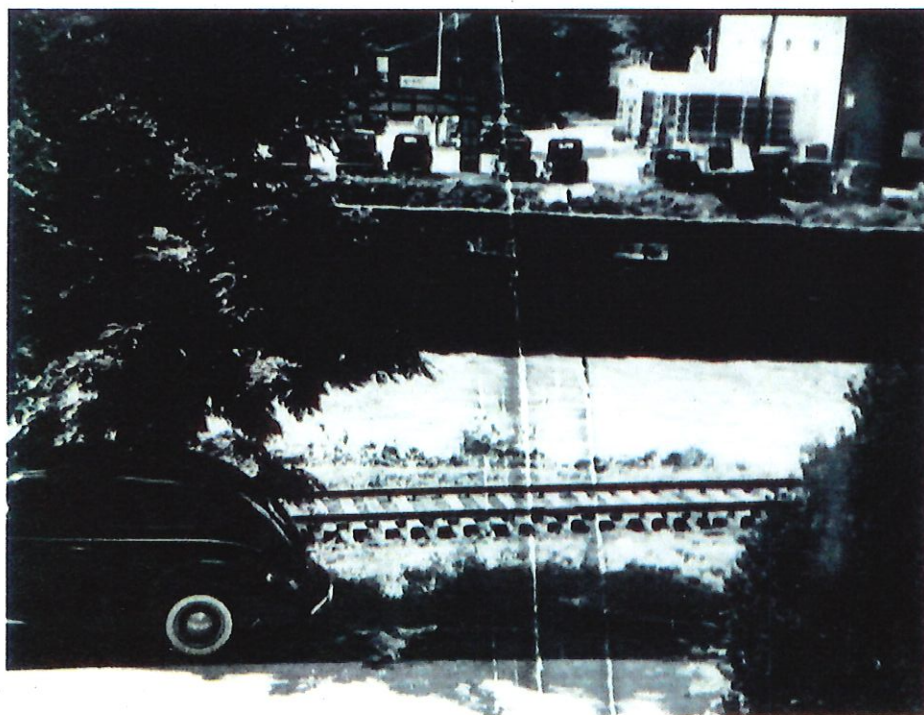
Flood Of 1940

The 1940 event, which was the most devastating flood ever recorded on the Tuckasegee River, claimed four lives. Torrential rains caused what area residents at the time termed, "cloudbursts" and "waterspouts," sending torrents of water from Canada and Caney Fork down the river. The floodwaters wiped out every bridge in the county that crossed the main Tuckasegee, including the steel bridge above that at the time was the main bridge across the river in Dillsboro, according to Harold Hensley. "After you crossed the bridge, you'd turn left to go to Franklin or right to go to Macktown," he said. The N.C. 107 bridge that spans the river's East Fork at Tuckasegee remained intact, but both approaches were washed away, which rendered the bridge unusable for a time.

Related article: [Back then: 1940 flood](#)

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Flood of 1940

A view looking toward Sylva right before Main and Mill diverge. Last week marked the 72nd anniversary of the largest and most devastating flood recorded on the Tuckasegee River. Four casualties were reported after torrential rains caused what area residents at the time termed "cloudbursts" and "waterspouts," sending torrents of water from Canada and Caney Fork down the river. Flood waters wiped out every bridge in the county that crossed the Tuckasegee. The N.C. 107 bridge that spans the river's East Fork at Tuckasegee remained intact, but both approaches were washed away and rendered the bridge unusable for a time. This photo and

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Slight chance of a
thunderstorm

Sunday



High 82°/Low 54°

Sunshine

Tomorrow



High 75°/Low 54°

Mix of sun and
clouds

Monday



High 83°/Low 57°

Sunny

7 Day Forecast

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the ones in this gallery were given to The Herald in 1980 by Herbert Gibson, a former Sylva resident, who discovered his undeveloped film 40 years after he captured images of the flood's devastation. Flood waters crested before daylight, so Gibson's pictures show the river at flood stage but well below the 21.1-foot high water mark reached during the night.



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Flooding in North Carolina

On this page you learn what types of flooding are typical in North Carolina and how do you protect yourself, your family and your home. You will also find out more about significant North Carolina floods. Finally, you'll find links to NWS offices that provide forecast and safety information for North Carolina, as well as links to our partners who play a significant role in keeping you safe.



Significant North Carolina Floods

- [1928 Okeechobee Hurricane](#)
- [The Great Catawba River Flood of 1916](#)
- [The 1940 Flood](#)

A widespread major flood event in August 1940 resulted from a landfalling tropical cyclone's decay and interaction with topography over western North Carolina during mid-August. This widespread and particularly devastating flood is found in many accounts of historic events in local newspaper archives. The hurricane's track was particularly conducive to producing extremely heavy rainfall due to slow movement and its initial motion to the west and subsequent northward curl, which maintained deep and moist upslope flow on the eastern slopes of the Appalachians.

The storm produced heavy rain over a 5-day period, from the 12th through the 16th, with rainfall exceeding 8 inches over most locations in the mountains. More than 12 inches of rain was recorded at Boone (12.11"), Hickory (12.45"), Highlands (12.80"), Crossnore (14.37"), and Mt. Mitchell (14.42"). Idlewild, in Ashe County, recorded a stunning 20.23 inches in just 5 days.

Private property and crop damage was widespread. In addition, extensive damage to rail lines, bridges and roads caused major disruption to transportation. No official damage estimates could be located for this event, but one reference states that the damage "probably exceeded \$20 million," which would be well over \$330 million today. The flash flooding and hundreds of resulting debris flows caused 26 fatalities in the state, mainly in the Pigeon River basin (Avery, Watauga, Ashe, Buncombe, McDowell, Yancy and Wilkes counties). There are still eight river gages in northwest North Carolina where the historical high water levels are attributed to this flood.

Excerpted from [A Flood Story for a Rainy Day](#)

"At 7:20 am, Engineer Sherman Pippin opened the throttle, Conductor Cy Crumley hopped up the steps of the combine, and the last train ever departed Boone, leaving 14 freight cars behind in the yard. 'Escaped from Boone' would be also an appropriate way to describe this departure, since rain was coming down in sheets. The ground, saturated from days of wet weather, could no longer absorb the rapidly falling water, so it cascaded down the mountainsides, swelling streams and rivers. At Shulls Mills, the train waded through 2 feet of water (try doing THAT with a diesel), and passed Grandfather Mountain where it looked like the entire mountainside was a giant waterfall."

"The crew knew in their hearts that they were making the last trip, because the line they were passing over had made little money, and the damage this flood would cause would seal the fate of the Linville River Railway. The rain continued unabated through the day as the train made its trip to Johnson City and began its return into the mountains. As they began the climb up into Cranberry Gap, a man flagged the train down and told the crew they were heading into a washout. As they began backing toward Cranberry, they encountered another, where a culvert had failed. So Number 9's journey ended on the hill between Cranberry and the Gap."

"Tweetsie Tales" tells of how much rain fell in the period ending at 5 pm on August 13, 1940, it also tells that several more inches fell between 5 and 6 in an intense cloudburst. My father, who was 13 then, has shown me how high the water got in North Wilkesboro. The flood's effects were visible for months, and the memories lasted for the lives of those who experienced it. Boone never saw another train."

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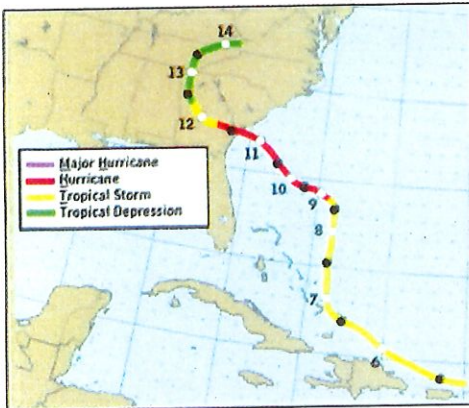
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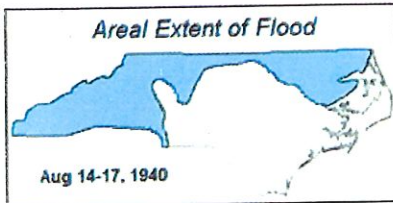
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Track of the 1940 hurricane from the National Hurricane Center, National Weather Service archive



Extent of the flooding, which was of much greater severity in the west, encompassing the French Broad, Catawba, Upper Yadkin, and New River basins; image is from the United States Geological Survey, Water-Supply Paper 2375, National Water Summary 1988-89, page 428



This photo shows the damaged trestle over Scotts Creek behind what is now Ward's Plumbing. Last week marked the 72nd anniversary of the largest and most devastating flood recorded on the Tuckasegee (sic) River. Four casualties were reported after torrential rains caused what area residents at the time termed "cloudbursts" and "waterspouts," sending torrents of water from Canada and Caney Fork down the river. Flood waters wiped out every bridge in the county that crossed the Tuckasegee (sic). The N.C. 107 bridge that spans the river's East Fork at Tuckasegee remained intact, but both approaches were washed away and rendered the bridge unusable for a time. This photo and the ones in this gallery were given to The Herald in 1980 by Herbert Gibson, a former Sylva resident, who discovered his undeveloped film 40 years after he captured images of the flood's devastation. Flood waters crested before daylight, so Gibson's pictures show the river at flood stage but well below the 21.1-foot high water mark reached during the night." A Photo and caption credit: The Sylva Herald



Last week marked the 72nd anniversary of the largest and most devastating flood recorded on the Tuckasegee(sic) River. Four casualties were reported after torrential rains caused what area residents at the time termed "cloudbursts" and "waterspouts," sending torrents of water from Canada and Caney Fork down the river. Flood waters wiped out every bridge in the county that crossed the Tuckasegee(sic). The N.C. 107 bridge that spans the river's East Fork at Tuckasegee remained intact, but both approaches were washed away and rendered the bridge unusable for a time. This photo and the ones in this gallery were given to The Herald in 1980 by Herbert Gibson, a former Sylva resident, who discovered his undeveloped film 40 years after he captured images of the flood's devastation. Flood waters crested before daylight, so Gibson's pictures show the river at flood stage but well below the 21.1-foot high water mark reached during the night.

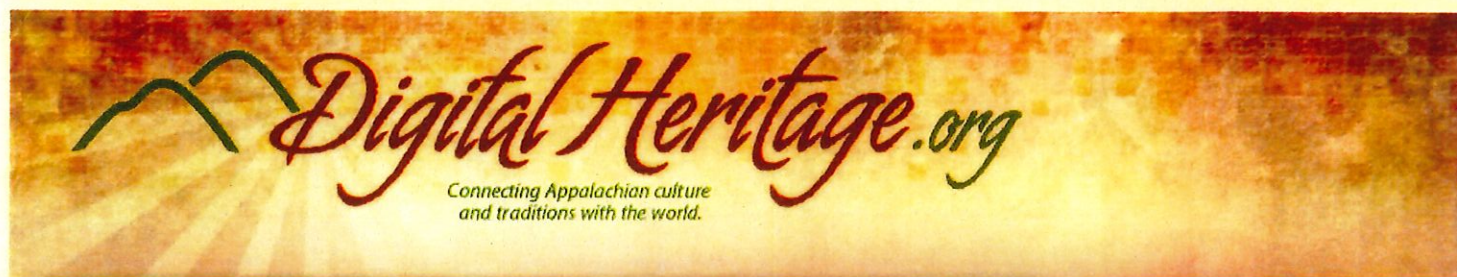
Hurricane Floyd (1999)

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Flood Hazard Information

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Floods of 1916 and 1940

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Many people in the mountains of Appalachia vividly remember September, 2004. During that month, the rains and winds of Hurricanes Frances and Ivan combined to swell the French Broad, Catawba, and Pigeon Rivers to record flood

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levels. Several fatalities and millions of dollars of damage resulted. But few residents recall an earlier event of similar proportions that devastated our region. That memory failure is because the last time such flooding overwhelmed our mountains was over 60 years ago, in 1940. Furthermore, it is necessary to go even further back, to 1916, to find a second flood that rivals the devastation experienced in 2004. Few natural catastrophes cause such widespread destruction as floods. The ones that occurred in 1916 and 1940 rank with those of 2004 as among the most challenging and destructive natural events to buffet the rural communities of Western North Carolina.

By the early 1900s, railroads had penetrated the mountains of North Carolina. The citizens of the region were enjoying increased contact with faraway places. The area was widely recognized as a tourist destination, a health retreat, and rich in natural resources. Nothing seemed to be able to slow the rapid progress being experienced by even the most remote communities. Nothing, that is, except Mother Nature.

The 1916 Flood

A 1917 Southern Railway publication reports of the 1916 flood:



"On July 5th and 6th a tropical cyclone swept over the Gulf Coast of Alabama, and [was] followed by torrential rains over a large part of the state and into Tennessee and the Carolinas. A second tropical cyclone passed over Charleston, S.C. during the morning of July 14th causing some local damage and, moving northwestward, expended its full force on the watersheds in western North Carolina where the rain from the first storm had already saturated the soil and filled the stream banks full. All previous records of rainfall in the United States were exceeded. The run-off from the saturated soil was very rapid, streams rose high above all previous flood records; resulting in the death of about 80 persons and in property damage estimated by the United States Weather Bureau at about 22 million dollars."

Details of fatalities and property damage slowly made their way out of isolated communities. In Marshall, 53 houses were reported washed away in the narrow valley where the town lies. There, five hundred excursionists from Knoxville found themselves marooned with only one railway bridge left standing in the entire county. The National Weather Bureau recorded 22.22 inches of rainfall in one day at Altapass near Grandfather Mountain. At the time it was the greatest 24-hour precipitation total ever recorded in the United States. Enormous volumes of water fell over an area of hundreds of square miles and subsequently rushed down the mountain sides and into the rivers, carrying destruction in its path.

The 1940 Flood

Cullowhee

April 29th, 2015

Cullowhee is an unincorporated community located in the Tuckasee Valley of Jackson County, North Carolina where Cullowhee Creek joins the Tuckasee River. Originally a Cherokee [\[...\]](#)

• About The Digital Heritage Project

DigitalHeritage.org includes essays, video interviews, and other materials created by the students of Western Carolina University. It also includes regional lesson plans created by teachers participating in the Adventure of the American Mind project sponsored by the Library of Congress. Radio spots created by WCU faculty and students may be heard on stations WKSF-FM, WMXF-AM, WPEK-AM, WWCU-FM, and WWNC-AM. A print version is available each month in the Laurel of Asheville.



Tonya Carroll (B.A., 2007 M.A., 2009) with Bruce Frazier (Carol Grotnes Belk Endowed Professor in Commercial & Electronic Music) in the recording studio.



The floods of 1940 were just as devastating. The severity of a flooding event is determined by a combination of four components: the river basin terrain, local thunderstorm movement, past soil moisture conditions, and the degree of vegetative clearing. During the mid- 20th century, increased development within the river basins of many western North Carolina counties, including Wilkes, Watauga, Haywood, and Jackson, left many communities particularly vulnerable to flash floods. Tragically, the late summer rains of 1940 were stronger than average. In one 24-hour period, a record rainfall of 8.7 inches fell in Jackson County along the Tuckasegee River.

Near Boone, the ground was saturated from days of wet weather and could no longer absorb the rapidly falling rain. Water cascaded down the mountainsides, swelling streams and rivers. Close by at Shulls Mills, a train (Old Number 9) waded through 2 feet of water and passed Grandfather Mountain where it looked like the entire mountainside was a giant waterfall. As the train began the climb up into Cranberry Gap, the crew was flagged down and told they were heading into a washout. They reversed direction and began backing toward the Cranberry community. Here they discovered the culvert behind them had failed and another washout had occurred. Consequently, Old Number 9's final journey ended on a hill between Cranberry and the Gap. Since that day, Boone has never enjoyed regular scheduled train service.

100 miles west, in the Canada community of Jackson County, four people lost their lives. The Sylva Herald & Ruralite recalled the event:

Albert McCall and his two children drowned after a tremendous slide hit their house and swept it away. The force of the slide "carried Mrs. McCall across the raging creek where she caught the top of a tree and saved herself." The body of the McCalls' 5-year-old son was swept nearly 60 miles by the flood waters and was found on an island near Bryson City. The bodies of Albert McCall and the other child were never found.



The fourth Canada resident to perish in the flood was Mrs. Vessie Mathis. Her husband told of a slide and huge quantities of water coming down Pistol Creek and carrying his home away. Mathis said "he held onto his wife as long as he could, then grabbed something solid and pulled himself from the waters." His wife's body was found the next morning. It was pitiful. Their house was gone. But just a little way from where the house had been their "pie safe" was standing upright, just like someone had set there. All

the food still looked good. The pickled beans they'd had for supper were right there and so was the cake she'd baked," Burrell said. "There was even a ten-dollar bill in one of the tea cups. That was to pay the granny woman when their baby came."

The floods of 1916 and 1940 left in their wake shattered lives and unimaginable devastation. The memories, though not pleasant, have endured for many generations and have become a permanent part of our mountain heritage.

This essay was based on information provided by The Sylva Herald, Slim Rail's Curtis Brookshire, the USGS, Wilkes Community College, Western Carolina University, and the WNC Heritage Project.

Essay by Timothy N. Osment

History, M.A.

WCU, 2008

For more information please see:

- *The Floods of 1916* edited by J.C. Williams.
- [The Flood of 1916](#)
- [The Flood of 1916 in McDowell County, NC](#) (includes an oral history about the flood)
- [Old Fort, North Carolina](#)
- [Photo from the D.H. Ramsey Library, Special Collections, University of North Carolina at Asheville](#)
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Multimedia:





2004 Atlantic hurricane season

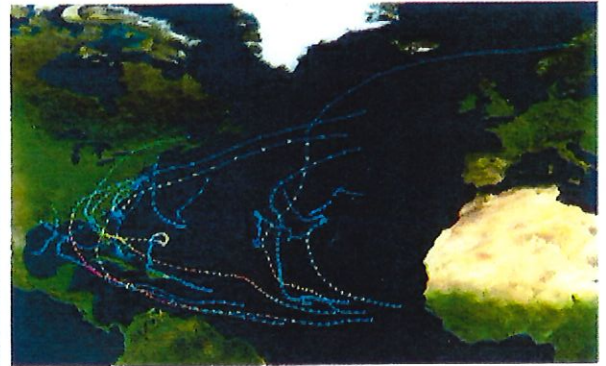
from Wikipedia, the free encyclopedia

The **2004 Atlantic hurricane season** was the costliest Atlantic hurricane season on record until surpassed by the following year. More than half of the 16 tropical cyclones brushed or struck the United States. The season officially began on June 1, and ended on November 30. Due to a Modoki El Niño – a rare type of El Niño in which unfavorable conditions are produced over the eastern Pacific instead of the Atlantic basin due to warmer sea surface temperatures farther west along the equatorial Pacific – activity was above average. The first storm, Alex, developed offshore of the Southeastern United States on July 31. It brushed the Carolinas and the Mid-Atlantic, causing one death and \$7.5 million (2004 USD) in damage.^[nb 1] Several storms caused only minor damage, including tropical storms Bonnie, Earl, Hermine, and Matthew. In addition, hurricanes Danielle, Karl, and Lisa, Tropical Depression Ten, Subtropical Storm Nicole and Tropical Storm Otto had no effect on land while tropical cyclones.

Hurricane Charley made landfall in Florida as a Category 4 hurricane on the Saffir–Simpson hurricane wind scale (SSHWS), causing \$15.1 billion in damage in the United States alone. Later in August, Hurricane Frances struck the Bahamas and Florida, causing at least 49 deaths and \$9.5 billion in damage. The most intense storm, and the one that caused the most damage, was Hurricane Ivan. It was a Category 5 hurricane that devastated multiple countries adjacent to the Caribbean Sea, before entering the Gulf of Mexico and causing catastrophic destruction on the Gulf Coast of the United States, especially Alabama and Florida. Throughout the countries it passed through, Ivan left 129 fatalities and over \$23.33 billion in damage. The most significant tropical cyclone in terms of deaths was Hurricane Jeanne. In Haiti, torrential rainfall in the mountainous areas resulted in mudslides and severe flooding, causing at least 3,006 fatalities. Jeanne also struck Florida, inflicting extensive destruction. Overall, the storm caused at least \$8.1 billion in damage and 3,042 deaths.

Collectively, the storms of this season caused at least 3,270 deaths and about \$57.37 billion in damage, making it the costliest Atlantic hurricane season at the time, until the following season. With six hurricanes reaching at least Category 3 intensity, 2004 also had the most major hurricanes since 1996.^[nb 2] However, that record would also be surpassed in 2005, with seven major hurricanes that year. In

2004 Atlantic hurricane season



Season summary map

Seasonal boundaries

First system formed July 31, 2004

Last system dissipated December 3, 2004

Strongest storm

Name	Ivan
• Maximum winds	165 mph (270 km/h) (1-minute sustained)
• Lowest <u>pressure</u>	910 mbar (hPa; 26.87 inHg)

Seasonal statistics

Total depressions	16
Total storms	15
Hurricanes	9
Major hurricanes (Cat. 3+)	6
Total fatalities	>3,270
Total damage	\$57.37 billion (2004 USD)

Related articles

- Timeline of the 2004 Atlantic hurricane season
- 2004 Pacific hurricane season
- 2004 Pacific typhoon season
- 2004 North Indian Ocean cyclone season

the spring of 2005, four names were retired: Charley, Frances, Ivan, and Jeanne. This tied the then-record most names retired with 1955 and 1995, while five were retired in 2005.

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Seasonal forecasts

Since 1984, forecasts of hurricane activity have been issued before each hurricane season by noted hurricane expert Dr. William M. Gray and his [associates](#) at Colorado State University (CSU), and separately by forecasters with the U.S. Government's National Oceanic and Atmospheric Administration (NOAA). According to CSU, the average season between 1950 and 2000 had 9.6 tropical storms, 5.9 hurricanes,

Predictions of tropical activity in the 2004 season

Source	Date	Tropical storms	Hurricanes	Major hurricanes
CSU	<i>Average (1950–2000)</i>	9.6	5.9	2.3
NOAA	<i>Average</i> ^[2]	11	6	2
CSU	December 5, 2003	13	7	3
CSU	April 2, 2004	14	8	3

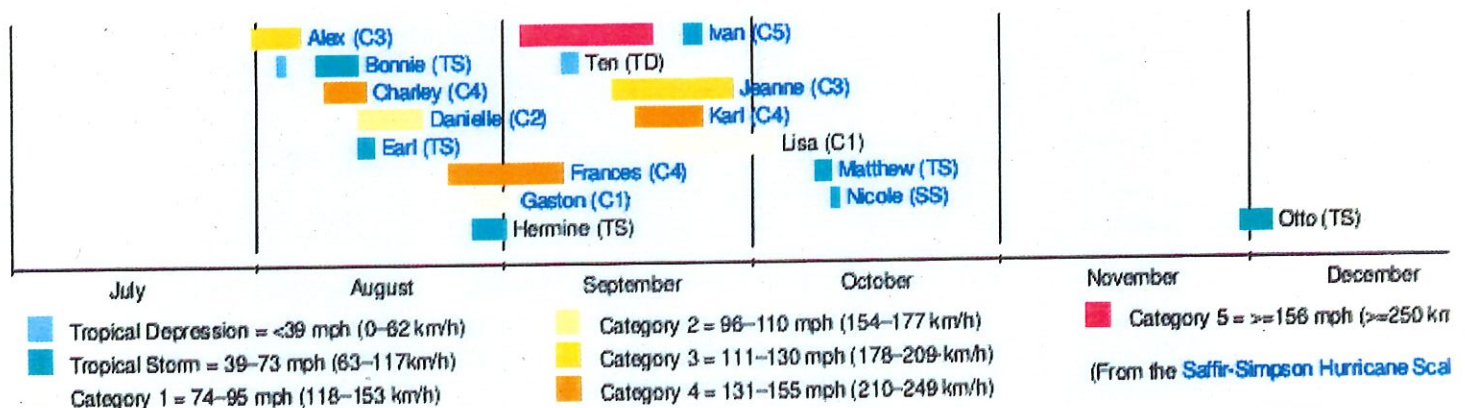
and 2.3 major hurricanes, which are Category 3 or higher on the Saffir-Simpson hurricane wind scale.^[3] A normal season, as defined by NOAA, is 12.1 named storms, of which 6.4 reach hurricane strength and 2.7 become major hurricanes.^[4]

NOAA	May 17, 2004	12–15	6–8	2–4
CSU	May 28, 2004	14	8	3
CSU	August 6, 2004	13	7	3
CSU	September 3, 2004	16	8	5
CSU	October 1, 2004	15	9	6
Actual activity		15	9	6

CSU released its first [prediction](#) on December 5, 2003, which projected an above average season, with 13 named storms, seven hurricanes, and three major hurricanes.^[5] This forecast was adjusted upward slightly on April 2.^[6] On May 17, prior to the start of the season, NOAA forecasters predicted a 50% probability of activity above the normal range, with twelve to fifteen tropical storms, six to eight of those becoming hurricanes, and two to four those hurricanes reaching major intensity.^[7] Dr. Gray released a prediction on May 28 that was similar, with 14 named storms, eight reaching hurricane strength, and three becoming major hurricanes.^[8]

After the season began, Dr. Gray announced he had revised his predictions slightly downwards on August 6, citing mild El Niño conditions. His new forecast was thirteen named storms, seven hurricanes, and three reaching major hurricane intensity.^[9] On August 10, NOAA released an updated prediction as well, with a 90% probability of above-to-near normal activity, but the same number of storms forecast.^[10] CSU issued another forecast on September 3, indicating sixteen tropical storms, eight hurricanes, and five major hurricanes.^[11] The season ended up with sixteen tropical depressions, fifteen named storms, nine hurricanes, and six major hurricanes,^[12] which matched CSU's final prediction on October 1.^[13]

Seasonal summary

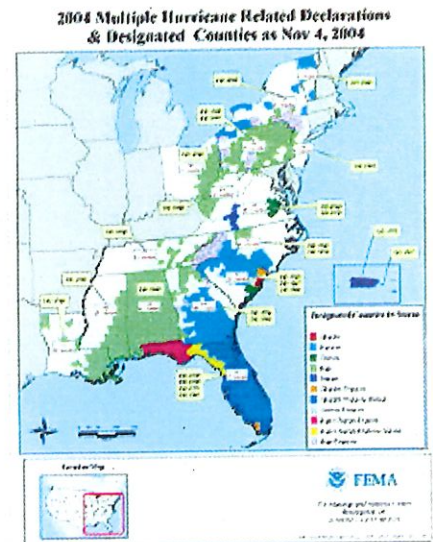


Activity

The Atlantic hurricane season officially began on June 1, 2004.^[10] However, the first system, Hurricane Alex, did not develop until July 31. It was an above average season in which 16 tropical cyclones formed. All but one tropical depression attained tropical storm status, and nine of these became hurricanes. Six hurricanes further intensified into major hurricanes.^[12] Due to a Modoki El Niño – a rare type of El Niño in which unfavorable conditions are produced over the eastern Pacific instead of the Atlantic basin due to warmer sea surface temperatures farther west along the equatorial Pacific – activity was above average.^[14] Five hurricanes and three tropical storms made landfall during the season and caused 3,270 deaths and about \$57.37 billion in

damage.^[15] Additionally, Hurricanes Alex and Tropical Storm Earl also caused losses and fatalities, though neither made landfall.^{[12][16]} The season officially ended on November 30, 2004.^[10]

Tropical cyclogenesis began at the end of July, with the development of Hurricane Alex on July 31.^[12] However, it did not become a named storm until the following day, which was the fifth-latest start since the 1952 season.^[17] August was an unusually active month, with eight named storms, including Alex, Bonnie, Charley, Danielle, Earl, Frances, Gaston, and Hermine.^[12] This broke the record for the most named storms in the month of August set in 1933 and 1995.^[18] This new record was tied in 2012. On average, there are only three tropical storms and one to two hurricanes in August.^[19] Of the eight systems that month, five became hurricanes and three strengthened further into major hurricanes. A total of five tropical cyclones developed in September, including the most intense system of the season, Hurricane Ivan. Activity decreased further in October, with the formation of only two systems, Tropical Storm Matthew and Subtropical Storm Nicole. The season then went dormant for over a month and a half, until Tropical Storm Otto developed on November 29. Otto was the final tropical cyclone of the season and degenerated into a remnant low pressure on December 3.^[12]



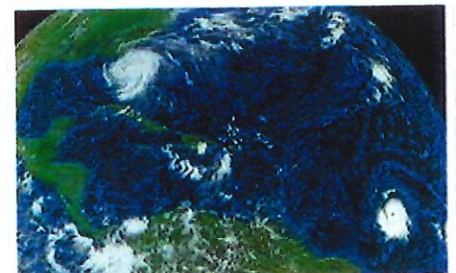
Map of counties in the United States designated as disaster areas in the aftermath of a storm(s)

Impact

The 2004 season was very deadly, with about 3,270 fatalities overall. Nearly all of the deaths were reported in Haiti following the floods and mudslides caused by Tropical Storm Jeanne. The other tropical cyclones that caused fatalities include Hurricane Alex, Charley, Frances, Gaston, and Ivan, and Tropical Storms Bonnie and Earl.^[15] Because four out of the six major hurricanes made several landfalls, the season was also extremely damaging, with losses estimated at about \$36.1 billion, over half of which was caused by Hurricanes Charley and Ivan.^{[12][20]} A few other tropical cyclones caused light to moderate damage, including Hurricanes Alex and Gaston and Tropical Storms Bonnie and Matthew. In addition to the 16 tropical cyclones of the season, a tropical low in May brought torrential flooding to Haiti and the Dominican Republic, killing 2,000 people and causing extensive damage. Though the system was not officially classified as a tropical storm, it did have a circulation with loosely organized convection, resembling a subtropical cyclone.^[21]

Records

The 2004 season had numerous unusual occurrences. With six hurricanes reaching at least Category 3 intensity, 2004 also had the most major hurricanes since 1996, a record which would be surpassed in 2005.^[22] Florida was severely impacted by four hurricanes during the season – Hurricane Charley, Frances, Ivan, and Jeanne. This was the first time four tropical cyclones produced hurricane-force winds in one state during a single season since four hurricanes made landfall in Texas in 1886.^[23] There were many other hurricanes in the season that were individually unusual. Hurricane Alex was the strongest hurricane on record to intensify north of 38°N latitude.^[24] Hurricane Ivan was the most unusual storm of the season. Ivan became the first major hurricane in the



Hurricanes Frances (top left) and Ivan (bottom right) on September 5

Atlantic on record to form as low as 10°N latitude.^[25] A 91 ft (28 m) wave, possibly the largest ever recorded, was attributed to Ivan; this wave may have been as high as 131 ft (40 m).^[26] Additionally, hurricanes Charley and Ivan ranked as the third and second costliest hurricanes in the United States at the time, respectively, behind only Hurricane Andrew.^[20] With \$57.37 billion in damage,^[15] this was the costliest season at the time, until 2005.^[27]

Accumulated cyclone energy (ACE)

The season's activity was reflected with a accumulated cyclone energy (ACE) rating of 227, one of the highest values on record in the Atlantic basin. 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.^[22]

Systems

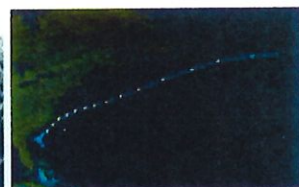
Hurricane Alex

The interaction between a trough and tropical wave resulted in the development of a tropical depression on July 31, while centered about 200 mi (320 km) east of Jacksonville, Florida. After initially being poorly organized, the depression strengthened into Tropical Storm Alex late on August 1. The storm tracked northeastward and became a hurricane on August 3. As Alex moved out to sea, it intensified into a Category 3 hurricane and peaked with winds of 120 mph (195 km/h). Alex reached major hurricane status second farthest north in the Atlantic, after Hurricane Ellen in 1973. Eventually, Alex weakened due to cooler sea surface temperatures. The hurricane fell to tropical storm intensity around 12:00 UTC on August 6. Six hours later, it became extratropical while located about 955 mi (1,540 km) east of Cape Race, Newfoundland, and was soon absorbed by a large extratropical cyclone.^[24]

Rough seas and a storm surge up to 6 ft (1.8 m) on the Outer Banks of North Carolina caused minor beach erosion and washed out portions of a highway in Cape Fear. A man drowned near Nags Head due to these conditions. Strong winds also pelted the area, with sustained winds reaching 77 mph (124 km/h) and gusts up to 105 mph (169 km/h) in Hatteras.^[24] As a result, 10,000 buildings and houses were left without electricity.^[28] The combination of strong winds and the storm surge damaged more than 100 buildings and houses.^[29] At Ocracoke, coastal flooding was considered the worst since Hurricane Gloria in 1985.^[24] Additionally, rainfall up to 7.55 in (192 mm) on the Outer Banks flooded nearly 500 cars.^[29] Damage in North Carolina reached about \$7.5 million. In Rehoboth Beach, Delaware, three people were injured by rip currents, while five others were hospitalized in New Jersey.^[30]

Tropical Storm Bonnie

Category 3 hurricane (SSHWS)



Duration	July 31 – August 6
Peak intensity	120 mph (195 km/h) (1-min) 957 mbar (hPa)

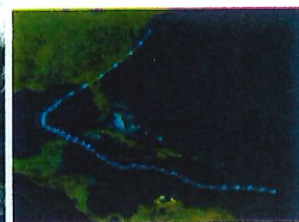
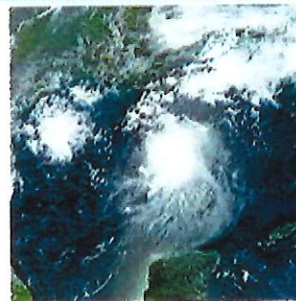
A tropical wave developed into Tropical Depression Two on August 3, while located about 315 mi (505 km) east of Barbados. The depression crossed the Lesser Antilles on August 4, before degenerating back into a tropical wave. The remnants traversed the Caribbean Sea, and re-developed into Tropical Depression Two on August 8. The depression strengthened further upon reaching the Gulf of Mexico and was upgraded to Tropical Storm Bonnie on August 9. A break in a mid-level ridge re-curved Bonnie northward on August 10 and then northeastward on August 11. Later that day, the storm peaked with winds of 65 mph (100 km/h), before wind shear began weakening it. At 14:00 UTC on August 12, Bonnie made landfall near Apalachicola, Florida with winds of 45 mph (75 km/h). The storm rapidly weakened inland and degenerated as a remnant low offshore of New Jersey on August 14.^[31]

In the Lesser Antilles, the storm brought light winds and mostly localized flooding to Saint Vincent and the Grenadines.^[32] The regenerated system brought light rainfall to the Yucatan Peninsula.^[33] In North Florida, scattered power outages were reported, and rainfall and storm surge flooded roads, especially in Taylor County. A tornado in Jacksonville damaged several businesses and homes. Tornadoes were also reported in The Carolinas, and Virginia, with one in North Carolina destroying 17 homes and impacting 59 others. It also caused three deaths and \$1.27 million in damage.^[30] In Greenville County, South Carolina, a few roads were washed out, while portions of U.S. Route 501 were inundated with 1 ft (0.30 m) of water.^[34] Minor flooding also occurred in Mid-Atlantic and New England.^[30] In Atlantic [Canada](#), basement and road flooding was reported, especially in Edmundston, New Brunswick. Slick roads caused one death in that area.^[35]

Hurricane Charley

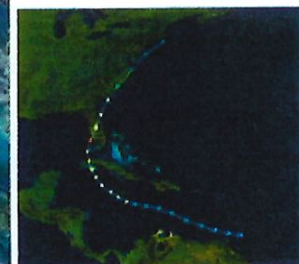
A tropical wave developed into Tropical Depression Three on August 9 to the south-southeast of Barbados. Early on August 10, it was upgraded to Tropical Storm Charley, before reaching hurricane intensity south of Jamaica on August 11. Charley continued to strengthen after curving northwestward and was a 120 mph (195 km/h) Category 3 hurricane when it made landfall near Alquizar, Cuba on August 13. After emerging into the Straits of Florida, Charley weakened to a Category 2 hurricane. However, the storm abruptly strengthened into a Category 4 hurricane later on August 13, with winds peaking at 150 mph (240 km/h). At 19:45 UTC on August 13, Charley made landfall at Cayo Costa, Florida, followed by another landfall in Punta Gorda about an hour later. Charley rapidly weakened over Florida, falling to Category 1 by early on August 14. Later that day, the storm emerged into the Atlantic, before making two more landfalls in Cape Romain and Myrtle Beach, South Carolina as a minimal hurricane. Late on August 14, Charley weakened to a tropical storm over southeastern North Carolina, shortly before becoming extratropical near Virginia Beach, Virginia.^[36]

Tropical storm (SSHWS)



Duration	August 3 – August 13
Peak	65 mph (100 km/h) (1-min)
intensity	1001 mbar (hPa)

Category 4 hurricane (SSHWS)



Duration	August 9 – August 14
Peak	150 mph (240 km/h) (1-min)
intensity	941 mbar (hPa)

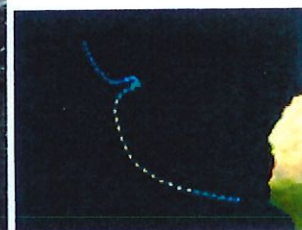
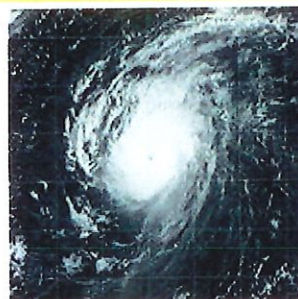
The storm brought rainfall and strong winds to the island of Jamaica. In Westmoreland Parish, flooding inundated several homes and damaged roadways. Winds in the parish caused a large tree to fall on a house, resulting in significant damage to the home.^[37] In Kingston, high winds damaged power lines and homes. Widespread power outages occurred due to numerous downed trees and power lines.^[38] The storm left \$4.1 million in damage and one fatality in Jamaica.^[39] Winds up to 118 mph (190 km/h) in Cuba left all of Pinar del Río Province and more than 50% of La Habana Province without electricity for several days.^{[39][40]} At least 70,290 homes and about 3,000 agricultural buildings were either damaged or destroyed. Roughly 95% of sugar cane, bean, and banana crops were ruined. There were four deaths and \$923 million in damage.^[40] Impact in Florida was extreme: strong winds caused 2 million power outages and destroyed more than 2,439 structures and impacted over 26,749 others. Charley caused 24 deaths and 792 injuries. Agricultural losses were heavy, especially to oranges. Damage to agriculture totaled about \$2.2 billion. In South Carolina, 2,231 houses were damaged, with 2,317 of those severely damaged and 40 were destroyed.^[30] Approximately 141,00 people were left without electricity.^[41] Winds up to 85 mph (137 km/h) in North Carolina downed trees and power lines, and left 65,000 homes without power. Charley destroyed 40 houses and damaged 2,231 other homes in the state.^[30] Throughout the United States, the storm caused \$15.1 billion in damage,^[20] with nearly all of it in Florida.^[30] The remnants of Charley produced light rainfall in Nova Scotia and Newfoundland.^[42]

Hurricane Danielle

A tropical wave developed into Tropical Depression Four while south-southeast of Cape Verde on August 31.^[43] Although sea surface temperatures were only marginally warm,^[44] the depression strengthened into Tropical Storm Danielle early on August 14. Further intensification occurred and by early on August 15, Danielle reached hurricane status. The storm deepened significantly over the next 24 hours and became a Category 2 hurricane. Later on August 16, Danielle peaked as strong Category 2 hurricane with winds of 110 mph (175 km/h) and a minimum barometric pressure of 964 mbar (28.5 inHg).^[43]

At the time of peak intensity on August 16, Danielle was heading northward to north-northwestward because of a subtropical ridge. Shortly thereafter, southwesterly vertical shear began increasing, causing the hurricane to weaken. Mid-level flow associated with a diffluent trough caused Danielle to move northeastward on August 18. Later that day Danielle deteriorated to a Category 1 hurricane, hours before being downgraded to a tropical storm. On August 19, Danielle became nearly stationary and moved erratically while southwest of the Azores. Eventually, the storm curved west-southwestward and weakened to a tropical depression on August 20. About 24 hours later, Danielle degenerated into a remnant low pressure area. The remnant low moved westward and then to the north-northwest, before dissipating about 795 mi (1,280 km) west-southwest of the westernmost islands of the Azores.^[43]

Category 2 hurricane (SSHWS)



Duration	August 13 – August 21
Peak intensity	110 mph (175 km/h) (1-min) 964 mbar (hPa)

Tropical Storm Earl

Tropical storm (SSHWS)

By August 13, a tropical wave developed into Tropical Depression Five while located about 1,150 mi (1,850 km) east of the Lesser Antilles. The depression headed westward between 21 and 29 mph (34 and 47 km/h) due to a strong subtropical ridge located to its north. After developing banding features and an increase in Dvorak intensity estimates, the depression was upgraded to Tropical Storm Earl at 18:00 UTC on August 14. The storm strengthened slightly further and on the following day, it reached maximum sustained winds of 50 mph (85 km/h). Later on August 15, Earl crossed the Windward Islands and passed just south of Grenada.^[45]



Duration	August 13 – August 15
Peak intensity	50 mph (85 km/h) (1-min) 1009 mbar (hPa)

Although Earl appeared well-organized, it unexpectedly degenerated into a tropical wave on August 16, after a reconnaissance aircraft reported no closed circulation. The remnants eventually reached the Pacific Ocean and developed into Hurricane Frank on August 23.^[45] Tropical storm force winds and heavy rainfall in Grenada damaged at least 34 homes^[46] and a nursing home^[47] and toppled several trees and electrical poles.^[46] Damage on other islands was confined to a few impacted [homes](#), moderate crop losses, and widespread power outages, especially in Saint Vincent and the Grenadines and Tobago.^[48] One fatality occurred and 19 people were listed as missing.^[16]

Hurricane Frances

Around 00:00 UTC on August 24, a tropical wave developed into Tropical Depression Six, while located about 755 mi (1,215 km) west-southwest of the southernmost islands of Cape Verde. Moving west-northwestward, the depression strengthened into Tropical Storm Frances later that day. Frances reached hurricane status late on August 25 while curving northwestward. By August 28, the storm reached a primary peak intensity as a Category 4 hurricane with winds of 130 mph (215 km/h). Late the following day, Frances weakened to a Category 3 hurricane during an eyewall replacement cycle. However, by August 31, the storm re-intensified into a Category 4 hurricane and attained its maximum sustained wind speed of 145 mph (230 km/h). While approaching the Bahamas, wind shear and increasing westerly winds aloft caused Frances to weaken to a Category 3 hurricane late on September 2.^[49]

Category 4 hurricane (SSHWS)



Duration	August 24 – September 8
Peak intensity	145 mph (230 km/h) (1-min) 935 mbar (hPa)

At 19:30 UTC on September 2, the system made landfall on San Salvador Island with winds of 125 mph (205 km/h). Early the next day, Frances struck Cat Island while somewhat weaker. The system decelerated and weakened slightly to a Category 2 hurricane before landfall in Eleuthera hours later. By September 4, Frances made another landfall on Grand Bahama with winds of 105 mph (165 km/h). Moving slowly west-northwestward, the hurricane made landfall in Hutchinson Island, Florida at the same intensity, early on September 5. Rapidly weakening, Frances fell to Category 1 intensity around midday and deteriorated to a tropical storm about six hours later. On September 6, the storm emerged into the Gulf of Mexico near New Port Richey, before another landfall at the mouth of the Aucilla River with winds of 60 mph (95 km/h). Early on

September 7, Frances weakened to a tropical depression over Georgia. By late the next day, the system became extratropical, though the remnants persisted until dissipation over the Gulf of Saint Lawrence on September 11.^[49]

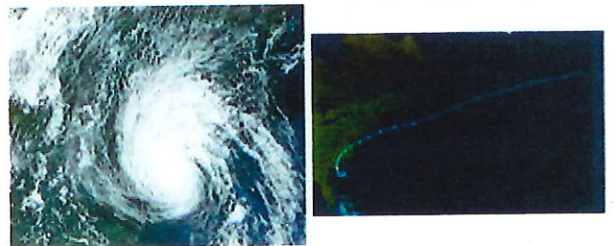
in the Bahamas, about 75% of residents lost electricity. Between 13 and 17 percent of the non-native Australian pine on San Salvador Island experienced damage, primarily from snapping, though some browning from salt spray was noted.^[50] Several feet of water flooded the international airport at Freeport.^[51] Insured losses reached about \$300 million.^[52] Severe damage was also dealt to banana, corn, and pineapple crops. About 4,160 homes received minor damage, while 2,522 houses were rendered uninhabitable or destroyed.^[53] About 700 people were left homeless. Additionally, sea walls, schools, bridges, roads, and docks suffered damage.^[54] Strong winds brought severe damage to Florida, especially counties along the east coast. Hundreds of homes, mobile homes, and businesses were destroyed in Indian River, Martin, and St. Lucie counties, and damage was inflicted on thousands of other structures there. In the tri-county area alone, damage totaled approximately \$4.5 billion.^[55] Palm Beach County also suffered particularly severely, with 15,000 houses and 2,400 businesses damaged there.^[56] About 4.27 million customers were left without electricity in Florida.^[57] Frances and its remnants brought extensive flooding to other states, especially in Georgia, North Carolina, Ohio, and Pennsylvania.^[55] The storm spawned 101 tornadoes in the United States, with 45 in South Carolina alone.^[49] Damage in the United States totaled approximately \$9.5 billion, placing Frances among the costliest hurricanes in the country.^[20] Overall, the storm caused 49 deaths, two each in the Bahamas and Ohio, eight in Georgia, and thirty-seven in Florida.^[49]

Hurricane Gaston

A frontal low pressure area developed into Tropical Depression Seven at 12:00 UTC on August 27, while located about 130 mi (210 km) east-southeast of Charleston, South Carolina. The depression gradually strengthened and was upgraded to Tropical Storm Gaston early on August 28. Initially, Gaston tracked slowly, moving southeastward and then westward, before a developing mid- to upper-level ridge re-curved the storm northwestward. Gaston strengthened and became a hurricane at 12:00 UTC on August 29. Two hours later, the storm made landfall near Awendaw, South Carolina with winds of 75 mph (120 km/h). Gaston weakened rapidly inland and was only a tropical depression by early on August 30. Gaston re-strengthened into a tropical storm while located over eastern Virginia on August 31, just hours before emerging into the Atlantic. Gaston re-intensified slightly further, but became extratropical near Sable Island on September 1.^[58]

In South Carolina, an unofficial measurement indicated wind gusts up to 82 mph (132 km/h) in South Capers Island, which is near Parris Island.^[58] Strong winds destroyed eight homes, damaged more than 3,000 buildings, and left more than 150,000 people without power.^[55] Additionally, flash flooding further inland severely damaged or destroyed at least 20 homes in Berkeley County.^[58] In North Carolina, widespread street flooding occurred, including inundation of portions of Interstates 40 and 95. Several trees were downed by strong winds, especially in Chatham and Johnston counties. A tornado in Hoke County damaged several homes.^[30] Severe flooding occurred in east-central Virginia due to rainfall amounts up to 12.6 in (320 mm).^[59] In Chesterfield, Dinwiddie, Hanover, Henrico, and Prince George counties, 350 homes and 230 businesses

Category 1 hurricane (SSHWS)



Duration	August 27 – September 1
Peak	75 mph (120 km/h) (1-min)
intensity	985 mbar (hPa)

