Keystone Riverine Flooding Events in South Carolina

Prepared by

South Carolina State Climatology Office

Land, Water, and Conservation Division

South Carolina Department of Natural Resources

Flooding in Loris, SC from Florence in 2018 (Hope Mizzell/SCDNR))

A BRIEF HISTORY OF

RIVERINE FLOODS

THIS TIMELINE SHOWS SOME OF THE MOST SIGNIFICANT RIVERINE FLOODING OBSERVED IN SOUTH CAROLINA SINCE 1900, AND IS NOT A COMPLETE LIST OF EVENTS.

1903

The Great Pacolet Flood in June caused the most significant loss of life on record from river flooding in South Carolina.

1908

Heavy rains in August caused record crests and extensive flooding along the Wateree and Congaree Rivers.

1916

Wettest July on record for the state since 1895 due to two landfalling tropical cyclones.

1928

Multiple tropical systems tracked through the state in August and September caused flooding statewide.

1929

The Bahamas Hurricane in October caused flooding in the Santee and Savannah River basins.

1940

The Hurricane of 1940 made landfall near Hilton Head in August, and produced significant rainfall across the Lowcountry and Upstate

1945

The Homestead Hurricane made a second landfall along the South Carolina coast in September, causing flooding across the state.

1990

Remnants of Tropical Storm Klaus and Marco caused flooding in the South Carolina Midlands in October.

1995

Tropical Storm Jerry in August dumped up to 16" in portions of the South Carolina Upstate.

1999

Hurricane Floyd produces the highest 24-hour rainfall total for the state (14.80") and causes flooding in the Lower Pee Dee basin.

2015

Widespread and extensive flooding occurs after multiple days of rain in October.

2016

In October, Hurricane Matthew caused significant flooding in the Pee Dee Region.

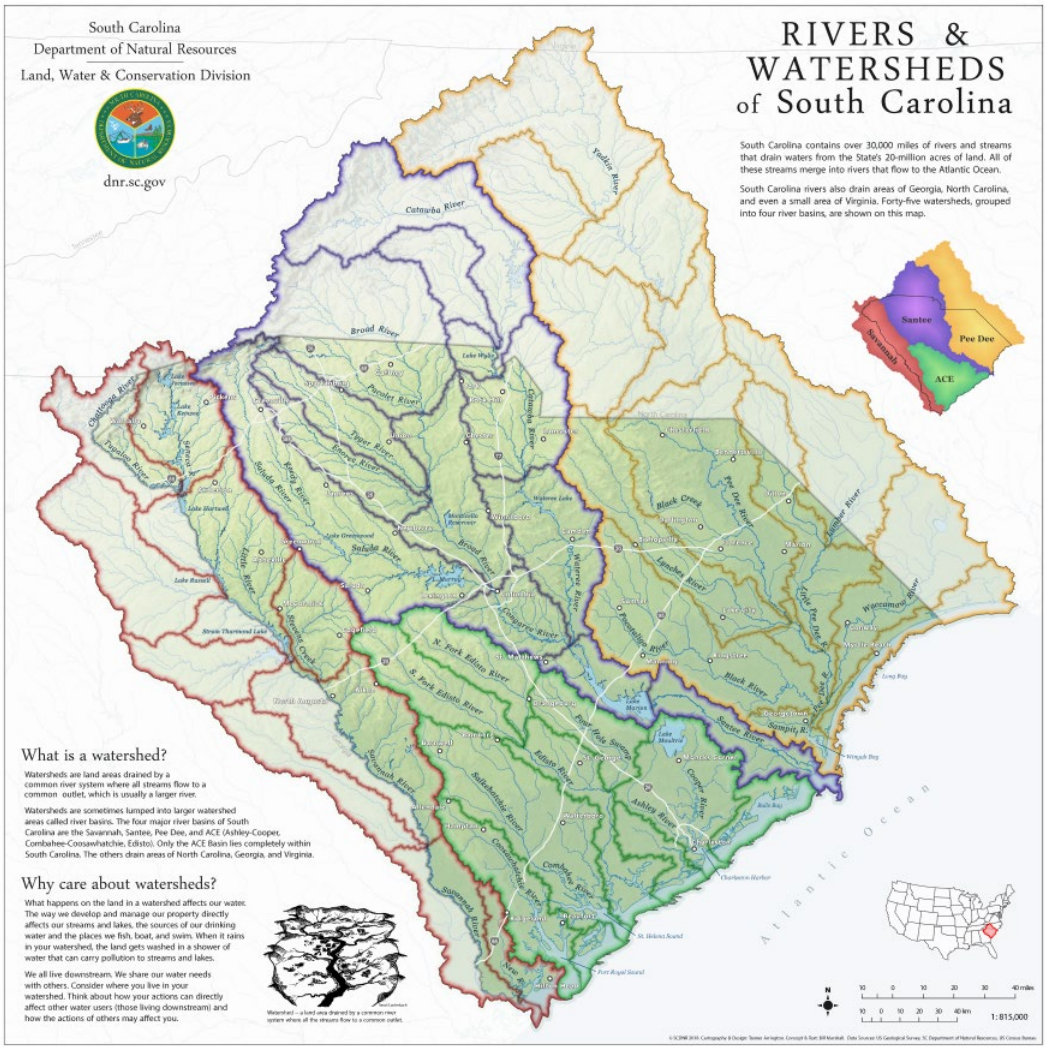
2018

Tropical Storm Florence dropped two to three feet of rain across portions of the Pee Dee Region over four days in September.

GENERAL INFORMATION

The general definition of a flood is the temporary condition of a partial or complete inundation of typically dry land. There are three common types of flooding; fluvial, pluvial, and coastal.

1. Fluvial flooding, also known as riverine flooding, is the flooding of typically dry areas caused by an increase in the water level of an established lake, river, or stream when the water overflows its banks. The damage from fluvial flooding can be widespread, extending miles away from the original body of water. This type of flooding is caused by excessive freshwater from a severe or prolonged rain event.
2. Pluvial flooding occurs when an extreme rainfall event causes an independent flood of an overflowing water body and is often described as flash flooding or surface water flooding. Pluvial flooding can happen in urban or rural locations when drainage systems are overwhelmed, and water flows into nearby roadways and structures.
3. Coastal flooding is the inundation of land by ocean/saltwater and is commonly caused by high tides, storm surges, and tsunamis.

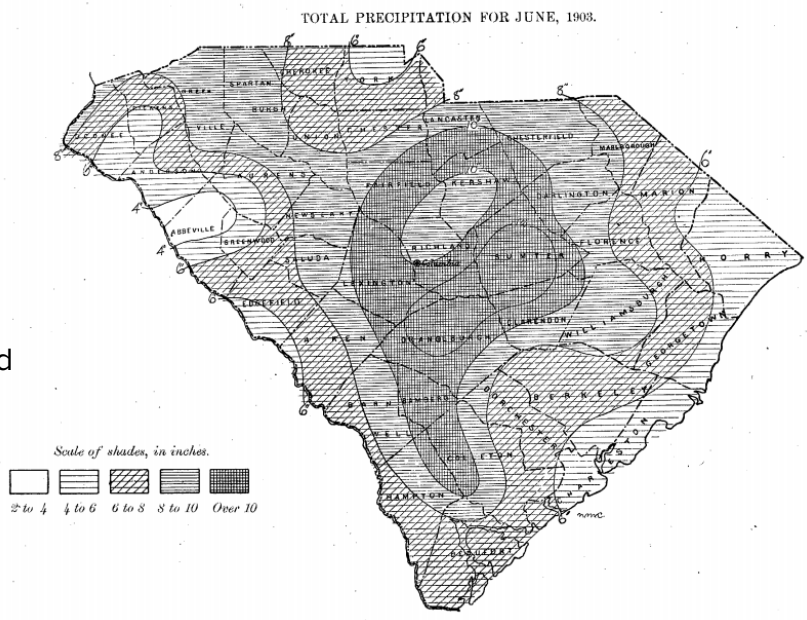


Flooding is very complex, and multiple types of flooding can occur within one single flood event, sometimes referred to as compound flooding. Numerous factors other than rain determine the occurrence of flooding, including the location of the rainfall within the river basin, the areal extent of rain, duration and rate of rainfall, and land use.

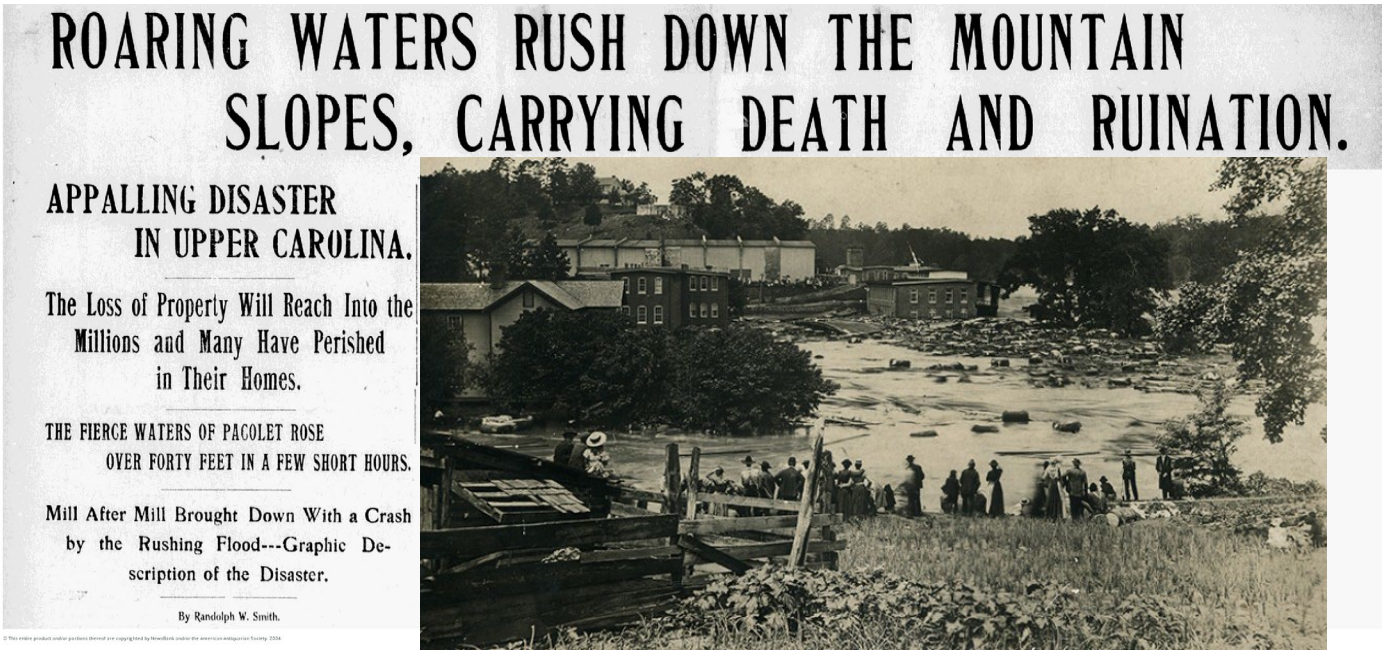
For the purposes of this document, ten of the multiple fluvial flood events recorded in the state will be discussed.

THE GREAT PACOLET FLOOD
JUNE 1903

The most significant loss of life from river flooding this century in South Carolina occurred along the Pacolet River near Pacolet during the early morning of June 6, 1903. In the days before the event, the region experienced multiple days of rain, with precipitation totals in the Upstate ranging from two and five inches. On June 5, strong convergence plus the upslope flow of warm moist air associated with low pressure, which tracked across northwestern South Carolina, produced the heavy rain that caused the flooding. The official station in Spartanburg, the nearest National Weather Service station to the impacted area, measured a 24-hour total ending the morning of June 6 of five inches.



The raging flood waters drowned sixty-five people. According to the National Weather Service Monthly Weather Review, the water rose so rapidly that the land near the river was covered by 40 feet of water within one hour. There was a complete loss of houses, churches, industrial plants, and corn and flour mills along the river, and the floodwaters disrupted railway traffic and services. The flood hit the textile communities of Clifton and Pacolet the hardest, but flood damage also occurred along other streams in northwest South Carolina. The damage devastated the economy by $5 million (1903 dollars).



ROARING WATERS RUSH DOWN THE MOUNTAIN SLOPES, CARRYING DEATH AND RUINATION.

APPALLING DISASTER IN UPPER CAROLINA.

The Loss of Property Will Reach Into the Millions and Many Have Perished in Their Homes.

THE FIERCE WATERS OF PACOLET ROSE OVER FORTY FEET IN A FEW SHORT HOURS.

Mill After Mill Brought Down With a Crash by the Rushing Flood---Graphic Description of the Disaster.

By Randolph W. Smith.

THE CONGAREE FLOOD
AUGUST 1908

A low-pressure center formed in the Gulf of Mexico and moved northeastward across South Carolina, causing unprecedented statewide flooding. Excessive amounts of rain fell in all the northern and western counties, where some locations recorded two to four times the normal amounts, most of which fell from the 23rd to the 26th causing floods in all the streams and rivers of the upper and central portions of the state.

Reports indicate that 14.31 inches fell in 34 hours in Anderson, 9.05 inches fell in 23 hours in Camden, 16.94 inches fell in Greenville in 78 hours, and 7.10 inches fell in 48 hours at Winthrop College.

Rainfall Totals (Aug 23 – 26)	Station	County
16.94”	Greenville Downtown AP	Greenville
13.26”	Anderson	Anderson
12.02”	Liberty	Pickens
11.15”	Camden 3 W	Kershaw
11.32”	Santuck	Union
10.12”	Catawba	York
8.93”	Winnsboro	Fairfield
4.88”	Batesburg	Lexington
4.23”	Cheraw	Chesterfield
3.97”	Columbia	Richland

The flood of August 26-30, 1908, was the most extensive flood of record (at the time); as all major rivers in the state rose from 9 to 22 feet above flood stage. The narrative from the Weather Bureau report for August 1908 stated, “The flood waters rose to greater heights and the floods were more destructive and the money value of the damage was greater than ever before known, authentic records being available for comparison since 1840.”

Weather Bureau observers remarked on the floods in comparison to events that occurred in the mid-to-late 1800s.

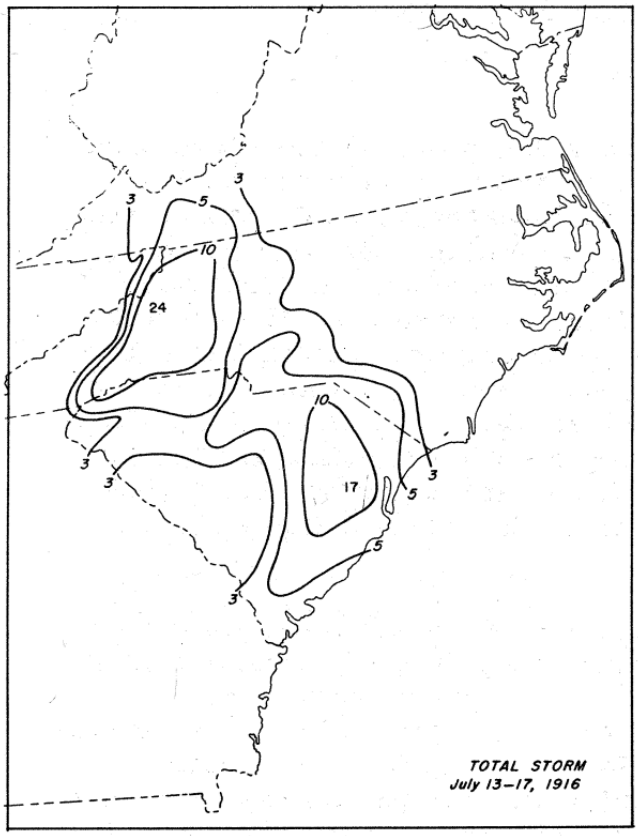
“The Savannah river near this place attained a height of from 8 feet to 10 feet higher than in 1888. The flood on the 26th was caused by “up-country” rains. The local streams were affected very little from the rainfall in Edgefield county.” – Wm. S. Middleton (Clarks Hill)

“Bush river was not as high as it was in September 1888, and Little river, above the point, where it was affected by backwater from the Saluda river, lacked 6 feet of being as high as 1888, but near the Saluda river it was 7 feet higher than 1852.” – W. G. Peterson (Newberry)

WETTEST MONTH ON RECORD
JULY 19 16

Heavy rains over the headwaters of the Santee Watershed on July 9 -10 produced some flooding along the Saluda, Catawba, Wateree, and upper Santee rivers. River heights were still high during the middle of the month when a hurricane (The Charleston Hurricane) made landfall near Awendaw, SC, as a Category 2, with winds recorded at over 80 mph on July 14, 1916.

Rainfall Totals (Jul 13 -17)	Station	County
12.69”	Summerville 4 W	Dorchester
12.63”	Beaufort WWTP	Beaufort
12.11”	Anderson	Anderson
11.75”	Caesars Head	Greenville
11.22”	Greenwood	Greenwood
11.09”	Landrum 1 NE	Spartanburg
9.03”	Saluda	Saluda



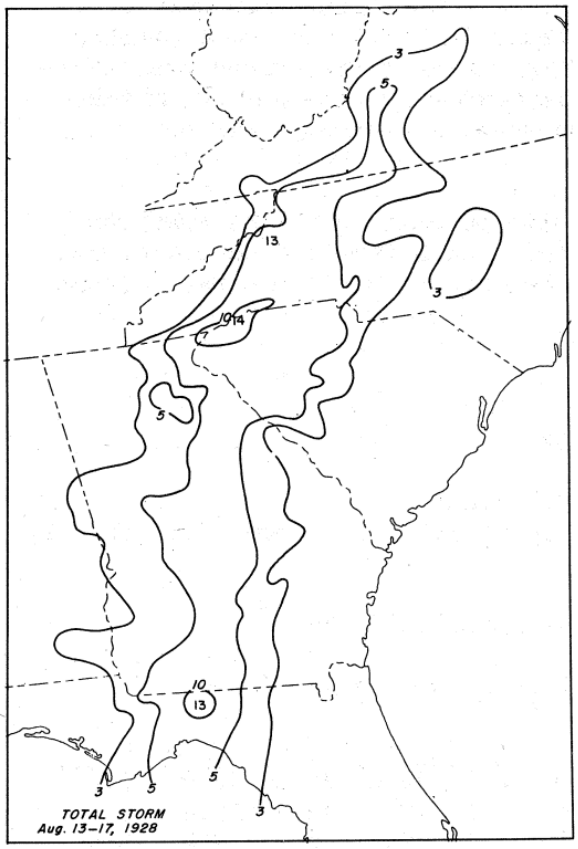
It slowly moved to the northwest across South Carolina, which resulted in record rainfall and widespread flooding. In Effingham, SC (Florence County), a reporting station recorded 13.25 inches of rain in only 24 hours. The storm caused about $10 million ($245 million in 2021) in damages, destroyed over 700,000 acres of crops and produced the most extensive flooding of the Santee River System since records began in 1840. The river stage was 12 feet above the Catawba River record for the 1908 Flood and 3 feet above the Wateree River record. Damage was also severe in the Lynches and Black river basins. The torrential rain inland led to the Great Flood of 1916, which impacted portions of western North Carolina.

The station located in Kingstree recorded a rainfall total of 31.13 inches for July 1916, the highest monthly total on record for the state.

July 1916 is the wettest month on record for South Carolina since 1895, with a statewide rainfall total of 14.41 inches, 8.93 inches above the long-term average for July. On average, the state receives 47.61 inches of precipitation each year. The wettest year on record (since 1895) is 1964, with a statewide average rainfall total of 69.32 inches.

Month/Year	Statewide Rainfall Total
July 1916	14.41”
September 1924	13.16”
September 1928	12.70”
October 2015	12.17”
September 1945	12.06”

HURRICANE SEASON
AUGUST – SEPTEMBER 1928

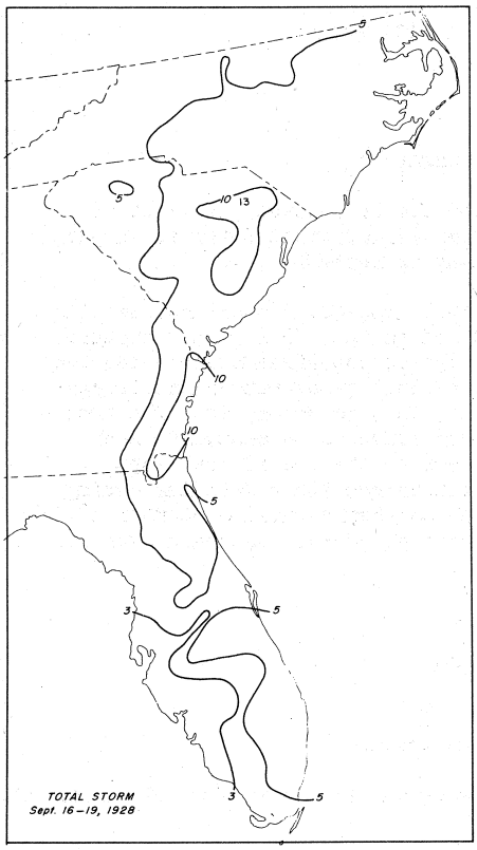


Referred to as the “stormiest weather in August and September since 1916,” most of the stations across the state reported annual precipitation totals well above normal; despite below-normal rainfall from October – December. Damage estimates from the excessive rains, flooding, and winds reached $3.4 Million (1928), with nearly one million of that occurring outside the ‘flood districts.”

Rainfall Totals (Aug 13 – 17)	Station	County
13.47”	Caesars Head	Greenville
8.53”	Walhalla	Oconee
8.40”	Greenwood	Greenwood
8.19”	Crescent 1 S	Spartanburg
7.95”	Laurens	Laurens
7.48”	Chester 1 SE	Chester
7.34”	Pelzer	Anderson

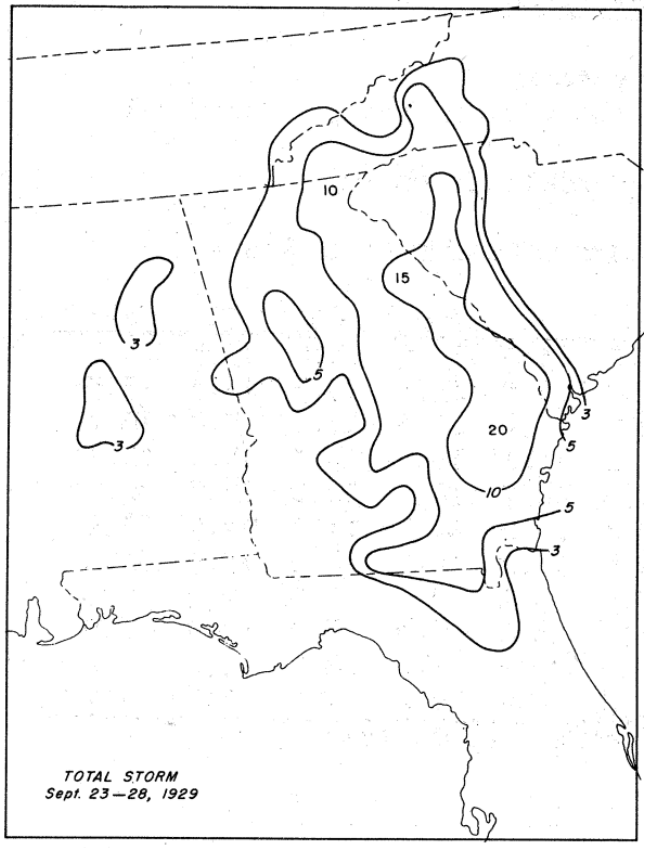
Heavy to excessive rains at the beginning of September, were followed by high water in all river systems across the state, and the situation was aggravated by rainfall from the landfall of the Lake Okeechobee Hurricane near Edisto Island in mid-September. The Black River at Kingstree crested at 18.0 feet, The flood losses in the Santee were estimated to be $1.6 million (1928), and Flooding in the lower portions of the Black and Pee Dee lingered into the beginning of October. In some locations, it was, “in fact the worse conditions since July 1916.” Damage estimates in September reached $3.3 million.

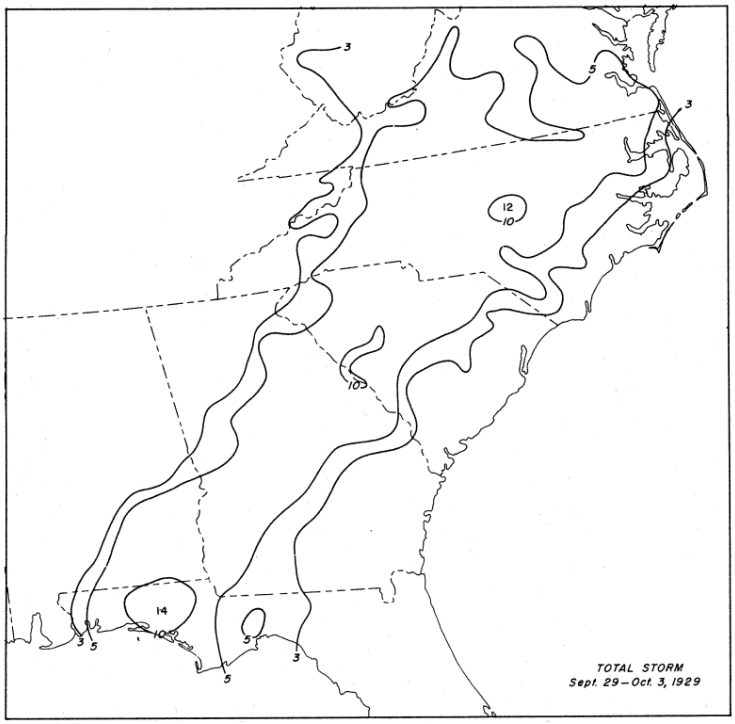
Rainfall Totals (Sep 16 – 19)	Station	County
12.50”	Darlington	Darlington
12.23”	Eutawville	Orangeburg
12.17”	Florence #1	Florence
11.70”	Pee Dee	Marion
11.55”	Camden 3 W	Kershaw
11.10”	Kingstree	Williamsburg
10.39”	Summerville 4 W	Dorchester



THE BAHAMAS HURRICANE
SEPTEMBER – OCTOBER 1929

Extremely heavy pre-hurricane rainfall had fallen over the region, especially in and along the Savannah River basin and portions of the Upper Santee from September 23 – 28.





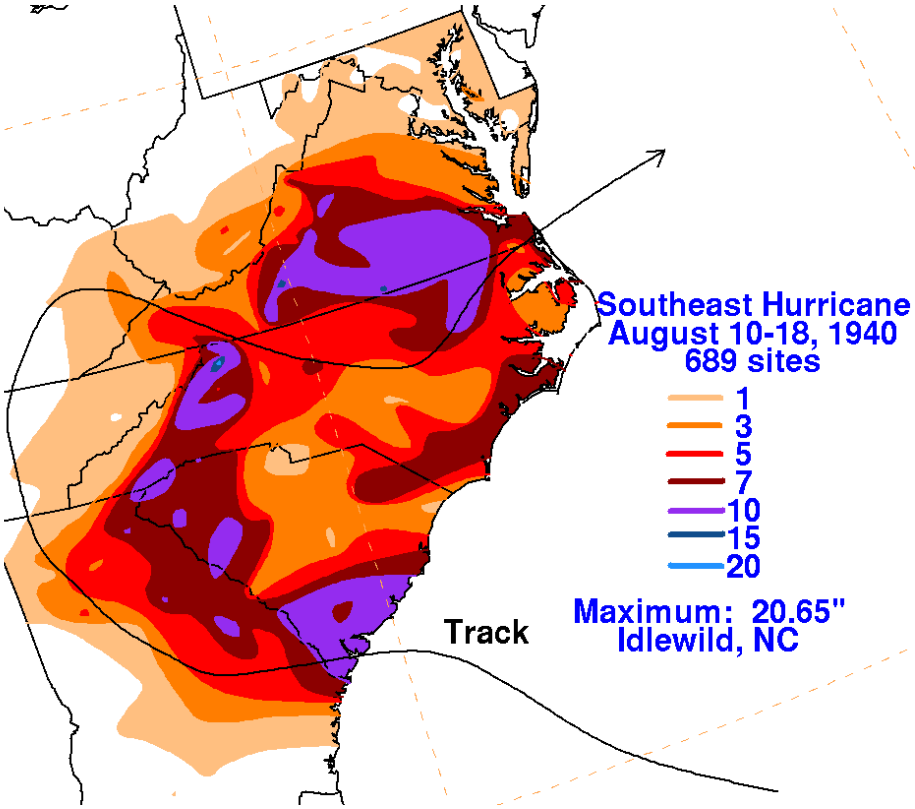
The remnants of the Bahamas Hurricane moved from the Gulf, northeastward over the Southeast, bringing excessive rains across areas impacted by heavy rains at the end of September. Damaging floods were reported on most streams and rivers, where “previous high-water marks were overtopped twice in one week,” and “the Savannah River at Augusta set a record crest of 45.1 feet,” 13 feet above flood stage.

Rainfall Totals (Sep 28 – Oct 3)	Station	County
10.98”	Saluda	Saluda
10.56”	Edgefield 3 NNE	Edgefield
10.25”	Newberry	Newberry
10.17”	Greenwood	Greenwood
9.70”	Camden 3 W	Kershaw
8.74”	Aiken 5 SE	Aiken
8.67”	Fort Mill 4 NW	York

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC DRAINAGE—continued					
Santee:	*Feet*			*Feet*	
Rimini, S. C.	1	2 (1)	(2)	31.8	6
Ferguson, S. C.	12	1	(2)	21.0	7
Jamestown, S. C.	12	7		29.1	11–12
Catawba:					
Mount Holly, N. C.	15	2	3	19.0	3
Catawba, S. C.	12	2	4	28.7	3
Wateree:					
Camden, S. C.	24	2	5	36.0	3
Malta, S. C.	14	4	7	18.0	6
Congaree: Columbia, S. C.	15	2	6	33.1	3
Broad: Blairs, S. C.	15	1	5	39.5	3
Saluda:					
Pelzer, S. C.	7	1	4	11.6	2
		22	23	8.6	22
Chappells, S. C.	14	(1)	6	30.7	2
		23	24	17.9	24
Savannah:					
Calhoun Falls, S. C.	6	1	3	10.1	2
Augusta, Ga.	32	1	4	45.1	2–3
Peedee:					
Cheraw, S. C.	27	2	6	39.8	4
Mars Bluff, S. C.	17	3	14	27.3	7
Poston, S. C.	18	6	17	26.5	10
Lynches: Effingham, S. C.	14	6	10	19.4	7

THE SOUTHEAST HURRICANE
AUGUST 1940

This Category 2 hurricane, known as the South Carolina Hurricane, made landfall near Hilton Head with winds of 105 mph and continued to move into central Georgia before curving to the north and heading into eastern Tennessee. Locations in the Lowcountry recorded more than ten inches of rain. High tides caused property damage along the southern coast from Folly Beach to Beaufort, including the U.S. Marine corps base on Parris Island and Port Royal. The extreme high tide at Charleston was determined as 10.71 feet above mean low water. Crop losses, including corn, hay, cotton, and truck, were severe in the coastal sections, and trees and roofs were damaged to some extent 50 miles inland.



WARNED ABOUT RIVER FLOODS

People of State Told to Remove Livestock From Lowlands

Columbia, Aug. 15. (AP)—The Columbia weather bureau warned citizens to remove cattle and other stock from the swamps and lowlands today as South Carolina rivers continued their rise, swelled by continued rain Wednesday and last night in the upper part of the state.

The bureau listed these prospects for the rivers.

The Congaree at Columbia will crest at around 27 feet by Friday morning. This will be eight feet

STREAMS ARE NOW RECEDING

Mountain, Hill-country Deaths Number 19; Big Damage

Asheville, N. C., Aug. 15. (AP)—Muddy flood-waters of mountain streams in five states swirled seaward today, leaving in their wake 19 known dead and property damage of millions of dollars.

Rivers in the mountain areas of the Carolinas, Virginia, Tennessee and Georgia were receding today, but areas in the lower sections were menaced by rising waters and lowlands were evacuated.

The sun shone brightly here this morning and activity consisted

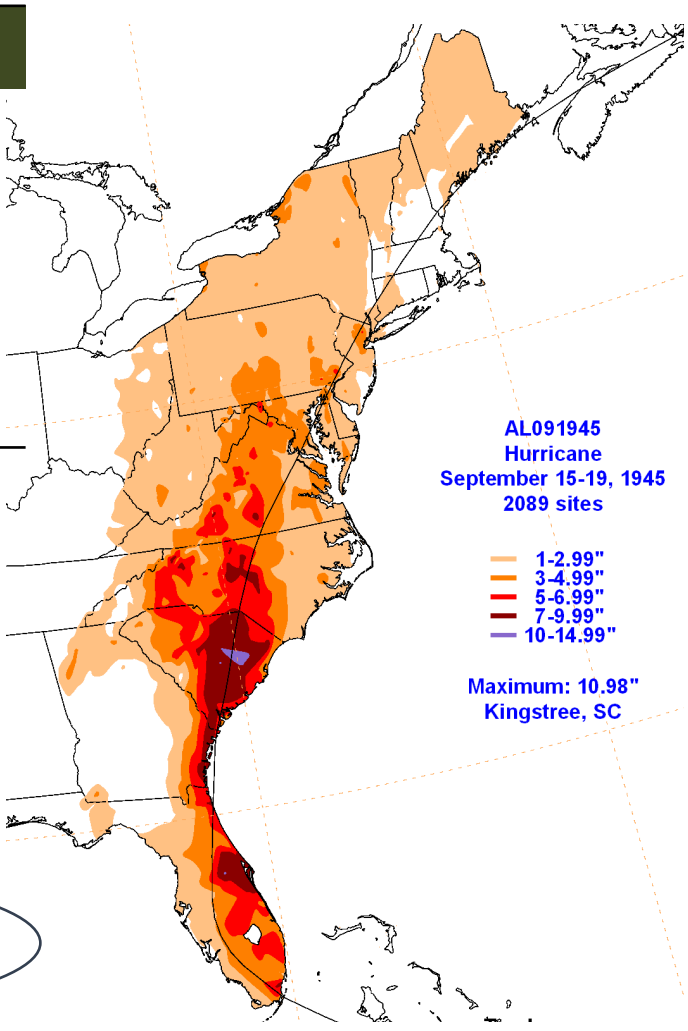
Rainfall Totals (Aug 10 -18)	Station	County
12.69”	Summerville 4 W	Dorchester
12.63”	Beaufort WWTP	Beaufort
12.11”	Anderson	Anderson
11.75”	Caesars Head	Greenville
11.22”	Greenwood	Greenwood
11.09”	Landrum 1 NE	Spartanburg
9.03”	Saluda	Saluda

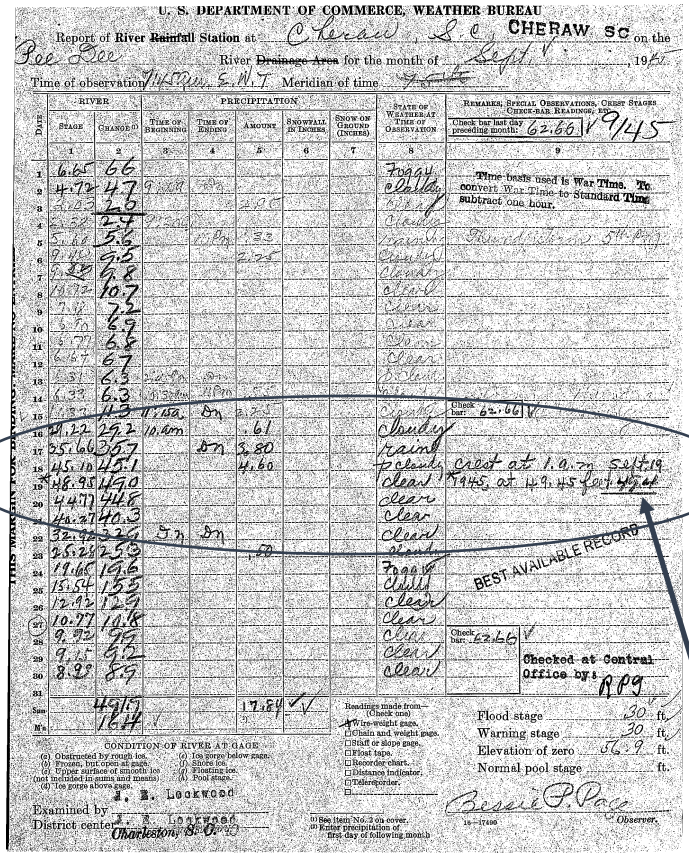
According to the U.S. Weather Bureau’s monthly climatological report for August 1940, “Moderate to high flood crests occurred at Chappells (Saluda River), Blairs (Broad River), Catawba (Catawba River), Columbia (Congaree River), Camden (Wateree River), and Rimini (Santee River) from Aug 14 – 29. Moderate flood crests occurred in the Pee Dee River from Aug 18 – 25.”

THE HOMESTEAD HURRICANE
SEPTEMBER 1945

Noted as one of the “warmest Septembers since 1933 and wettest since 1928,” severe damage resulted to cotton, corn, peanuts, and other unharvested crops in the eastern half of the state during the passage of the “Florida’ hurricane. Now known as the Homestead Hurricane, the storm made a second landfall near the Savannah/Hilton Head areas as a tropical storm before moving northward across the Pee Dee region. Most of the damage, estimated at over $5 million (1945), was attributed to the heavy rains and winds. All rivers in the central and eastern portion of the state, except the Saluda, exceeded flood stage during the second half of September due to additional heavy rainfall that fell across the Pee Dee watershed in North Carolina and drained through the state.

Rainfall Totals (Sep 15 -18)	Station	County
12.63”	Camden 3 W	Kershaw
11.88”	Kingstree	Williamsburg
11.26”	Cheraw	Chesterfield
10.21”	Sumter	Sumter
10.20”	Darlington	Darlington
10.18”	Rimini 2 SSW	Clarendon
10.10”	McColl 3 NNW	Marlboro




U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

Report of River Rainfall Station at Cheraw, S. C. CHERAW SC on the Pee Dee River Drainage Area for the month of Sept., 1945

Time of observation 7:45 a.m. E.W.T. Meridian of time

Time basis used is War Time. To convert War Time to Standard Time subtract one hour.

Check bar last day preceding month: 62.66 9/1/45

Check bar: 62.66

Check bar: 62.66

Checked at Central Office by: RPG

BEST AVAILABLE RECORD

Flood stage 30 ft.
Warning stage 30 ft.
Elevation of zero 56.9 ft.
Normal pool stage ft.

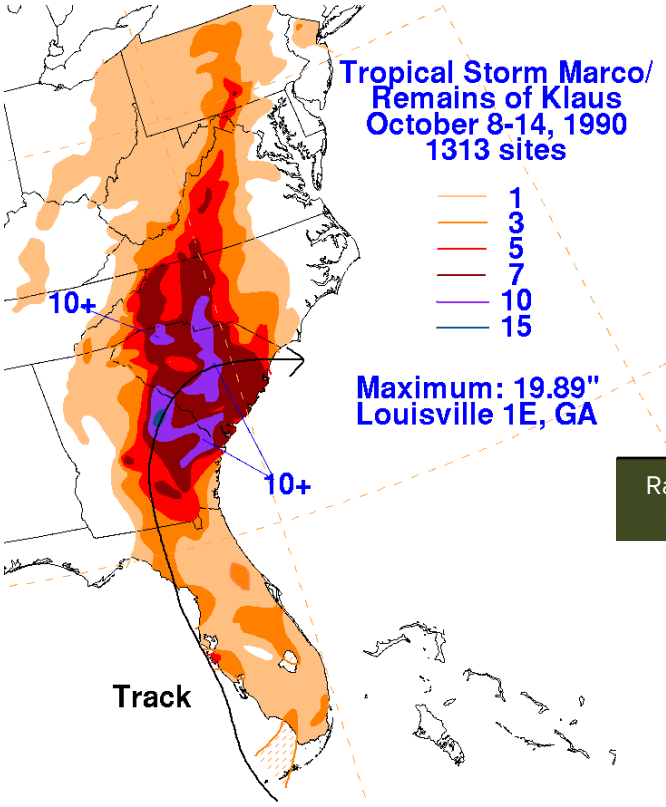
Bessie P. Page Observer.

J. B. Lockwood

Examined by J. B. Lockwood
District center Charleston, S. C.

Pee Dee River rose from a stage of 6.3 feet on Sep 14 to over 40 feet by Sep 18.
“Crest at 1 a.m. Sept 19, 1945, at 49.45 feet” – Bessie P. Page (Cheraw Weather Bureau Observer)

KLAUS AND MARCO
OCTOBER 1990



The remnants of Hurricane Klaus and Tropical Storm Marco moved along a stationary front, producing heavy rain and flooding across the state in October 1990. Rainfall totals were excessive, with most of the state recording between five and fifteen inches of rain, including one unofficial report of nearly 17 inches in the town of Rembert. The highest official 24-hour total amount recorded on October 12 was 10.47 inches at the R.B Simms Filter Plant in Spartanburg.

Rainfall Totals (Oct 8 - 14)	Station	County
13.96”	Pageland	Chesterfield
12.91”	Sullivans Island	Charleston
12.64”	Orangeburg 2	Orangeburg
12.07”	Kershaw 1 SW	Lancaster
11.90”	Rimini 2 SSW	Clarendon
11.86”	Camden 3 W	Kershaw
11.59”	Wedgefield	Sumter

Water over the dam

Staff Photo by Tom Spain

Water pours though the floodgates of the Santee Dam at a rate of almost 300,000 gallons per second Monday as Santee Cooper officials open the gates to eight feet to lessen the pressure on the dam from water flowing into Lake Marion. The water comes from rivers swollen from rain spawned by the remains of Tropical Storm Marco. See story, Page 3-B.

Flooding was widespread in most parts of the state, with the worst occurring in the Midlands and Coastal Plain. Numerous bridges and roads were washed away or closed through parts of the Pee Dee and Santee River basins. There were multiple water rescues and evacuations of low-lying areas near creeks and rivers. Seventeen earthen dams failed, and 81 dams were damaged from overtopping. The rainfall caused more than $12 million (1990)in damages.

The News and Courier, Charleston, S.C., Tuesday, October 16, 1990—3-B

Santee Cooper opens floodgates

Rivers continue to swell as utility tries to control excess water

By DAVID QUICK
Of the Post-Courier staff

Santee Cooper opened its six floodgates at the Santee Dam almost as far as possible Monday to further control massive quantities of water flowing into Lake Marion, a Santee Cooper spokesman said.

The utility first opened the floodgates two feet on Saturday to get rid of excess water coming from the Wateree and Congaree rivers into the lake, Santee Cooper communications specialist Beth Oliver said.

Rivers across the state still continue to swell — and many have yet to crest — as a result of the downpours from last week's remnants of tropical storms Klaus and Marco.

Santee Cooper tries to maintain a level of 75 feet at Lake Marion. Before the past weekend, the last time the utility opened the dam was in October 1989 after heavy rains from Hurricane Hugo.

The dam is located about 10 miles northwest of St. Stephen.

Saturday's dam opening allowed 10,000 cubic feet of water per second, or about 74,800 gallons of water per second, to go from Lake Marion into the Santee River. On Sunday, the utility opened the floodgates even more, by six feet, allowing 30,000 cubic feet of water per second, or 224,000 gallons per second, into the Santee, Ms. Oliver said.

The utility opened the floodgates on Monday to eight feet, almost to its nine-foot maximum opening. The wider opening will increase the amount of water into the Santee to 40,000 cubic feet of water per second, or almost 300,000 gallons of water per second.

"There is still a lot more water coming in than going out," said Ms. Oliver.

But other than to logging and farming equipment, the increased amounts of water in the Santee will not pose a threat because much of the water will be spread out, absorbed or evaporated in the Santee Swamp, she said.

By comparison, about 4,500 cubic feet of water per second, or 33,660 gallons per second, is passing through the utility's hydroelectric plant into the Cooper River.

Ms. Oliver said utility representatives are unsure how long the floodgates will remain open.

Meanwhile, 10 teams of federal disaster experts arrived in South Carolina Monday to assess damage left last week when heavy rains flooded parts of the Upstate and Midlands, the governor's office said.

Gov. Carroll A. Campbell Jr. over the weekend requested assessors with the Federal Emergency Management Agency to determine eligibility for federal disaster assistance in wake of flooding.

Campbell sent out teams from his office Friday when he also announced a plan for up to $5 million in state and federal money to be available for damaged communities.

"Individuals and their local governments in many parts of the state have sustained considerable damage," Campbell said Monday in a news release. "Five of the FEMA teams will focus on individual assistance and smal business aid, while the other five teams will determine the need for help to local governments."

The ten target counties are: Sumter, Kershaw, Lee, Darlington, Cherokee, Aiken, Calhoun, Chesterfield, Union and Spartanburg. Six other counties also could be examined, the release said.

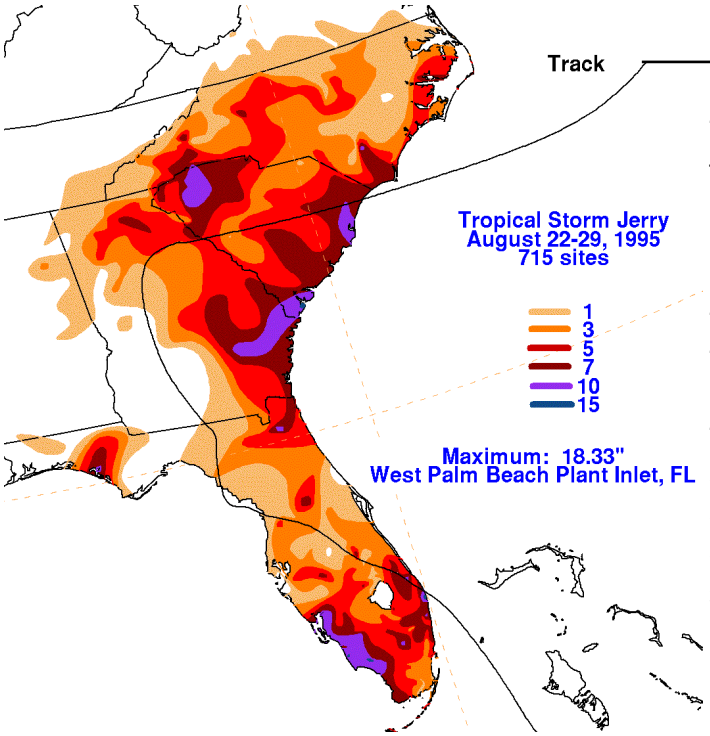
TROPICAL STORM JERRY
AUGUST 1995

After making landfall along the Florida coast, the remnants of Tropical Storm Jerry moved slowly through Georgia and eastward across the state. Heavy rains were reported statewide, with amounts varying from five inches to over a foot in some locations. There was an unofficial report of nearly 20 inches of rain falling near Pelham in Spartanburg County. In parts of the Upstate, most of the rain fell in about eight hours.

A truck sits partially submerged in water behind a house in the Appalachee community near Greer Sunday after heavy rains from Tropical Storm Jerry caused extensive damage in the Piedmont region.

The heavy rain produced flash flooding in flood-prone areas, widespread flooding on many rivers, broken dams, flooded streets, some homes, and low-lying farmland. Flooding in the eastern half of Greenville and the western side of Spartanburg County was the worst in the memory of all but the very oldest residents and compared with flooding associated with several tropical systems which affected the area shortly after the turn of the century.

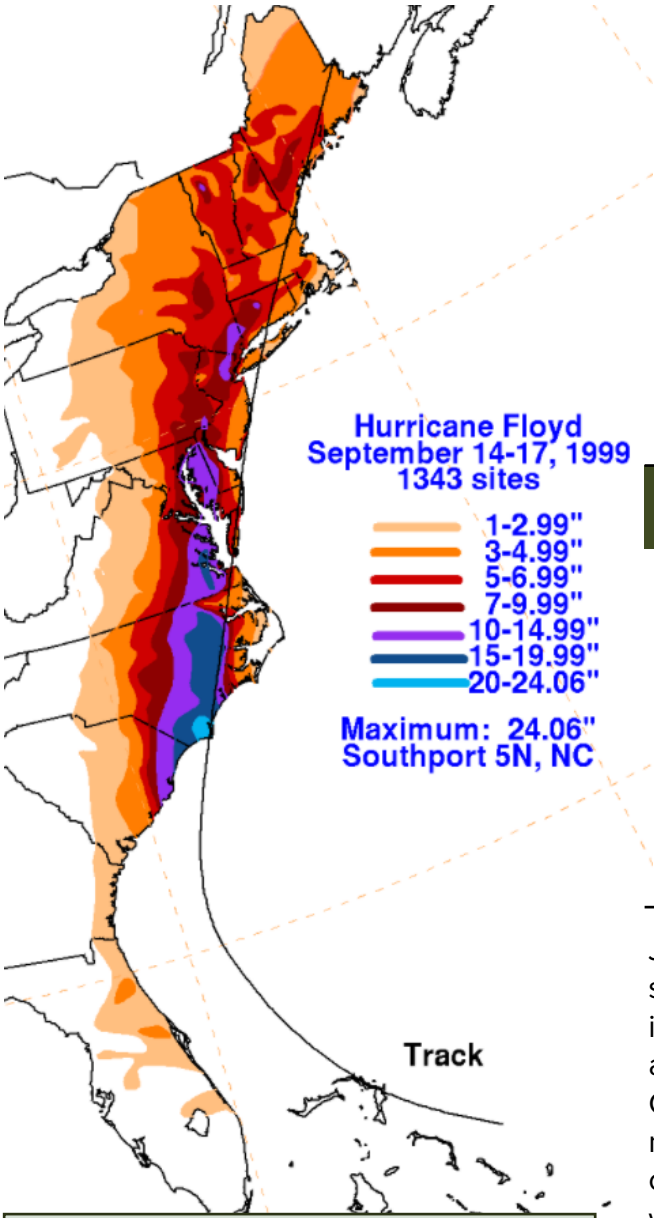
Rainfall Totals (Aug 22 – 29)	Station	County
15.13”	Hilton Head	Beaufort
14.85”	Greenville-Spartanburg Int’l Airport	Greenville
14.57”	West Pelzer	Anderson
14.29”	Georgetown 2 E	Georgetown
11.30”	Branchville 6 SW	Bamberg
9.81”	Orangeburg 2	Orangeburg
9.59”	Charleston Int’l Airport	Charleston



The Reedy River crested in Greenville at more than 16 feet; the second highest stage recorded at that gauge. The Saluda River recorded its seventh highest crest (27.22 ft) behind events in 1908, 1928, 1929, and 1940. The South Carolina Department of Transportation estimated statewide damage to roads and bridges to be $4.5 million (1995). The heavy rains ended near drought conditions in some areas and helped some crops; however, the rains swamped many crops, including soybeans and cotton, which suffered damage. There was coastal flooding at times of high tide along South Carolina beaches.

HURRICANE FLOYD
SEPTEMBER 1999

The center of Hurricane Floyd, a Category 3 storm, moved northeast about 60 miles off the coast of Georgetown County and about 40 miles from North Myrtle Beach in Horry County before making landfall at Cape Fear, NC, as a Category 2 storm. Rainfall was heavy across the Pee Dee, with around a foot of rain falling in Georgetown County and near 18 inches reported in eastern Horry County. Roads were covered in water waist-deep, and many washouts from North Myrtle Beach to Garden City as drainage systems failed to accommodate the rain.




Flooding in Myrtle Beach. (Dave Saville/ FEMA)

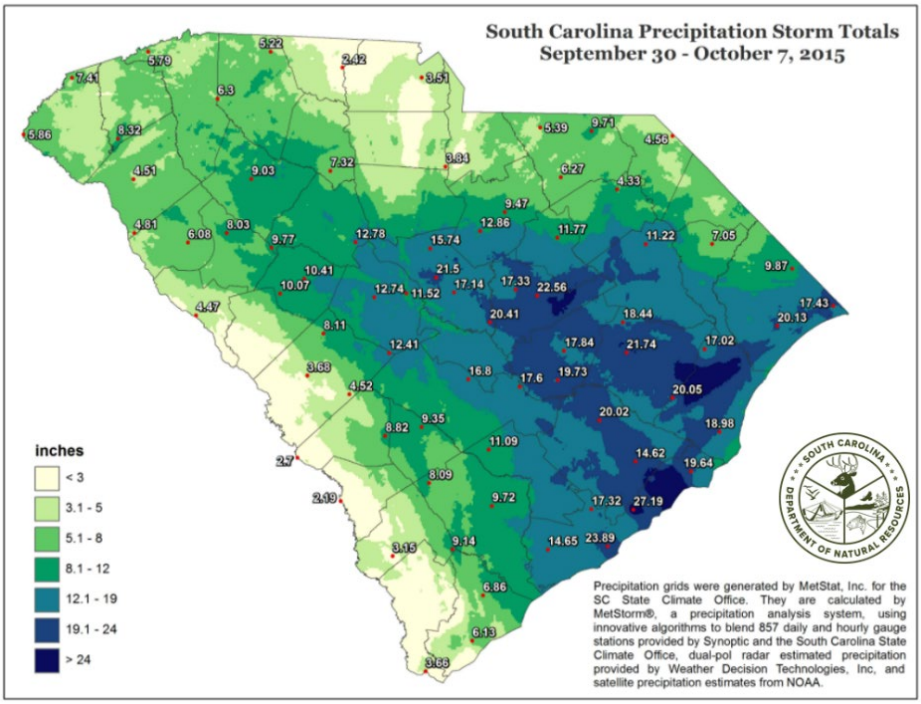
Rainfall Totals (Sep 15 – 17)	Station	County
16.80”	North Myrtle Beach	Horry
14.71”	Brookgreen Gardens	Georgetown
13.84”	Georgetown 2 E	Georgetown
13.05”	Conway	Horry
5.63”	Dillon	Dillon
4.21”	Cades 4 W	Williamsburg
3.81”	Effingham	Florence

Just about two weeks before Floyd affected the state, Hurricane Dennis dropped three to five inches over a portion of the Waccamaw River basin and higher totals across eastern North Carolina. Coastal rivers were still running high when Floyd made landfall. The Waccamaw River at Conway crested at 17.61 ft on September 27, a crest that was the second highest on record (at the time) behind the 17.81 ft. measured in September 1928. Rivers started to drop in early October but rose again when Hurricane Irene dumped three to seven inches of the same area impacted by Dennis and Floyd.

14.80"

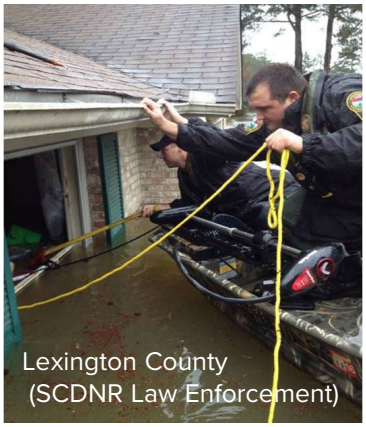
STATE 24- HOUR RAINFALL RECORD SEPTEMBER 16, 1999, AT MYRTLE BEACH, SC

THE OCTOBER FLOOD
OCTOBER 2015



Rainfall Totals (Sep 30 – Oct 7)	Station	County
27.19”	Charleston 6.4 NE	Charleston
23.88”	Georgetown County Airport	Georgetown
23.68”	Kingstree 9.5 NW	Williamsburg
22.59”	Sumter	Sumter
20.97”	Moncks Corner 3.6 E	Berkeley
19.74”	Summerton 8.4 SE	Clarendon
18.17”	Coward 5.1 NNW	Florence


Washed-out road in Clarendon County. (SCDNR Law Enforcement)

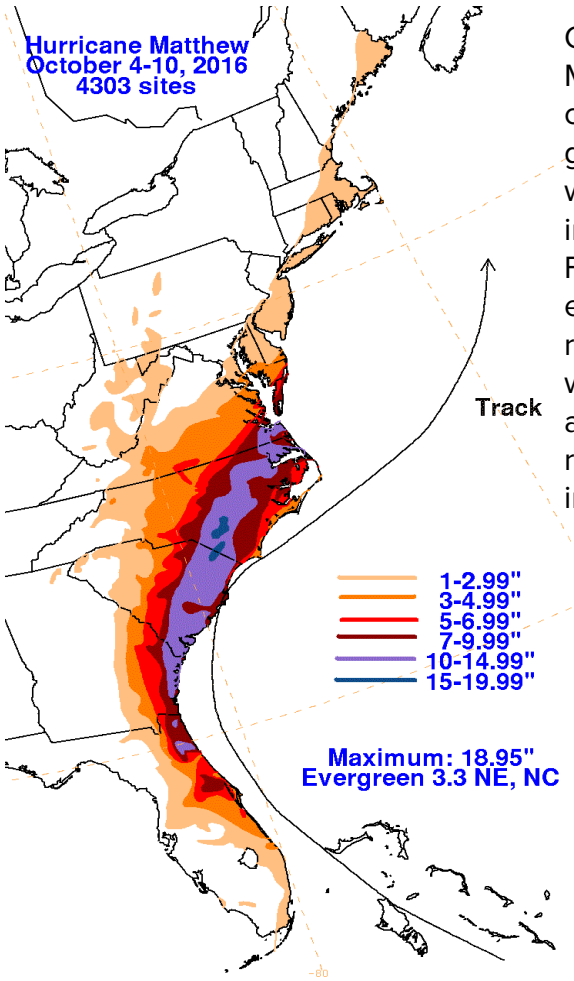

Lexington County (SCDNR Law Enforcement)

More information at http://www.dnr.sc.gov/flood2015

A record-setting and historic rainfall event occurred from October 1 - 5, 2015, producing widespread and significant flooding across much of South Carolina. The heavy rains and subsequent catastrophic flooding occurred a week after heavy rain fell across the state. On October 1, a cold front swept across the state and stalled offshore for the next five days. This boundary tapped into deep tropical moisture over the Gulf of Mexico as it sat offshore the Low Country. At the same time, Hurricane Joaquin rapidly deepened over the Bahamas and interacted with the stalled coastal front, providing additional moisture into the region.

All–time precipitation records were shattered, with rainfall totals ranging from 10 to over 26 inches from the Midlands to the coast. Streams and creeks swelled out of their banks, and 17 U.S. Geological Survey (USGS) gauges reached record peaks, including the Black River at Kingstree, which reported a crest of 22.65 ft., and a streamflow value of 83,700 CFS, surpassing the previous records set in 1973.

HURRICANE MATTHEW
OCTOBER 2016



On October 8, Hurricane Matthew made landfall near McClellanville as a Category 1 hurricane. Matthew caused severe beach erosion, and hurricane-force gusts downed thousands of trees along the coast and well inland. The remnants of Matthew dumped 10-17 inches of rain from Savannah, Georgia, through Florence, South Carolina, and into a wide area of eastern North Carolina. The most widespread heavy rain fell in the Pee Dee Basin and into North Carolina, where significant flooding occurred. Rainfall totals across portions of the Pee Dee surpassed the record rains of the "Bulls Bay Hurricane" in 1916 and "Hazel" in 1954.

Rainfall Totals (Oct 8 - 10)	Station	County
17.11"	Dillon 3.8 NW	Dillon
15.06"	Mullins	Marion
14.10"	Daufuskie Island 1.7 SW	Beaufort
13.56"	Kingstree 7.9 NW	Williamsburg
13.05"	Reevesville 1.0 SSE	Dorchester
12.39"	NWS Charleston	Charleston
11.32"	Yemassee 1 N	Hampton

On October 9, the Lumber, Little Pee Dee, and Waccamaw rivers had swelled to a "Major Flood Stage" and were rising. On October 12, the Little Pee Dee River at Galivant's Ferry rose to 17.10 feet. The town of Nichols was submerged under the adjacent Lumber River floodwaters. Non-elevated property along the Waccamaw River near and below Conway had to be abandoned. The Waccamaw River near Conway reached a record stage of 17.89 feet on October 18, surpassing the flood of September 1928. Many riverside docks and decks, private or state-owned, had been swept away. On November 2, and after 25 days at or above flood stage (11 feet), the Waccamaw River near Conway subsided to below flood stage.

Flooding in Marion County, SC. (Maria Cox Lamm/SCDNR)

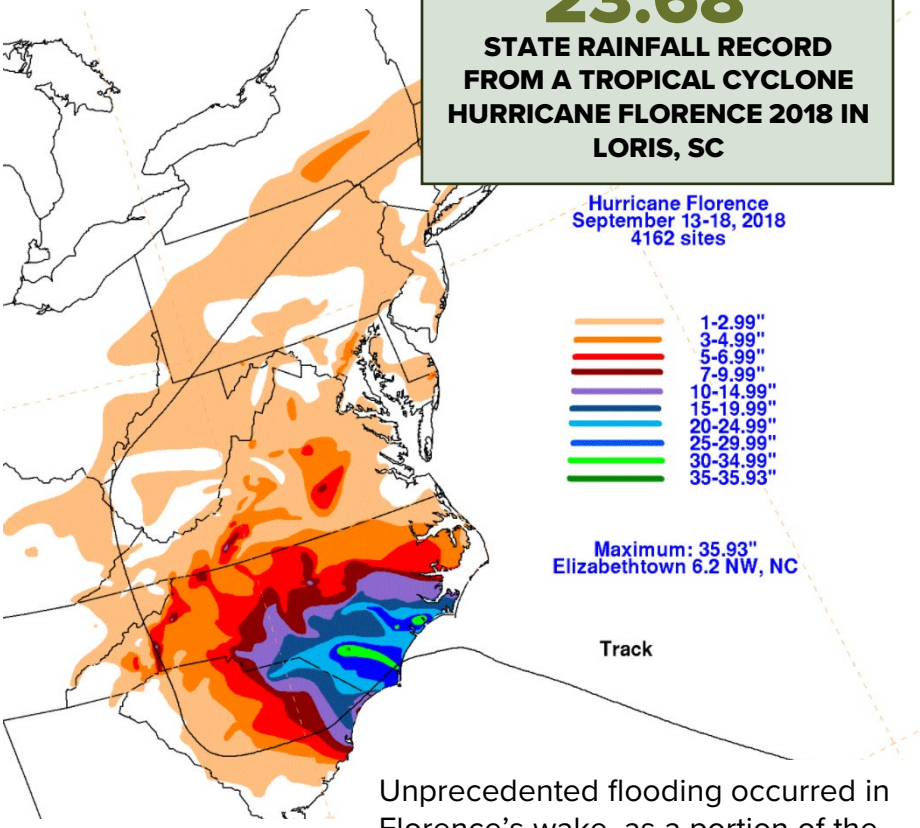
More information at http://www.dnr.sc.gov/matthew2016

TROPICAL CYCLONE FLORENCE
SEPTEMBER 2018

Florence was a Category 1 Hurricane when it made landfall near Wrightsville Beach, North Carolina, on September 14. It proceeded to stall and remain nearly stationary for an entire day before it began a slow turn to the southwest, which is not a typical movement for tropical cyclones. It traveled across South Carolina at a speed of 2-3 mph. The storm continued to weaken during the 15th and accelerated to the north-northeast and out of the state on September 16. The slow-moving system dropped more than 30 inches of rain across portions of eastern North Carolina and over 20 inches in Chesterfield and Horry counties.

23.68"

STATE RAINFALL RECORD FROM A TROPICAL CYCLONE HURRICANE FLORENCE 2018 IN LORIS, SC



River Gauge	Florence Crest (ft.)	Previous Crest (ft.)	Previous Crest Data/Event
Waccamaw at Longs	20.22	17.94	9/22/1999 Hurricane Floyd
Waccamaw above Conway	19.82	15.77	10/16/2016 Hurricane Matthew
Waccamaw at Conway	21.16	17.87	10/18/2016 Hurricane Matthew
Pee Dee at Bennettsville	94.25	89.94	04/12/2003
Black Creek Near Quinby	17.37	16.81	10/05/2015 October Floods
Little Pee Dee at Galivants Ferry	17.21	17.10	10/12/2016 Hurricane Matthew

More information at http://www.dnr.sc.gov/florence2018

Unprecedented flooding occurred in Florence's wake, as a portion of the excessive amount of rainfall measured in North Carolina fell in the Yadkin-Pee Dee River watershed. For weeks after the initial landfall, flooding plagued most of the Pee Dee Region, with significant impacts along the Pee Dee, Little Pee Dee, Lumber, Lynches, and Waccamaw rivers and their tributaries. Many of these river gauges reached crest values that fell within the top five highest measured crests at their locations, while several of the rivers set new record crest values. The Pee Dee River at Pee Dee reached a height of 31.83 ft. during the flooding, which was 1.5 ft. lower than the historic crest of 33.3 ft. in 1945. Gauges along Waccamaw exceed previous record crests by three or more feet during this event.

River Gauge	Historic Crest (ft.)	2nd Highest Crest (ft.)	3rd Highest Crest (ft.)	4th Highest Crest (ft.)	5th Highest Crest (ft.)
UPSTATE	**Shaded crests indicate an event discussed in the report.**				
Enoree River near Whitmire	08/28/1995 (37.32)	10/10/1976 (32.58)	02/08/2020 (31.21)	07/25/1997 (19.73)	10/13/1990 (29.67)
Saluda River at Chappells	08/26/1908 (36.70)	10/02/1929 (32.70)	09/28/1929 (32.20)	09/01/1888 (31.60)	08/17/1928 (31.10)
MIDLANDS					
Congaree River at Columbia**	08/27/1908 (39.80)	07/17/1916 (35.50)	08/18/1928 (33.50)	04/08/1936 (33.10)	10/03/1929 (33.10)
North Fork Edisto at Orangeburg	09/01/1928 (14.70)	09/18/1945 (14.28)	10/06/2015 (13.64)	03/05/1971 (11.64)	09/06/1979 (11.56)
Wateree River near Camden	07/18/1916 (4.40)*	08/26/1908 (39.70)	04/07/1936 (36.63)	10/03/1929 (36.00)	03/17/1912 (35.40)
PEE DEE					
Black River at Kingstree	10/07/2015 (22.65)	06/14/1973 (19.77)	09/21/1928 (18.00)	10/10/2016 (16.41)	09/20/1945 (16.07)
Great Pee Dee at Cheraw	09/19/1945 (50.40)	08/27/1908 (47.20)	09/18/2018 (46.60)	01/01/1864 (45.50)	09/20/1928 (44.90)
Little Pee Dee River near Galivants Ferry	09/21/2018 (17.21)	10/12/2016 (17.10)	09/15/1928 (16.00)	09/23/1945 (13.23)	10/09/1964 (13.01)
Pee Dee River at Pee Dee	09/22/1945 (33.30)	09/21/2018 (31.83)	09/23/1928 (31.60)	04/06/2003 (29.48)	10/07/1929 (29.20)
Santee River near Jamestown	07/26/1916 (33.00)	04/15/1936 (32.00)	08/26/1928 (30.00)	10/10/1929 (29.80)	02/14/2020 (23.37)
Waccamaw River near Conway	09/26/2018 (21.16)	10/18/2016 (17.89)	09/30/1928 (17.81)	09/27/1999 (17.61)	10/10/2015 (16.20)
LOWCOUNTRY					
Edisto River at Givhans Ferry	02/01/1925 (17.50)	09/21/1945 (17.28)	08/01/1904 (17.00)	10/08/2015 (16.06)	06/14/1973 (15.84)
Savannah River at Burton's Ferry***	10/01/1929 (30.80)	08/18/1940 (27.00)	12/03/1948 (24.91)	3/26/1944 (23.40)	01/23/1944 (22.60)
Savannah River near Cylo***	10/06/1929 (29.70)	04/13/1936 (26.00)	01/24/1925 (23.90)	08/22/1940 (23.60)**	08/23/1928 (22.30)

*most recent of multiple crest values
** prior to construction of Lake Murray Dam

**prior to construction of the dam/lock system on Savannah River

UNDERSTANDING THE 100 – YEAR EVENT

Events can be drought, rainfall, flood stage, streamflow, or earthquakes.

###- Year Event

Average period, in years, between the exceedance of an event at a given location. Also called Average Return Interval or ARI.

Both provide a measure of the rarity of the observed or forecasted event.

Both can be used to explain the likelihood of an event.

Annual Exceedance Probability (AEP)

Percent chance that an event will happen in any given year. Simply the inverse of ARI or (1/ARI)*100.

THERE IS NO ONE-TO-ONE RELATIONSHIP BETWEEN RAIN AND FLOOD EVENTS.

Multiple factors other than rain determine the occurrence of flooding, such as:

- Basin size
- Areal extent of rainfall
- Duration of rain
- Intensity/Rain rate
- Land use

A 500-year rainfall event may not produce a 500-year flood.

A 500-year rainfall event can occur in consecutive years, or it might only happen once in 100 years.

### - Year Event (ARI)	Annual Exceedance Probability (AEP)
100	1%
200	0.5%
500	0.2%
1000	0.1%

Highest Rainfall Totals per Tropical Cyclones and their Remnants (1956 – 2023) in South Carolina

Rainfall Total	Tropical Cyclone	Dates	Location
23.68”	Florence	Sep 15-18, 2018	**Loris 2.9 WSW**
17.45”	Beryl	Aug 13-18, 1994	Jocassee 8 NW
16.92”	Matthew	Oct 7-8, 2016	Edisto Island Middleton
16.80”	Floyd	Sep 15-16, 1999	Myrtle Beach
15.21”	Dorian	Sep 5-6, 2019	**Pawleys Island 5.6 NNE**
15.13”	Jerry	Aug 23-28, 1995	Hilton Head
14.17”	Hermine	Sep 1-3, 2016	**Georgetown 6.0 S**
14.11”	TD #8	Aug 15-18, 1971	Sullivans Island
13.96”	Marco/Klaus	Oct 10-13, 1990	Pageland
13.80”	Gladys	Oct 17-20, 1968	Marion

Stations operated by the National Weather Service or **CoCoRaHS**

Narratives, data, and images included in this document were provided by the National Centers for Environmental Information, the National Hurricane Center, the National Weather Service, the United States Geological Survey, the Army Corps of Engineers, the Southeast Regional Climate Center, the South Carolina State Climatology Office, the SCDNR Flood Mitigation Program, the South Carolina State Library, NewsBank, and the Richland County Library.

If you have any additional questions regarding the information provided in this document, please contact Dr. Hope Mizzell or Melissa Griffin at the State Climatology Office, or Maria Cox Lamm, with SCDNR Flood Mitigation Program.

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Fall 2023