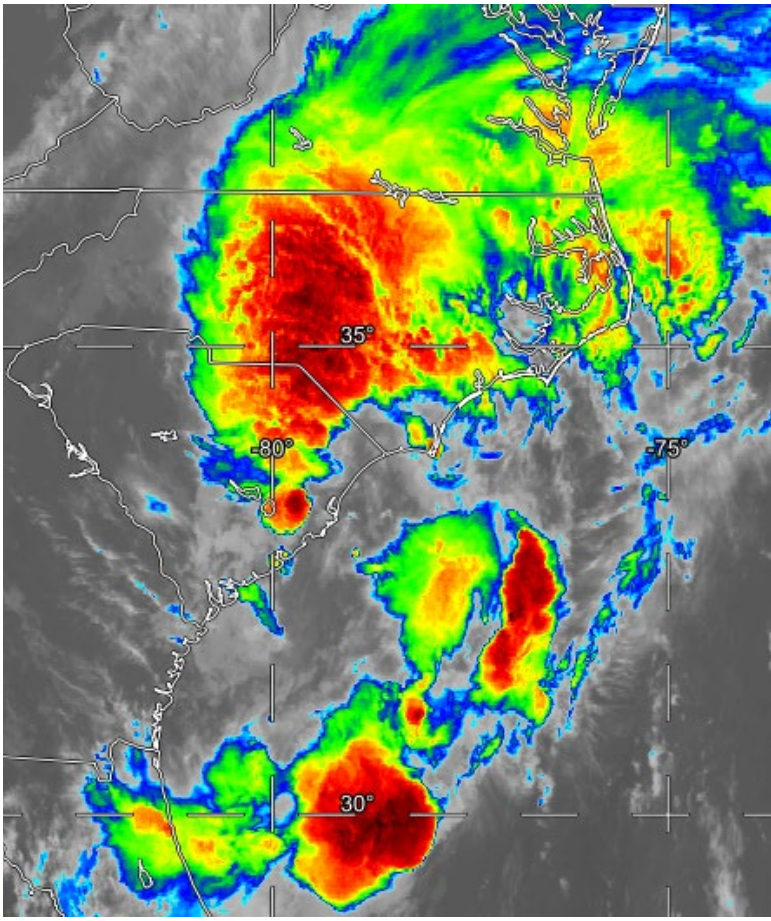
Tropical Storm Debby

Open File Report

Prepared by the South Carolina State Climatology Office
Report Originally Issued August 22, 2024
Website: https://www.dnr.sc.gov/climate/sco/

Storm History and Impacts Report

August 2-9, 2024



Color-enhanced infrared satellite image shows Debby at 1:50 a.m. EDT on August 8, 2024, around the time it made its second landfall near Bulls Bay.

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This report serves as a preliminary dissemination of information on the impacts of Hurricane Idalia across South Carolina. If you have any additional questions regarding the data provided in this document, please contact Hope Mizzell, Frank Strait, or Melissa Griffin at the State Climatology Office.

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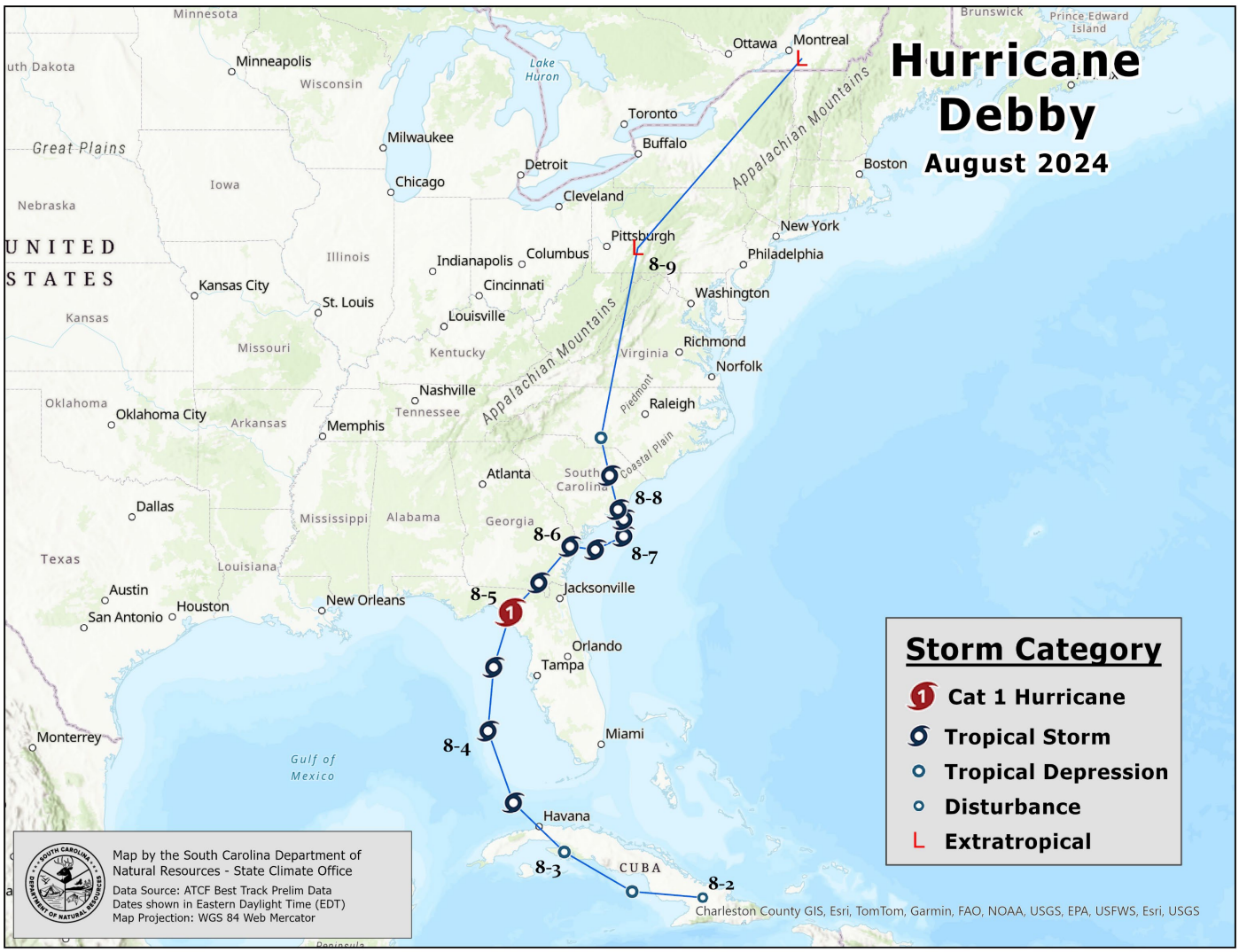
Debby Track Map

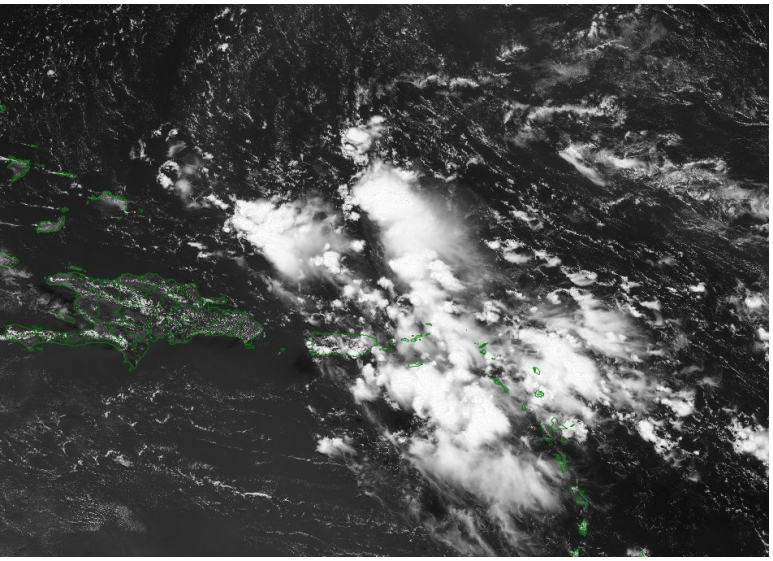
The first advisory issued by the National Hurricane Center on the tropical wave that would become Debby came at 11 a.m. EDT on August 2 for Potential Tropical Cyclone Four. It became a tropical cyclone as Tropical Depression Four later that day. It strengthened into a tropical storm and received the name Debby on August 3. It slowly and steadily intensified while moving over the simmering waters of the eastern Gulf of Mexico through the early morning of August 5, becoming a hurricane just before making landfall near Steinhatchee, Florida around 7 a.m. that day.

It slowed while tracking over Florida and Georgia before wandering over the Atlantic Ocean on August 6. It spent around 36 hours over the Atlantic before making its second landfall near Bulls Bay in South Carolina around 2 a.m. on August 8. Debby then accelerated northward, exiting South Carolina that afternoon as it weakened. It became a tropical depression that evening, then an extratropical storm on August 9 as it crossed the Appalachian Mountains, passing through Pennsylvania and New York.



Synoptic Summary

Debby began as a tropical wave that reached the Atlantic Ocean from West Africa around July 22, 2024. It drifted westward over the following days through the tropical Atlantic. A swirl of clouds associated with this wave caught the attention of forecasters at the National Hurricane Center (NHC) once it reached around 40° west longitude on July 26. At the time, they indicated a 20 percent chance for it to become a tropical cyclone within seven days.



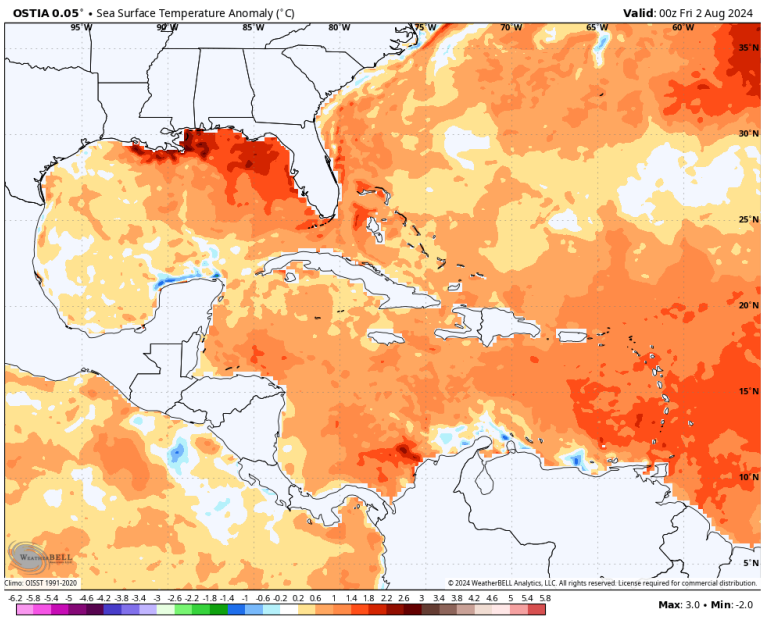
A visible satellite image from 12:50 p.m. EDT on July 31, 2024, shows a cluster of thunderstorms around the Leeward Islands and Puerto Rico that would eventually become Debby.

Image Source: SLIDER by RAMMB

Thunderstorm activity was sparse around the tropical wave until it reached the Lesser Antilles on July 29. Thunderstorms became more widespread after that, but development was slow. The wave was embedded in a dry air mass, so the increase in thunderstorm coverage was gradual, and it took days for a surface circulation to form.

By the time the tropical wave reached eastern Cuba on August 2, NHC forecasters had enough confidence in development and significant impacts that they designated the slowly developing system as Potential Tropical Cyclone Four. The first advisory they issued indicated that Debby would become a tropical storm before crossing Florida, then pass just off the South Carolina coast.

By that evening, thunderstorms had become widespread and organized enough to classify this feature as Tropical Depression Four, centered near Cayo Cinco Blas, Cuba. Waters were warmer than average for the date around Cuba, and vertical shear was low. However, intensification was expected to be slow due to interaction with land and dry air around the system. It took 36 hours for the depression to reach tropical storm strength and gain the name Debby at 5 p.m. EDT on August 3. It then passed over waters much warmer than usual (generally 86-90°F) for the date over the eastern Gulf of Mexico. It also entered a more humid air mass, so intensification was steady. It became a hurricane at 11 p.m. EDT the following day, hours before making landfall near Steinhatchee, Florida, around 7 a.m. EDT on August 5. Maximum sustained winds in Debby were 80 mph at the time.

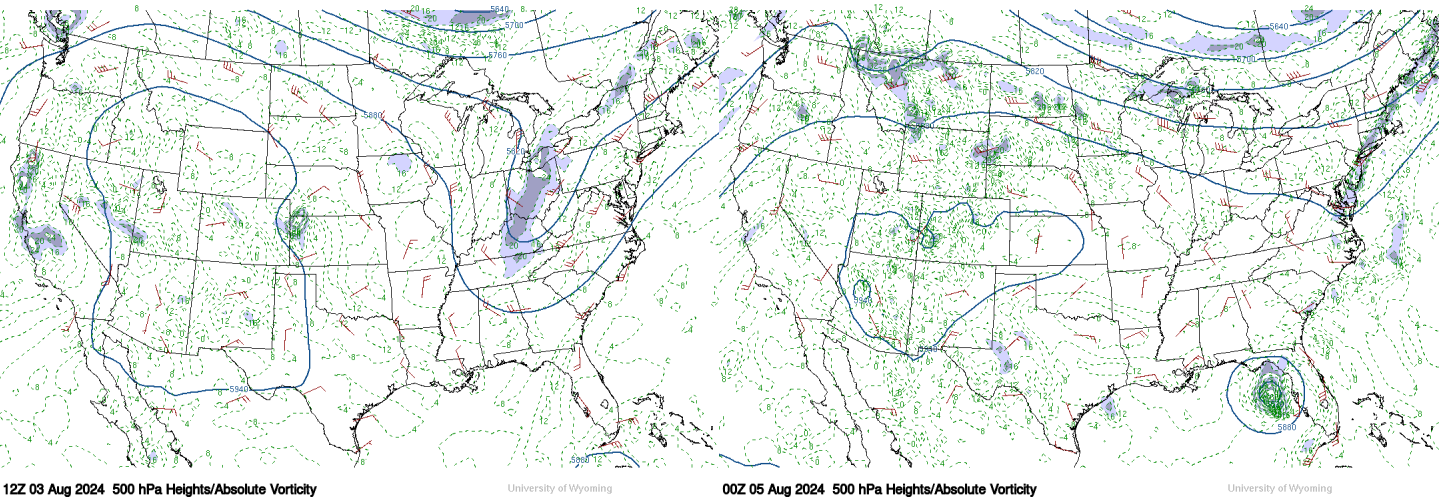


A plot of sea surface temperature anomalies from August 1, 2024, across the Atlantic Basin shows warmer-than-average waters for the date across the areas in the Caribbean Sea, southwestern Atlantic and eastern Gulf of Mexico.

Image Source: WeatherBELL

Synoptic Summary

An upper-level trough over the Midwestern states and the lower Mississippi Valley caused Debby's northward turn over the Gulf of Mexico. As it settled into the eastern United States in early August, the trough supported a cold front crossing the eastern United States. The front became stationary over South Carolina during August 3-4 before it dissipated. The front and upper trough generated widespread diurnal thunderstorms across South Carolina with locally heavy rainfall. Much of the state saw over an inch of rain, and this predecessor rain event brought heavy rainfall of 3-5 inches to parts of Richland, Greenville, Spartanburg, Florence, and Darlington Counties.



Upper-air analyses at 500 hPa from 8 a.m. EDT August 3 (left) and 8 p.m. August 4 (right) show the upper trough that sent a front into the southeastern United States with locally heavy rainfall those days; the trough also steered Debby northward over the Gulf of Mexico. The trough can be seen weakening and lifting northward on the August 4 map, which left Debby with weak steering currents for days after it made landfall in Florida. A disturbance over Montana evident on the August 4 map would pass too far north to pull Debby out of South Carolina and it would be August 8 before a stronger trough would form over the Great Lakes region to eject Debby from the region.

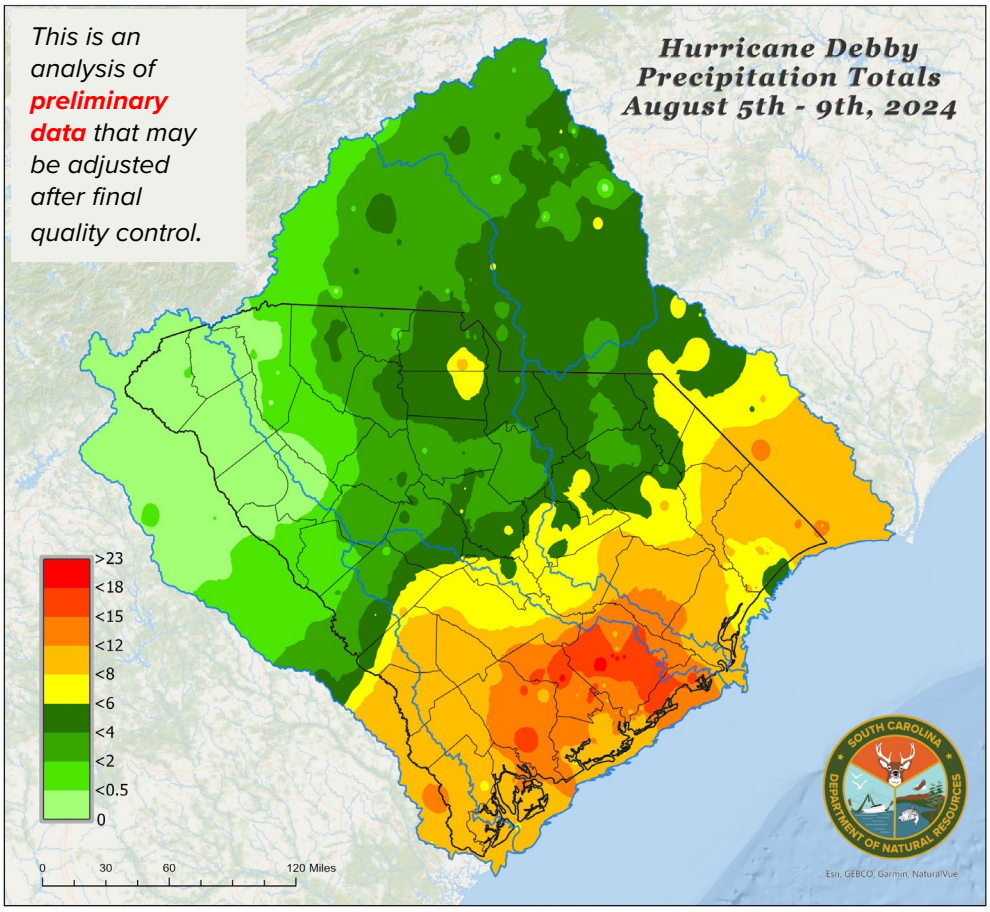
Image Source: University of Wyoming Weather Web

The upper-level trough weakened and retreated northward starting on August 5. This left Debby with weak steering currents, resulting in the storm slowing to a crawl and wandering near the Georgia and South Carolina coastlines through August 8. Debby's slow drift through northern Florida and southern Georgia along with an influx of dry air weakened it to a minimal tropical storm with 40 mph maximum sustained winds before it emerged over the Atlantic Ocean at midday on August 6. By this time, the storm was so disrupted that reorganization and significant intensification over the waters off the South Carolina coast was unlikely. Debby's center was over water for about 36 hours before it made its second landfall around 2 a.m. on August 8. Despite passing over waters of 83-87°F, about 2°F warmer than average for the date, it only strengthened to a 60-mph tropical storm upon reaching the South Carolina coast near Bulls Bay. Debby then accelerated northward, and its center exited South Carolina around 2 p.m. on August 8. However, heavy rain lingered across the state's Coastal Plain through that night and into August 9 near the Grand Strand.

Another cold front followed Debby into South Carolina, which produced thunderstorms that dropped additional heavy rainfall later August 9 into August 10. The heavy rain from these thunderstorms exacerbated the ongoing flash flooding and river flooding from Debby's deluge; some areas saw new or renewed flooding. Rainfall for August 9-10 was over an inch over much of South Carolina, and parts of Horry, Cherokee, Greenville, and Marion Counties received 3-5 inches.

Rainfall Totals

Debby's slow drift through South Carolina and vicinity resulted in an extreme rainfall and flooding event over parts of the state. Rainfall totals were comparable to other recent extreme rainfall events caused by Hurricanes Matthew in 2016 and Florence in 2018, along with the flood event of early October 2015. While the rainfall was heaviest along the Coastal Plain, and this is where the most widespread flash flooding and river flooding occurred, flooding rain also occurred in parts of York, Chester, and Lancaster Counties.



Select Rainfall Totals in South Carolina From Tropical Storm Debby (August 5 – 9, 2024)

Station Name	County	Provider	5-Day Rainfall Totals	Annual Exceedance Probability (%) 4-Day Event	Annual Exceedance Probability (%) 7-Day Event
Moncks Corner 6.6 SW	Berkeley	CoCoRaHS	22.02	0.1	0.1
Ridgeville 3.2 WSW	Dorchester	CoCoRaHS	18.86	0.1	0.1
Mount Pleasant 8.1 NE	Charleston	CoCoRaHS	18.47	0.1	0.2
Green Pond 1.3 S	Colleton	CoCoRaHS	17.57	0.1	0.2
Beaufort 5.7 NE	Beaufort	CoCoRaHS	14.30	0.2	0.5
Andrews	Georgetown	NWS	13.10	0.2	0.5
Hardeeville 6.7 ENE	Jasper	CoCoRaHS	12.45 (M)	1	2
Longs 1.3 NW	Horry	CoCoRaHS	12.35	1	2
Kingstree 7.9 NW	Williamsburg	CoCoRaHS	11.85	1	2
Holly Hill 1 SW	Orangeburg	NWS	11.84	1	2
Mullins	Marion	NWS	11.51	1	2
Hampton 0.8 SW	Hampton	CoCoRaHS	11.32	1	2

Rainfall Total with (M) denotes the totals with missing data.

Annual Exceedance Probability (AEP): Percent chance that an event will happen in any given year. Based on data from NOAA Atlas 14. This event spanned 5-Days and NOAA Atlas 14 only provides AEP values for 4- and 7-Day Events, which are the closest to these event totals.

Rainfall Totals

Debby's peak rainfall in South Carolina of 22.02" inches near Moncks Corner ranks second among rainfall from tropical cyclones in South Carolina's history and came within two inches of the record set during Hurricane Florence. Rainfall from the October 2015 rainfall and flooding event, while enhanced by proximity of Hurricane Joaquin, is not considered to be solely caused by a tropical cyclone. Therefore, this event is not included in the historical records for South Carolina's tropical cyclone rainfall events. For comparison, the peak rainfall from the October 1-5, 2015, event was 27.19 inches near Mount Pleasant.

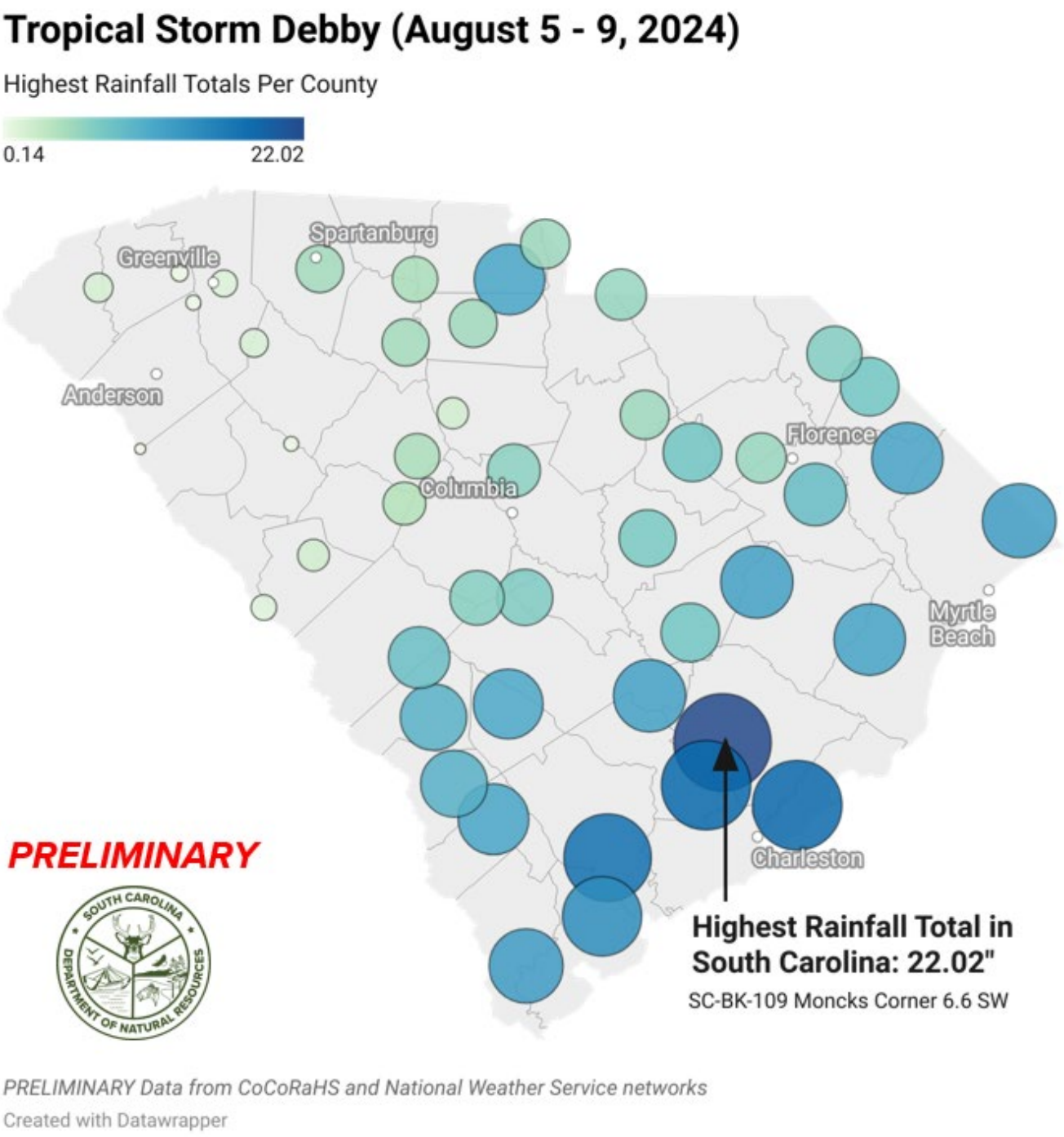
Highest Rainfall Totals in South Carolina From Tropical Cyclones and their Remnants (1956 – 2024)

Rainfall Total	Tropical Cyclone	Dates	Location
23.68"	Florence	Sep 15 – 18, 2018	**Loris 2.9 WSW**
22.02"	Debby	Aug 5 – 9, 2024	**Moncks Corner 6.6 SW**
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**

*All data is considered **PRELIMINARY,** and rainfall totals may be adjusted after final quality control has been completed.*

Rainfall Totals



*All data is considered **PRELIMINARY,** and rainfall totals may be adjusted after final quality control has been completed.*

Highest Rainfall Totals Per County in South Carolina From Tropical Storm Debby (August 5 – 9, 2024)

*All data is considered **PRELIMINARY,** and rainfall totals may be adjusted after final quality control has been completed. Rainfall Total with (M) denotes the totals with missing data.*

County	Rainfall Total	Station
Abbeville	0.14” (M)	**Due West 0.6 NE**
Aiken	8.41”	**Williston 4.3 NNW**
Allendale	10.03”	**Allendale 1.7 SE**
Anderson	0.33”	**Powdersville 0.5 SSE**
Bamberg	10.96”	Bamberg
Barnwell	9.91”	**Barnwell 1.2 WSW**
Beaufort	14.30”	**Beaufort 5.7 NW**
Berkeley	22.02”	**Moncks Corner 6.6 SW**
Calhoun	6.90” (M)	**North 8.6 ENE**
Charleston	18.47”	**Mount Pleasant 8.1 NE**
Cherokee	4.40”	**Lockhart 5.4 N**
Chester	4.95”	**Chester 0.2 NNE**
Chesterfield	5.65”	**Pageland 9.0 WNW**
Clarendon	7.56” (M)	**Summerton 7.6 ESE**
Colleton	17.57”	**Green Pond 1.3 S**
Darlington	5.39”	**Darlington 7.3 SSW**
Dillon	7.57”	**Dillon 3.8 NW**
Dorchester	18.86”	**Ridgeville 3.2 WSW**
Edgefield	1.98”	**Edgefield 3.3 N**
Fairfield	1.92”	**Blair 6.3 ESE**
Florence	8.67” (M)	**Effingham 5.3 E**
Georgetown	13.10”	Andrews
Greenville	1.35”	Greenville Downtown Airport
Greenwood	0.32”	Greenwood 8 NE
Hampton	11.32”	**Hampton 0.8 SW**
Horry	12.35”	**Longs 1.3 NW**
Jasper	12.45” (M)	**Hardeeville 6.7 ENE**
Kershaw	5.18”	**Cassatt 0.1 NE**
Lancaster	5.24”	**Fort Mill 3.3 E**
Laurens	1.53”	**Fountain Inn 4.6 S**
Lee	7.62”	Bishopville 1.4 ENE
Lexington	6.45”	**Swansea 6.1 SW**
McCormick	1.21” (M)	**Clarks Hill 2.5 SE**
Marion	11.51”	Mullins
Marlboro	6.62”	**Clio 1.6 WNW**
Newberry	4.33”	**Prosperity 4.0 E**
Oconee	1.63”	**Keowee Key 0.9 SW**
Orangeburg	11.84”	Holly Hill 1 SW
Pickens	0.48”	**Easley 4.8 NNE**
Richland	6.13”	**Blythewood 5.0 W**
Saluda	3.85”	**Leesville 8.0 N**
Spartanburg	4.85”	Spartanburg 3 SSE
Sumter	7.14” (M)	**Sumter 3.3 SW**
Union	4.75”	Santuck
Williamsburg	11.85”	**Kingstree 7.9 NW**
York	11.30”	**Rock Hill 4.8 SSW**

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

Rain and Flash Flooding Impacts

One of the many examples of flash flooding in South Carolina was along I-26 at mile marker 189 near Ridgeville in Dorchester County. The interstate had to be closed in this area at around 8 a.m. on August 8 as it became impassible due to flooding. The flood waters damaged the eastbound lanes, resulting in those lanes remaining closed for two days. The detour around the closure resulted in delays of up to an hour for commuters. One eastbound lane and the westbound lanes reopened on August 9 after waters receded and the other lane reopened on the morning of August 10 after the repairs were completed.

This flash flooding in Jasper County initially prevented technicians from reaching a radio repeater on August 6. With help from SCDNR law enforcement vehicles, the technician was able to reach and perform maintenance on the equipment.

Rain and Flash Flooding Impacts

Flash flooding on August 6 along U. S. Highway 17 near Seewee Road in Awendaw (Charleston County) led to the closure of the road for a time and detours around the flooding.

Photo Credit: Charleston County Sheriff's Office

Flash flooding also occurred on Guerins Bridge Road in Awendaw (Charleston County), leaving it impassible on August 6.

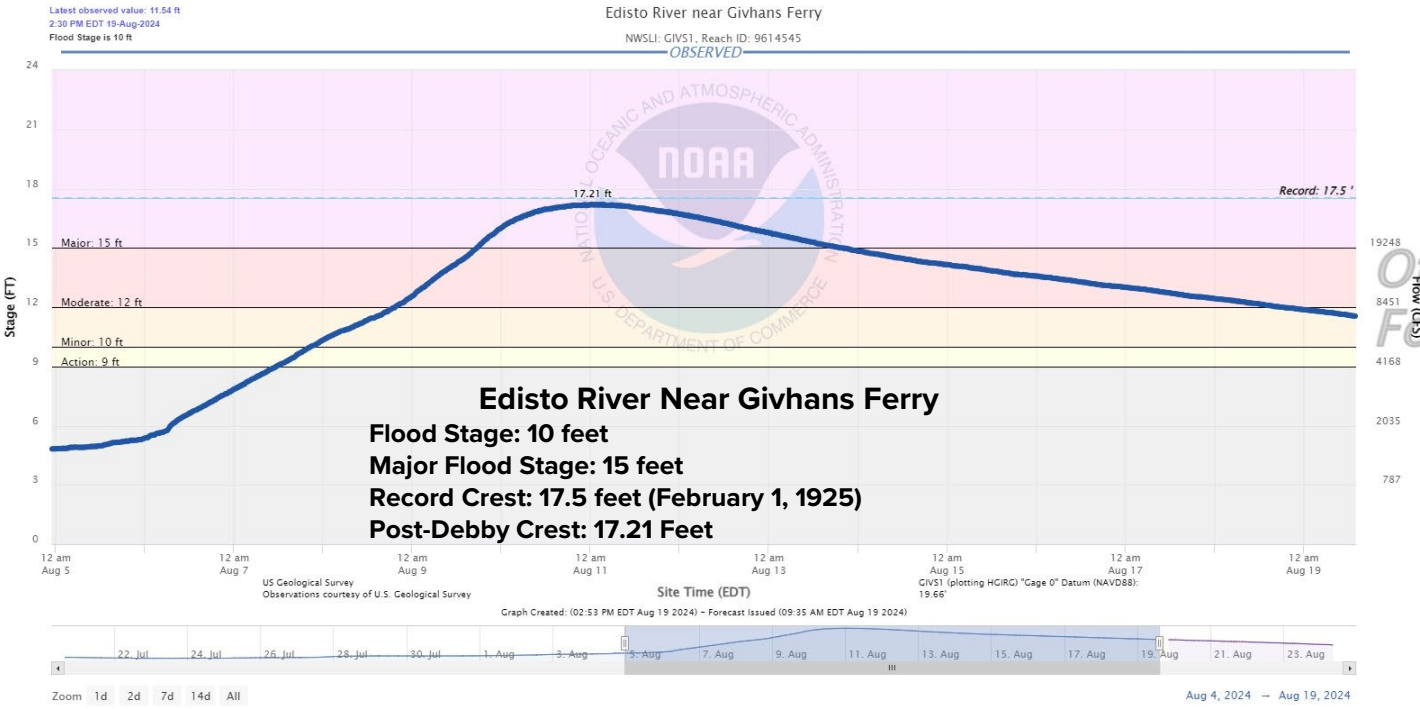
Photo Credit: Charleston County Sheriff's Office

Flash flooding closed the eastbound lanes of Dave Lyle Boulevard near Chamberside Drive in Rock Hill (York County) on the morning of August 8.

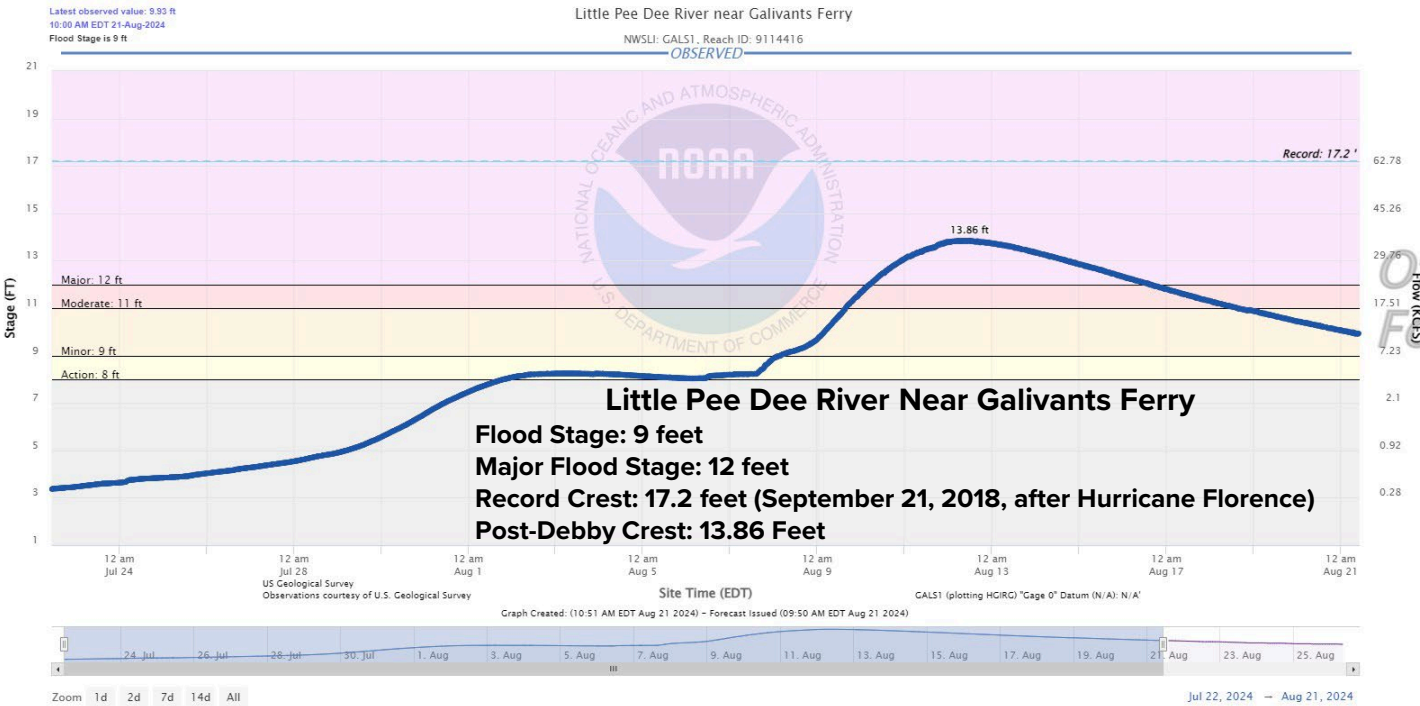
Photo Credit: Rock Hill Police Department

River Flooding

The extreme rainfall from Debby led to moderate to major river flooding along several rivers in South Carolina. None of South Carolina's rivers set a record crest. However, the Edisto River near Givhans Ferry crested at 17.21 feet, third highest on record and only slightly below the second highest crest on record of 17.28 feet in 1945 and the highest of 17.50 feet in 1925.

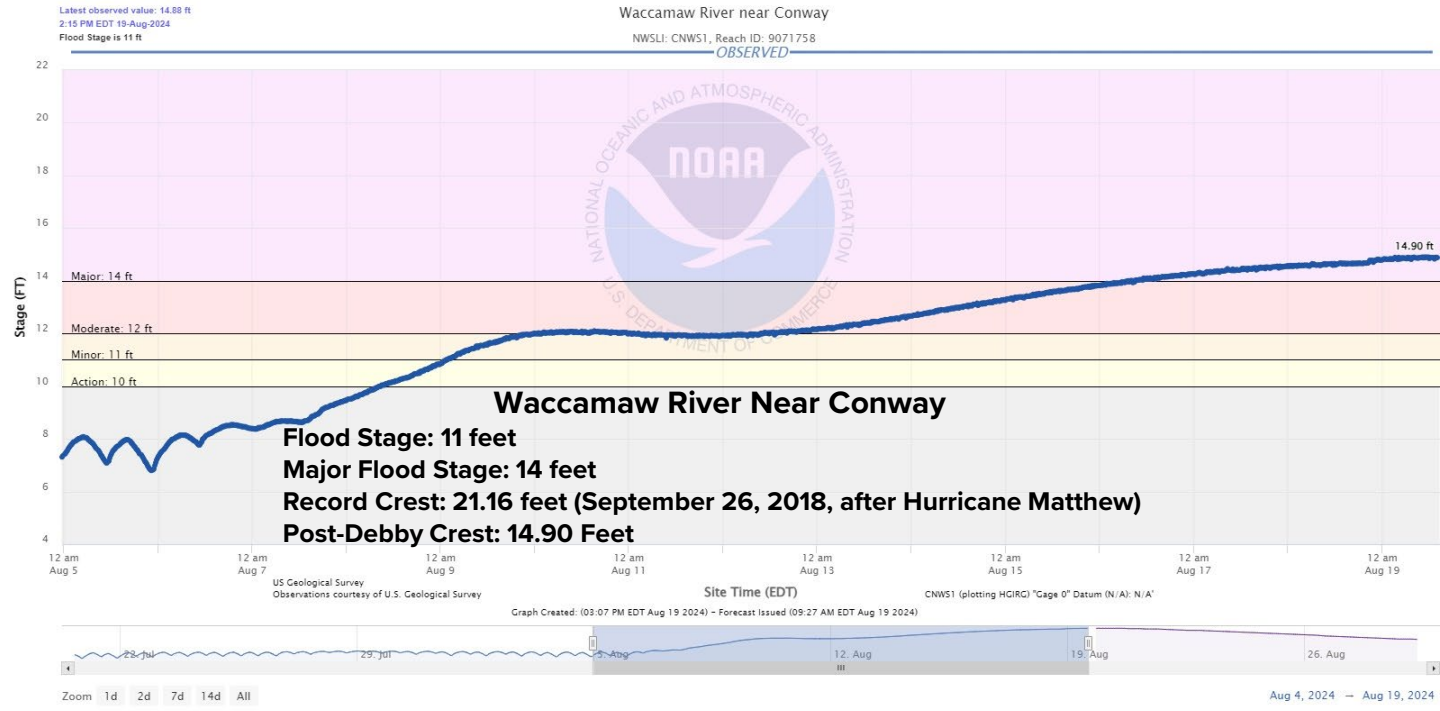


The Little Pee Dee River, which had shrunk to a trickle in July 2024 after months of drought, was above major flood stage for days in the wake of Debby.

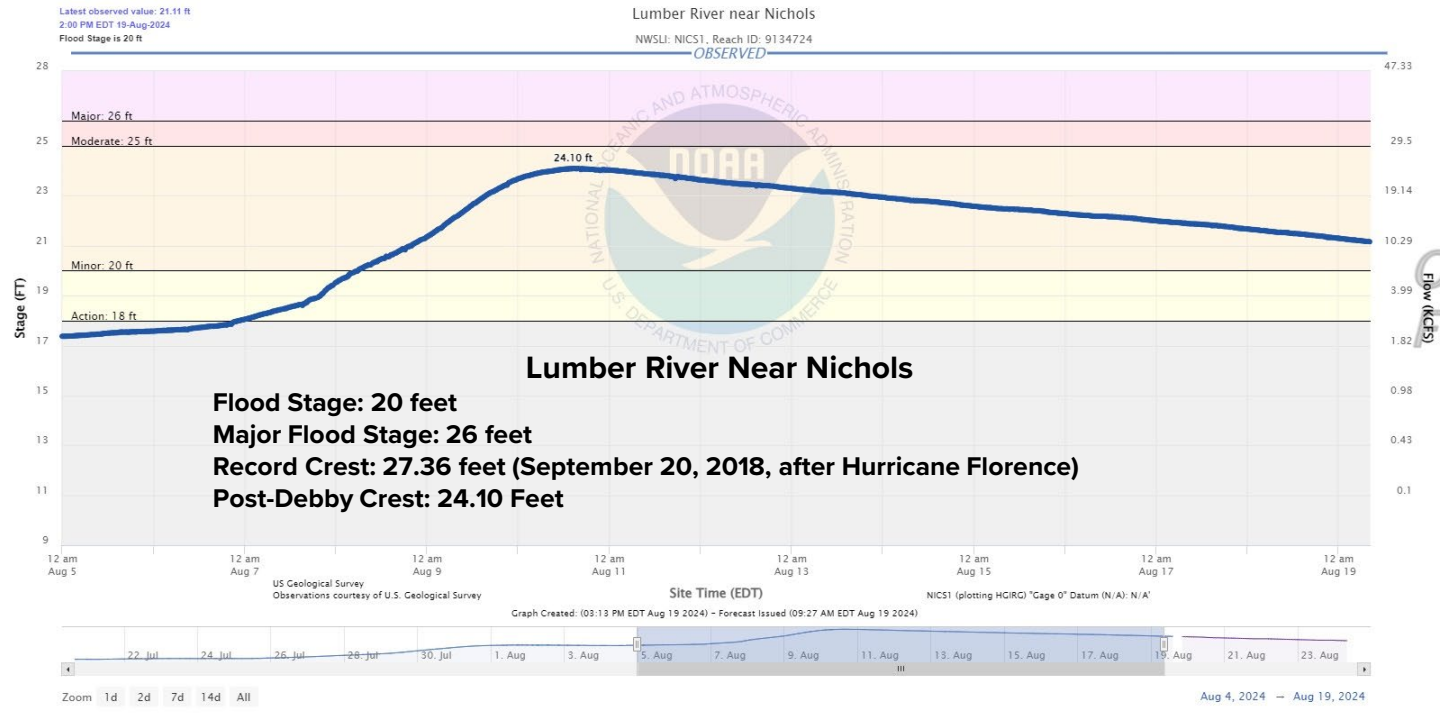


River Flooding

Major flooding began along the Waccamaw River near Conway on August 16 and was still in progress when this report was released. At the time, major flooding was forecast to continue until August 23 with the river expected to remain above flood stage until around August 30.



Flooding along the Lumber River in the Nichols area was not as bad as initially feared, as rainfall was not as extreme as forecast in the river's watershed in North Carolina. However, the crest after Debby was the third highest on record, and widespread flooding occurred in the Town of Nichols for the sixth time in the last ten years.



River Flooding Impacts

This photo of the Gator Walk Road area of Dorchester County from the morning of August 8 shows the extent of flooding along this part of the Edisto River.

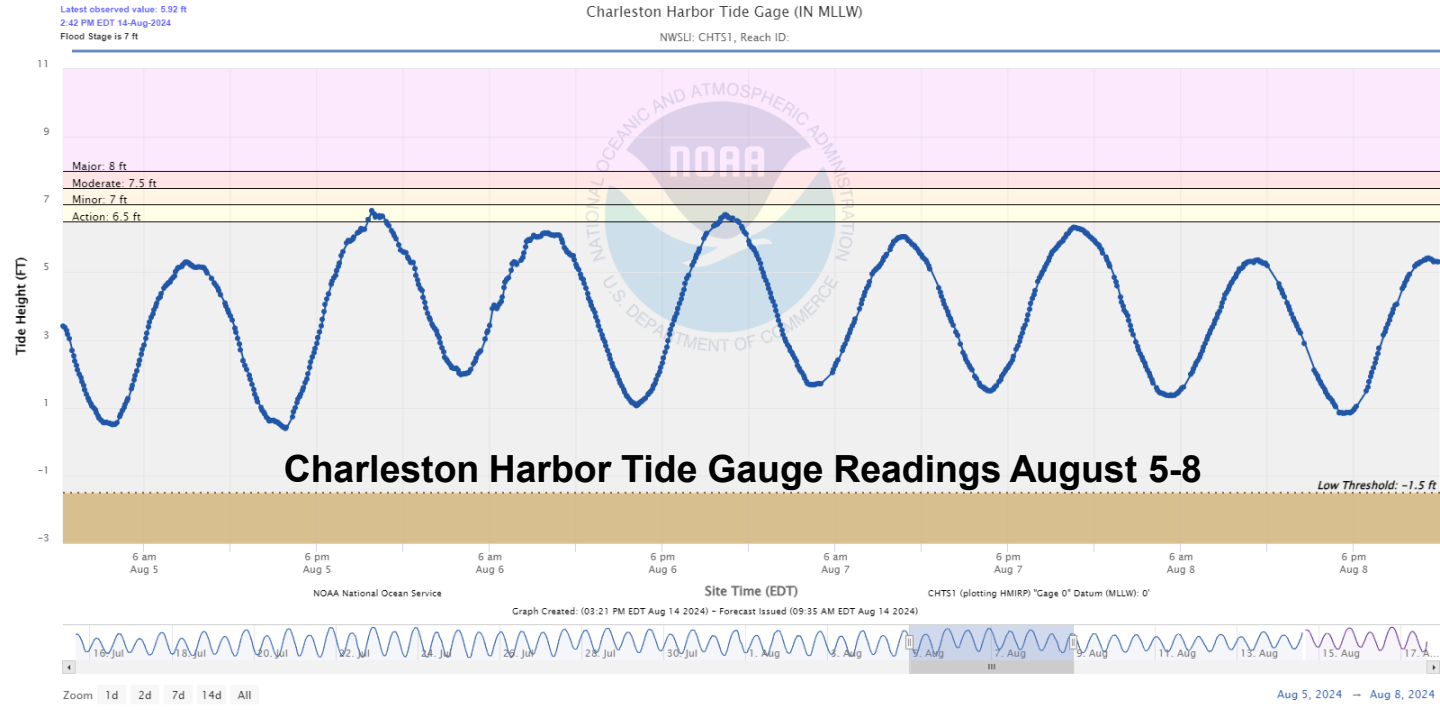
Photo Credit: SCDNR / John P. Jones

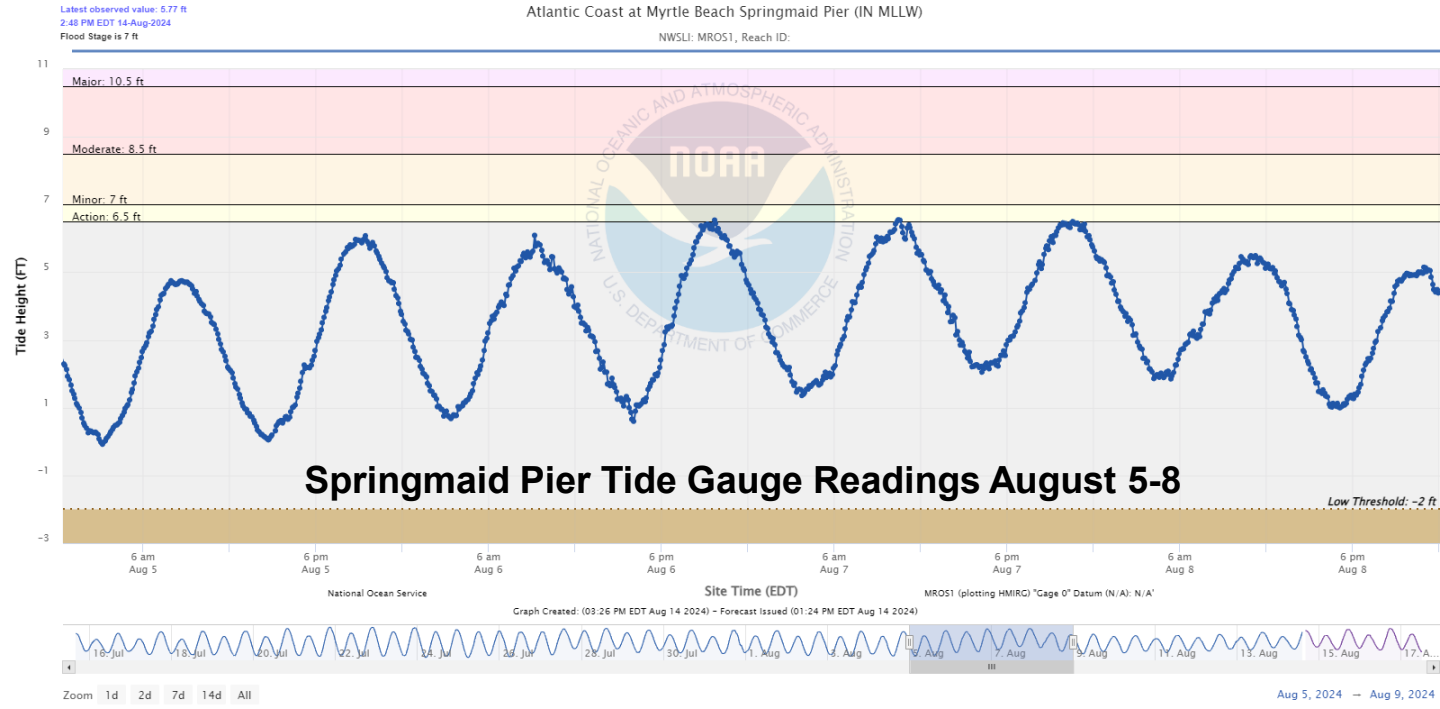
This photo of the Lumber river shows flooded homes downstream from the Nichols area.

Photo Credit: SCDNR / Maria Cox Lamm

Storm Surge

It was unusual that Debby caused only a small surge along the South Carolina coastline. It is typical for a storm of Debby's strength to cause a 2-4 foot storm surge when passing near or making landfall along a coastal area. However, the storm surge from Debby was only 1.0-1.5 feet. Despite elevated high tides from a new moon on August 4, no significant coastal flooding from storm surge occurred along South Carolina's coast. This was welcomed because of the severe flooding from Debby's heavy rain, especially by residents of Charleston County, who are particularly vulnerable to coastal flooding from any cause.





Peak Wind Gusts

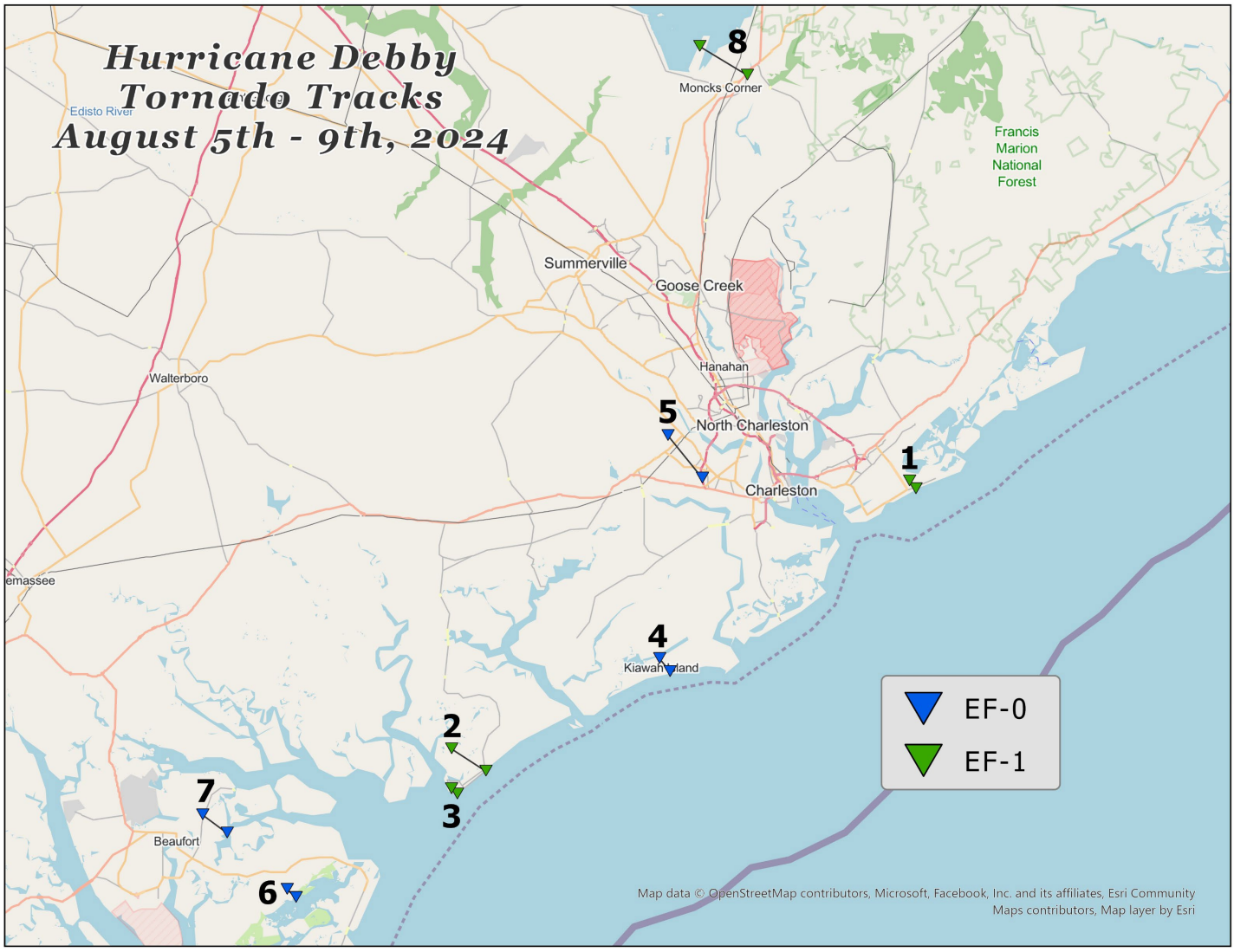
Damaging winds from Debby were much less impactful than the heavy rainfall and flooding. However, there were sporadic reports of wind damage in South Carolina. This was primarily in the form of tree and power line damage. This occurred in several locations along the coast, but some inland areas saw minor wind damage as well. The risk of wind damage was increased by the soil becoming saturated, making it possible for trees to be downed by weaker winds. This was significant in York and Chester Counties on August 8, where there were several instances of tree and power line damage despite highest wind speeds only in the 40-50 mph range. The wind damage was noted just across the state line in North Carolina as well, with Charlotte Douglas International Airport reporting a peak wind gust of 47 mph as Debby moved through.

Peak Wind Gusts From Debby August 5-8			
Station	**Provider**	**County**	**Gust (mph)**
Folly Beach South End	WeatherFlow	Charleston	63
Battery Point Charleston	WeatherFlow	Charleston	59
Isle of Palms Pier	WeatherFlow	Charleston	56
Beaufort – Seaside Road	WeatherFlow	Beaufort	55
Charleston International Airport	NOAA	Charleston	52
Botany Bay	SCDNR	Charleston	50
Beaufort – Ribault Road	WeatherSTEM	Beaufort	49
Springmaid Pier	NOAA	Horry	49
Charleston Tide Gauge	NOAA	Charleston	48
Beaufort MCAS	NOAA	Beaufort	48
Sullivan's Island	WeatherFlow	Charleston	46
Hilton Head Island	NOAA	Beaufort	44
Bennettsville – Marlboro County Jetport	NOAA	Marlboro	44
Rock Hill – York County Airport	NOAA	York	43
Carolina Sandhills NWR	WeatherFlow	Chesterfield	42
Chester – Catawba Regional Airport	NOAA	Chester	38
Peak Gusts from SC Marine Stations			
Shutes Folly	WeatherFlow	Charleston	51
Buoy 41004 (40 nm SE Sullivan's Island)	NOAA	Int'l Waters	49
Fripp Nearshore Buoy (3.8 nm SE Fripp Island)	NOAA	Colleton	49
Fort Sumter	WeatherFlow	Charleston	47
Murrells Inlet	WeatherFlow	Horry	47

Tornadoes

Debby spawned seven tornadoes in South Carolina, all in the Lowcountry. The National Weather Service rated four of them EF-1 and three of them EF-0. The tornadoes occurred during the late evening of August 5 and early morning of August 6. Though some of the tornadoes occurred during times when most people are sleeping, there were no casualties reported.

1. Isle of Palms, rated EF-1
2. Edisto Beach (North), rated EF-1
3. Edisto Beach (South), rated EF-1
4. Kiawah Island, rated EF-0
5. Charleston West Ashley, rated EF-0
6. St. Helena Island, rated EF-0
7. Ladys Island, rated EF-0
8. Moncks Corner, rated EF-1



Tornadoes

Tornado 1:
Isle of Palms, Charleston County

Rating: EF-1
Start Time: 9:33 p.m. August 5
Duration: 4 minutes
Estimated Peak Wind: 87 mph
Path Length: 0.72 miles
Path Width: 75 yards

This tornado began as a waterspout over the Atlantic that came ashore near 25th Avenue. It tracked along 25th Avenue and northwestward across Waterway Boulevard before lifting over the Intracoastal Waterway. It caused considerable tree damage along its path, with many trees uprooted or snapped. There was also minor structural damage to several homes such as stripped shingles and stripped siding, along with the front door pulled off one home.

Tornado 2:
Edisto Beach Area, Colleton and Charleston Counties

Rating: EF-1
Start Time: 9:35 p.m. Tuesday, August 6
Duration: 10 minutes
Estimated Peak Wind: 97 mph
Path Length: 2.89 miles
Greatest Path Width: 300 yards

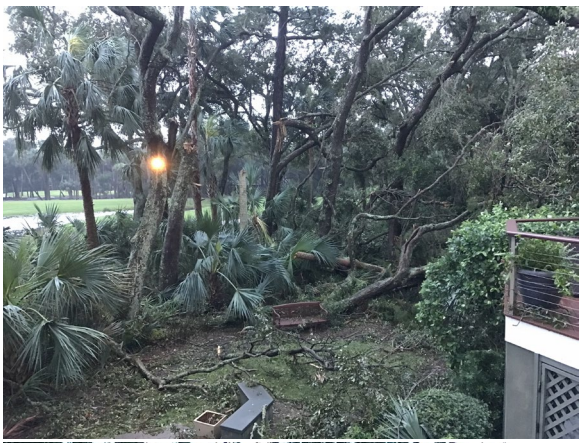
This tornado was a waterspout over the Atlantic Ocean that moved ashore on Edisto Island near Coral Street. It moved northwestward across Palmetto Boulevard and Jungle Road, then Palmetto Road, Palmetto Pointe Lane and Cocktail Lane. The worst damage was to homes and trees along Fishing Creek Drive.

Tornado 3:
Second Edisto Beach Tornado, Colleton County

Rating: EF-1
Start Time: 10:08 p.m. August 5
Duration: 3 minutes
Estimated Peak Wind: 90 mph
Path Length: 0.56 miles
Path Width: 100 yards

This tornado began as a waterspout that came ashore near the intersection of Point Street and Laroche Street. It moved across Palmetto Boulevard, Myrtle Street, Lee Street, Neptune Street, and the southwest part of the Plantation Course at Edisto. The tornado caused damage to numerous trees and minor structural damage, including the demolition of a screened porch along Palmetto Boulevard.

Tornado 4:
Kiawah Island, Charleston County



Rating: EF-0
Start Time: 10:55 p.m. August 5
Duration: 4 minutes
Estimated Peak Wind: 85 mph
Path Length: 1.18 miles
Greatest Path Width: 150 yards

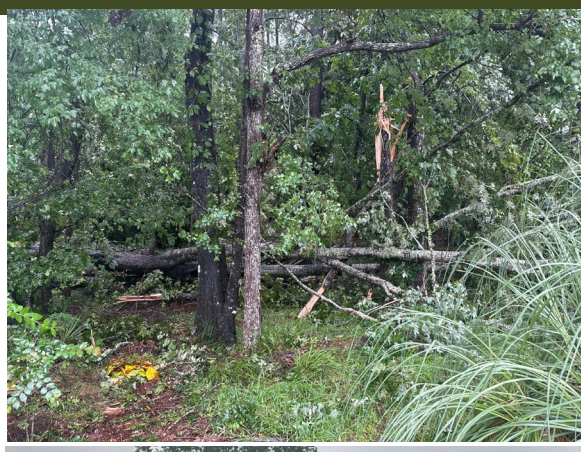
This tornado began as a waterspout over the Atlantic Ocean and came ashore along Surfsong Road, then moved northwestward over Glen Abbey, Doral Open, Governors Drive before ending over marshland near Rhetts Bluff Road. The tornado caused no structural damage but caused some tree damage and left debris over the golf course along its path.

Tornadoes

Tornado 5:
Charleston West Ashley, Charleston County

Rating: EF-0
Start Time: 12:14 a.m. August 6
Duration: 8 minutes
Estimated Peak Wind: 77 mph
Path Length: 3.88 miles
Path Width: N/A

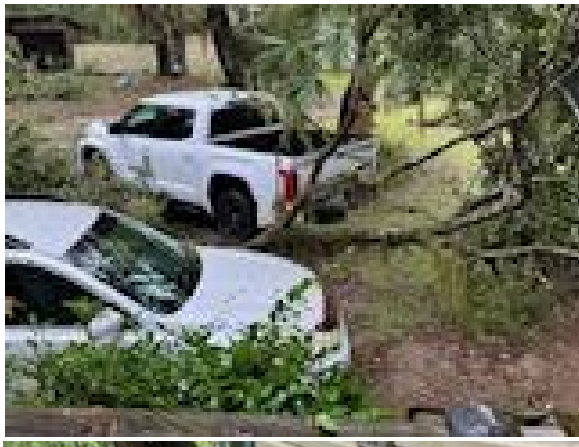
This tornado began along I-526 near Citadel Mall and tracked northwestward over Bon Secours Hospital, Glenn McConnell Parkway, Mariners Ferry, and across the Hickory Hall Plantation neighborhood, ending near Muirfield Parkway. The tornado did not cause any structural damage, but caused several instances of tree damage, including some downed or snapped trees.



Tornado 6:
St. Helena Island, Beaufort County

Rating: EF-0
Start Time: 12:41 a.m. August 6
Duration: 2 minutes
Estimated Peak Wind: 74 mph
Path Length: 0.85 miles
Path Width: 60 yards

This tornado began as a waterspout over Harbor River and crossed marshland and came ashore near 1st Coleman Road. It tracked along that road and lifted as it reached Seaside Road. The tornado primarily caused tree damage along its path, but it also broke a flagpole and damaged the metal skirting of a mobile home.



Tornadoes

Tornado 7:
Lady's Island, Beaufort County

Rating: EF-0
Start Time: 12:28 a.m. August 6
Duration: 3 minutes
Estimated Peak Wind: 88 mph
Path Length: 2.14 miles
Path Width: N/A

This tornado began in marshland adjacent to Point Creek and moved northwestward across Holly Hall Road, Sheppard Road and S. C. Highway 802 (Sam's Point Road), then ended along Wade Hampton Drive. The tornado snapped several trees and caused other tree damage; no structural damage was caused directly by the tornado's wind, but some of the tree debris landed on homes and vehicles and caused damage.

Tornado 8:
Moncks Corner, Berkeley County

Rating: EF-1
Start Time: 2:53 a.m. Tuesday, August 6
Duration: 7 minutes
Estimated Peak Wind: 95 mph
Path Length: 3.88 miles
Greatest Path Width: 150 yards

This tornado began along U. S. Highway 52 and moved northwestward through the north part of Monck's Corner, crossing over a part of Lake Marion before ending in Pinopolis. Several businesses and homes were damaged, with the worst damage at Arby's along McCormick Circle.

Additional Damage Photos

McConkey's Jungle Shack in Edisto Beach suffered major damage from the First Edisto Beach Debby Tornado. The restaurant was closed for many days after the tornado.

Photo Credit: Jimmy King

A home along Neptune Street in Edisto Beach had a board driven into its roof by the Second Edisto Beach Debby Tornado.

Photo Credit: Jimmy King