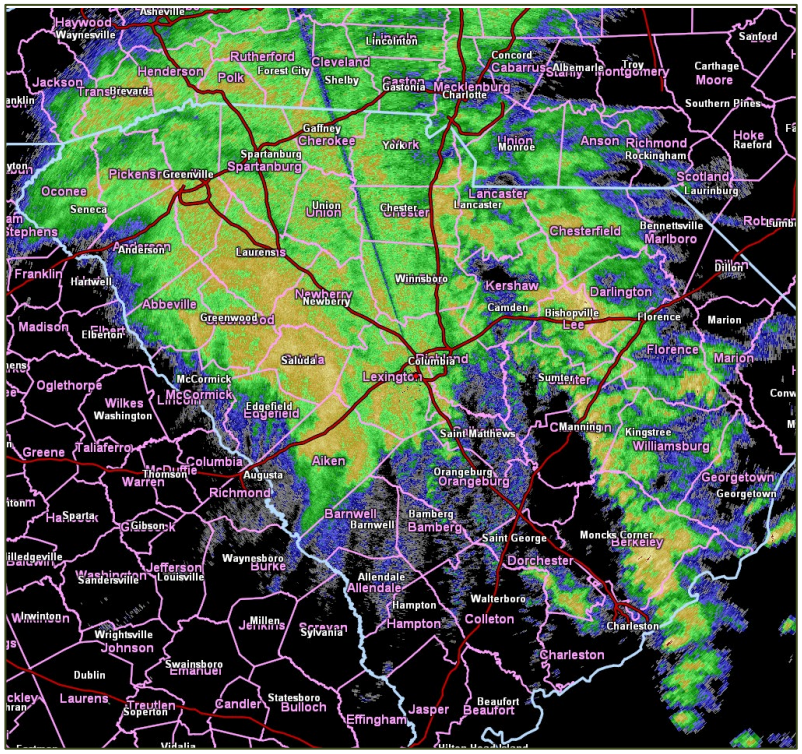
Tropical Cyclone Helene

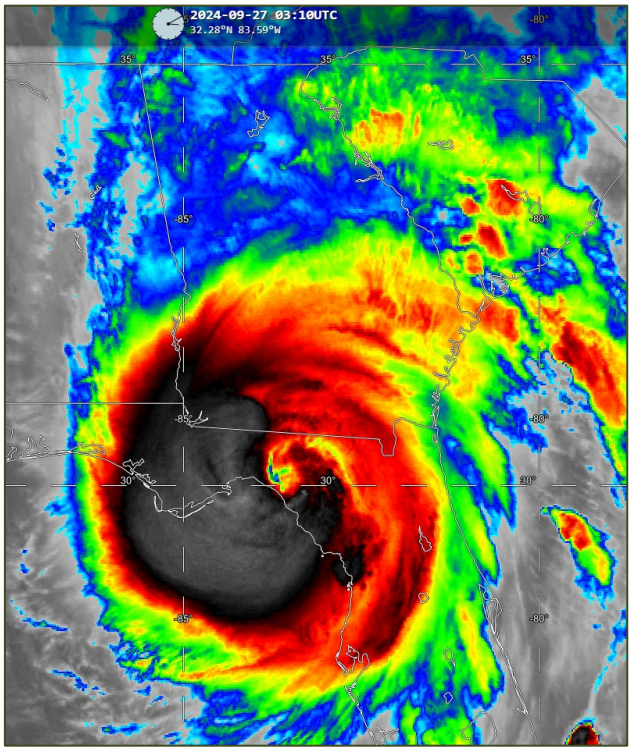
Open File Report

Prepared by the South Carolina State Climatology Office
Report Issued October 8, 2024; latest update June 23, 2025
Website: https://www.dnr.sc.gov/climate/sco/

Storm History and Impacts Report
September 26 – 29, 2024



This radar reflectivity image from the NEXRAD radar at Columbia Metro Airport from 6:36 a.m. EDT on September 27, 2024, shows the extent of extreme rainfall ongoing at the time.



This color-enhanced satellite image shows Helene at the time it made landfall in Florida at 11:10 p.m. EDT on September 26, 2024.

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This report serves as a preliminary dissemination of information on the impacts of Tropical Cyclone Helene across South Carolina. All data is considered PRELIMINARY and may be adjusted after final quality control has been completed. 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 National Weather Service Weather Prediction Center, the United States Geological Survey, the Army Corps of Engineers, the Southeast Regional Climate Center, the South Carolina Emergency Management Division, and the South Carolina State Climatology Office. 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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Land, Water, and Conservation Division
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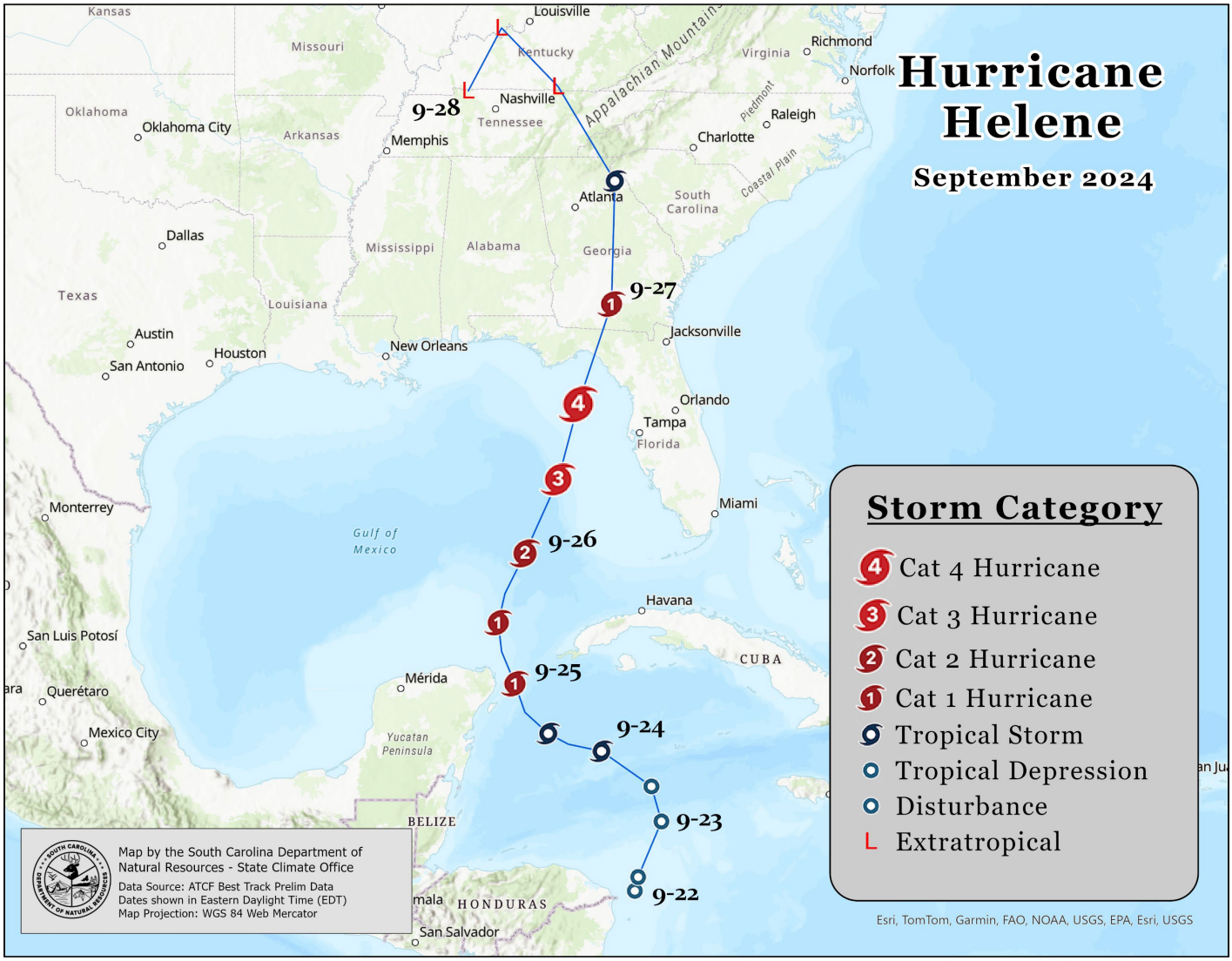
Tropical Cyclone Helene – Track Map

The first advisory issued by the National Hurricane Center on the feature that become Helene came at 11 a.m. EDT on September 23. At the time, it was a broad area of low pressure centered southwest of the Cayman Islands and designated Potential Tropical Cyclone Nine. It became a tropical cyclone the following day at 11 a.m. EDT; with 45 mph winds found by the Hurricane Hunters in the system that morning, it was named Tropical Storm Helene. It drifted to the northwest and strengthened into a hurricane by 11 a.m. EDT on September 25, while centered close to Cancun, Mexico. It then turned to the north-northeast and intensified further, becoming a Category 3 major hurricane at 2:25 p.m. EDT on September 27, then a Category 4 hurricane at 6:20 p.m. Landfall occurred about 10 miles west-southwest of Perry, Florida at 11:10 p.m. on September 26. The hurricane weakened over land through September 27. It weakened to a tropical storm at 5:00 a.m. EDT as it passed east of Macon, Georgia. By 8 a.m., it still packed maximum sustained winds of 60 mph and gusts to hurricane force while the center crossed eastern Georgia. By 2 p.m., Helene weakened to a tropical depression with the center of the storm near the Tennessee-Kentucky state line. At 4 p.m. on September 27, the National Hurricane Center changed the storm's classification to post-tropical. Advisories were issued by the Weather Prediction Center after that, with their last advisory issued at 11 a.m. EDT on September 28.

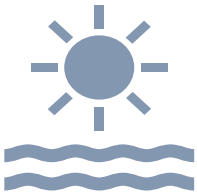


Tropical Cyclone Helene – Overview

Highest Rainfall Total:

19.69” at Jocassee 8 WNW (Sep 26 – 29)*

**Third-highest rainfall total from a Tropical Cyclone and its remnants since 1956*



New Record River Crests:

20.26 ft. at Saluda River above Old Easley Road on Sep 28
29.48 ft. at Broad River at Alston on Sep 29
16.19 ft. at Reedy River at Hudson Street on Sep 27

Confirmed Tornadoes: 21

Worst tropical cyclone tornado outbreak in SC since 2004 (Frances, 46)
Worst tornado outbreak in SC since April 13, 2020 (28)
EF-U: 1
EF-0: 15
EF-1: 5

Highest Recorded Wind Gust:

77 mph at the Fort Lindley historical site in Laurens County on September 27

Storm Surge

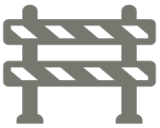
No notable surge; however, the Charleston Harbor Tide Gauge reached 8.02 ft. MLLW

Tropical Cyclone Helene – Overview

This information was provided by the South Carolina Emergency Management Division and is a preliminary dissemination of information on the impacts of Tropical Cyclone Helene across South Carolina.

Peak Power Outages: 1,358,000 customers

**More than Florida, Georgia, or North Carolina*



Peak Number of Road Closures: 912

Regulated Dams Breached or Failed: 0

Homes with Major Damage or Destroyed:
2,531 (as of Oct. 14, 2024)

Homes with Minor or Moderate Damage:
2,364 (as of Oct. 14, 2024)

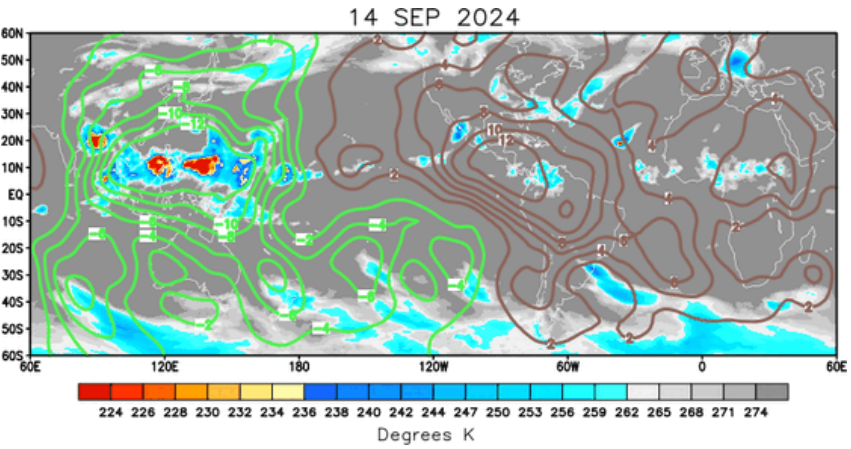
Timber and Forest Damage:
$194 million

Shelters Opened: 22
Peak Occupancy: 142 people

Tropical Cyclone Helene – Synoptic Analysis

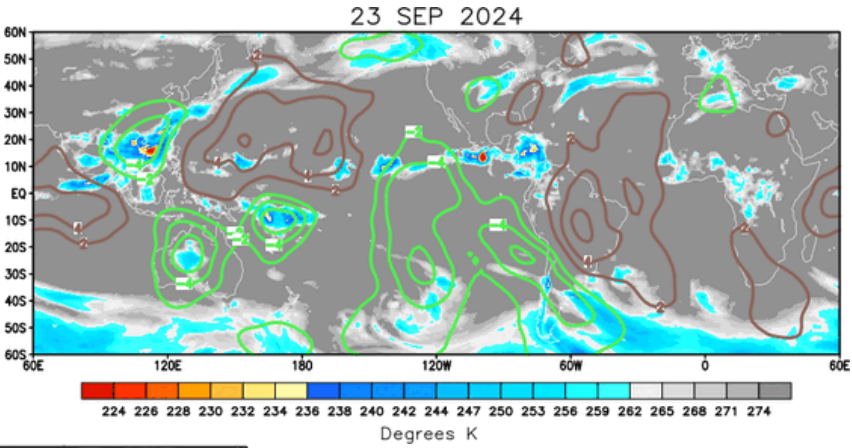
The story of Helene's development and eventual impacts on South Carolina and its neighbors begins days before the storm formed. In the wake of Hurricane Debby's rampage through the East Coast states, the Atlantic Basin entered a stretch of tranquil weather with no tropical cyclone developments.

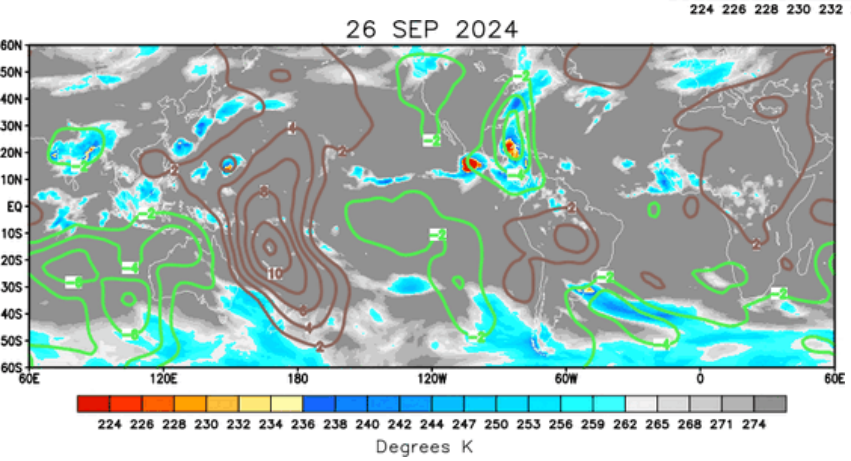
The active period that ended with Debby and Ernesto's formation in early August resulted from conditions that enhanced convection associated with the Madden-Julian Oscillation (MJO) being over the Atlantic tropics during early August. A shift in the MJO brought conditions that suppressed convection over the Atlantic tropics around August 15. The suppressed conditions held on for weeks as the MJO became a standing wave. Only two Atlantic storms formed during this time: Hurricane Francine, a Category 2 hurricane at its peak that impacted the lower Mississippi and Tennessee River Valleys, and Tropical Storm Gordon, which remained weak over the eastern Atlantic Ocean.



An analysis of velocity potential anomaly at the 200 hPa level is the most common method used to track the MJO. On September 14, this analysis indicated converging air at this level (indicated by the brown contours) over most of the Western Hemisphere. Convergence at this level, near the top of the troposphere, will result in generally sinking air over areas below, which suppresses thunderstorm and tropical cyclone formation.

By September 23, a velocity potential anomaly analysis indicated an increase in divergence at the 200 hPa level over much of the Atlantic Basin. Divergence at this level will result in rising air in areas below, leading to a favorable environment for thunderstorms and improves the odds of tropical cyclone development.

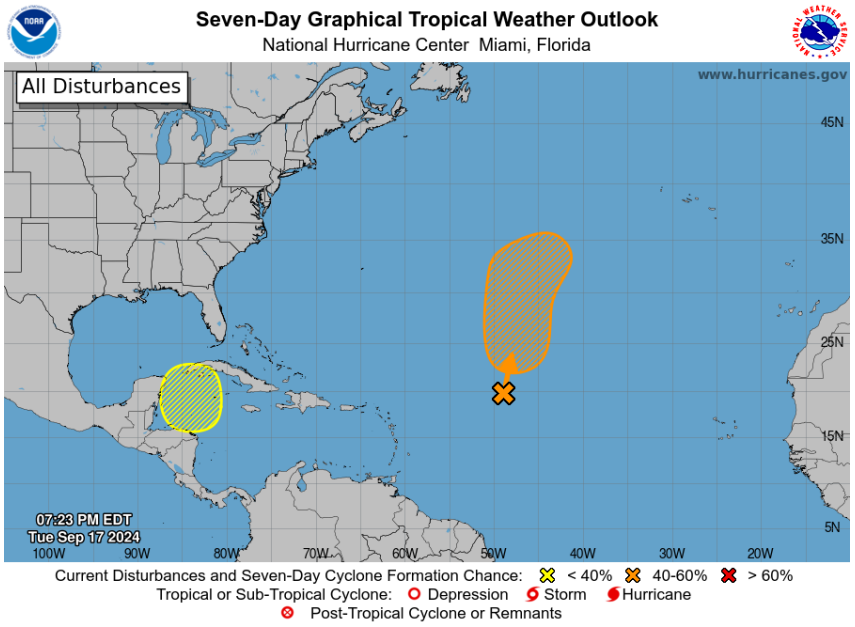




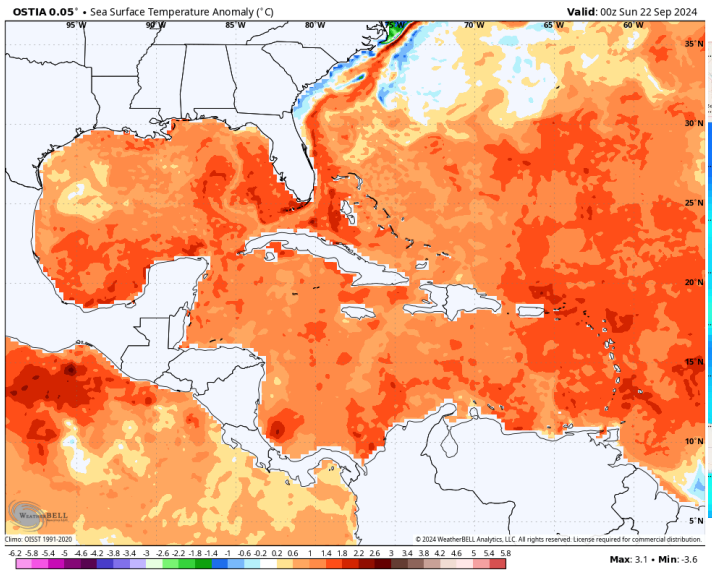
MJO-related conditions became increasingly favorable over the Western Caribbean Sea and Gulf of Mexico as Helene developed and started moving northward, which likely aided in the storm's steady intensification while crossing the Gulf of Mexico.

Tropical Cyclone Helene – Synoptic Analysis

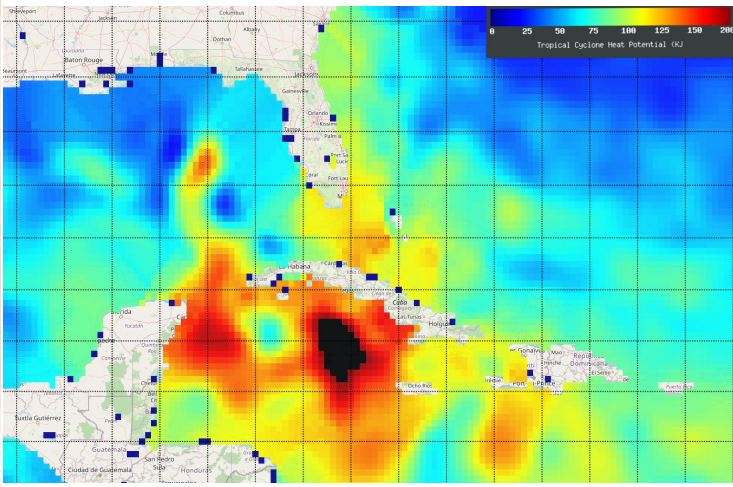
The MJO's convectively enhanced phase returned to the Atlantic Basin at the end of September, and with it came a spurt of activity to the basin that began with Helene's formation. Well before the storm formed, computer model forecasts began to show the potential for a tropical cyclone to form in the vicinity of the Yucatan Peninsula. The National Hurricane Center (NHC) first noted the potential for a storm to form in this area in their Seven-Day Tropical Weather Outlook product issued at 8 p.m. EDT on Tuesday, September 17.



Concern for potential impacts in the southeastern U. S. was high as NHC monitored the northwestern Caribbean Sea. In addition to the computer models showing that a tropical cyclone could form, sea surface temperatures were much warmer than average over the area of concern and over the eastern Gulf of Mexico, where computer models indicated a storm would eventually track. Sea surface temperatures were generally 84-88°F along the forecast storm track. Also, simmering waters of at least 80° were present to significant depth over those areas, so ocean heat content was high over most of the expected storm track.



A plot of sea surface temperature anomalies from September 23, 2024, shows that waters were 2-4°F warmer than average for the date over the eastern Gulf of Mexico and northwestern Caribbean Sea.



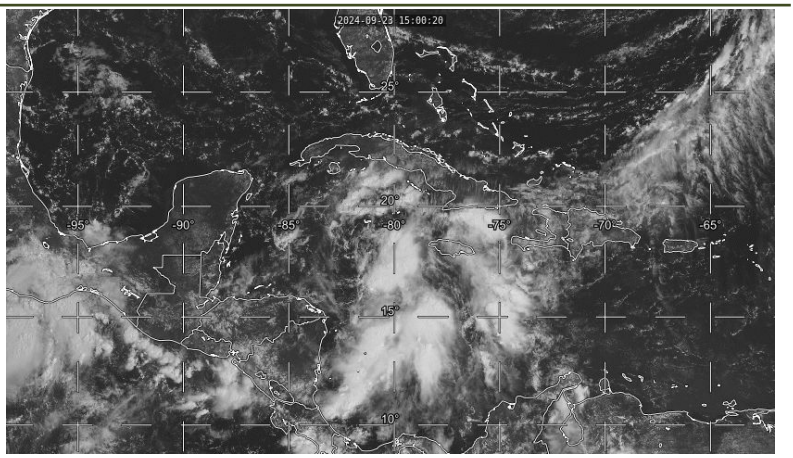
A plot of ocean heat content values from September 23, 2024, shows that the heat energy content of the waters of the eastern Gulf of Mexico and northwestern Caribbean Sea were extremely high.

Tropical Cyclone Helene – Synoptic Analysis

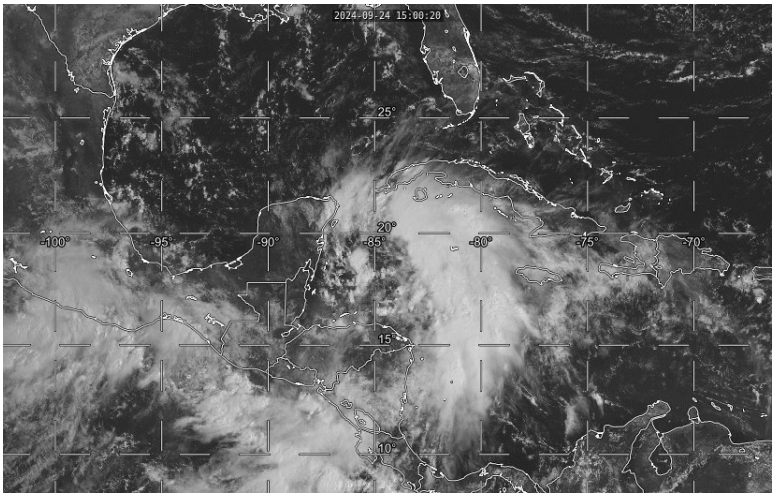
Helene's development began as Central American Gyre formed over the western Caribbean Sea and parts of Honduras, Nicaragua, El Salvador, Costa Rica, and Panama on September 20. A Central American Gyre is a broad area of low pressure that occasionally forms over Central America, most commonly during the late spring and early fall. Occasionally, small tropical cyclones form on the periphery of a Central American Gyre in both the Atlantic and Pacific Oceans. Sometimes, the entire feature wanders over the Gulf of Mexico, Caribbean Sea or Pacific Ocean and becomes a large tropical cyclone, as was the case with Helene.

By September 23, there was enough confidence that a tropical cyclone would form that NHC meteorologists began issuing advisories on the system. It did not meet the criteria to be classified as a tropical cyclone at the time as it lacked a surface circulation and persistent thunderstorms near its center. As a result, the feature was called Potential Tropical Cyclone Nine. Over the following 24 hours, it became a tropical cyclone while sitting over the simmering waters of the northwestern Caribbean Sea. NHC declared it a tropical cyclone at 11 a.m. EDT on September 24, 2024, and named it Tropical Storm Helene.

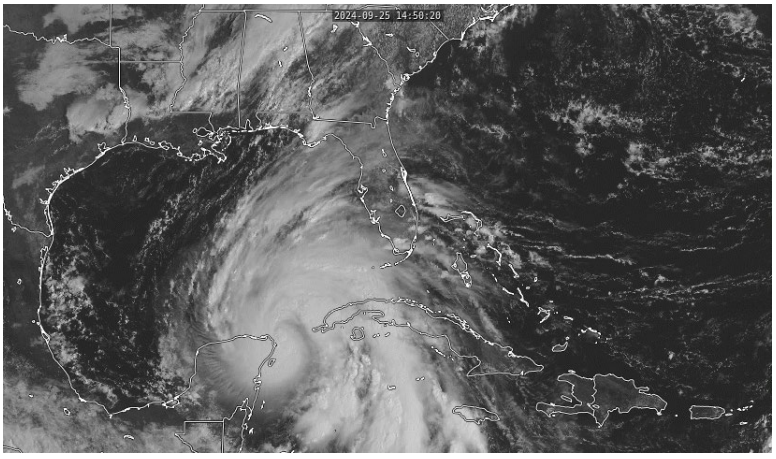
Helene steadily gained strength over the following 24 hours as its structure improved, and thunderstorms became better organized around its center. Interaction with the land masses of the Yucatan Peninsula and western Cuba only marginally slowed the intensification process because of the high heat content of seawater in the region.



A visible satellite image from 11 a.m. EDT on September 23, 2024, shows the poor structure of Potential Tropical Cyclone Nine at the time.



By 11 a.m. on September 23, sufficient thunderstorm activity clustered around the circulation center.



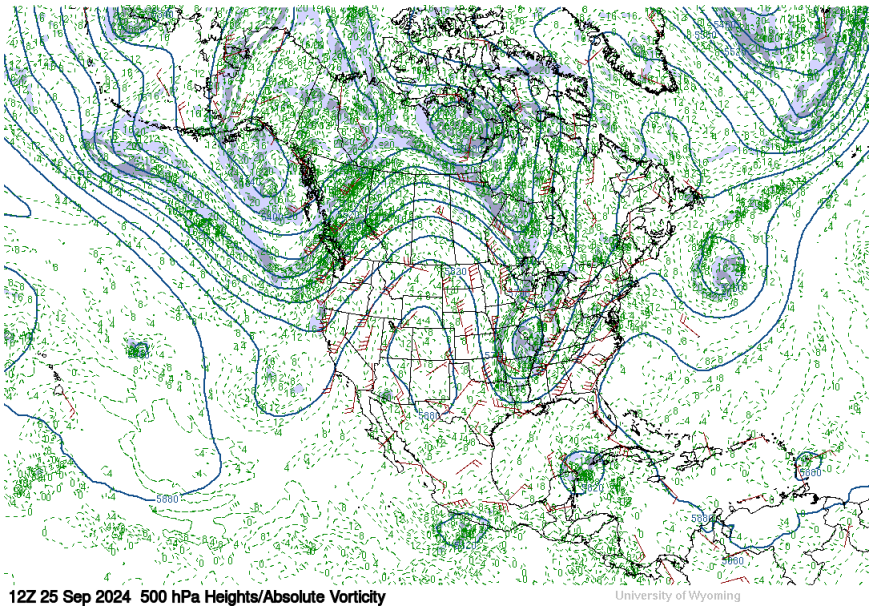
Helene became a hurricane at 11 a.m. on September 25.

Image Source: University of Wisconsin RealEarth

Tropical Cyclone Helene – Synoptic Analysis

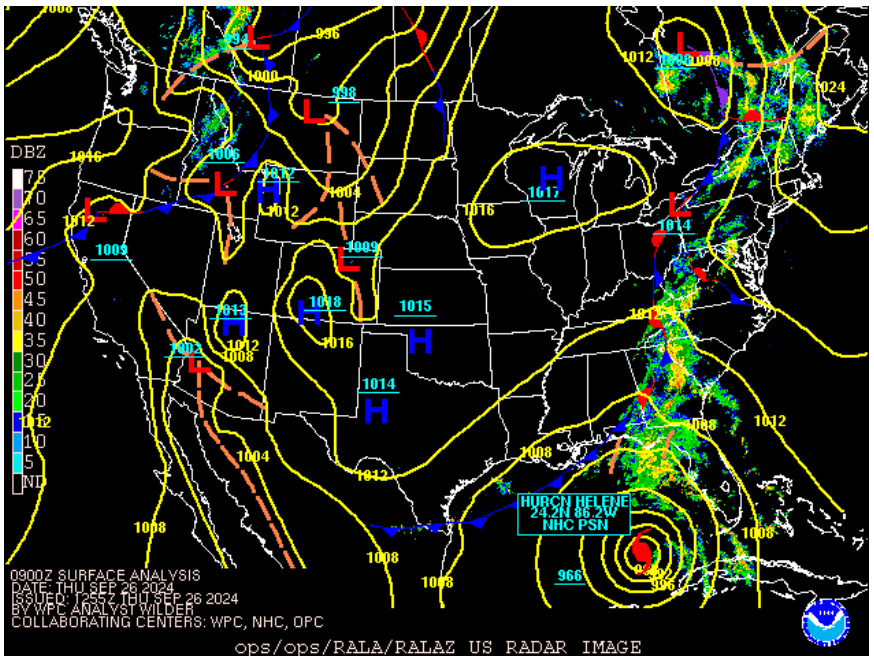
Meanwhile, the weather pattern across eastern North America was becoming favorable for Helene to track toward the Florida Panhandle and the Carolinas. An upper-level trough formed over the Mississippi River Valley on September 23-24 and quickly separated from the main jet stream flow to the north. The resulting upper-level low remained a persistent sprawling feature over the eastern United States for several days. It was primarily responsible for steering Helene northward into and through the eastern Gulf of Mexico, and it eventually captured Helene's remnants. More importantly, a cold front associated with the upper trough moving through the eastern part of North America became stationary over the Appalachian Mountains as the trough split away from the jet stream to the north.

The stationary front was in an environment containing tropical moisture streaming northward from Helene and diffluent flow at the upper levels to the east of the upper trough and developing closed low. This situation was ideal for generating heavy rainfall, and an extreme rainfall event occurred over western North Carolina, Upstate South Carolina and vicinity on September 26. This led to flash flooding and brought rivers over the area above their flood stage ahead of Helene's rain on September 27. The stage was set for historic flooding once Helene moved through.



An analysis of the 500 hPa level (near 18,500 feet) from 1200 UTC on September 25, 2024, indicates an upper trough over the middle Mississippi Valley that was becoming cut off from the main jet stream along the Canadian Border.

Image Source: University of Wyoming



A surface weather analysis from the Weather Prediction Center at 5 a.m. EDT on September 26, 2024, shows a stationary front draped across the western Carolinas; the radar overlay indicates that heavy rain was falling at the time.

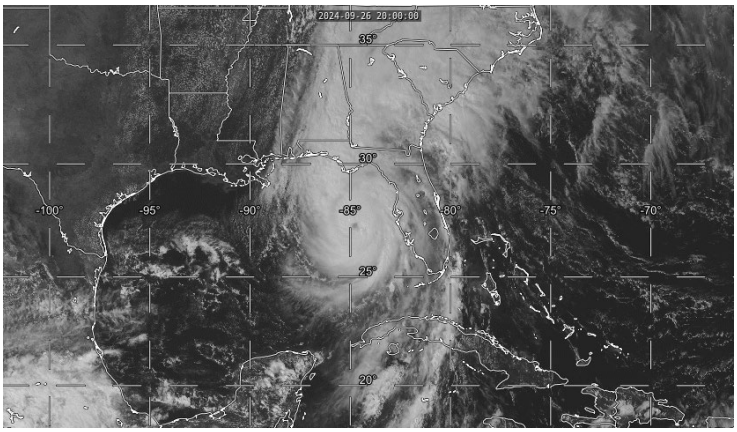
Tropical Cyclone Helene – Synoptic Analysis

Helene steadily intensified as it moved northward into and through the eastern Gulf of Mexico across warm waters. The influence of the upper trough over the southeastern states improved the environment for Helene, as the diffluent winds aloft allowed for better outflow for the hurricane. The trough also strengthened the steering flow around Helene, which caused it to accelerate northward.

Strengthening continued; it was packing 105 mph sustained winds by 11 a.m. EDT on September 26, then winds of 120 mph by 2:25 p.m., making Helene a Category 3 major hurricane. Its winds peaked at 140 mph hours before landfall in Florida, making it a Category 4 hurricane. However, it was later determined that the Stepped Frequency Microwave Radiometer, one of the instruments that the Hurricane Hunters use to estimate surface wind speed, gave inflated readings. The peak wind speed could be adjusted downward in the routine postseason review of Helene.

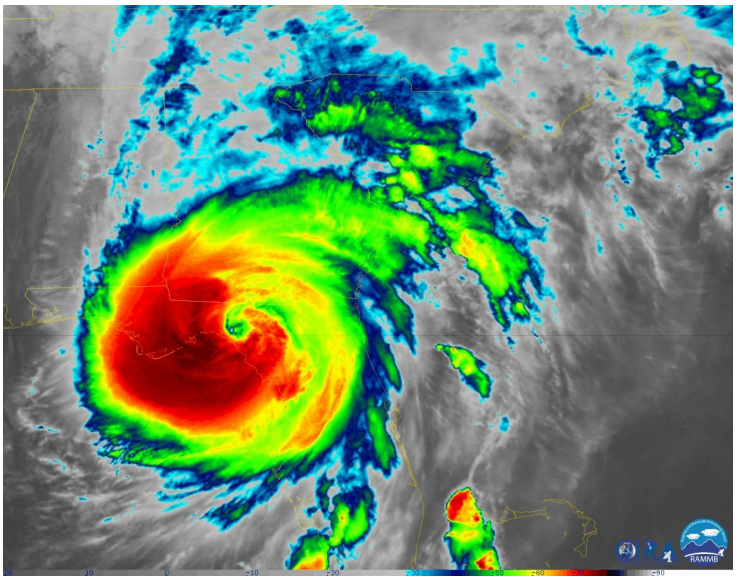
Landfall occurred at about 11:10 p.m., slightly east of the mouth of the Aucilla River in Apalachee Bay. From there, the hurricane slowly weakened as it moved north through the Florida Panhandle and into southern Georgia.

The same conditions that led to the extreme rainfall over the western Carolinas also contributed to Helene's winds only slowly weakening as it moved inland. The weather pattern was reminiscent of when Hurricane Hugo made landfall in South Carolina in 1989, with an upper-level low to the west of the storm generating diffluent flow aloft to its east over the hurricane, allowing for better ventilation of the hurricane's outflow at the upper levels. Another reason the winds remained so strong far inland was its fast forward speed; Helene was moving at 26 mph across southern Georgia and accelerated further as it moved northward.



A visible satellite image from 4 p.m. EDT on September 26, 2024, shows Helene approaching peak intensity around five hours before landfall.

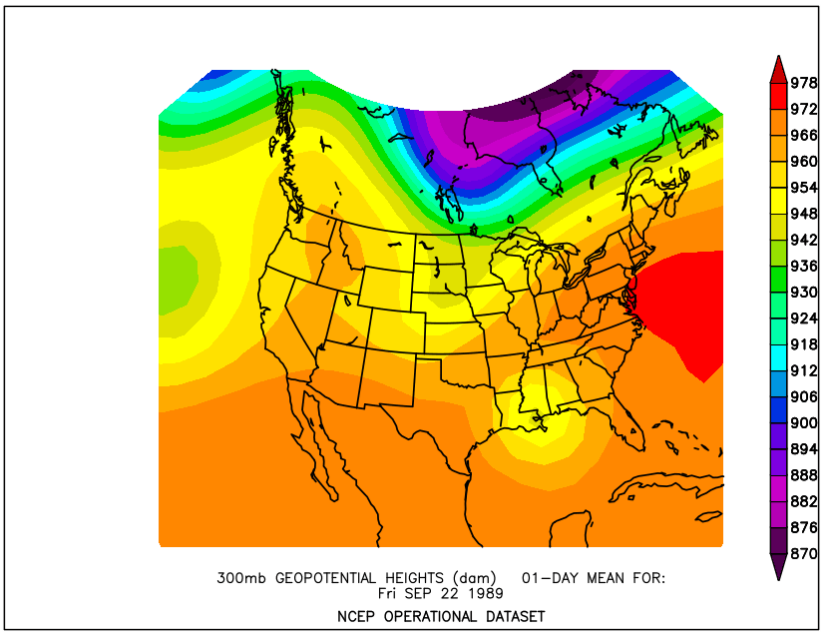
Image Source: University of Wisconsin RealEarth

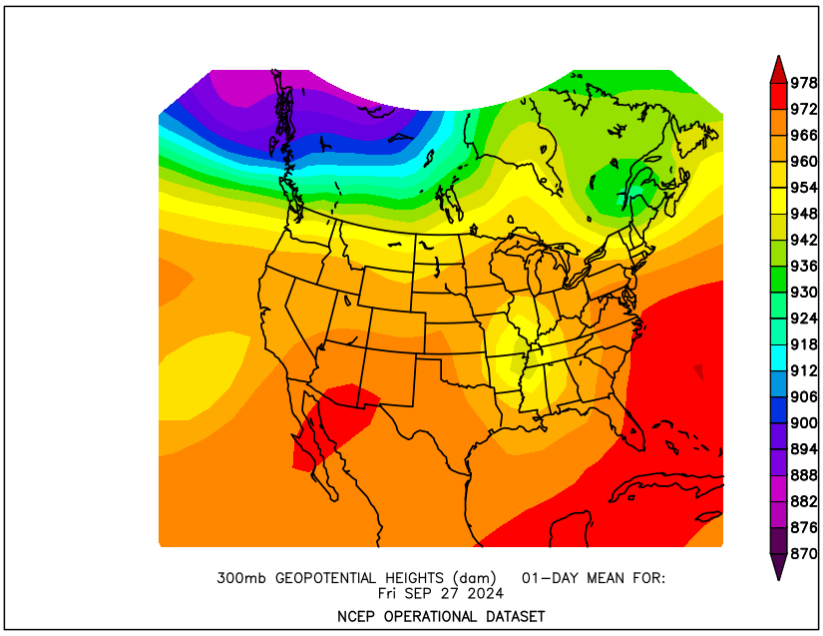


This infrared satellite image from 11:11 p.m. EDT on September 26 shows Helene as it made landfall in Florida. In this image, it appears that the eye is well inland, because vertical shear caused the eye to tilt northward with height; the surface center was right along the Florida coastline at this moment.

Image Source: SLIDER by RAMMB

Tropical Cyclone Helene – Synoptic Analysis



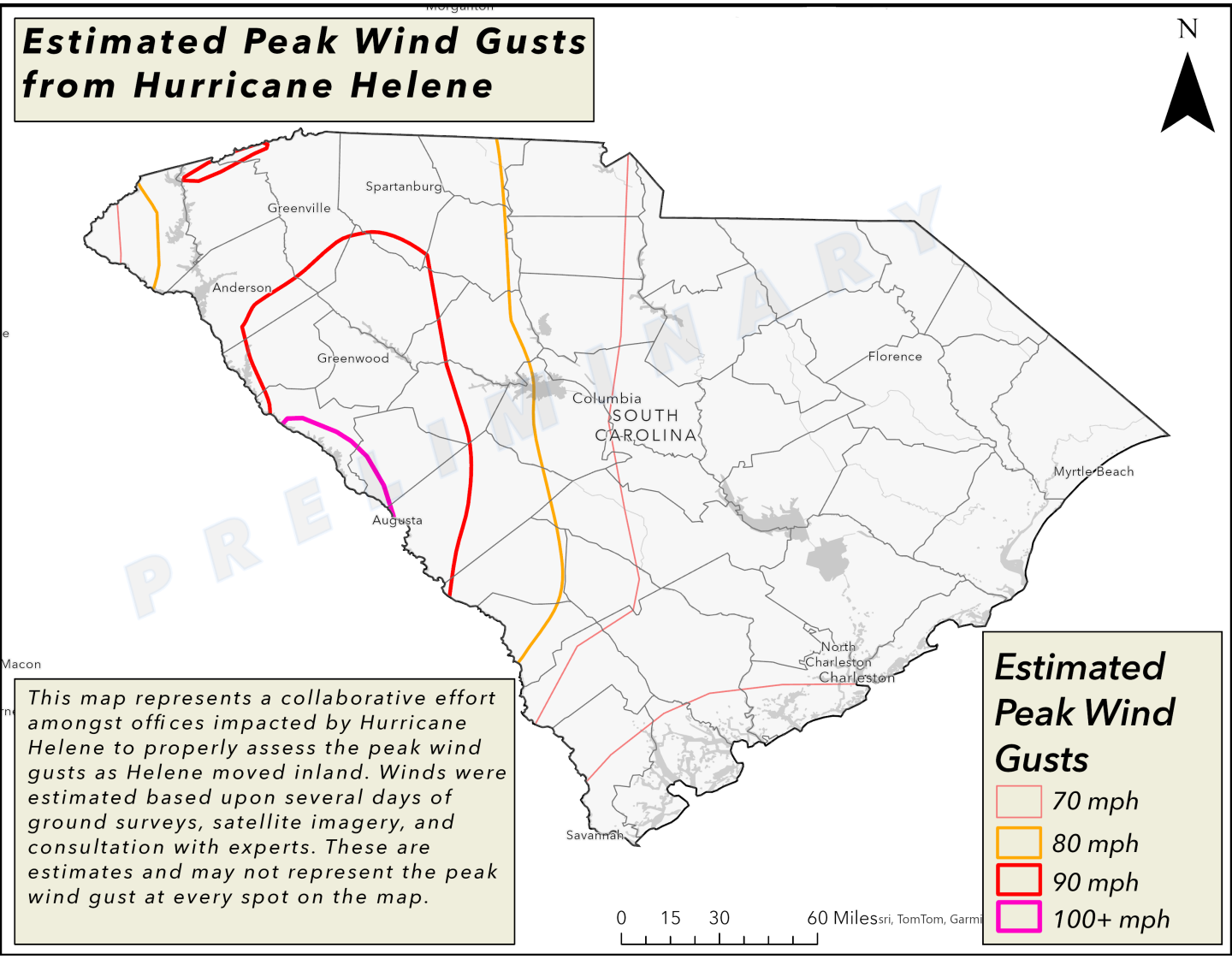


These images compare the upper-air weather pattern from the day that Hugo made landfall in South Carolina (September 22, 1989, top) to the day Helene made landfall in Florida (bottom). In both cases, a closed low at the 300 hPa level resulted in upper-level diffluence over the landfalling hurricane, which allowed for better storm outflow aloft, helping it maintain its intensity further inland. Also, in both cases, the closed low to the west resulted in a steering flow for the hurricane that accelerated it northward, meaning that the hurricane's high winds would penetrate further inland than typically seen.

Image Source: NOAA Physical Sciences Laboratory Atmospheric Variables Plotting Page

NHC's advisories indicated that Helene weakened to a tropical storm at 5 a.m. EDT as the center was passing about 37 miles east of Macon, Georgia, and that it remained a tropical storm while moving through Georgia, far southwestern North Carolina, and East Tennessee. While the maximum sustained winds were thought below hurricane force, much higher gusts above the 74-mph hurricane threshold occurred over northeastern Georgia, the Central Savannah River Area, Upstate South Carolina, and western North Carolina. A storm survey conducted by the Columbia National Weather Service office estimated that wind gusts of around 100 mph occurred locally along the Savannah River northwest of Augusta, including parts of McCormick and Edgefield Counties, based on tree damage in the area and observations from official and unofficial weather stations in the region. The survey also estimated that 70 mph gusts occurred as far east as the Columbia metropolitan area.

Tropical Cyclone Helene – Synoptic Analysis

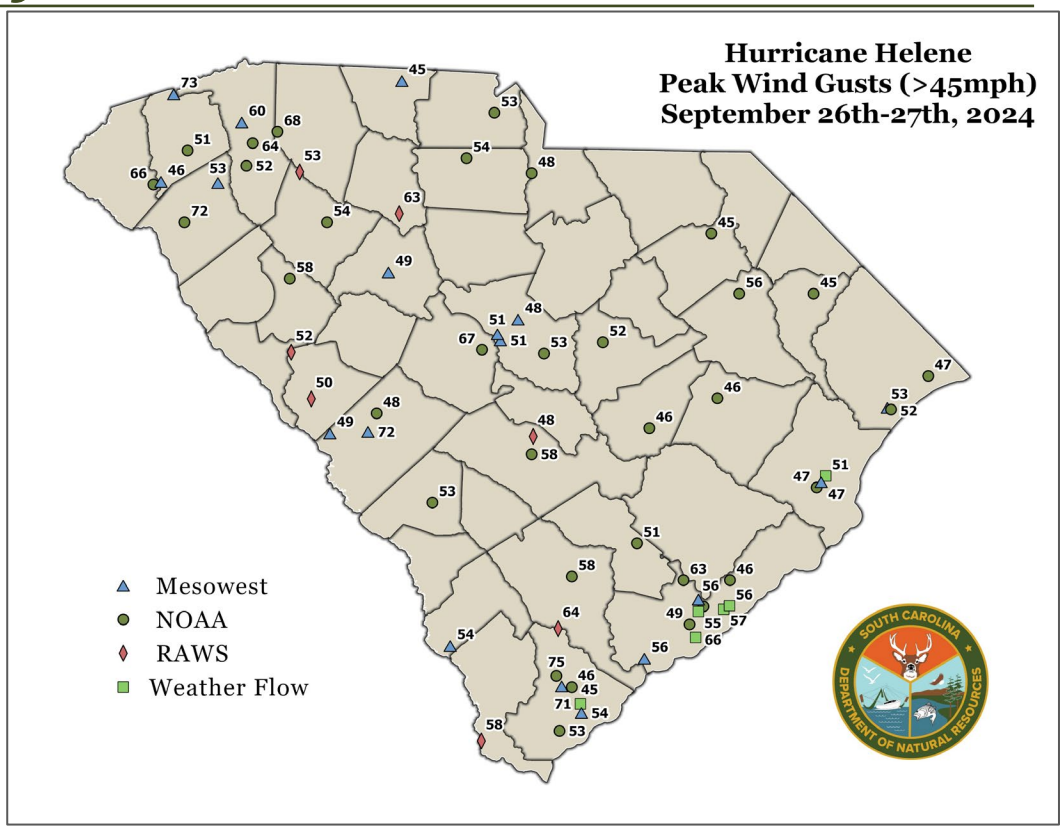


This map generated by the National Weather Service summarizes the results of their surveys of storm damage. The survey found evidence of peak gusts of 100 mph or higher from the damage over parts of McCormick and Edgefield Counties, and estimated gusts of at least 70 mph occurred over much of the Palmetto State.

Helene's track curved toward the west as it moved through Tennessee and Kentucky, as it weakened to a tropical depression and eventually became an extratropical storm system. Eventually, it merged with the upper-level low to the west. This combined system wandered over Tennessee and Kentucky through October 1, but only stray light showers reached Upstate South Carolina during this time. The merged system moved away to the east later October 1 into October 2.

Tropical Cyclone Helene – Peak Wind Gusts

Helene's wind field extended over 200 miles from the center of circulation, nearly 400 miles wide. Tropical storm-force gusts were reported across much of the state, including most of the Midlands and Lowcountry, a 75-mph hurricane-strength gust occurred at Beaufort MCAS. Many Upstate stations reported gusts over 60 mph. Additional peak wind gusts can be found in a table at the end of the report.



Also worth mentioning is that an 82-mph gust occurred at Augusta Regional Airport before it lost power; its weather instruments are about a mile west of the Savannah River on the Georgia side.

Select Peak Measured Wind Gusts From Helene

Location	County	Peak Gust (mph)	Time (EDT)	Provider
Fort Lindley	Laurens	77	6:55 AM	Private Station
Beaufort MCAS	Beaufort	75	4:20 AM	NOAA/ASOS
Sassafras Mountain	Pickens	73	6:55 AM	NC-ECONET
Anderson Regional Airport	Anderson	72	6:39 AM	NOAA/ASOS
ETV Aiken	Aiken	71	7:10 AM	MESOWEST
Beaufort	Beaufort	71	5:06 AM	WEATHERFLOW
Greenville-Spartanburg Int'l	Spartanburg	68	7:39 AM	NOAA/ASOS
Columbia Metropolitan AP	Lexington	67	6:09 AM	NOAA/ASOS
Clemson/Oconee Co, AP	Oconee	66	6:34 AM	NOAA/AWOS
Charleston Int'l Airport	Charleston	63	4:30 AM	NOAA/ASOS
Greenwood County Airport	Greenwood	58	6:14 AM	NOAA/ASOS
Florence Regional Airport	Florence	55	6:37 AM	NOAA/ASOS
Rock Hill/York Co. Airport	York	53	7:41 AM	NOAA/ASOS

Tropical Cyclone Helene – Wind Impact Photos

Tree damage in Pickens County on 10/03/2024.
Courtesy of M. Cox-Lamm, SCDNR

Helene's wind downed numerous trees at the SC National Guard's Clarks Hill Training Center on Lake Thurmond
SCARNG Photo

Tropical Cyclone Helene – Wind Impact Photos

Wind damage from Helene in Edgefield along Columbia Road.
Photo by SC Army National Guard on October 2

An aerial view of damage to a metal roof in rural Saluda County caused by Helene's winds.
Drone image by SC Army National Guard on October 3.

Tropical Cyclone Helene – Wind Impact Photos

Wind gusts estimated at over 90 mph caused this tree damage at a residence in the Mealing Heights neighborhood of North Augusta.
National Weather Service photo

Tree damage on Reynolds Avenue in Greenwood had been cleared but the power lines had not yet been addressed when this photo was taken on October 4.
Photo by SC Army National Guard.

Tropical Cyclone Helene – Wind Impact Photos

Crewmembers ponder their strategy to remove this tree down on a road on the south end of Greenville; the tree would flip onto a house if cut, so a crane was called in to pull the tree to a safer area.
SCARNG photo

A crew works to remove a cluster of mangled trees from Smith Street in Anderson.
SCARNG Photo

Tropical Cyclone Helene – Wind Impact Photos

An aerial view of the area around Lake Jocassee shows the extent of tree damage in this part of Oconee and Pickens Counties. The National Weather Service estimates peak wind gusts of 80-90 mph in this area. SCDNR photo by Ken Forrester

Tropical Cyclone Helene – Wind Impact Photos

High winds downed large limbs onto this mobile home in Saluda County southeast of Saluda.
SC State Guard drone photo

A tree downed by Helene's winds caused major damage to this house in Columbia's Shandon neighborhood.
SCDNR photo by Shannon Bobertz

Downed tree limbs and power lines in the wake of Helene littered this street in Taylors.
SCARNG photo

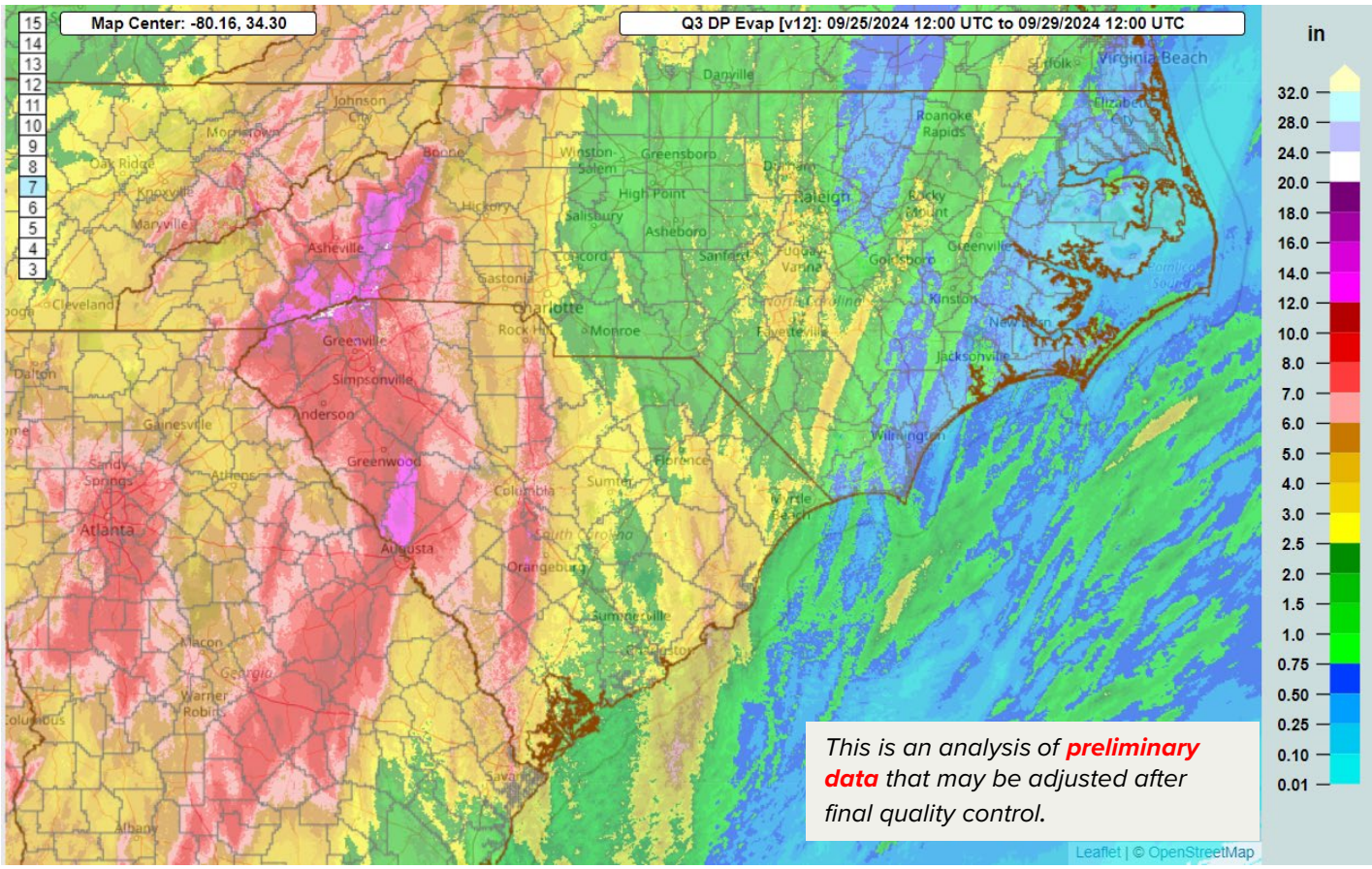
Tropical Cyclone Helene – Rainfall Totals

Predecessor rainfall and heavy rains from Helene fell across the state on September 25 and 26. Areas north and west of the Interstate 20 and Interstate 77 corridors received six to eighteen inches of rain, with the higher amounts falling north of the Interstate 85 corridor. The National Weather Service station near Jocassee reported a total of 19.69 inches of rain during the event (Sep 25 – 29, 2024). CoCoRaHS observers in Greenville, Oconee, and Pickens County reported over a foot of rain, and one observer near Slater-Marietta recorded 18.12 inches of rain. Portions of the Central Savannah River Area reported close to a foot of rain, and ten inches of rain was recorded on the eastern side of Richland County. Counties along the lower Savannah measured four to six inches from the system, while most locations in the Pee Dee and Lowcountry reported totals of less than four inches of rain.

Three counties set new 24-hour maximum rainfall totals from Helene:

- Edgefield County: 12.53 inches at Edgefield 10.5 N (CoCoRaHS) on Sep. 27, 2024
- Greenwood County: 10.02 inches at Greenwood 3.4 NNW (CoCoRaHS) on Sep. 27, 2024
- Oconee County: 10.59 inches at Jocassee 8 WNW (NWS) on Sep. 27, 2024

The statewide 24-hour maximum rainfall total is 14.80 inches from Hurricane Floyd, measured on Sep. 16, 1999, at Myrtle Beach.



The above image shows the radar-estimated rainfall totals from September 25 – 29, 2024, over portions of North and South Carolina. The pink colors indicate totals over six inches of rain, the purple colors highlight areas that received over twelve inches of rain, and the white pixels near the state line are estimated totals over twenty inches of rain.

Tropical Cyclone Helene – Rainfall Totals

Helene's preliminary peak rainfall in South Carolina of 19.69 inches near Jocassee in Oconee County ranks third among rainfall from tropical cyclones in South Carolina's history. This total ranks behind the 22.02 inches of rain recorded in Moncks Corner (Berkeley County) in August 2024, from Tropical Storm Debby. There is only one other year with two tropical cyclone maximum rainfall totals, which rank in the top ten highest totals: Hermine (September 2016) and Matthew (October 2016).

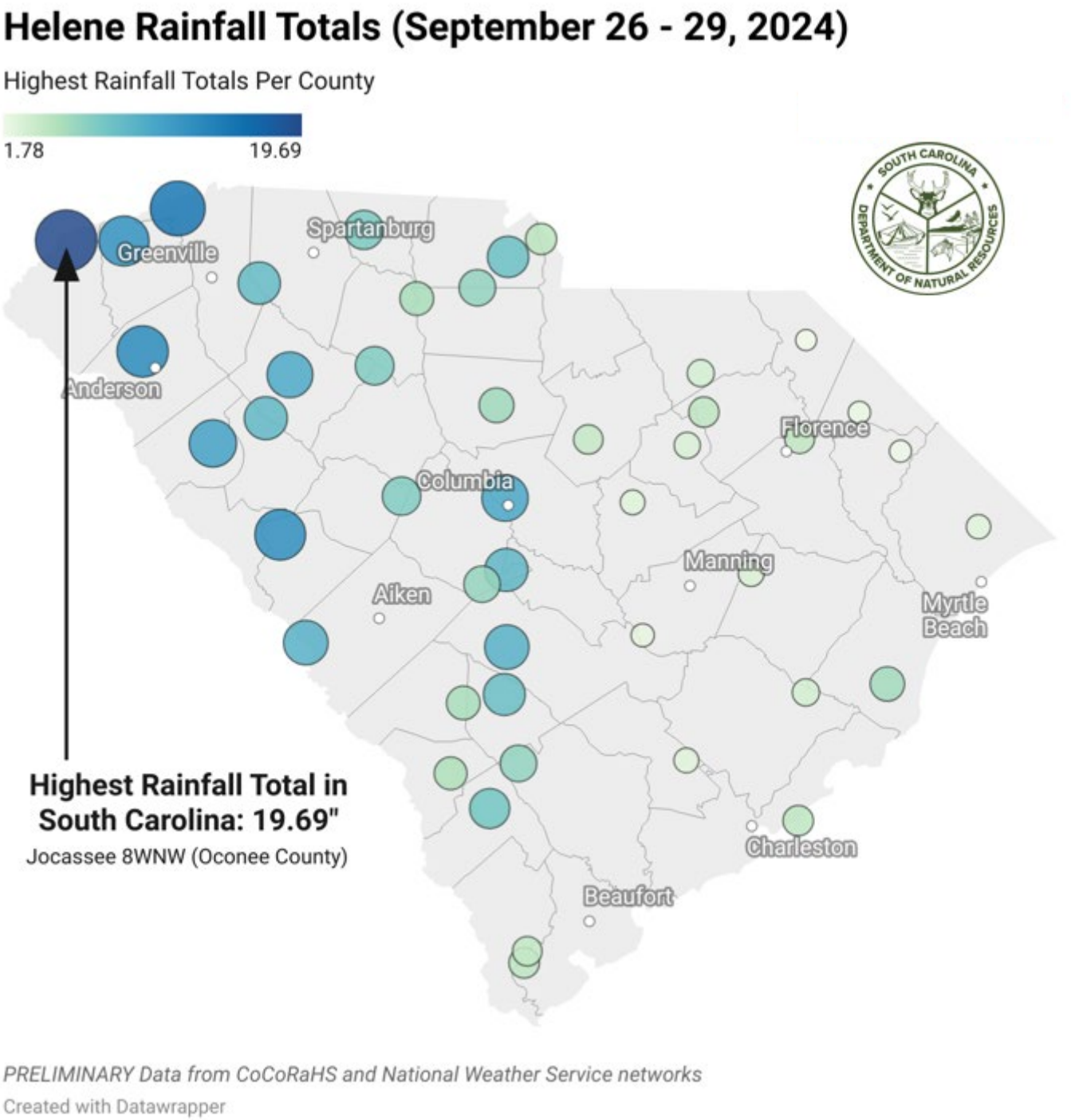
Highest Rainfall Totals in South Carolina From Tropical Cyclones and their Remnants (1956 – 2024)

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**
19.69"	Helene	Sep 26 – 29, 2024	Jocassee 8 WNW
17.45"	Beryl	Aug 13 – 18, 1994	Jocassee 8 WNW
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

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

Rainfall from the October 2015 rainfall and flooding event, while enhanced by the 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 October 1-5, 2015, was 27.19 inches near Mount Pleasant.

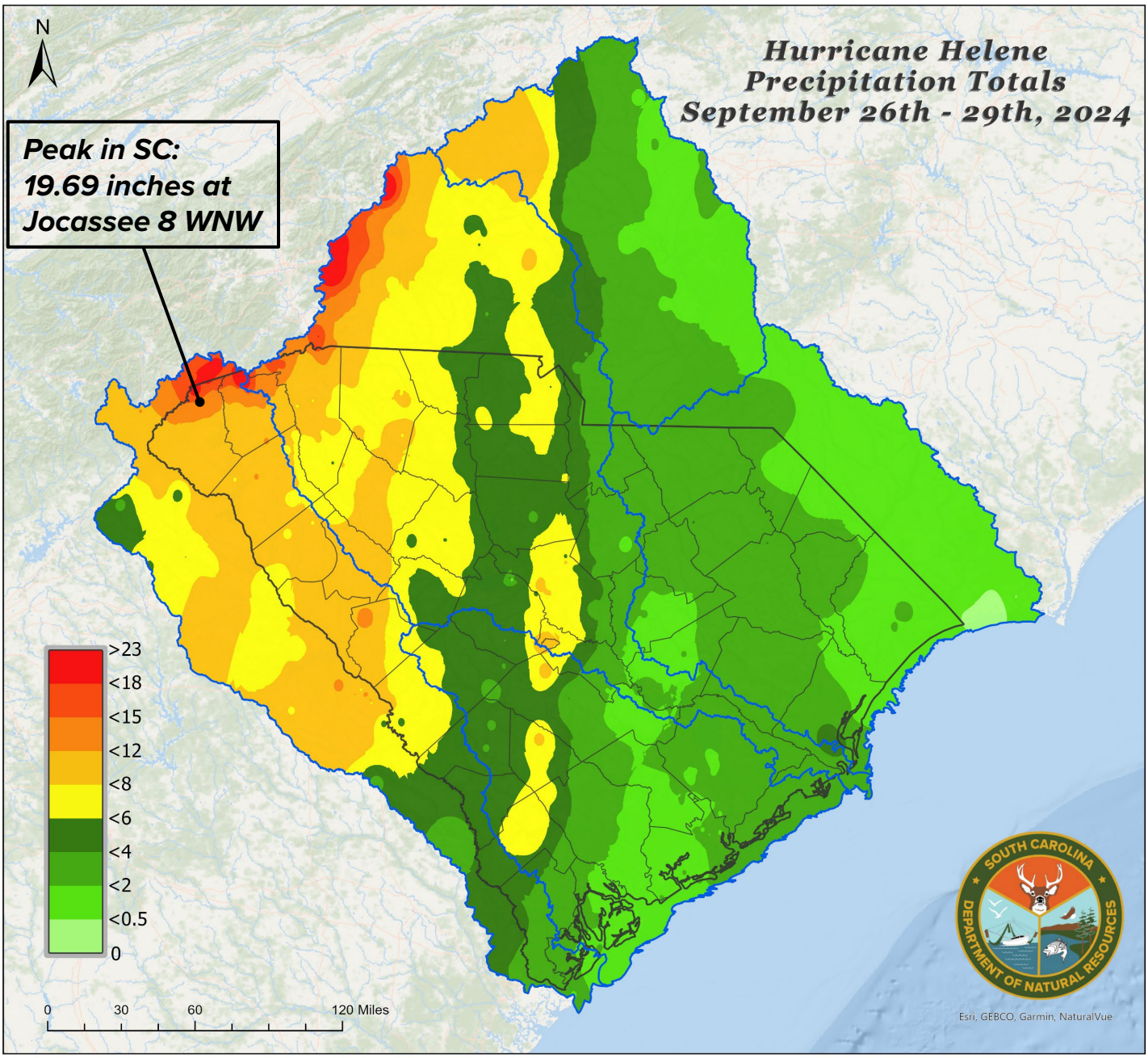
Tropical Cyclone Helene – Rainfall Totals



The data used for this plot was preliminary at the time the plot was generated and there may be slight differences between it and official quality-controlled data. However, the peak rainfall in SC of 19.69" passed quality control scrutiny.

Tropical Cyclone Helene – Rainfall Totals

Historic rainfall occurred in South Carolina and neighboring states from Helene and a cold front that moved into the region and became stationary late on September 25 through September 26. As with Debby only weeks before, the rainfall led to widespread flash flooding, and major river flooding followed the storm. The river flooding in the Upstate was among the worst in the region's history, with a record crest recorded on the Reedy, Saluda and Broad Rivers after Helene's passage. Some other rivers in the state saw a top-five highest river crest.



The data used for this plot was preliminary at the time the plot was generated and there may be slight differences between it and official quality-controlled data. However, the peak rainfall in SC of 19.69" passed quality control scrutiny.

Tropical Cyclone Helene – Rainfall Totals

Highest Rainfall Totals Per County in South Carolina From Tropical Cyclone Helene (September 26 – 29, 2024)

County	Rainfall Total	Station	County	Rainfall Total	Station
Abbeville	11.24”	**Iva 6.4 SSW**	Greenwood	9.56”	**Greenwood 5.0 W**
Aiken	9.87”	N Augusta 2.3 SSE	Hampton	7.80”	**Hampton 0.8 SW**
Allendale	5.03”	**Allendale 1.7 SE**	Horry	2.54”	**Conway 10.4 ENE**
Anderson	13.41” (M)	**Anderson 5.0 NW**	Jasper	3.93”	**Bluffton 7.6 NW**
Bamberg	8.57”	Bamberg	Kershaw	3.90”	Lugoff 2NE
Barnwell	5.30”	Barnwell	Lancaster	4.45”	**Fort Mill 3.3 E**
Beaufort	4.25”	**Beaufort 6.3 WNW**	Laurens	10.49”	**Laurens 1.1 SSW**
Berkeley	3.28”	Jamestown	Lee	3.00”	Bishopville 1.4 ENE
Calhoun	9.25”	Swansea 3.5 NE	Lexington	8.02”	**Chapin 6.0 SSW**
Charleston	4.24”	**Isle of Palms 1.5 ENE**	McCormick	8.26” (M)	**McCormick 4.4 W**
Cherokee	7.44”	**Gaffney 3.5 SW**	Marion	2.00”	Mullins
Chester	6.39” (M)	**Lowrys 3.6 ENE**	Marlboro	1.78”	Bennettsville 1.2 SE
Chesterfield	3.23”	**Hartsville 9.7 NNW**	Newberry	7.23” (M)	**Whitmire 2.3 NW**
Clarendon	2.27”	**Summerton 7.6 SW**	Oconee	19.69”	Jocassee 8 WNW
Colleton	6.41”	**Lodge 3.4 SW**	Orangeburg	8.85”	**North 5.2 E**
Darlington	4.20”	**Hartsville 3.6 WSW**	Pickens	14.48”	Table Rock
Dillon	2.08”	**Latta 0.3 NNE**	Richland	10.76”	**Columbia 2.1 NNW**
Dorchester	2.67” (M)	Summerville 4W	Saluda	7.14” (M)	**Leesville 8.0 N**
Edgefield	13.08”	**McCormick 12.9 E**	Spartanburg	9.30”	**Spartanburg 3.4 ENE**
Fairfield	5.74”	**Winnsboro 0.1 NNE**	Sumter	2.62”	**Dalzell 2.3 W**
Florence	4.07”	**Florence 6.2 NE**	Union	5.34”	Lockhart
Georgetown	5.60” (M)	Georgetown Co Airport	Williamsburg	2.94”	**Kingstree 7.9 NW**
Greenville	16.82”	Caesars Head	York	7.81” (M)	**Tega Cay 1.6 S**

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

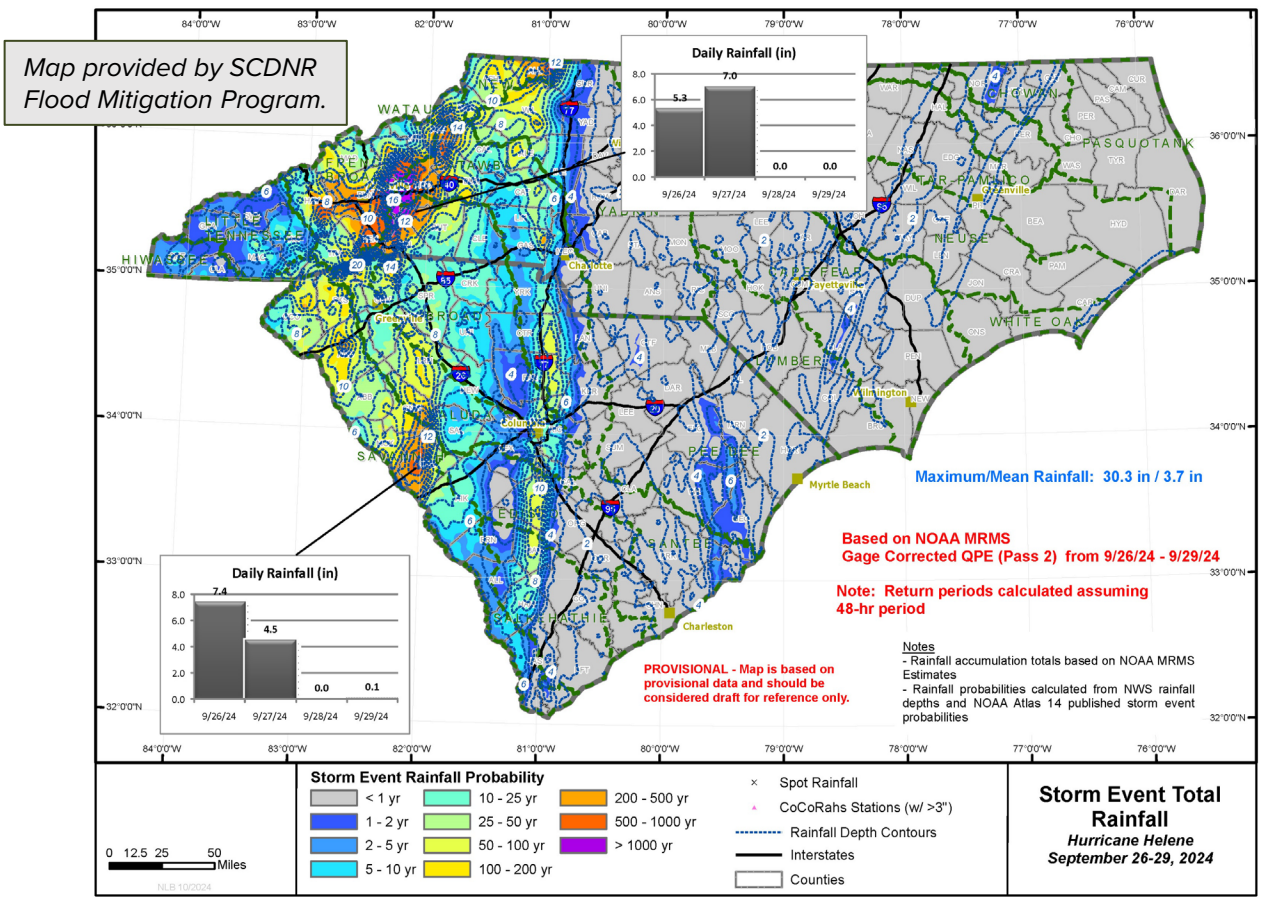
Tropical Cyclone Helene – Rainfall Totals

Select Rainfall Totals in South Carolina From Tropical Cyclone Helene (September 26 – 29, 2024)

Station Name	County	Provider	4-Day Rainfall Totals (inches)	Annual Exceedance Probability (%) 4-Day Event
Jocassee 8 WNW	Oconee	NWS COOP	19.69	0.1
Slater-Marietta 6.4 NW	Greenville	CoCoRaHS	15.48	0.1
Table Rock	Pickens	NWS COOP	14.48	0.2
Anderson 5.0 NW	Anderson	CoCoRaHS	13.41 (M)	0.5
McCormick 12.9 E	Edgefield	CoCoRaHS	13.08	0.5
Columbia 2.1 NNW	Richland	CoCoRaHS	10.76	1
Laurens 1.1 SSW	Laurens	CoCoRaHS	10.49	1

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.

Map provided by SCDNR Flood Mitigation Program.



Tropical Cyclone Helene – River Crests

Helene produced heavy rainfall locally in South Carolina and North Carolina. As a result, the river water levels and flow increased to above-average levels. The stream gauge readings in the Upper Savannah, Saluda, and Broad River basins specifically observed and recorded this. These same rivers had been experiencing low flows due to the persistent dry conditions. After the storm, Dominion Energy released approximately 18,000 cfs (cubic feet per second, one cubic foot is about 7.5 gallons) from the Lake Murray Dam. Santee Cooper released 130,000 cfs (nearly 1 million gallons of water per second) from Lake Marion.

River heights per the gauges rose into the moderate and major flood stage, especially in the Saluda and Broad River basins. Some of Helene's rain fell in portions of the upper Yadkin-Pee Dee watershed, causing some of the rivers in the Pee Dee region to rise into moderate flood stage a week after the storm. Below are some of the highest river crests observed in South Carolina, including three preliminary new records.

Select River Crests After Helene

River Gauge	Helene Peak Crest (ft.)	Record Crest Before Helene (ft.)	Record Crest Date/Event
Saluda River above Old Easley Road	**20.26**	19.38	10/07/1949
Reedy River at Hudson (Greenville)	**16.19 P**	13.62	02/07/2020
Broad River near Boiling Springs, NC	23.43 (2)	24.30	08/16/1928
Broad River at Alston, SC	**29.48**	29.02	06/07/1903
Wateree River at Wateree Dam	105.97 (3)	107.00	10/03/1989
Congaree River at Columbia	30.58 (9)	39.80	08/27/1908
Santee River at Jamestown	23.94 (5)	33.00	07/26/1916

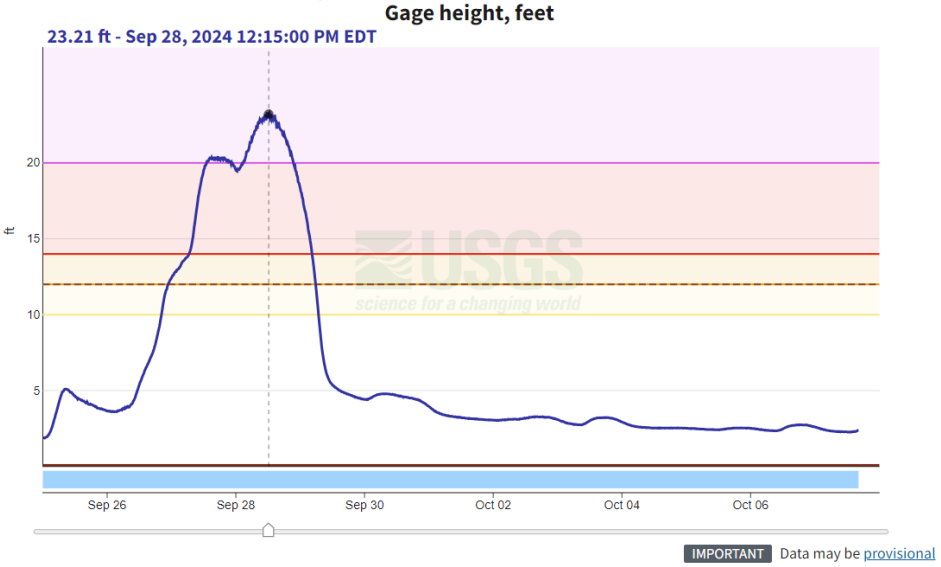
Bold text indicates New Record Crest From Helene
P indicates preliminary, non-quality-controlled data
Rank of non-record crests in (parenthesis)

The following pages show the hydrographs from some of the rivers that flow through the state, which were impacted by Helene's heavy rainfall. These hydrographs start on September 25, 2024, and end on the evening of October 7, 2024. Each one reflects the river height stage levels at each location. The heights along most rivers across the Upstate and Midlands have dropped below the action stage.

Tropical Cyclone Helene – River Crests

Disclaimer: The hydrographs provided below depict the height of the river at a specific location. They do not indicate the level of inundation and impacts of the river in the surrounding areas.

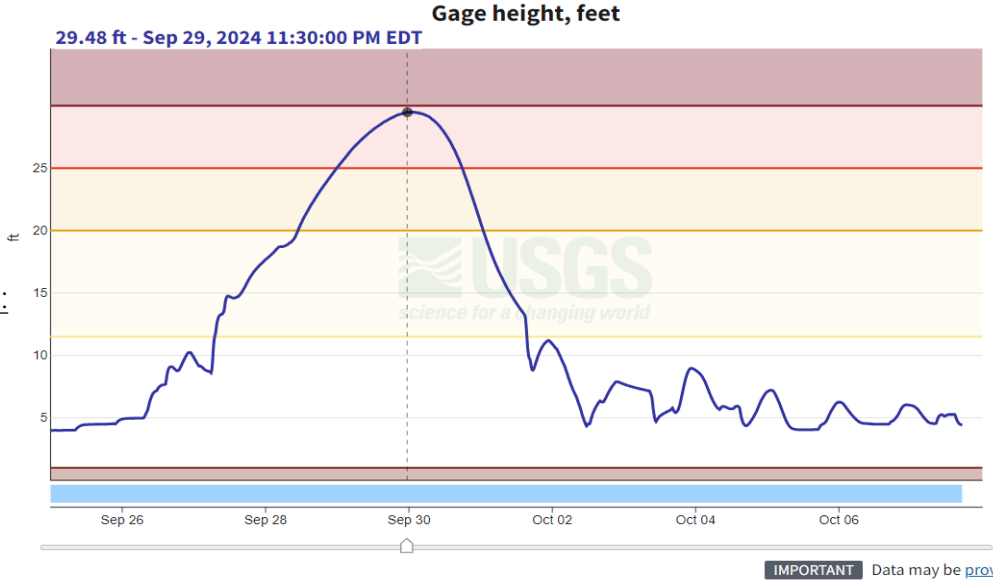
Broad River Near Boiling Springs, NC - 02151500



Helene Crest: 23.43 ft.
Record Crest: 24.30 ft. on 08/16/1928

Flood Stage Height (color):
Major: 20 ft. (Purple)
Moderate: 14 ft. (Red)
Minor: 12 ft. (Orange)
Action: 10 ft. (Yellow)

Broad River at Alston, SC - 02161000



Helene Crest: 29.48 ft.

Previous Record Crest:
19.32 ft. on 10/07/1949

Flood Stage Height (color):
Major: 30 ft. (Purple/Maroon)
Moderate: 25 ft. (Red)
Minor: 20 ft. (Orange)
Action: 11.5 ft. (Yellow)

Tropical Cyclone Helene – River Crests

Disclaimer: The hydrographs provided below depict the height of the river at a specific location. They do not indicate the level of inundation and impacts of the river in the surrounding areas.

Hydrograph Not Available for
Reedy River at Hudson Street

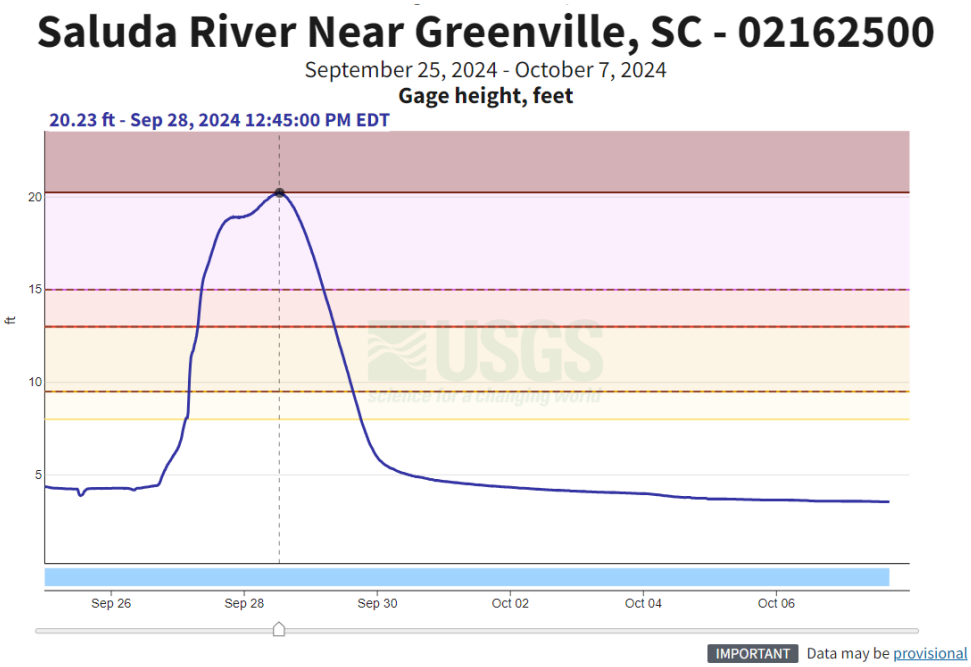
Helene Crest: 16.19 ft.
Previous Record Crest:
13.62 ft. on 02/07/2020

Flood Stage Height (color):
Major: 20 ft. (Purple)
Moderate: 14 ft. (Red)
Minor: 12 ft. (Orange)
Action: 10 ft. (Yellow)

Helene Crest: 20.26 ft.

Previous Record Crest:
19.32 ft. on 10/07/1949

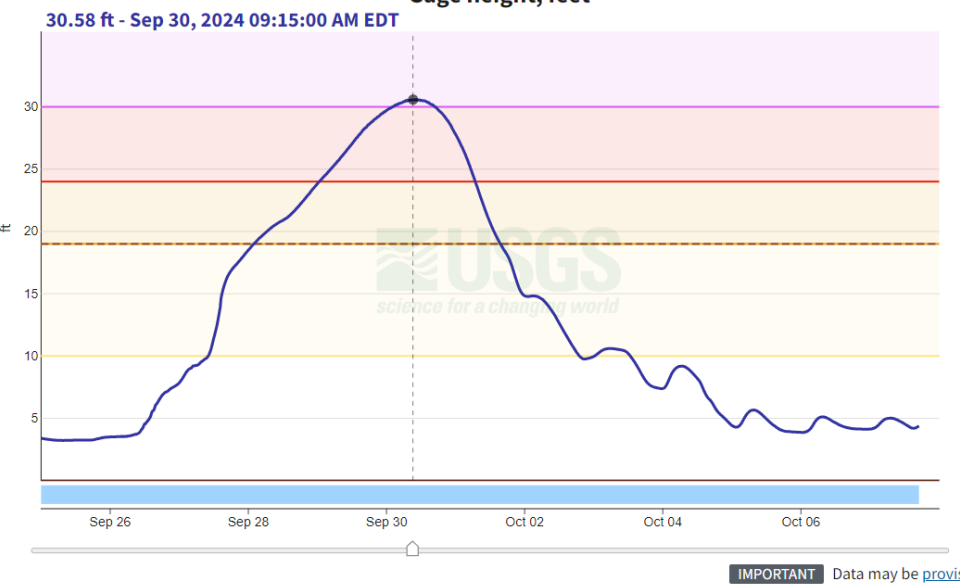
Flood Stage Height (color):
Major: 15 ft. (Purple)
Moderate: 13 ft. (Red)
Minor: 9.5 ft. (Orange)
Action: 8 ft. (Yellow)



Tropical Cyclone Helene – River Crests

Disclaimer: The hydrographs provided below depict the height of the river at a specific location. They do not indicate the level of inundation and impacts of the river in the surrounding areas.

Congaree River at Columbia, SC - 02169500



Helene Crest: 30.58 ft.
Record Crest: 39.08 ft. on 08/27/1908

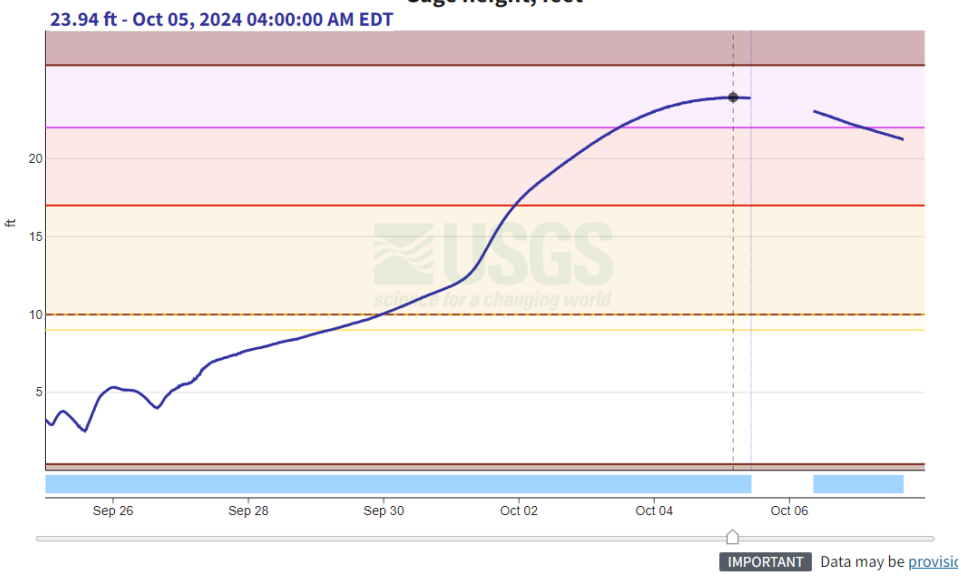
Flood Stage Height (color):
Major: 30 ft. (Purple)
Moderate: 24 ft. (Red)
Minor: 19 ft. (Orange)
Action: 16 ft. (Yellow)

Santee River NR Jamestown, SC - 02171700

Helene Crest: 23.94 ft.

Previous Record Crest: 33.00 ft. on 07/26/1916

Flood Stage (height, ft):
Major: 22 ft. (Purple)
Moderate: 17 ft. (Red)
Minor: 10 ft. (Orange)
Action: 9 ft. (Yellow)



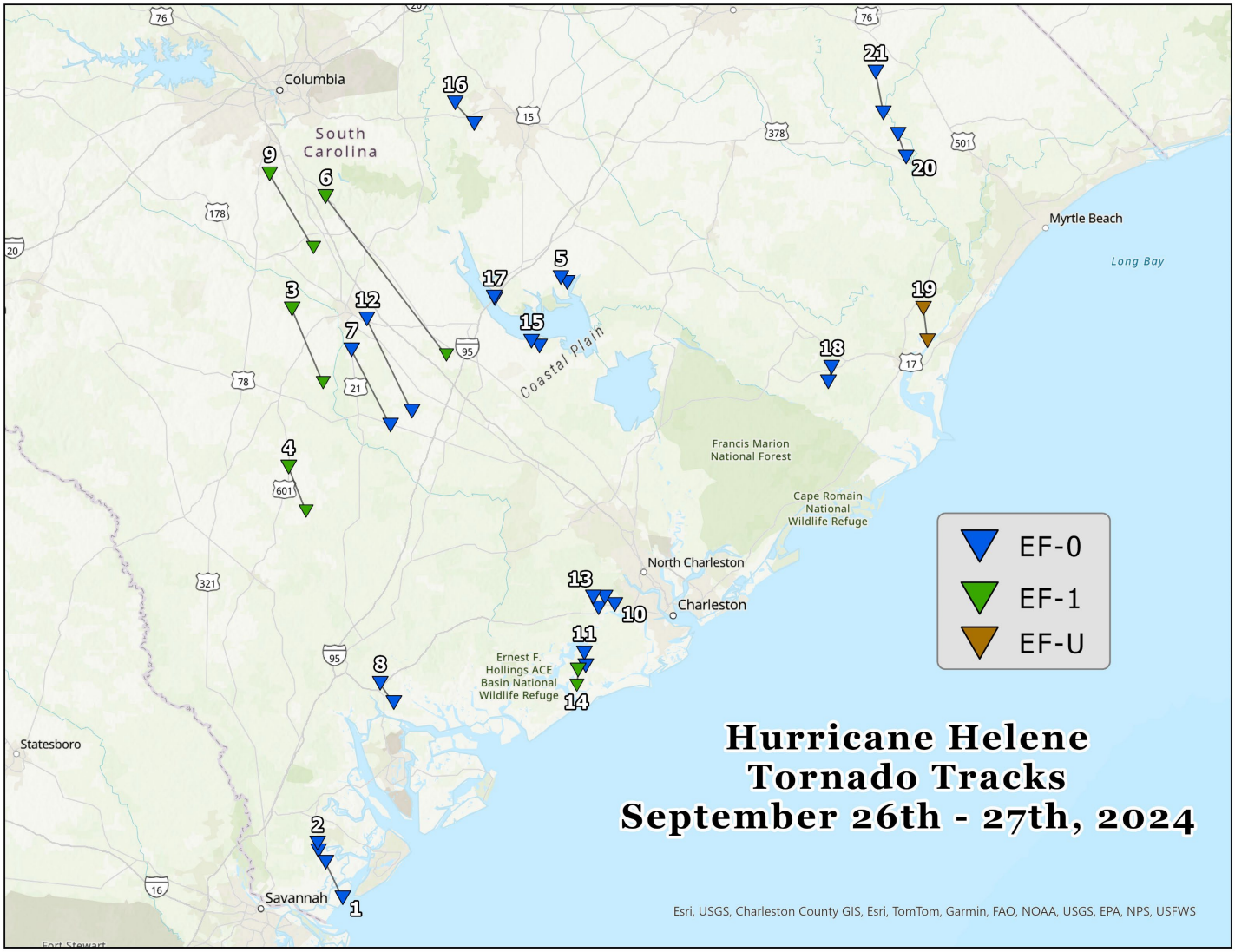
Tropical Cyclone Helene – River Impact Photos

US 276 washed out in Marietta, SC near the Greenville-Pickens county line on 10/3/2024
Courtesy of M. Cox-Lamm, SCDNR

Flooding along the Catawba River in York County near Charley Horse Road on the Catawba Reservation around 4 p.m. on September 29.
Photo courtesy of Tristan DiSanto

Tropical Cyclone Helene – Tornadoes

Tropical cyclones often spawn tornadoes over land as they make landfall. Helene was one of the most prolific tornado-producing tropical cyclones in South Carolina's history with conditions unusually favorable for tornadoes over areas to the right of Helene's Center late on September 26 and early on September 27. Helene spawned 21 tornadoes in South Carolina. National Weather Service storm survey teams rated 15 of the tornadoes EF-0 and five of them EF-1. They rated the tornado near Sampit in Georgetown County EF-U because the area where the tornado occurred is inaccessible to the storm survey team, preventing them from viewing the damage it caused and estimating the strength of the winds that caused the damage.



Tornado tracks are approximate. Tornadoes rarely follow straight paths; they often move in an arc and occasionally rapidly shift to the left or right.

The Enhanced Fujita Tornado Scale estimates tornado wind speeds based on the damage caused by a tornado. EF-0 tornadoes cause damage typical of 3-second wind gusts of up to 85 mph. EF-1 tornadoes cause damage typical of 3-second wind gusts of 86-110 mph.

Tropical Cyclone Helene – Tornadoes

Tornadoes Spawned By Helene in SC

Tornado	Rating	Counties	Start Point	Start Time (EDT)	End Point	Path Length (Miles)	Duration (minutes)
1	EF-0	Beaufort	Turtle Beach Road, Daufuskie Island	7:03 a.m. September 26	Moreland Road, Palmetto Bluff	6.66	13
2	EF-0	Beaufort	Headwaters Road, Palmetto Bluff	7:20 a.m. September 26	Rose Dhu Creek Plantation Drive, Bluffton	1.27	2
3	EF-1	Orangeburg	Hudson Road, Branchville	10:39 a.m. September 26	Beason Road, Orangeburg	13.36	21
4	EF-1	Colleton, Bamberg	Gabriel Road, Ashton	12:52 p.m. September 26	U. S. 601 (Broxton Bridge Road), Ehrhardt	7.81	19
5	EF-0	Clarendon	Russell Drive, White Oak	10:17 p.m. September 26	Pearson Road, White Oak	1.31	12
6	EF-1	Orangeburg, Calhoun	Askew Avenue, Providence	12:33 a.m. September 27	U. S. Highway 176 (Old State Road), Hammond Crossroads	33.11	44
7	EF-0	Orangeburg	U. S. Highway 78, Branchville	1:15 a.m. September 27	Garland Road, Rowesville	13.77	13
8	EF-0	Beaufort	Wimbee Landing Road, Lobeco	1:29 a.m. September 27	U. S. Highway 17 (Charleston Highway), Gardens Corner	3.87	3
9	EF-1	Orangeburg, Calhoun, Lexington	Providence Road, Staley Crossroads	1:51 a.m. September 27	Irvin Jumper Street, Gaston	13.97	15
10	EF-0	Charleston	U. S. Highway 17 (Savannah Highway), Boltons Landing	4:00 a.m. September 27	Bear Swamp Road, Boltons Landing	2.02	3
11	EF-0	Charleston	Bentz Road, Wadmalaw Island	4:06 a.m. September 27	Bears Bluff Road, Wadmalaw Island	2.09	3
12	EF-0	Orangeburg	Reevesville Road, Bowman	4:17 a.m. September 27	U. S. Highway 301 (Five Chop Road), Orangeburg	17.04	11
13	EF-0	Charleston	U. S. Highway 17 (Savannah Highway), Rantowles	4:20 a.m. September 27	Home Town Lane, Rantowles	1.96	2
14	EF-1	Charleston	McCants Road, Wadmalaw Island	4:40 a.m. September 27	Allandale Plantation Road, Wadmalaw Island	2.48	3

Tropical Cyclone Helene – Tornadoes

Tornadoes Spawned By Helene in SC

Tornado	Rating	Counties	Start Point	Start Time (EDT)	End Point	Path Length (Miles)	Duration (minutes)
15	EF-0	Orangeburg	Heyward Street, Eutaw Springs	4:56 a.m. September 27	Belvedere Drive, Fountain Lake	1.53	2
16	EF-0	Sumter	Bronco Road, Wedgefield	5:32 a.m. September 27	Clairemont Lane, Stateburg	1.27	6
17	EF-0	Clarendon	I-95/U. S. Highway 15 Interchange, Adams Landing	5:32 a.m. September 27	Cooper Lane, Adams Landing	0.29	1
18	EF-0	Georgetown	Columbus Road, Sampit	12:52 p.m. September 27	U. S. Highway 17 (Saints Delight Road), Sampit	2.42	3
19	EF-U	Georgetown	Hagley Landing, Waccamaw River	6:53 a.m. September 27	4 SW Plantersville	5.5	6
20	EF-0	Marion, Horry	Bay Road, Brittons Neck	7:23 a.m. September 27	Little Pee Dee River near Britton's Neck	13.77	13
21	EF-0	Marion	Locust Tree Court, Gresham	7:30 a.m. September 27	Cicero Gibson Road, Centenary	6.67	7

Two aspects of the tornadoes that struck South Carolina in Helene's outer bands stand out. The first is the rapid motion of the tornadoes that touched down in the state. This is common in tornadoes spawned by tropical cyclones. The tornadoes that hit the Palmetto State moved at speeds of generally 45-55 mph. The long-tracked tornado (Tornado 6) in Orangeburg and Calhoun County had an average forward speed of about 56 mph. This rapid motion illustrates why it is unwise to try to outrun a tornado in a vehicle, especially those spawned by tropical cyclones. Aside from it often being difficult to drive as fast as a tornado can move, the tornado usually will follow a straighter path than the road that a fleeing motorist must follow.

The other aspect is that several of the tornadoes were unusually wide. The Bowman area tornado (Tornado 3) was 1,100 yards (nearly two-thirds of a mile) wide; the Sumter County tornado (Tornado 16) was 1,000 yards (just over a half-mile) wide; the long-tracked Orangeburg and Calhoun County tornado (Tornado 6) was 800 yards wide; the Orangeburg, Calhoun and Lexington County tornado (Tornado 9) was 710 yards wide; and the Branchville area tornado (Tornado 7) was 500 yards wide. The Bowman area tornado holds the distinction of being the widest tornado spawned by a tornado on record in the United States.

It is uncommon for weaker tornadoes that are more typical in tropical cyclones to be this wide. The unusual width allowed the tornadoes to cause more widespread damage than typical tropical cyclone tornadoes.

Tropical Cyclone Helene – Tornadoes

Tornadoes From Tropical Cyclones In SC

For the tornado historical period 1950 to present

Rank	Tropical Cyclone	Dates	Tornado Count
1	Frances	September 6-7, 2004	46
2	Beryl	August 16, 1994	23
3	Helene	September 26-27, 2024	21
4	Jeanne	September 27, 2004	17
5	Sally	September 17, 2020	12
6	Allison	June 12-13, 2001	10
	Fred	August 17, 2021	10
7	Fay	August 26, 2004	8
8	Nate	October 8, 2017	7
	Ivan	September 16, 2004	7
	Danny	July 23-24, 1997	7
9	Florence	September 16, 2018	6
	Cleo	August 29, 1964	6

The tornado outbreak from Helene generated the largest tornado count of any outbreak since April 13, 2020, and the largest from a tropical cyclone since Frances impacted South Carolina in 2004.

Additional Data – Rainfall

Select Rainfall Reports from September 26 – 29, 2024

Station Name	County	Provider	Rainfall (Inches)	4–Day Annual Exceedance Probability (%)
Sassafras Mountain	Pickens	NC ECONET	15.79	0.2
Salem 1.9 NE	Oconee	CoCoRaHS	13.86 (M)	0.2
Sunset 0.5 NW	Pickens	CoCoRaHS	12.75	0.5
Liberty 4.3 SSE	Pickens	CoCoRaHS	12.29	0.5
Walhalla	Oconee	NWS COOP	11.86	0.5
Iva 3.1 NNE	Anderson	CoCoRaHS	11.63 (M)	0.5
Sandy Springs 2 NE	Anderson	NWS COOP	11.44	1
Belton 4.7 W	Anderson	CoCoRaHS	11.35	1
Iva 6.4 SSW	Abbeville	CoCoRaHS	11.24	1
Travelers Rest 8.9 N	Greenville	CoCoRaHS	10.90	1
North Saluda Reservoir	Greenville	NWS COOP	10.83	1
N Augusta 2.3 SSE	Aiken	NWS COOP	9.87	1
Seneca 1.4 E	Oconee	CoCoRaHS	9.82	1
Dentsville 6.6 NE	Richland	CoCoRaHS	9.38	2
Swansea 3.5 NE	Calhoun	NWS COOP	9.25	2
Clemson University	Pickens	NWS COOP	9.16	2
Hodges 6.5 ENE	Greenwood	CoCoRaHS	9.16	2
Laurens 0.7 SSW	Laurens	CoCoRaHS	9.12	2
Greer 7.9 SSE	Spartanburg	CoCoRaHS	8.82	2
Inman 4.5 WSW	Spartanburg	CoCoRaHS	8.78	2
Laurens	Laurens	NWS COOP	8.67	2
Bamberg	Bamberg	NWS COOP	8.57	4
Winthrop University	York	NWS COOP	8.38 (M)	4
Denmark 4.7 NNE	Bamberg	CoCoRaHS	8.21 (M)	4
Tega Cay 1.6 S	York	CoCoRaHS	7.81 (M)	4
Hampton	Hampton	CoCoRaHS	7.80	10
Gaffney 3.5 SW	Cherokee	CoCoRaHS	7.44	10

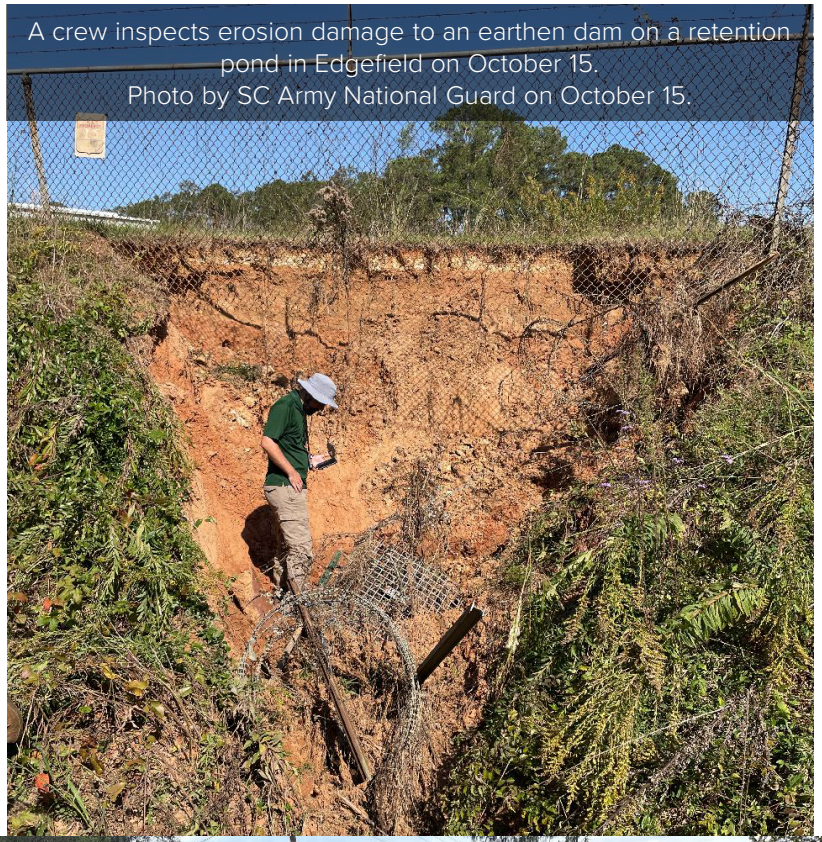
Annual Exceedance Probability (AEP): Percent chance that an event will happen in any given year.

Additional Data – Peak Wind Gusts

Select Peak Wind Gusts from Helene (September 27, 2024)

Location	County	Peak Gust (mph)	Time (EDT)	Provider
Charleston Tide Gage	Charleston	67	6:06 AM	NOAA/NOS
Folly Beach	Charleston	66	3:57 AM	WEATHERFLOW
Combahee	Colleton	64	5:49 AM	RAWS
2.4 SE Burton (WeatherSTEM)	Beaufort	64	4:50 AM	MESOWEST
Greenville Downtown AP	Greenville	64	6:56 AM	NOAA/ASOS
Whitmire RAWS	Union	63	6:58 AM	RAWS
Paris Mnt. SP (WeatherSTEM)	Greenville	60	10:30 AM	MESOWEST
Savannah NWR	Jasper	58	4:23 AM	RAWS
Orangeburg Airport	Orangeburg	58	6:44 AM	NOAA/ASOS
Sullivans Island	Charleston	57	6:29 AM	WEATHERFLOW
Isle of Palm	Charleston	56	6:29 AM	WEATHERFLOW
SCDNR Botany Bay HP	Charleston	56	4:30 AM	MESOWEST
SCDNR Webb Wildlife Center	Hampton	54	4:20 AM	MESOWEST
Chester Catawba Reg. AP	Chester	54	7:15 AM	NOAA/AWOS
Laurens County Airport	Laurens	54	6:35 AM	NOAA/AWOS
Barnwell Regional Airport	Barnwell	53	2:55 AM	NOAA/AWOS
Hilton Head Airport	Beaufort	53	6:50 AM	NOAA/AWOS
McEntire JNG	Richland	53	5:38 AM	NOAA/ASOS
Myrtle Beach	Horry	52	9:04 AM	NOAA/AWOS
Georgetown Fishing Pier	Georgetown	51	8:05 AM	WEATHERFLOW
Summerville Airport	Dorchester	51	4:35 AM	NOAA/AWOS
Pickens County Airport	Pickens	51	7:35 AM	NOAA/AWOS
Lancaster McWhirter Field	Lancaster	48	6:35 AM	NOAA/AWOS
North Myrtle Beach	Horry	47	9:47 AM	NOAA/ASOS
Santee Cooper Regional AP	Clarendon	46	5:35 AM	NOAA/AWOS
Kingstree	Williamsburg	46	6:15 AM	NOAA/AWOS
Darlington County Airport	Darlington	45	8:05 AM	NOAA/AWOS

Tropical Cyclone Helene – Other Damage Photos



A crew inspects erosion damage to an earthen dam on a retention pond in Edgefield on October 15.
Photo by SC Army National Guard on October 15.

A crew works to repair a washed-out section of U. S. Highway 276 (Geer Highway) just west of Cleveland on October 4.
Photo by SC Army National Guard.

Tropical Cyclone Helene – Other Damage Photos

SC Forestry Commission chainsaw crews assisted with clearing trees from roads and the hardest hit areas for over a week.
SCFC Photo

Rain from Helene and from a stationary front the day before led to this washed-out driveway leading to a home in Pickens County west of Easley.
SCARNG photo