NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM COLIN

(AL032022)

1–2 July 2022

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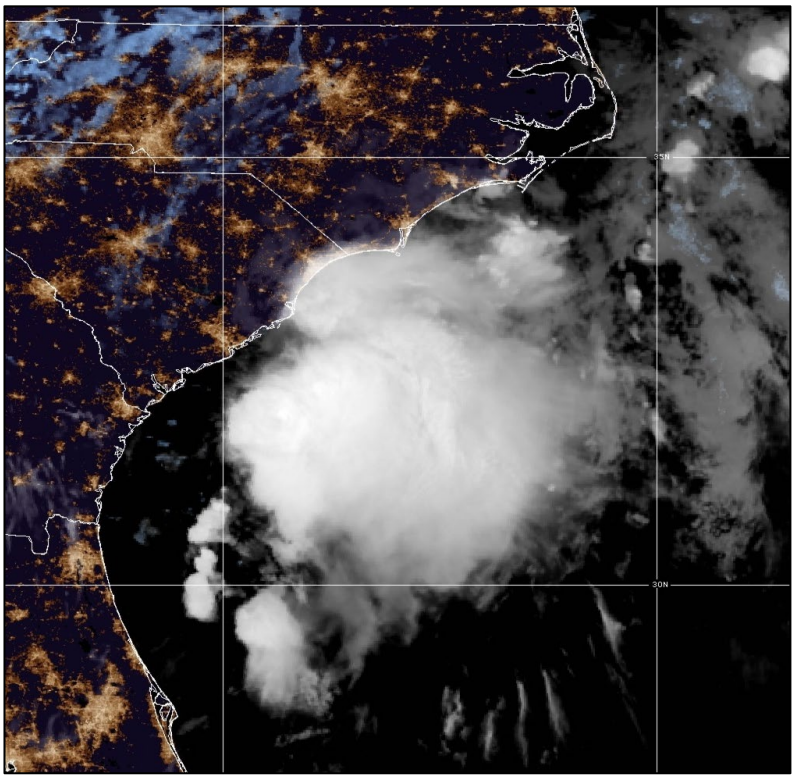
National Hurricane Center
1 December 2022[1]



GOES-16 GEOCOLOR IMAGE OF TROPICAL STORM COLIN AT 0900 UTC 2 JULY 2022 WHEN ITS CENTER WAS JUST INLAND BETWEEN CHARLESTON AND MYRTLE BEACH, SOUTH CAROLINA. IMAGE COURTESY OF NOAA/NESDIS/STAR.

Colin was a short-lived tropical storm that formed offshore of the South Carolina/Georgia coast and made landfall near Hunting Island, South Carolina, a few hours later. Colin slowly weakened as it remained just inland and dissipated before entering North Carolina.

[1] Original report date 18 November 2022. This version includes a correction in the Casualty and Damage section.

Tropical Storm Colin

1–2 JULY 2022

SYNOPTIC HISTORY

Colin's initial disturbance originated from the northern end of a surface trough that meandered offshore of the southeastern United States from 29–30 June. The trough moved just inland across eastern Georgia and South Carolina by early 1 July while it produced disorganized convection. Later that morning, the trough drifted eastward back offshore. During that same time, deep convection developed and became more organized just east of the trough's axis. By 1800 UTC that day, visible satellite imagery and surface observations indicated that an area of low pressure with a well-defined center had formed about 30 n mi east-southeast of Savannah, Georgia, marking the formation of a tropical depression. The "best track" chart of the tropical cyclone's path is given in Fig. 1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1[2].

After formation, the depression began moving northward toward the South Carolina coast as the system was steered by a building subtropical ridge over the western Atlantic. Deep convection increased near the center of circulation, and it is estimated that the depression strengthened into Tropical Storm Colin by 2330 UTC that day as it made landfall near Hunting Island, South Carolina. Colin turned northeastward just after landfall and maintained this motion for the remainder of its existence. This path did not take the storm very far inland, with the center remaining within 20 n mi of the coastline as the system headed toward North Carolina. The storm's proximity to the coast and persistent deep convection across the eastern portion of the circulation allowed for Colin to maintain tropical-storm-force winds through 1200 UTC 2 July. However, the convection steadily waned later that morning, and by 1800 UTC the system weakened to a tropical depression. By 0000 UTC 3 July, surface observations suggested that the low-level circulation had dissipated over northeastern South Carolina.

METEOROLOGICAL STATISTICS

Observations in Colin (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), objective Advanced Dvorak Technique (ADT) estimates and Satellite Consensus (SATCON) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Global Precipitation

[2] A digital record of the complete best track, including wind radii, can be found on line at ftp://ftp.nhc.noaa.gov/atcf. Data for the current year's storms are located in the *btk* directory, while previous years' data are located in the *archive* directory.

Mission (GPM), the European Space Agency's Advanced Scatterometer (ASCAT), and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Colin. In addition, radar data from the National Weather Service WSR-88D radar from Charleston was beneficial in tracking the cyclone and its remnants.

Selected surface observations from land stations and data buoys are given in Table 2.

Winds and Pressure

Colin's peak intensity of 35 kt from 2330 UTC 1 July to 1200 UTC 2 July is based on scatterometer data and surface observations. A pair of scatterometer overpasses revealed winds of 35 kt and 37 kt at 0206 and 0254 UTC 2 July, respectively, just offshore of the South Carolina coast. At 0255 UTC, a WeatherFlow station located on Fort Sumter Range Front Light near the entrance to Charleston Harbor measured a sustained wind of 34 kt. There were also two buoy observations offshore of North Carolina and South Carolina that measured sustained 33-kt winds at an elevation of 4 m at 0730 and 0731 UTC that day. Also at 0730 UTC, an observing station at Wrightsville Beach, North Carolina, measured a sustained wind of 36 kt. The overall satellite appearance of the cyclone did not change much from the time of landfall through the times that these wind observations occurred. Therefore, it is assumed that the cyclone had reached tropical storm intensity by the time it made landfall at 2330 UTC 1 July. In addition, there were several observing stations along the South Carolina and southeastern North Carolina coast that measured tropical-storm-force wind gusts during the passage of Colin (Table 2).

The estimated minimum pressure of 1011 mb is based on surface observations.

Storm Surge[3]

The peak observed water level was 1.1 feet above Mean Higher High Water (MHHW) at the Charleston Cooper River Entrance. There were no reports of damage or flooding due to storm surge.

Rainfall and Flooding

Colin produced localized heavy rainfall over portions of the coastal regions of northeastern Florida, Georgia, South Carolina, and southeastern North Carolina (Fig. 4). However, due to the sheared nature of the cyclone, much of the precipitation associated with the system remained offshore. The highest rainfall amount recorded was 7.59 inches at Wadmalaw Island, South Carolina. There were many other observing sites around the Mount Pleasant and Charleston areas that reported rainfall totals ranging from 3 to 7 inches. Rainfall amounts of 3 to 4 inches

[3] Several terms are used to describe water levels due to a storm. **Storm surge** is defined as the abnormal rise of water generated by a storm, over and above the predicted astronomical tide, and is expressed in terms of height above normal tide levels. Because storm surge represents the deviation from normal water levels, it is not referenced to a vertical datum. **Storm tide** is defined as the water level due to the combination of storm surge and the astronomical tide, and is expressed in terms of height above a vertical datum, i.e. the North American Vertical Datum of 1988 (NAVD88) or Mean Lower Low Water (MLLW). **Inundation** is the total water level that occurs on normally dry ground as a result of the storm tide, and is expressed in terms of height above ground level. At the coast, normally dry land is roughly defined as areas higher than the normal high tide line, or Mean Higher High Water (MHHW).

occurred in a few locations in coastal northeastern Florida, Georgia, and southeastern North Carolina. Only minor flooding was reported due to the rainfall from Colin.

Tornadoes

There were no tornadoes reported in association with Colin.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage associated with Colin. However, there was one direct casualty[4]. The high surf along the South Carolina and North Carolina coasts associated with Colin continued into 3 July as strong winds persisted over portions of those waters after the system's circulation had dissipated. A 52-year-old man drowned at a beach in Oak Island, North Carolina, due to the associated rough surf.

FORECAST AND WARNING CRITIQUE

Colin's genesis was not anticipated, as most of the forecast models suggested that the incipient disturbance would not develop or would move inland. A low probability (<40%) of formation was first introduced into the Tropical Weather Outlook at 1800 UTC 1 July (Table 3). In post-analysis, that was determined to have been the time of genesis.

Due to Colin's short existence, there was only one verifying 12-h forecast. Thus, a comprehensive verification of official and guidance track and intensity forecast errors is not provided. The one official 12-h forecast had a track error of 16.1 n mi and an intensity error of 5.0 kt. These errors were slightly lower than the mean 12-h official track and intensity errors for the previous 5-yr period (2017–2021) of 23.6 n mi and 5.4 kt, respectively.

Watches and warnings associated with Colin are given in Table 4. There was no lead time for the Tropical Storm Warning that was issued at 0900 UTC on 2 July, as tropical-storm-force winds had already occurred along the coast several hours before the warning was issued. The lack of lead time was due to the low probability of the system becoming a tropical cyclone. Local NWS forecast offices were already issuing products to highlight the disturbance's impacts prior to its genesis.

[4] Deaths occurring as a direct result of the forces of the tropical cyclone are referred to as "direct" deaths. These would include those persons who drowned in storm surge, rough seas, rip currents, and freshwater floods. Direct deaths also include casualties resulting from lightning and wind-related events (e.g., collapsing structures). Deaths occurring from such factors as heart attacks, house fires, electrocutions from downed power lines, vehicle accidents on wet roads, etc., are considered indirect" deaths.

ACKNOWLEDGEMENTS

Data in Table 3 were compiled from a post-storm report provided by the National Weather Service Forecast Office in Wilmington, NC. Additional data was provided by the National Ocean Service and the National Data Buoy Center. David Roth of the NOAA Weather Prediction Center provided additional rainfall reports and analysis.

Table 1. Best track for Tropical Storm Colin, 1–2 July 2022.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage

01 / 1800	31.8	80.5	1014	30	tropical depression
01 / 2330	32.4	80.5	1011	35	tropical storm
02 / 0000	32.5	80.4	1011	35	"
02 / 0600	33.0	79.9	1011	35	"
02 / 1200	33.4	79.4	1011	35	"
02 / 1800	33.8	78.9	1015	30	tropical depression
03 / 0000					dissipated
01 / 2330	32.4	80.5	1011	35	minimum pressure, maximum winds, and landfall near Hunting Island, South Carolina

Table 2. Selected surface observations for Tropical Storm Colin, 1–2 July 2022

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Offshore									
Buoys and C-MAN Stations									
Folly Island, SC (FBIS1) (32.69N 79.89W)	02/0600	1014.3	02/0120	27 (10 m, 10 min)	34				
Edisto (41004) (32.50N 79.10W)	02/0810	1015.2	02/0731	33 (4 m, 1 min)	39				
Frying Pan Shoals, NC (41013) (33.44N 77.76W)	02/2150	1015.0	02/0730	33 (4 m, 1 min)	37				
Sunset Nearshore, NC (41024) (33.85N 78.48W)	02/2108	1013.9	02/1008	23 (3 m, 1 min)	37				
Capers Nearshore (32.80N 79.62W)	02/0608	1013.4	02/0408	27 (3 m)	37				
Fripp Nearshore, SC (41033) (32.28N 80.41W)	02/0208	1012.7							
South Carolina									
International Civil Aviation Organization (ICAO) Sites									
Myrtle Beach AP (KMYR) (33.69N 78.93W)	02/1856	1014.6	02/0829	19 (10 m, 2 min)	34				
NOS Sites									
Springmaid Pier (MROS1) (33.66N 78.92W)	02/2148	1015.2	02/0436	29 (7 m)	36	1.2		0.3	
Charleston, Cooper River Entrance (CHTS1) (32.78N 79.92W)	02/0554	1012.6	02/0130	27 (9 m)	31	1.4		1.1	
WeatherFlow Sites									
Fort Sumter Range Front Light (XSUM) (32.75N 79.87W)	02/0555	1013.4	02/0255	34 (12 m)	40				
Winyah Bay (XWIN) (33.19N 79.18W)	02/0848	1010.7	02/0843	31 (15 m)	43				
Murrells Inlet (XMUR) (33.52N 79.03W)	02/1005	1013.0	02/0705	28 (7 m)	35				

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Folly South End (XFSE) (32.64N 79.97W)	02/0357	1013.1	02/0037	33 (11 m)	39				
Shutes Folly (XSLV) (32.77N 79.91W)	02/0544	1012.0	02/0214	30 (13 m)	41				
Sullivan's Island (XSLV) (32.77N 79.82W)	02/0948	1012.4	02/0232	27 (10 m)	39				
Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) Sites and other rainfall observations									
Wadmalaw Island 4.1 NE (SC-CR-228) (32.70N 80.12W)									7.59
Mount Pleasant 7.5 NE (SC-CR-192) (32.89N 79.77W)									6.80
Charleston 5.2 WNW (US1SCCR002) (32.81N 80.08W)									6.70
Isle of Palms 0.1 E (SC-CR-166) (32.80N 79.76W)									6.37
Johns Island 3.3 WNW (SC-CR-218) (32.71N 80.09W)									6.24
Mount Pleasant 8.2 NE (SC-CR-146) (32.90N 79.75W)									5.72
Johns Island 1.4 NNW (SC-CR-251) (32.72N 80.04W)									5.50
Kiawah Island 1.5 NE (SC-CR-83) (32.63N 80.04W)									5.32
Kiawah Island 1.0 SW (SC-CR-154) (32.60N 80.07W)									5.01
Mount Pleasant 0.4 E (SC-CR-148) (32.82N 79.86W)									4.82
Mount Pleasant 7.0 NE (SC-CR-112) (32.90N 79.79W)									4.70

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Johns Island 1.8 NE (SC-CR-74) (32.72N 80.01W)									4.69
Mount Pleasant 4.1 NE (SC-CR-26) (32.86N 79.81W)					56				4.67
Mount Pleasant 8.1 NE (SC-CR-225) (32.90N 79.76W)									4.62
Kiawah River 3.5 W (SC-CR-189) (32.63N 80.12W)									4.43
Mount Pleasant 1.4 ENE (SC-CR-206) (32.83N 79.84W)									4.28
Mount Pleasant 6.4 NE (SC-CR-69) (32.90N 79.80W)									4.06
Edisto Island 3.6 E (SC-CR-115) (32.55N 80.24W)									4.03
Charleston 4.6 SSE (SC-CR-13) (32.73N 79.96W)									3.69
Mount Pleasant 2.1 SSE (SC-CR-85) (32.80N 79.84W)									3.64
Folly Beach 4.5 N (SC-CR-36) (32.74N 79.93W)									3.62
Mount Pleasant 2.7 S (SC-CR-229) (32.78N 79.86W)									3.59
Edisto Island 2.2 ESE (SC-CR-238) (32.54N 80.26W)									3.51
Meggett 1.8 W (SC-CR-32) (32.70N 80.29W)									3.48
Charleston 5.2 ESE (SC-CR-96) (32.74N 79.92W)									3.48

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Georgetown 5.3 NNE (SC-GT-1) (33.43N 79.25W)									3.43
Charleston 2.9 W (SC-CR-178) (32.79N 80.04W)									3.42
Wadmalaw Island 2.3 SSW (SC-CR-98) (32.76N 80.00W)									3.42
Charleston 1.6 SSW (SC-CR-194) (32.76N 80.00W)									3.41
North Carolina									
NOS Sites									
Beaufort, Duke Marine Lab (BFTN7) (34.72N 76.67W)	03/0830	1013.7	02/2306	20 (7 m)	28	0.9		0.6	
Wilmington (WLON7) (34.23N 77.95W)	03/0642	1013.8				1.3		0.4	
Wrightsville Beach (JMPN7) (34.21N 77.79W)	03/0712	1014.0	02/0730	36 (8 m)	42	1.2		0.4	
WeatherFlow Sites									
Federal Point (XFED) (33.96N 77.94W)	03/0722	1012.8	02/1526	24 (15 m)	37				
Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) Sites and other rainfall observations									
Longwood COOP (315116) (34.01N 78.55W)									3.46
Shallotte 10 WNW (LNGN7) (34.01N 78.55W)									3.46
Beaufort ASOS (KARW) (34.73N 76.65W)									3.37
Georgia									
Rainfall Observations									
Coffee Bluff (US1GACT0015) (31.94N 81.16W)									4.33

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Savannah 5.9 SSW (US1GACT0015) (31.94N 81.16W)									4.25
Florida									
Rainfall Observations									
Jacksonville Beach (JCFK1) (30.29N 81.39W)									4.39
Ormond Beach 3.5 SE (US1FLVL0005) (29.27N 81.05W)									3.59

[a] Date/time is for sustained wind when both sustained and gust are listed.
[b] Except as noted, sustained wind averaging periods for C-MAN and land-based reports are 2 min; buoy averaging periods are 8 min.
[c] Storm surge is water height above normal astronomical tide level.
[d] For most locations, storm tide is water height above the North American Vertical Datum of 1988 (NAVD88). Storm tide is water height above Mean Lower Low Water (MLLW) for NOS stations in Puerto Rico, the U.S. Virgin Islands, and Barbados.
[e] Estimated inundation is the maximum height of water above ground. For NOS tide gauges, the height of the water above Mean Higher High Water (MHHW) is used as a proxy for inundation.

Table 3. Number of hours in advance of formation associated with the first NHC Tropical Weather Outlook forecast in the indicated likelihood category. Note that the timings for the "Low" category do not include forecasts of a 0% chance of genesis.

	Hours Before Genesis	
	48-Hour Outlook	**120-Hour Outlook**
Low (<40%)	0	0
Medium (40%-60%)	-	-
High (>60%)	-	-

Table 4. Watch and warning summary for Tropical Storm Colin, 1–2 July 2022.

Date/Time (UTC)	Action	Location
2 / 0900	Tropical Storm Warning issued	South Santee River to Duck
2 / 2100	Tropical Storm Warning modified to	Cape Fear to Duck
3 / 0300	Tropical Storm Warning discontinued	All

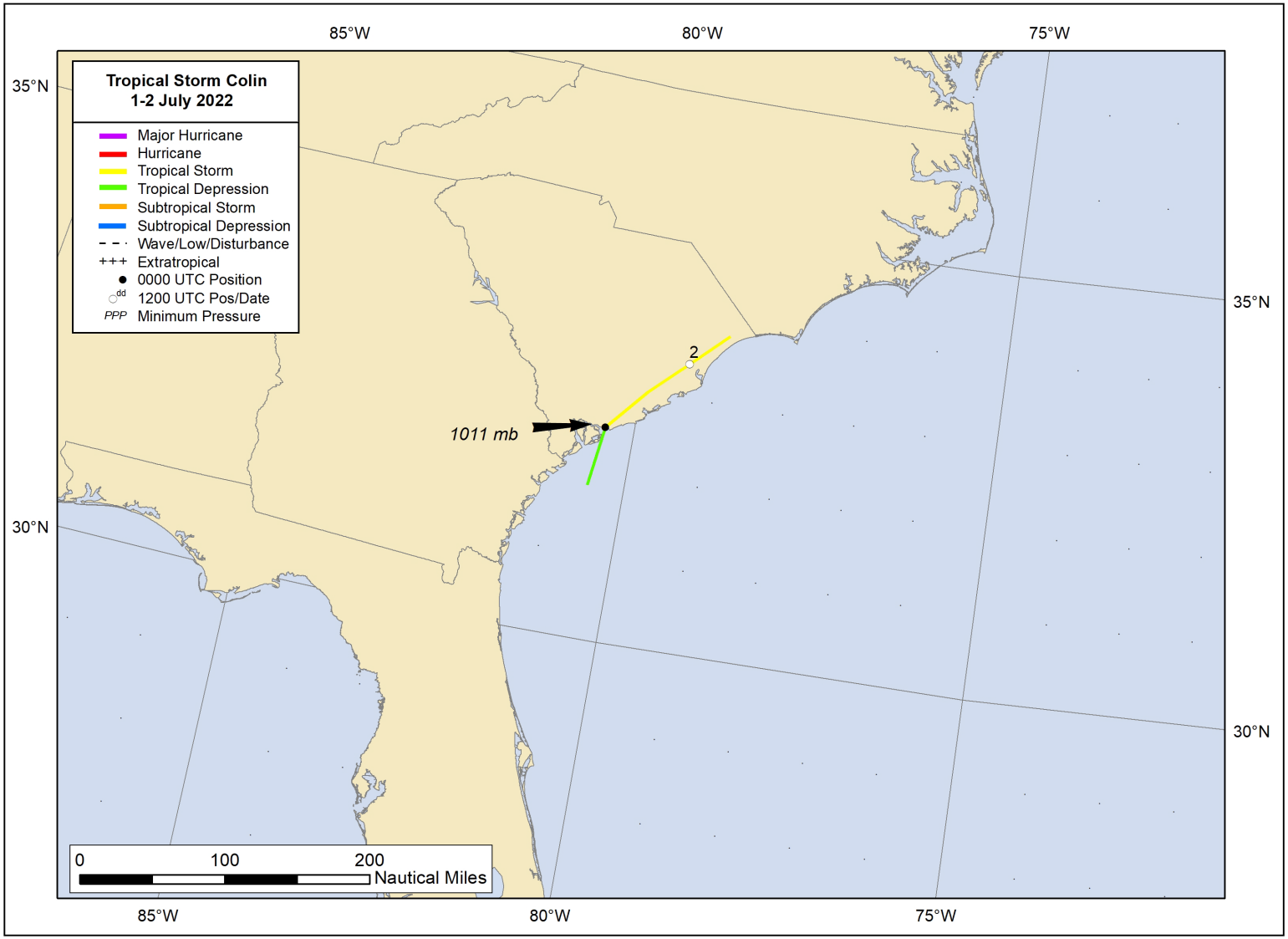


Figure 1. Best track positions for Tropical Storm Colin, 1–2 July 2022.

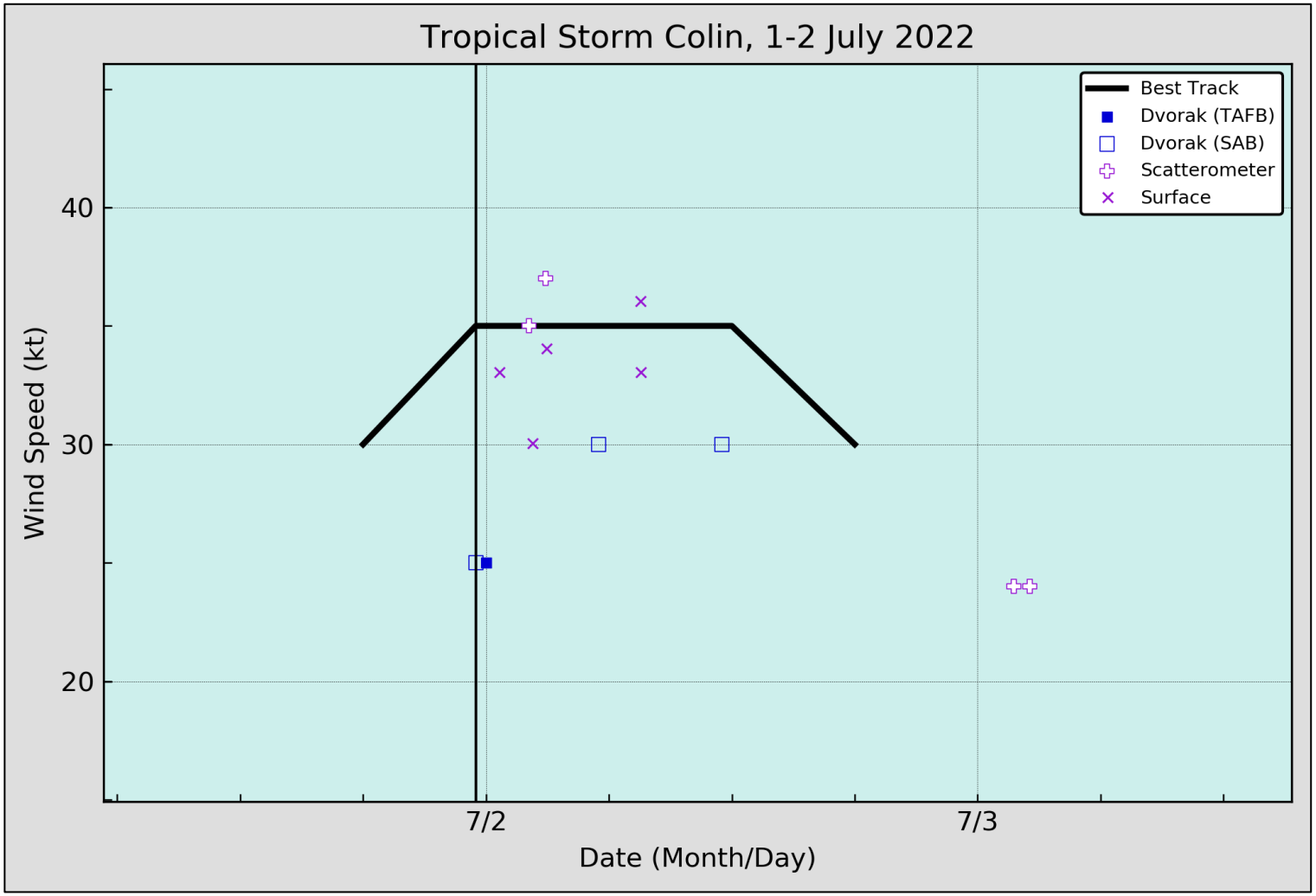


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Colin, 1–2 July 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC. The solid vertical line corresponds to landfall.

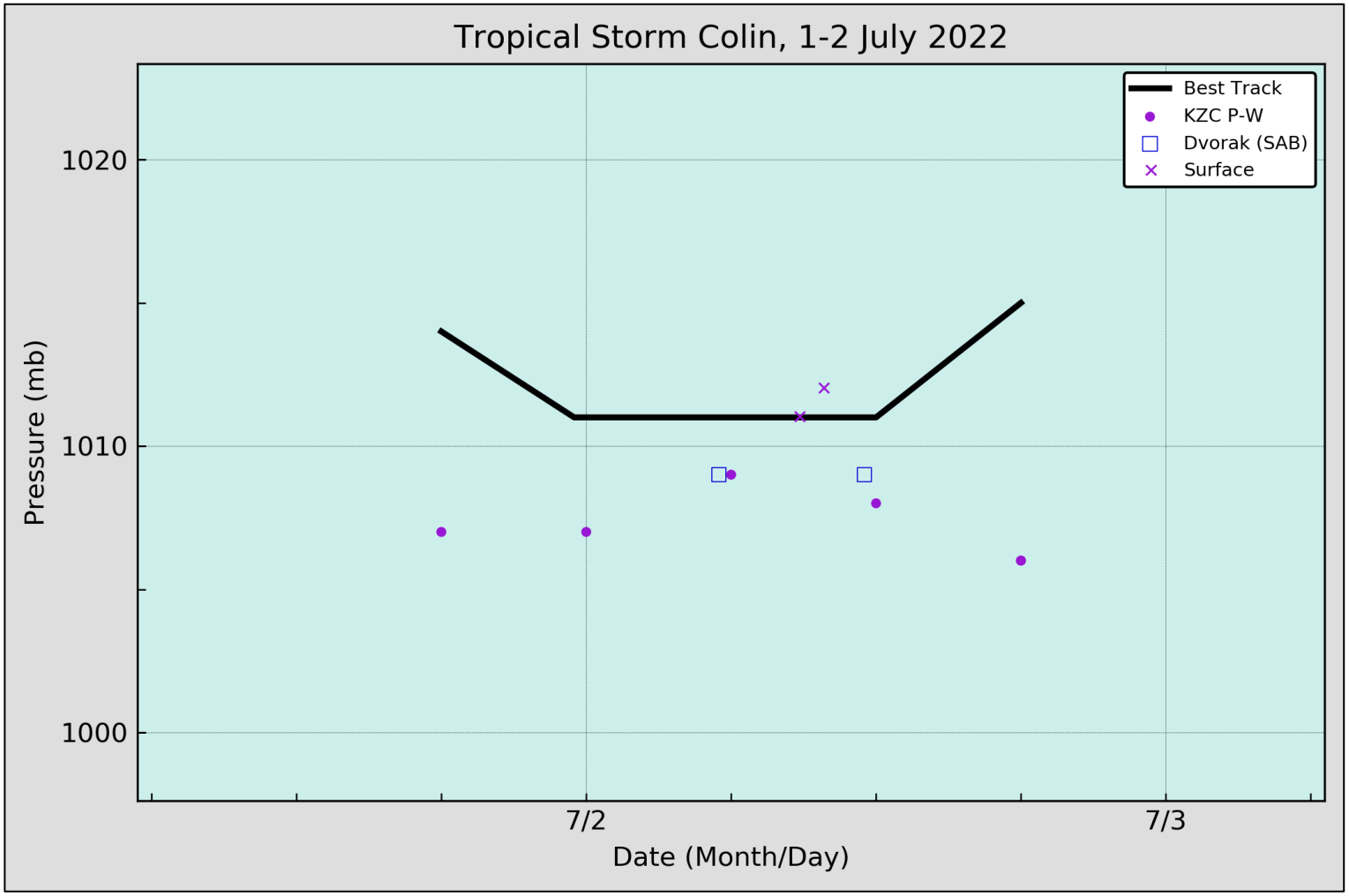


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Colin, 1–2 July. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC. The solid vertical line corresponds to landfall.

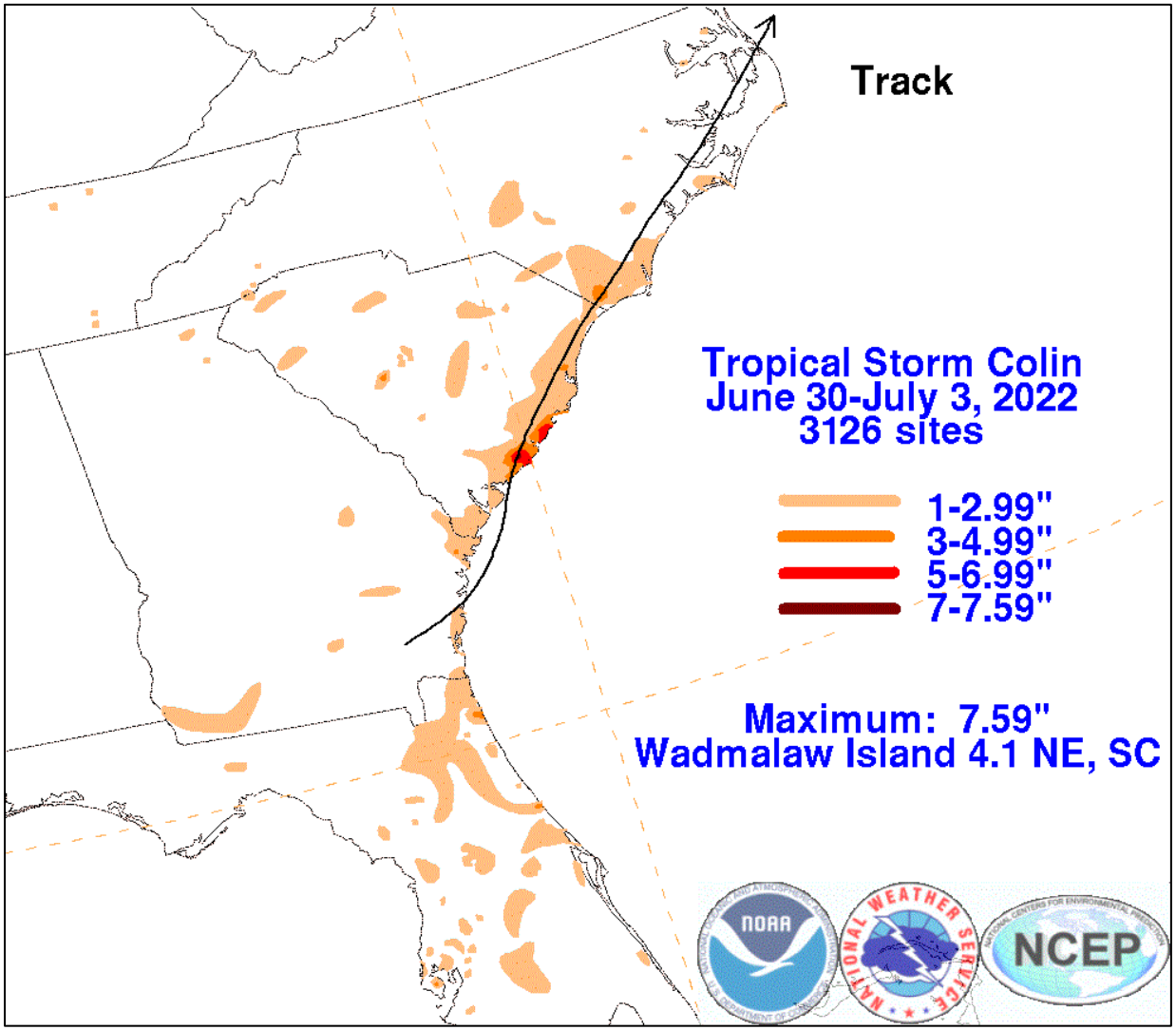


Figure 4. Total rainfall (inches) near the path of Colin's precursor disturbance, while it was a tropical cyclone, and shortly after dissipation. Image courtesy of David Roth of the NOAA Weather Prediction Center.