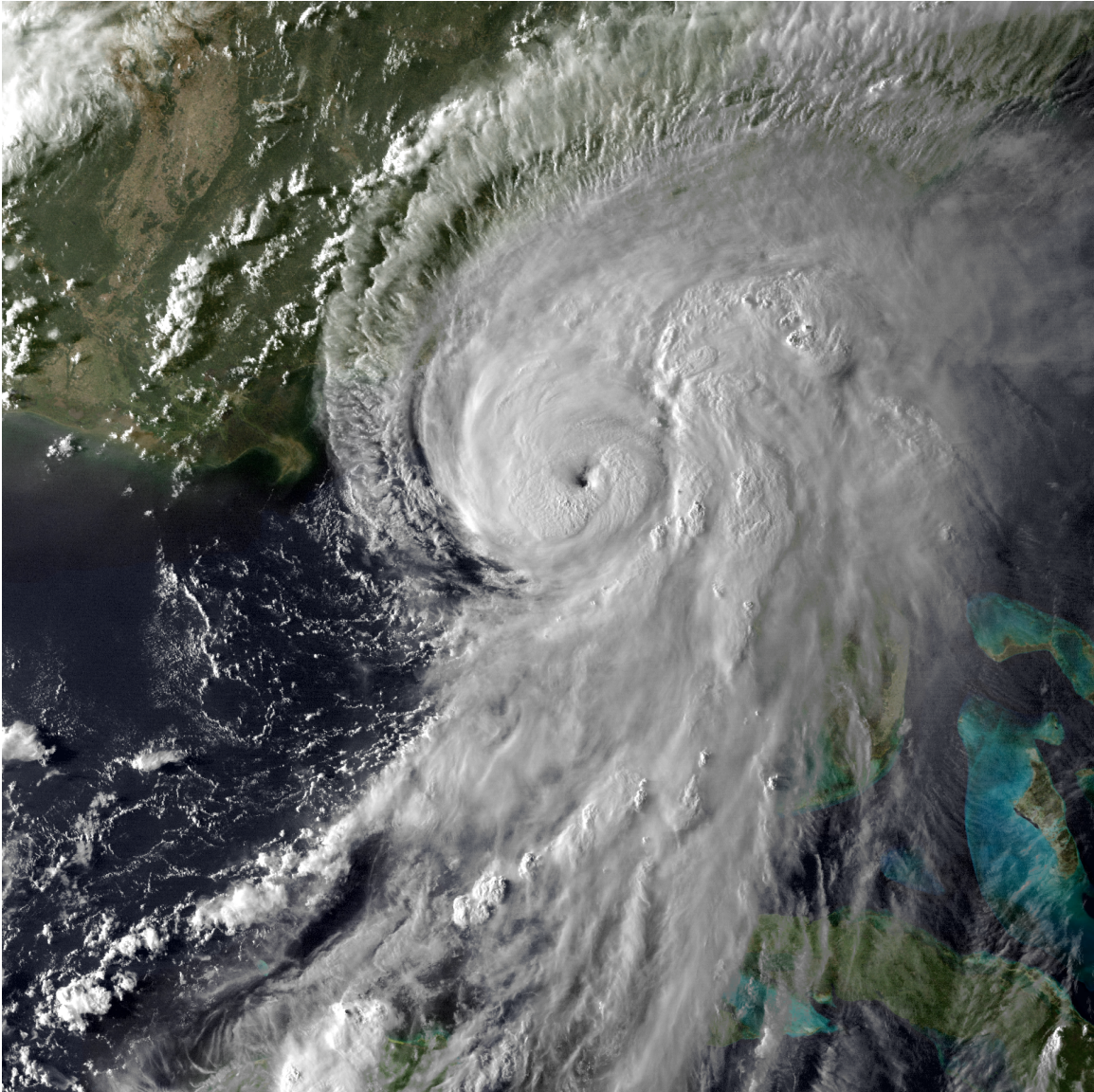


Hurricane Hermine – the First Hurricane to Landfall on Florida since 2005
Prepared by Daniel J. Brouillette, Florida Climate Center



Courtesy: NASA Naval Research Laboratory.

Introduction

At around 1:30 AM EDT on 2 September 2016, Hurricane Hermine made landfall near Saint Marks, Wakulla County, in the Big Bend region. Hermine was the first hurricane to make landfall on Florida since Hurricane Wilma made landfall near Cape Romano, Collier County, on 24 October 2005. The streak of no Florida hurricane landfalls spanned 3966 days and was record long. The previous record-long streak was 2271 days between the time of landfall of Hurricane David near West Palm Beach on 3 September 1979 and the time of landfall of Hurricane Kate near Mexico Beach, Bay County, on 21 November 1985. Hermine was also the first hurricane to make landfall on Apalachee Bay coastline since Hurricane Alma made landfall near Alligator Point, Wakulla County, on 9 June 1966.

Hermine was the second named storm of 2016 to landfall on Florida after Tropical Storm Colin did so on 6 June.

Development and Evolution

Hermine had a protracted history and path before it made landfall. On 18 August, forecasters at the National Hurricane Center called attention to a tropical wave that had developed about 300 miles southwest of the Cape Verde islands. After strong wind shear and dry air hindered its development for a few days, a poorly defined circulation was evident by the 23rd, when the wave was just east of Guadalupe in the Caribbean Sea. The strength and organization of the wave waxed and waned as it then moved across the Caribbean Sea, impacting Puerto Rico and the southern Bahamas, before it gained a well-defined circulation on the 28th. At that time, located in the Florida Straits between the Florida Keys and Cuba (which saw some rains from outer bands), it was christened as Tropical Depression Nine (Figure 1). Suffering from considerable westerly wind shear and dry air to its west, the depression had a ragged presentation on satellite imagery as it moved into the Gulf of Mexico. By the 31st, conditions improved, allowing the storm to strengthen into a tropical storm at a position in the eastern Gulf some 400 miles southwest of Apalachicola, Franklin County. At this time, a mid-level trough was deepening over the southeastern U.S., forcing the acceleration of the storm to the northeast. Moving over Gulf waters with surface temperatures of around 86 degrees Fahrenheit, Hermine continued to gather strength, sending heavy rainfall and tropical-storm winds to its east, as far east as the western half of the Florida peninsula, as the calendar turned to September. Upgraded to Category 1 hurricane strength by early afternoon on the 1st, Hermine continued to strengthen until landfall. At the time of landfall during the middle of the following night, maximum sustained winds were estimated at 80 miles per hour, and the central pressure was 982 millibars.

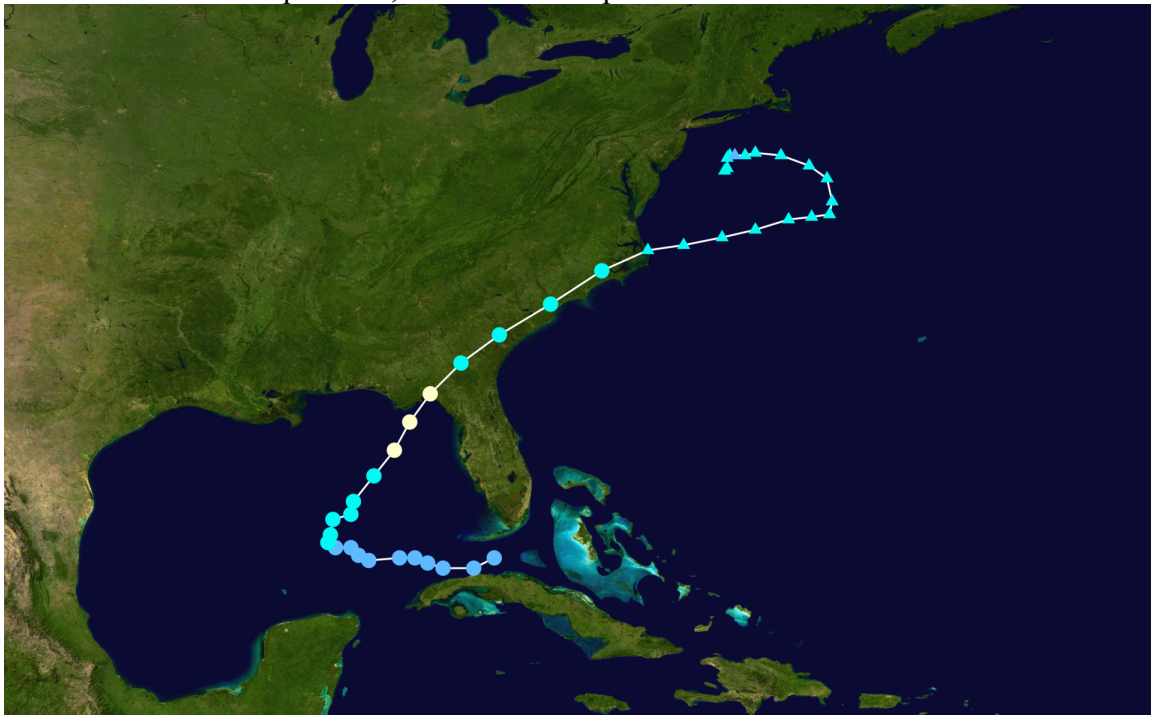


Figure 1: The track of Hurricane Hermine from its christening as a tropical depression in the Florida Straits, south of the Keys, to its landfall on the coast of the Apalachee Bay as a Category 1 hurricane.

Impacts

Although Hermine had numerous impacts, its greatest impact away from the coast was damaging wind gusts. Winds were strong near, and especially off, the western coast from the Tampa Bay region northward through the Nature Coast and the north-central part of the peninsula and into the Big Bend region. Damage from these wind gusts, though seen in much of the Big Bend, was most evident in Tallahassee, the largest population center affected by Hermine at its peak strength. A number of factors came together in Tallahassee to yield widespread damage. First, Tallahassee is well known for its dense, thick tree canopy, which includes many live oaks and yellow pines. Additionally, a storm of the approximate magnitude of Hermine had not occurred since Hurricane Kate in 1985, allowing for the build-up of diseased and vulnerable tree limbs in canopies that had not been pruned regularly. Furthermore, the heavy rains from the storm fell onto the region's characteristically sandy soil, softening it. Lastly, for much of the time in which the storm progressed through the region, Tallahassee resided within the northwestern quadrant of the storm's eye wall, which was strengthening all the way to the time of landfall. Zones of strengthening within a hurricane, especially its eyewall, are associated with zones of evolving momentum, which is mixed to the surface and manifested as zones of particularly strong winds. Although the highest wind gust measured in Tallahassee during the storm was 64 miles per hour from a WeatherSTEM sensor mounted near Doak Campbell Stadium on the campus of the Florida State University, it is plausible that somewhat higher wind gusts, not recorded by sensors, may have occurred in and near Tallahassee (Figure 2).

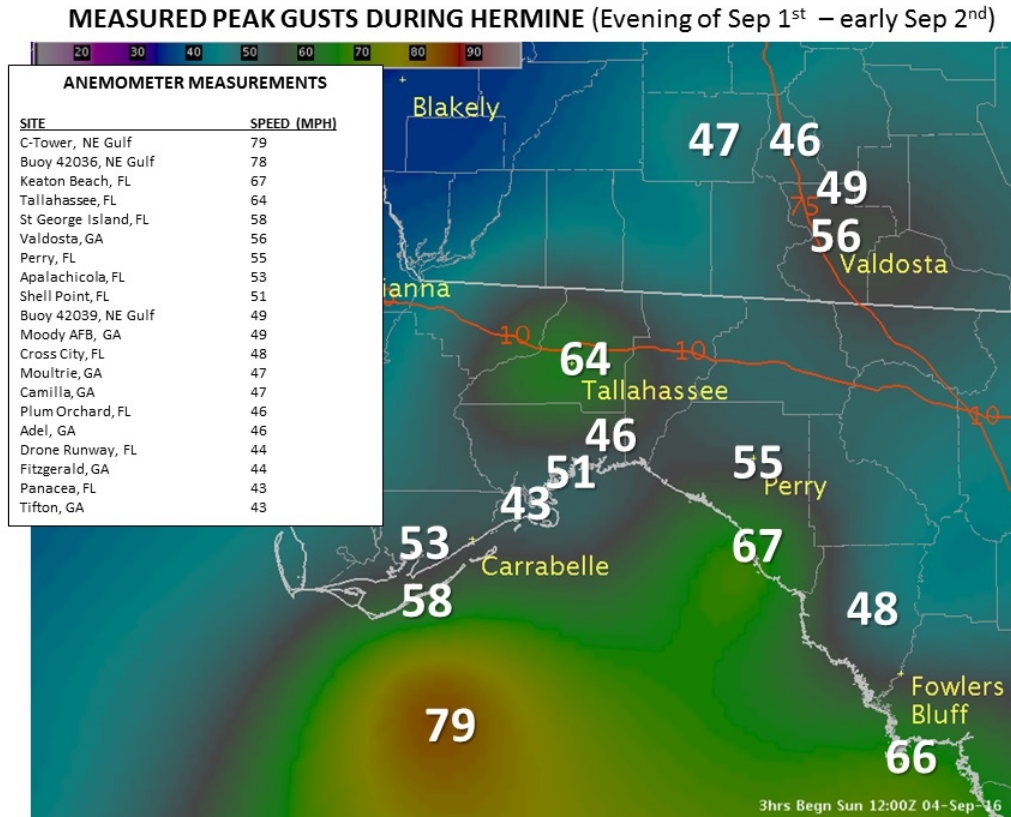


Figure 2: Measured peak wind gusts during Hurricane Hermine in the Big Bend region of Florida and the adjacent part of south Georgia. Courtesy: NWS Tallahassee.

In any event, all these factors came together to topple trees and snap tree branches, which fell onto many power lines and roads and some homes and businesses. Damage and widespread power outages were seen in Gadsden, Wakulla, Franklin, Leon, Jefferson, Taylor, Dixie, Lafayette, and Suwannee counties. Approximately 80 percent of customers of Tallahassee’s municipal electric utility were without power on the morning of the 14th, and restoration of some customers’ power took up to a week.

Another major impact in the near vicinity of the coast was storm-surge flooding and attendant damage to buildings and roads. The shape of the coastline in the Apalachee Bay contributes to relatively severe storm-surge flooding compared to surrounding coastline on the Gulf of Mexico. Figure 3 shows the storm-surge inundation observed along the Apalachee Bay. Evacuations from near-coastal zones were requested in Franklin and Wakulla Counties, and damage to some coastal structures (homes and roads) because of storm-surge flooding, especially in the vicinity of Alligator Point, was said to be substantial.

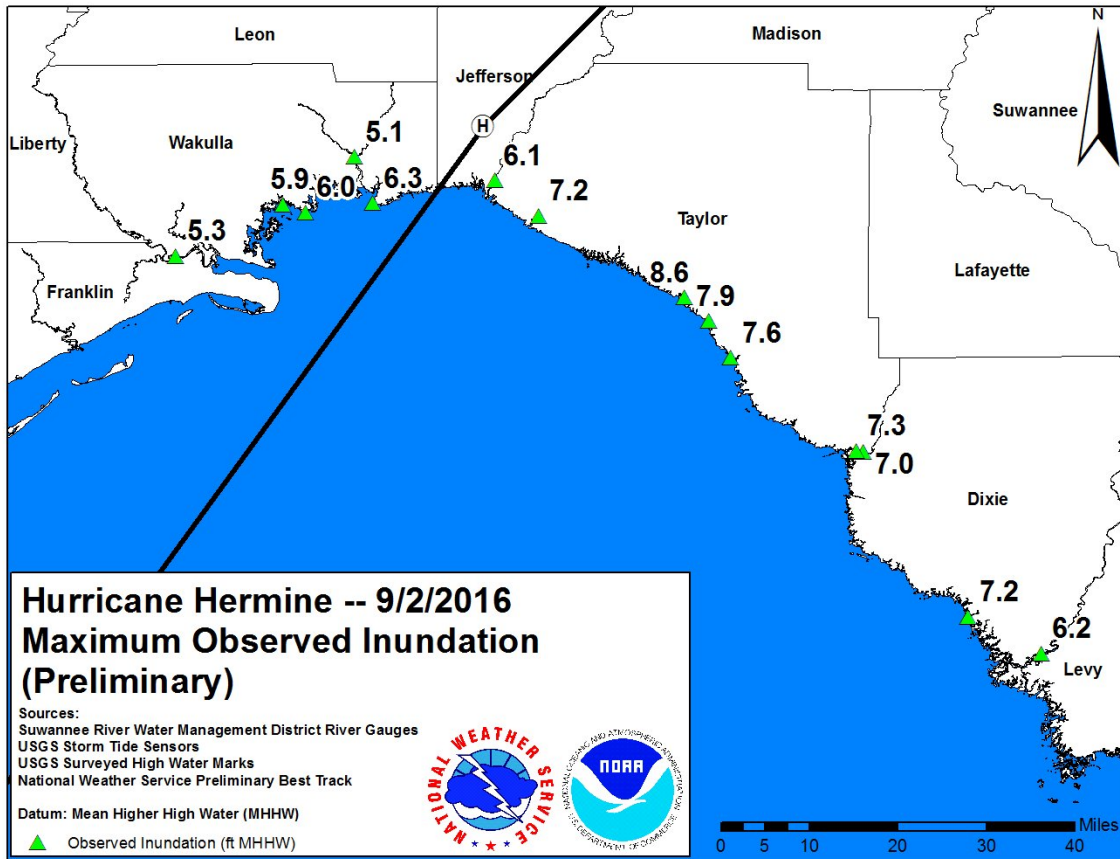


Figure 3: A map of maximum observed inundation from storm surge in Hurricane Hermine in the Apalachee Bay. Courtesy: NWS Tallahassee.

Three brief tornadoes occurred in southern Taylor County. All three were rated weak, or EF-0, on the Enhanced Fujita Scale and passed over rural areas. Figure 4 shows where they occurred.

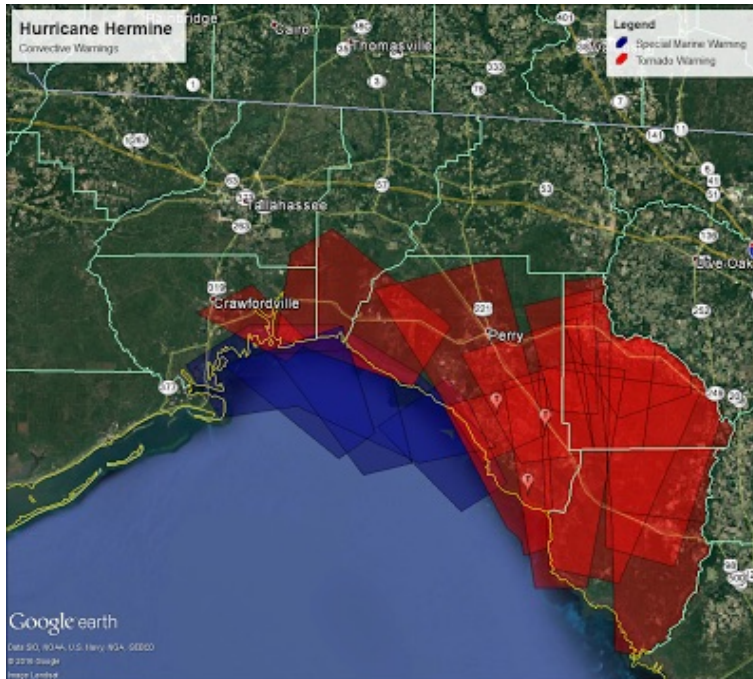


Figure 4: Map showing where the National Weather Service Weather Forecast Office in Tallahassee issued tornado warnings (red polygons) and where the three EF-0 tornadoes in southern Taylor County were confirmed (red pegs). Courtesy: NWS Tallahassee.

Additionally, one tornado touched down in the Hamlin Grove community of Winter Garden, Orange County, at around 8:38 PM EDT on the 1st and remained on the ground for one minute. The tornado was weak, rated EF-0 on the Enhanced Fujita Scale by a storm-survey team headed by the National Weather Service Weather Forecast Office in Melbourne. It had a path length of 1.2 miles, a maximum path width of 150 yards, and maximum winds of 80 to 85 miles per hour. The damage was summarized as follows: *“Toward the north end of the track, the tornado affected a neighborhood of new homes, resulting in minor damage to several of them. A pool screen enclosure and fences were damaged and a few homes experienced soffit, window and air conditioning unit damage due to impact from flying debris. Over 100 trees were damaged along the track, including dozens of pine trees snapped several feet from the ground. The tornado lifted near New Independence Parkway, east of Hamlin Groves Trail”*.

Rainfall from Hermine was particularly heavy in coastal areas of the Tampa Bay region, where minor to moderate flash flooding was reported. Rainfall occurred there, and elsewhere in the west-central part of the peninsula, as early as the afternoon of the 31st as the outermost bands of Hermine moved over the region. In the Big Bend, where rains were mainly confined to the 1st and 2nd, because Hermine was advancing fairly quickly, rainfall was moderate but not excessive. In particular, the rainfall generally did not result in flash flooding. The heaviest amounts in the Big Bend were observed in Dixie and Lafayette Counties (Figure 5).

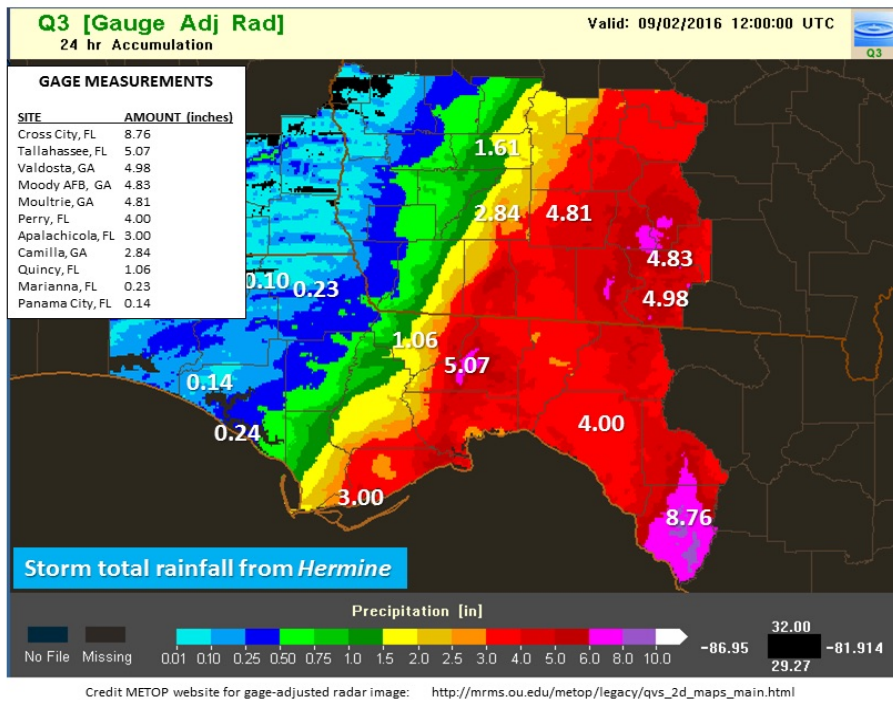


Figure 5: Map showing rainfall totals from Hurricane Hermine in the Big Bend region and south Georgia. Courtesy: NWS Tallahassee.

The following table shows selected 48-hour rainfall totals in excess of 3.00 inches ending the morning the 2nd measured by various gauges in Florida. These totals can be regarded as storm totals.

GAUGE LOCATION	COUNTY	RAINFALL TOTAL (inches)	OBSERVATION NETWORK
Seminole 3.2 WNW	Pinellas	16.64	CoCoRaHS
Largo	Pinellas	11.57	USGS
Seminole 1.2 WSW	Pinellas	11.33	CoCoRaHS
South Pasadena 0.6 E	Pinellas	10.65	CoCoRaHS
Largo 0.7 W	Pinellas	9.98	CoCoRaHS
Largo 2.2 ESE	Pinellas	9.50	CoCoRaHS
South Pasadena 1.0 NE	Pinellas	9.10	CoCoRaHS
Holiday 0.6 E	Pasco	8.74	CoCoRaHS
Hudson 1.1 ESE	Pasco	8.55	CoCoRaHS
Sarasota/Bradenton Airport	Sarasota	8.55	ASOS
Palmetto 1.2 W	Manatee	8.54	CoCoRaHS
Cross City 1 E	Dixie	8.43	NWS COOP
Dunedin 3.0 SE	Pinellas	8.32	CoCoRaHS
Clearwater 2.2 S	Pinellas	8.25	CoCoRaHS
Oldsmar 2 NW	Pinellas	8.02	USGS
Dunedin 2.8 ESE	Pinellas	7.88	CoCoRaHS

Bradenton 3.5 WNW	Manatee	7.80	CoCoRaHS
Tarpon Springs	Pinellas	7.79	USGS
Dunedin	Pinellas	7.75	USGS
Clearwater 3 E	Pinellas	7.68	USGS
Pinellas Park	Pinellas	7.26	USGS
Pinellas Park 2 N	Pinellas	7.19	USGS
Bronson 3.0 SE	Levy	7.16	CoCoRaHS
Suwannee 6 NE	Levy	7.13	USGS
Port Richey 2.0 NNE	Pasco	7.12	CoCoRaHS
Land O' Lakes 1.8 SE	Pasco	6.90	CoCoRaHS
St. Petersburg 2.3 SSW	Pinellas	6.84	CoCoRaHS
Dunedin 1 SE	Pinellas	6.80	USGS
Chiefland 2.4 WSW	Levy	6.71	CoCoRaHS
Tallahassee 5.7 SE	Leon	6.65	CoCoRaHS
Lake Ward/Bradenton 5 SE	Manatee	6.61	USGS
St. Petersburg 4.6 N	Pinellas	6.46	CoCoRaHS
St. Petersburg 2.4 NW	Pinellas	6.38	CoCoRaHS
Land O Lakes 1.5 SSE	Pasco	6.30	CoCoRaHS
St. Petersburg 2.4 N	Pinellas	6.30	CoCoRaHS
Oldsmar 3 NE	Hillsborough	6.25	USGS
Sulphur Springs 3 NW	Hillsborough	6.18	USGS
St. Petersburg 3.2 NNW	Pinellas	6.14	CoCoRaHS
Apollo Beach 3.0 ENE	Hillsborough	6.13	CoCoRaHS
Sarasota 1.4 E	Sarasota	6.13	CoCoRaHS
Mayo	Lafayette	6.10	NWS COOP
Tallahassee 3.3 SSE	Leon	6.00	CoCoRaHS
St. Petersburg 3.9 N	Pinellas	5.98	CoCoRaHS
Citrus Park 1.3 ENE	Hillsborough	5.96	CoCoRaHS
Tampa 6.5 NNE	Hillsborough	5.88	CoCoRaHS
Ruskin 1.8 ESE	Hillsborough	5.88	CoCoRaHS
University West 2.0 WNW	Hillsborough	5.83	CoCoRaHS
Crawfordville 7.3 SSE	Wakulla	5.81	CoCoRaHS
Riverview 4.8 SSW	Hillsborough	5.76	CoCoRaHS
St. Petersburg 4.5 NW	Pinellas	5.75	CoCoRaHS
Dade City 4.3 N	Pasco	5.74	CoCoRaHS
Tampa International Airport	Hillsborough	5.73	ASOS
Riverview 4.4 SSW	Hillsborough	5.72	CoCoRaHS
St. Petersburg 2.3 SSE	Pinellas	5.67	CoCoRaHS
Madison 1.2 ENE	Madison	5.60	CoCoRaHS
Monticello 9.8 SW	Jefferson	5.58	CoCoRaHS
Cross City 4.7 E	Dixie	5.56	CoCoRaHS
Lamont 7.7 SW	Jefferson	5.56	CoCoRaHS

Brooksville Airport	Hernando	5.53	ASOS
Temple Terrace 1.5 SE	Hillsborough	5.52	CoCoRaHS
Tallahassee 10.2 NE	Leon	5.52	CoCoRaHS
Tampa 5.2 SSW	Hillsborough	5.43	CoCoRaHS
Tallahassee 14.2 NE	Leon	5.42	CoCoRaHS
Bloomingtondale 7.6 ESE	Hillsborough	5.39	CoCoRaHS
Tampa 10.2 NNW	Hillsborough	5.39	CoCoRaHS
Sun City Center 1.0 NE	Hillsborough	5.35	CoCoRaHS
St. Petersburg/Clearwater Airport	Pinellas	5.33	ASOS
Chiefland 8.5 ENE	Levy	5.32	CoCoRaHS
Spring Hill 3.3 SE	Hernando	5.30	CoCoRaHS
Tallahassee 9.3 ESE	Leon	5.29	CoCoRaHS
Tallahassee 5.1 NE	Leon	5.25	CoCoRaHS
St. Petersburg – Albert Whitted Airport	Pinellas	5.23	ASOS
Lutz 2.0 E	Hillsborough	5.22	CoCoRaHS
Spring Hill 2.4 NW	Hernando	5.21	CoCoRaHS
Wimauma 4 SW	Hillsborough	5.19	USGS
Tampa 5.0 NNE	Hillsborough	5.16	CoCoRaHS
Sarasota 4.0 S	Sarasota	5.12	CoCoRaHS
Valrico 1.1 SE	Hillsborough	5.09	CoCoRaHS
Dade City 1.8 WSW	Pasco	5.08	CoCoRaHS
Tampa – Progress Boulevard	Hillsborough	5.08	USGS
Riverview 0.9 ENE	Hillsborough	5.07	CoCoRaHS
Tallahassee 8.1 NE	Leon	5.05	CoCoRaHS
Lutz 0.6 WSW	Hillsborough	5.02	CoCoRaHS
Tallahassee 1.3 SW	Leon	5.02	CoCoRaHS
Lutz 3.4 NE	Pasco	5.01	CoCoRaHS
Greater Northdale 0.4 ENE	Hillsborough	5.00	CoCoRaHS
Valrico 2.2 SE	Hillsborough	4.99	CoCoRaHS
Tallahassee 5.5 ENE	Leon	4.94	CoCoRaHS
Trenton 4.0 NW	Gilchrist	4.91	CoCoRaHS
Spring Hill 2.4 WSW	Hernando	4.90	CoCoRaHS
Tampa – Delaney Creek	Hillsborough	4.80	USGS
Monticello 2.9 WSW	Jefferson	4.85	CoCoRaHS
Monticello 4.3 ENE	Jefferson	4.72	CoCoRaHS
Tampa – East Lake	Hillsborough	4.70	USGS
Newberry 4.0 WNW	Gilchrist	4.66	CoCoRaHS
Crystal River 4.7 ESE	Citrus	4.65	CoCoRaHS
Lutz 1.3 SSE	Hillsborough	4.64	CoCoRaHS
Tampa 4.8 SW	Hillsborough	4.61	CoCoRaHS
Dade City 4.3 S	Pasco	4.61	CoCoRaHS

Plant City 6.4 NW	Hillsborough	4.57	CoCoRaHS
Live Oak 10.0 W	Suwannee	4.52	CoCoRaHS
Brandon 2.7 N	Hillsborough	4.51	CoCoRaHS
Tallahassee 5.2 E	Leon	4.51	CoCoRaHS
Tampa Dam	Hillsborough	4.50	USGS
Palmetto 6.4 ENE	Manatee	4.49	CoCoRaHS
Madison 8.3 NNE	Madison	4.45	CoCoRaHS
Tallahassee 0.6 SE	Leon	4.44	CoCoRaHS
Apalachicola 0.8 WNW	Franklin	4.41	CoCoRaHS
Auburndale 1.7 NW	Polk	4.41	CoCoRaHS
Tallahassee 10.8 N	Leon	4.40	CoCoRaHS
Thonotosassa 3 N	Hillsborough	4.40	USGS
Glen St. Mary 4.4 SW	Baker	4.39	CoCoRaHS
Ellenton 6.6 E	Manatee	4.39	CoCoRaHS
Dade City 4.6 SSE	Pasco	4.37	CoCoRaHS
High Springs 3.2 SW	Alachua	4.33	CoCoRaHS
Tampa 5.1 S	Hillsborough	4.32	CoCoRaHS
Trenton 8.0 ENE	Gilchrist	4.30	CoCoRaHS
Interlachen 1.3 SW	Putnam	4.30	CoCoRaHS
Lithia	Hillsborough	4.25	USGS
Gainesville Regional Airport	Alachua	4.23	ASOS
Bradenton 10.8 SE	Manatee	4.20	CoCoRaHS
Live Oak 9.1 NW	Suwannee	4.19	CoCoRaHS
Archer 5.5 E	Alachua	4.15	CoCoRaHS
Fort White 3.2 WNW	Columbia	4.11	CoCoRaHS
Gainesville 1.8 SW	Alachua	4.09	CoCoRaHS
Zephyrhills 0.9 ENE	Pasco	4.08	CoCoRaHS
Lorraine 1 SW	Manatee	4.07	USGS
Crystal River 5.3 NNE	Citrus	4.05	CoCoRaHS
Lakeland Highlands 0.3 SE	Polk	4.05	CoCoRaHS
Gainesville 1.7 SE	Alachua	4.00	CoCoRaHS
North Brooksville 6.3 NE	Hernando	4.00	CoCoRaHS
Zephyrhills 2.6 NNW	Pasco	3.99	CoCoRaHS
Lakeland 8.7 SW	Polk	3.98	CoCoRaHS
Auburndale 1.1 W	Polk	3.98	CoCoRaHS
Bradenton 11.0 E	Manatee	3.93	CoCoRaHS
Fort Lonesome	Hillsborough	3.90	USGS
Gainesville 3.8 W	Alachua	3.89	CoCoRaHS
Sarasota 6.4 NNE	Manatee	3.88	CoCoRaHS
Perry 2.0 S	Taylor	3.82	CoCoRaHS
Micanopy 8.5 W	Alachua	3.77	CoCoRaHS
Gainesville 7.7 W	Alachua	3.74	CoCoRaHS
Inverness	Citrus	3.74	NWS COOP

Spring Hill 1.6 NNW	Hernando	3.74	CoCoRaHS
Lakeland 6.9 SW	Polk	3.73	CoCoRaHS
Gainesville 3.4 S	Alachua	3.72	CoCoRaHS
Interlachen 10.4 NNE	Putnam	3.70	CoCoRaHS
Weeki Wachee 7.1 NNE	Hernando	3.69	CoCoRaHS
Live Oak 0.4 NE	Suwannee	3.69	CoCoRaHS
Macclenny 2.5 S	Baker	3.67	CoCoRaHS
Sarasota 5.8 SE	Sarasota	3.65	CoCoRaHS
Knights 4NE	Hillsborough	3.63	USGS
Lakeland 4.0 S	Polk	3.63	CoCoRaHS
Polk City 1.1 S	Polk	3.62	CoCoRaHS
Rockledge 1.1 WSW	Brevard	3.61	CoCoRaHS
Gainesville 6.5 NW	Alachua	3.60	CoCoRaHS
High Point 0.2 E	Hernando	3.59	CoCoRaHS
Myakka State Park	Sarasota	3.58	USGS
Eastpoint 1.4 NW	Franklin	3.57	CoCoRaHS
Gainesville 8.1 SW	Alachua	3.56	CoCoRaHS
Alachua 5.2 NNW	Alachua	3.53	CoCoRaHS
Orlando 2.9 NNE	Orange	3.50	CoCoRaHS
Glen St. Mary 1 W	Baker	3.47	NWS COOP
Havana 4.2 SW	Gadsden	3.45	CoCoRaHS
Gainesville 5.4 W	Alachua	3.38	CoCoRaHS
Gainesville 2.4 SW	Alachua	3.37	CoCoRaHS
Lutz 2.2 SSE	Hillsborough	3.35	CoCoRaHS
Ocala 14.3 S	Marion	3.32	CoCoRaHS
Brighton 7 NW	Highlands	3.28	USGS
Bushnell 1.0 NNW	Sumter	3.27	CoCoRaHS
Brooker 6.6 SSE	Alachua	3.26	CoCoRaHS
Kenansville 2NW	Osceola	3.25	S. Fla. Water Mgmt. Dist.
Inverness 2.6 ENE	Citrus	3.23	CoCoRaHS
Venice 2.4 SSE	Sarasota	3.23	CoCoRaHS
Lakeland 5.3 WNW	Polk	3.20	CoCoRaHS
Lake City 7.9 SSW	Columbia	3.19	CoCoRaHS
Cape Canaveral 0.6 ESE	Brevard	3.18	CoCoRaHS
Madison	Madison	3.17	NWS COOP
Jasper	Hamilton	3.15	NWS COOP
Dunnellon 10.1 NW	Levy	3.12	CoCoRaHS
Macclenny 4.9 SSW	Baker	3.09	CoCoRaHS
Glen St. Mary 1.7 N	Baker	3.07	CoCoRaHS
Jacksonville 6.7 WSW	Duval	3.06	CoCoRaHS
Myakka Head 8 W	Manatee	3.06	USGS
Palm Shores 1.4 W	Brevard	3.05	CoCoRaHS

Supplementary Links (all working as of 28 September 2016)

A summary of Hermine from the Tallahassee National Weather Service Weather Forecast Office: http://www.weather.gov/tae/hurricane_hermine2016

A report about the storm-damage survey for the tornado that touched down in Hamlin Grove, Orange County:
http://www.weather.gov/media/mlb/surveys/HamlinGroveTornado_090116.pdf

A link to a NWS Tallahassee Twitter post addressing storm surge during Hermine:
<https://twitter.com/NWSTallahassee/status/776808700514226176>

An archive of products issued by the National Hurricane Center for Hermine:
<http://www.nhc.noaa.gov/archive/2016/refresh/HERMINE+shtml/190402.shtml?>

Archived Doppler radar imagery of Hermine, courtesy of Brian McNoldy, University of Miami/Rosenstiel School: <http://andrew.rsmas.miami.edu/bmcnoldy/tropics/radar/>