NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM CINDY

(AL032017)

20–23 June 2017

Robbie Berg
National Hurricane Center
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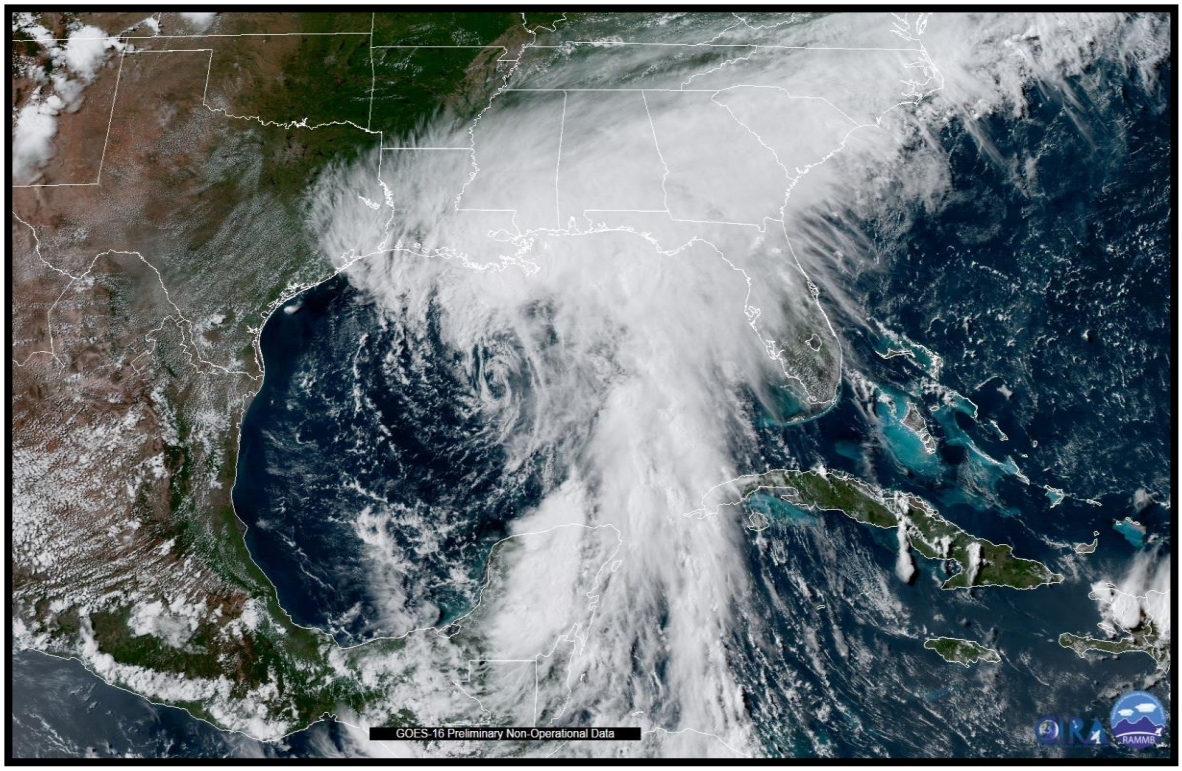

GOES-16 GEOCOLOR VISIBLE SATELLITE IMAGE OF TROPICAL STORM CINDY AT 2115 UTC 20 JUNE 2017. IMAGE COURTESY OF CIRA AND RAMMB.

Cindy was a large, sprawling tropical storm that formed in the Gulf of Mexico and made landfall just east of the Louisiana-Texas border. Cindy produced heavy rainfall and river flooding, as well as some coastal flooding, over the northern Gulf coastal region. The storm caused one direct death in Alabama.

Tropical Storm Cindy

20–23 JUNE 2017

SYNOPTIC HISTORY

Cindy developed within a large Central American cyclonic gyre, which was likely induced by the positive phase of the Madden-Julian Oscillation during the second week of June and then subsequently enhanced by the passage of two consecutive tropical waves. The first tropical wave moved off the west coast of Africa on 4 June and eventually contributed to a northward influx of moisture near Central America on 14–15 June. The following tropical wave, which initially moved off the west coast of Africa on 7 June, caught up to this area of disturbed weather over the far western Caribbean Sea on 17 June. The vorticity associated with the second wave rotated northwestward across the northwestern Caribbean Sea and Yucatan Peninsula within the Central American gyre, reaching the south-central Gulf of Mexico on 19 June. Even though a broad area of low pressure had developed by that time and was already producing gale-force winds east of the surface trough, the system did not have a well-defined center, and the low-level circulation was elongated with multiple embedded swirls. In addition, a large but linear band of deep convection extended east of the trough axis over the eastern Gulf of Mexico. The next day, the multiple low-level swirls consolidated into a sufficiently well-defined center of circulation, and deep convection showed increasing curvature around the new center. As a result, a tropical storm formed over the central Gulf of Mexico by 1800 UTC 20 June while centered about 210 n mi south-southwest of the mouth of the Mississippi River. Ship and dropsonde data indicate that the tropical storm had 45-kt sustained winds at the time of genesis. The "best track" chart of Cindy'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[1].

Due to its broad structure and a less-than-ideal environment, Cindy strengthened only a little after genesis to a peak intensity of 50 kt by 0000 UTC 21 June. However, the deepest convection subsequently moved inland over southern Louisiana, and the cyclone's maximum winds decreased to 45 kt by 1800 UTC that day. Cindy maintained that intensity while it moved northwestward and then northward over the northwestern Gulf of Mexico, with the center of circulation crossing the coast just east of Sabine Pass, or 20 n mi west of Cameron, Louisiana, around 0700 UTC 22 June. Cindy gradually weakened while it moved northward near the Louisiana-Texas border during the day, and it became a tropical depression by 0000 UTC 23 June about 25 n mi north-northeast of Shreveport, Louisiana. After its circulation became less defined and deep convection waned, the depression degenerated into a remnant low by 1800 UTC that day near the Land Between the Lakes National Recreation Area, about 30 n mi west of Hopkinsville, Kentucky. The remnant low continued east-northeastward across the central

[1] 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.

Appalachian Mountains, ultimately dissipating after 0600 UTC 24 June over the Mid-Atlantic states.

METEOROLOGICAL STATISTICS

Observations in Cindy (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), and objective Advanced Dvorak Technique (ADT) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from five flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Global Precipitation 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 Cindy.

Ship reports of winds of tropical storm force associated with Cindy are given in Table 2, and selected surface observations from land stations and data buoys are given in Table 3. Figure 4 shows selected locations along the northern Gulf Coast and over the Gulf of Mexico that reported sustained winds of 34 kt or higher.

Winds, Pressure, and Structure

Cindy's estimated intensity of 45 kt at the time of its genesis at 1800 UTC 20 June is based on coastal marine observations and dropsonde data from an Air Force Reserve reconnaissance mission. While flying through a convective band about 160 n mi north-northeast of Cindy's nascent center, the reconnaissance aircraft launched a dropsonde at 1542 UTC that measured an average wind of 51 kt in the lowest 150 m of the profile, corresponding to surface winds of 40-45 kt. That same convective band later moved over the mouth of the Mississippi River, where the Pilot's Station East National Ocean Service (NOS) station at Southwest Pass, Louisiana, recorded a sustained wind of 52 kt at 2136 UTC at a height of 24 m (corresponding to equivalent 10-m winds of 45-50 kt). Interpolating temporally between these data points supports maximum sustained winds of 45 kt at 1800 UTC. Although the ship *Pacific Sharav* (D5DY4) also reported sustained winds of 40-45 kt between 1400 and 1600 UTC, the ship's anemometer is 89 m above the water line, well above the standard 10-m height.

Cindy's estimated peak intensity of 50 kt from 0000 UTC to before 1800 UTC 21 June is also based on aircraft data. An Air Force Reserve flight measured an 850-mb flight-level wind of 62 kt at 0123 UTC 21 June (which equates to a surface intensity of 50 kt), and the plane's SFMR recorded surface winds of 49-51 kt for four consecutive minutes. In addition, ASCAT data from 0347 UTC also suggested that winds just under 50 kt were blowing away from the coast of southeastern Louisiana. Later in the day, the next Air Force Reserve mission did not find flight-level winds quite as high, but it still measured maximum SFMR winds of 51 kt at 1526 UTC.

Cindy's estimated landfall intensity of 45 kt is based on data from the oil rig *High Island 376B* (KHQI), which measured a sustained wind of 56 kt at 2255 UTC 21 June. Accounting for the anemometer's height yields a 10-m wind estimate of about 45 kt. In addition, an NOS station at Calcasieu Pass, Louisiana, recorded a sustained wind of 45 kt at 1036 UTC 22 June, more than three hours after Cindy made landfall.

Cindy's central pressure was at its lowest in the hours just before and up until landfall. A dropsonde released from an Air Force Reserve reconnaissance plane at 0342 UTC 22 June measured a splash pressure of 992 mb with a surface wind of 14 kt, yielding an estimated minimum central pressure of 991 mb.

Cindy had some subtropical characteristics throughout its life. As a result of 25 kt of deep-layer southwesterly shear, the cyclone did not have a central dense overcast over its center of circulation. In addition, Cindy was located a couple of hundred miles southeast of an upper-level low, suggesting that the cyclone was somewhat cold core in the upper troposphere, deriving some of its energy from baroclinic sources. Cindy also had a large circulation, but aircraft and marine observations showed that the cyclone had two radii of maximum winds: one in a convective band 60 n mi northwest of the center and another in convection 150 n mi northeast of the center. Because there was at least some convection near the center of circulation along with an inner radius of maximum winds, NHC opted to classify Cindy as a tropical storm instead of a subtropical storm.

Storm Surge[2]

The highest measured storm surge was 6.02 ft above normal tide levels at an NOS gauge at Shell Beach, Louisiana, on Lake Borgne. The combined effect of the surge and tide produced inundation levels of 2 to 4 ft above ground level along the coast of Louisiana, and the most vulnerable areas along the Louisiana coast may have received inundation of up to 5 ft above ground level. The NOS gauge at Shell Beach recorded a maximum water level of 4.8 ft above Mean Higher High Water (MHHW), and the gauge at Freshwater Canal Locks in Vermilion Parish measured a maximum water level of 4.2 ft MHHW. Figure 5 shows storm tide observations above MHHW from NOS and Texas Coastal Ocean Observing Network (TCOON) gauges, which provide rough approximations of inundation above normally dry ground.

Elsewhere, maximum inundation levels along the coasts of Mississippi, Alabama, the Florida Panhandle, and Texas were 3 ft or less. The maximum heights measured by tide gauges in each state were 3.3 ft MHHW at the Bay Waveland Yacht Club, Mississippi; 3.1 ft MHHW at

[2] 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).

Chickasaw Creek, Alabama; 2.2 ft MHHW at Pensacola, Florida, and 2.8 ft MHHW at Texas Point, Sabine Pass, Texas.

Rainfall and Flooding

Cindy produced heavy rainfall mainly well to the east of where the center made landfall, where heavy rain bands set up over the same areas for several days. Rainfall totals of 7 to 10 inches, with isolated higher amounts, occurred over portions of southeastern Mississippi, southwestern Alabama, and the extreme western part of the Florida Panhandle. The maximum reported storm-total rainfall was 18.69 inches near Ocean Springs, Mississippi. The highest amount in Alabama was 11.37 inches near Thomasville, and 10.68 inches was recorded near Navarre, Florida. Because of Cindy's highly asymmetric structure, much lower amounts were reported in Louisiana and Texas, closer to the storm's landfall location. The highest rainfall total measured in Texas was 8.86 inches in Silsbee, and 7.82 inches were recorded in St. Martinville, Louisiana. Figure 6 shows an analysis of total rainfall accumulations produced by Cindy, as well as its precursor and remnants, between 19–24 June.

Cindy's heavy rains caused flash flooding and minor to moderate flooding on several rivers. Moderate flooding occurred on the Biloxi River in Mississippi, with the river cresting 6.25 ft above flood stage near Wortham and 4.42 ft above flood stage near Lyman. The West Hobolochitto Creek near McNeil and the East Hobolochitto Creek near Caesar both crested several feet above flood stage, and moderate flooding was also reported on the Pearl River.

Tornadoes

Cindy produced ten tornadoes while it was a tropical cyclone: two in Florida, six in Alabama, and two in Mississippi (Fig. 7). All but two of the tornadoes were rated EF-0 (on the Enhanced Fujita Scale), causing a total property damage estimate of $125,000. The most damaging tornado was an EF-1 that cut a five-mile path near Green Bay, Alabama, causing significant tree damage and $50,000 worth of structural damage. A second EF-1 tornado occurred near Birmingham in Red Ore, Alabama.

Eight additional EF-0 and EF-1 tornadoes occurred in Kentucky (2), West Virginia (3), Pennsylvania (1), and New Jersey (2) after Cindy had become a post-tropical remnant low (Fig. 7). The three tornadoes in West Virginia were the most damaging, causing total estimated property damages of $385,000. An EF-1 tornado in Maken, West Virginia, alone accounted for $300,000 of that total. Two EF-1 tornadoes in Mathers Mill and St. Francis, Kentucky, also caused total estimated property damages of $250,000.

CASUALTY AND DAMAGE STATISTICS

Cindy caused one direct death[3] as a result of waves along the coast. A 10-year-old boy died after he was struck by a log pushed onshore by a large wave outside his family's condominium in Fort Morgan, Alabama. A 57-year-old man also died in Fort Morgan when he drowned in a rip current while attempting to rescue two children. However, the drowning occurred after Cindy had become a remnant low while centered over the Tennessee Valley. Two children were injured when a tree fell on their mobile home in Terrebonne Parish, Louisiana.

The NOAA National Centers for Environmental Information (NCEI) estimates that wind and water damage from Cindy totaled less than the $25 million standard used to tabulate tropical U.S. tropical cyclone costs. Effects from the storm were largely limited to numerous roads being flooded or damaged in Alabama, Mississippi, Louisiana, and Texas due to river flooding and storm surge. Some beach erosion was reported, and storm surge overtopped a local levee in Plaquemines Parish, Louisiana, resulting in minor flooding of lowland property near Myrtle Grove. Wind toppled some trees, including one which caused significant damage when it fell on a home in Lake Charles, Louisiana. The U.S. Coast Guard delivered a pump by helicopter to a shrimp trawler, which was at risk of sinking after taking on water about 80 miles off the coast of Galveston, Texas.

FORECAST AND WARNING CRITIQUE

The genesis forecasts for Cindy were quite good and provided a significant amount of lead time. Table 4 provides the number of hours in advance of formation associated with the first NHC Tropical Weather Outlook (TWO) forecast in each likelihood category. The incipient disturbance was introduced in the TWO and given a low (<40%) chance of genesis during the ensuing five days 174 h (7.25 days) before Cindy became a tropical cyclone. The five-day genesis probabilities were raised to the medium (40–60%) category 132 h (5.5 days) before formation and to the high (>60%) category 84 h (3.5 days) before formation. The disturbance was given a low chance of formation during the ensuing two days 96 h (4 days) before it became a tropical cyclone, and those probabilities were raised to the medium category 66 h (2.75 days) before genesis and to the high category 48 h (2 days) before genesis. The high confidence in Cindy's eventual formation and the expectation that it would bring tropical storm conditions to the northern Gulf Coast prompted NHC to initiate Potential Tropical Cyclone advisories at 2100 UTC 19 June, almost 24 h before Cindy became a tropical cyclone.

A verification of NHC official track forecasts for Cindy is given in Table 5a. Official forecast track errors were lower than the mean official errors for the previous 5-yr period for all forecast

[3] 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.

times (12 to 48 h). Cindy's track predictability was typical of most Atlantic tropical cyclones, with climatology and persistence model (OCD5) errors being comparable to their respective mean errors during the previous 5-yr period at all times. A homogeneous comparison of the official track errors with selected guidance models is given in Table 5b. The Hurricane Weather and Research Forecasting (HWFI) model performed spectacularly well for Cindy's track, besting the official forecasts at all forecast times and being about 50% better at 48 h. The European Centre for Medium-Range Weather Forecasts (EMXI) model and the TVCX multi-model consensus also performed well, beating the official track forecasts from 24 to 48 h.

A verification of NHC official intensity forecasts for Cindy is given in Table 6a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period at all forecast times (12 to 48 h). However, OCD5 errors were also lower than their respective 5-yr means, indicating that Cindy's intensity was relatively easier to forecast than that of a typical tropical cyclone. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 6b. Overall, the official intensity forecasts had lower errors than most of the guidance models. The only exceptions were Decay-SHIPS (DSHP), the Logistic Growth Equation Model (LGEM), and the ICON intensity consensus, which had lower errors than the official forecasts at 36 and 48 h.

Coastal watches and warnings associated with Cindy are given in Table 7. A Tropical Storm Warning was first issued at 2100 UTC 19 June from the Pearl River to Intracoastal City, Louisiana, and a Tropical Storm Watch was issued at the same time from Intracoastal City to High Island, Texas, when NHC initiated Potential Tropical Cyclone advisories. The Tropical Storm Warning was extended over time to encompass the entire coastline from the Alabama-Florida border to San Luis Pass, Texas, by 0300 UTC 21 June. Sustained tropical-storm-force winds are estimated to have first reached the coast within the warning area around 0300 UTC 21 June, indicating that the initial Tropical Storm Warning provided a lead time of 30 h. A storm surge watch and warning were not issued for Cindy since the area affected by storm surge inundation of 3 ft or greater was expected to be isolated in nature.

ACKNOWLEDGMENTS

Data in Table 3 were compiled from Post Tropical Cyclone Reports issued by the NWS Forecast Offices (WFOs) in Mobile, Alabama; Slidell, Louisiana; Lake Charles, Louisiana; and Houston/Galveston, Texas. Data from the Weather Prediction Center, National Data Buoy Center, NOS Center for Operational Oceanographic Products and Services, and United States Geological Survey were also used in this report.

Table 1. Best track for Tropical Storm Cindy, 20–23 June 2017.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
19 / 1800	23.6	88.6	1003	35	disturbance
20 / 0000	24.0	89.2	1000	35	"
20 / 0600	24.4	89.8	999	35	"
20 / 1200	25.0	90.3	997	40	"
20 / 1800	25.6	90.6	996	45	tropical storm
21 / 0000	26.2	90.9	995	50	"
21 / 0600	26.8	91.5	994	50	"
21 / 1200	27.3	92.3	993	50	"
21 / 1800	27.8	93.0	993	45	"
22 / 0000	28.5	93.4	992	45	"
22 / 0600	29.4	93.6	991	45	"
22 / 0700	29.8	93.7	991	45	"
22 / 1200	30.5	93.8	993	40	"
22 / 1800	31.6	93.8	996	35	"
23 / 0000	32.8	93.6	999	30	tropical depression
23 / 0600	34.2	92.8	1000	30	"
23 / 1200	35.5	90.8	1001	30	"
23 / 1800	36.7	88.1	1002	25	low
24 / 0000	37.7	84.4	1003	25	"
24 / 0600	38.9	78.5	1003	25	"
24 / 1200					dissipated
21 / 0000	26.2	90.9	995	50	maximum winds
22 / 0600	29.4	93.6	991	45	minimum pressure
22 / 0700	29.8	93.7	991	45	landfall just east of Sabine Pass

Table 2. Selected ship reports with winds of at least 34 kt for Tropical Storm Cindy, 20–23 June 2017, while it was a tropical cyclone. Note that many wind observations are taken from anemometers located well above the standard 10 m observation height.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
20 / 1800	9HXD9	21.1	85.8	140 / 40	1006.0
20 / 1800	D5DY4	26.2	91.4	360 / 38	1002.5
20 / 1800	CQHT	26.4	90.2	190 / 38	1000.8
20 / 1800	V7MO2	27.2	91.1	040 / 40	
20 / 1800	WCE506	28.8	88.9	060 / 37	1008.6
20 / 1900	D5DY4	26.2	91.4	010 / 38	1003.0
20 / 1900	WCE506	28.8	88.8	060 / 40	1007.2
20 / 2000	D5DY4	26.2	91.4	360 / 40	1001.0
20 / 2100	9HXD9	20.7	86.1	140 / 35	1004.0
20 / 2100	D5DY4	26.2	91.4	360 / 39	1000.8
20 / 2100	WDF296	28.4	86.8	150 / 40	1009.0
20 / 2200	WCE506	28.9	88.8	130 / 36	1004.6
20 / 2300	9HXD9	20.4	86.4	140 / 35	1004.0
20 / 2300	D5DY4	26.2	90.4	010 / 57	999.0
21 / 0000	D5DY4	26.2	91.4	010 / 37	999.8
21 / 0000	WDF296	28.1	86.6	140 / 40	1008.8
21 / 0000	WDF476	29.8	88.2	090 / 45	1012.3
21 / 0000	WBYQ	30.0	88.0	080 / 50	1009.1
21 / 0100	WDF476	29.7	88.1	090 / 60	1011.3
21 / 0300	WDF476	29.6	88.0	110 / 50	1011.5
21 / 0400	WHED	27.3	89.4	150 / 35	1003.3
21 / 0600	WBYQ	30.0	88.0	140 / 40	1009.1
21 / 0900	D5DY4	26.2	91.4	240 / 37	1000.0
21 / 1000	D5DY4	26.2	91.4	230 / 37	1000.5
21 / 1200	WDF296	26.4	85.0	130 / 35	1011.0
21 / 1200	V7MO2	27.2	91.1	180 / 36	100.0
21 / 1200	ELXX9	28.8	94.7	030 / 37	1007.0
21 / 1200	WDF476	29.0	87.3	150 / 35	1013.1
21 / 1200	C6FU7	29.2	87.6	140 / 35	1009.0
21 / 1300	D5DY4	26.2	91.4	210 / 38	1001.0

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
21 / 1400	D5DY4	26.2	91.4	210 / 39	1001.2
21 / 1900	WDF476	29.3	87.6	150 / 38	1011.7
21 / 2100	WDF476	29.3	87.8	150 / 40	1012.4
22 / 0100	WDF476	29.5	87.9	130 / 35	1011.3
22 / 0300	WDF476	29.3	87.7	140 / 35	1011.8
22 / 1200	WDF476	29.9	88.3	170 / 36	1013.3
24 / 1200	KABP	36.8	72.8	230 / 36	1011.1

Table 3. Selected surface observations for Tropical Storm Cindy, 20–23 June 2017.

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)				
Florida									
International Civil Aviation Organization (ICAO) Sites									
Pensacola NAS (KNPA) (30.36N 87.32W)	21/0856	1010.6	21/2330		41				7.94
Pensacola (KPNS) (30.47N 87.20W)	21/0953	1010.9	22/0008		36				8.28
Milton/Whiting Field (KNSE) (30.72N 87.02W)									9.58
Crestview (KCEW) (30.76N 86.57W)	21/0953	1012.1							5.08
Destin (KDTS) (30.40N 86.50W)	21/0853	1011.1							4.95
National Ocean Service (NOS) Sites									
Pensacola (8729840) (30.40N 87.21W)	21/0948	1010.7	21/2336		35	2.21	3.14	2.2	
Panama City Beach (8729210) (30.21N 85.88W)	21/0912	1012.2	21/1412	34 (9 m)	38	1.97		2.1	
Panama City (8729108) (30.15N 85.67W)	21/0900	1012.5				1.52	2.46	1.7	
Apalachicola (8728690) (29.72N 84.98W)	21/0900	1012.3				1.67	2.33	1.5	
Weatherflow Sites									
Pensacola Bay (XFPL) (30.36N 87.21W)	21/0732	1010.1	21/2337		42				
Okaloosa Pier (XOFP) (30.39N 86.59W)	21/0825	1009.8	22/0800		39				
Ft. Walton Beach (XFWB) (30.40N 86.56W)			22/0810		40				
Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) Sites									
Navarre 2.1 WNW (Santa Rosa Co.) (FL-SR-12) (30.41N 86.90W)									10.68
Gonzalez 2.5 NNW (Escambia Co.) (FL-ES-4) (30.60N 87.31W)									9.46
Gulf Breeze 7.2 ENE (Santa Rosa Co.) (FL-SR-19) (30.39N 87.08W)									8.55
Century 12 W (Escambia Co.) (FL-ES-39) (30.96N 87.47W)									6.96

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)				
NWS Cooperative Observer Program (COOP) Sites									
Atmore (ATMA1) (31.02N 87.49W)									6.31
Niceville (NCVF1) (30.50N 86.46W)									5.80
Alabama									
ICAO Sites									
Mobile Regional (KMOB) (30.67N 88.24W)	21/2156	1009.7	22/1559		38				6.81
Mobile Brookley (KBFM) (30.64N 88.07W)	21/2153	1010.1	22/0005		35				
Coastal-Marine Automated Network (C-MAN) Sites									
Dauphin Island (DPIA1) (30.25N 88.08W)	21/0900	1008.9	20/0208		39				
Dauphin Island Sea Lab Sites									
Middle Bay Lighthouse (MBLA1) (30.43N 88.01W)	21/2212	1008.1	22/0000	35 (14 m)	45				
Katrina Cut (KATA1) (30.25N 88.21W)	21/2214	1007.5	21/0300	34 (16 m)	39				
Cedar Point (CRTA1) (30.30N 88.14W)	21/0645	1009.4	21/2153		34				
NOS Sites									
Chickasaw Creek (8737138) (30.78N 88.07W)						3.69		3.1	
Coast Guard Sector Mobile (8736897) (30.65N 88.06W)	21/2212	1010.1				3.16		3.0	
Mobile State Docks (8737048) (30.70N 88.04W)	21/2218	1009.5				2.84	4.04	2.9	
Bayou La Batre (8739803) (30.41N 88.25W)						2.83	3.60	2.7	
West Fowl River Bridge (8738043) (30.38N 88.16W)						2.84	3.58	2.7	
Dog River Bridge (8735391) (30.55N 88.09W)						2.97		2.6	

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)				
East Fowl River Bridge (8735523) (30.44N 88.11W)						2.81		2.4	
Weeks Bay, Mobile Bay (8732828) (30.42N 87.83W)						2.32		2.2	
Dauphin Island (8735180) (30.25N 88.08W)	21/2330	1009.8	21/0424	34 (3.6 m)	40	2.31	2.69	2.0	
Weatherflow Sites									
Mobile - Buccaneer Yacht Club (XBUC) (30.58N 88.07W)	21/2217	1008.1	22/1642		38				
Foley – Gulf Shores (XGLF) (30.36N 87.65W)	21/2225	1007.6	22/0655		38				
Perdido Bay (XMLP) (30.27N 87.56W)	21/0807	1009.0	22/1517		38				
CoCoRaHS Sites									
Saraland 7 NNW (Mobile Co.) (AL-MB-14) (30.91N 88.12W)									8.97
Pollard 2.4 N (Escambia Co.) (AL-ES-1) (31.05N 87.17W)									8.55
Mobile 4.5 WSW (Mobile Co.) (AL-MB-73) (30.66N 88.16W)									8.21
Bay Minette 10.9 N (Baldwin Co.) (AL-BW-59) (31.03N 87.74W)									7.85
Foley 4.5 SE (Baldwin Co.) (AL-BW-74) (30.40N 87.63W)									7.76
Pine Hill (Wilcox Co.) (AL-WX-1) (31.96N 87.64W)									7.73
Grove Hill 6.1 SW (Clarke Co.) (AL-CK-3) (31.64N 87.85W)									7.58
Loxley (Baldwin Co.) (AL-BW-26) (30.62N 87.76W)									7.03

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)				
Jackson 4.3 WSW (Washington Co.) (AL-WS-1) (31.50N 87.96W)									6.99
Greenville 1.5 WSW (Butler Co.) (AL-BT-2) (31.82N 86.65W)									6.99
HADS Sites									
New Augusta (MAGM6) (31.20N 89.03W)									5.28
NWS COOP Sites									
Evergreen (EVRA1) (31.43N 86.96W)									6.38
Fairhope (FHPA1) (30.52N 87.90W)									6.24
Dauphin Island (DAUA1) (30.25N 88.11W)									5.92
Mississippi									
ICAO Sites									
Gulfport (KGPT) (30.40N 89.07W)	21/2231	1007.1	21/2025		43				8.01
Biloxi/Keesler AFB (KBIX) (30.43N 88.92W)	21/0833	1007.4	21/2050		35				7.98
Pascagoula (KPQL) (30.46N 88.53W)	22/0035	1008.8							4.64
C-MAN Sites									
Petit Bois Island, Port of Pascagoula (PTMB6) (30.21N 88.51W)	21/0600	1008.9	21/0254	38 (4.6 m)	48				
NOS Sites									
Bay Waveland Yacht Club (8747437) (30.33N 89.33W)	21/2230	1006.6	21/2018	36 (9.9 m)	46	4.09	4.35	3.3	
Dock E, Port of Pascagoula (8741041) (30.35N 88.51W)						2.67		2.5	
Pascagoula NOAA Lab (8741533) (30.37N 88.56W)						2.74		2.5	
United States Geological Survey (USGS) Sites									

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)				
Pascagoula River at Old Fort Bayou at Ocean Springs (30.42N 88.83W)						3.2[E]	3.92		
Weatherflow Sites									
Ship Island (XSHI) (30.23N 88.98W)	21/0829	1005.2	21/0239	34 (11 m, 1 min)	42				
CoCoRaHS Sites									
Ocean Springs 3.6 ESE (Jackson Co.) (MS-JC-12) (30.38N 88.75W)									18.74
Ocean Springs 3.3 E (Jackson Co.) (MS-JC-2) (30.41N 88.75W)									18.24
Ocean Springs 3.2 SE (Jackson Co.) (MS-JC-8) (30.37N 88.77W)									17.47
Gulfport 2.0 NE (Harrison Co.) (MS-HR-13) (30.41N 89.04W)									15.28
Vancleave 9.5 WSW (Jackson Co.) (MS-JC-23) (30.50N 88.82W)									11.34
Biloxi 13.1 NNW (Harrison Co.) (MS-HR-34) (30.50N 89.05W)									10.02
Pass Christian 5.0 N (Harrison Co.) (MS-HR-19) (30.39N 89.25W)									9.84
Gautier 4.9 N (Jackson Co.) (MS-JC-22) (30.46N 88.67W)									9.78
Pass Christian 3.5 NE (Harrison Co.) (MS-HR-10) (30.36N 89.21W)									9.64
Long Beach 0.8 SSE (Harrison Co.) (MS-HR-12) (30.35N 89.16W)									9.59

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)				
Long Beach 0.7 S (Harrison Co.) (MS-HR-27) (30.35N 89.17W)									9.15
Gulfport 4.3 NNW (Harrison Co.) (MS-HR-7) (30.45N 89.08W)									8.75
Pass Christian 8.9 NNW (Harrison Co.) (MS-HR-15) (30.44N 89.28W)									8.75
Kiln 3.3 N (Hancock Co.) (MS-HC-9) (30.47N 89.43W)									8.70
Pass Christian 9.8 NNW (Harrison Co.) (MS-HR-37) (30.46N 89.24W)									8.33
Diamondhead 0.9 NNW (Hancock Co.) (MS-HC-5) (30.40N 89.38W)									8.08
Waveland 1.0 NW (Hancock Co.) (MS-HC-18) (30.30N 89.40W)									7.15
Kiln 6.6 N (Hancock Co.) (MS-HC-13) (30.52N 89.43W)									7.13
HADS Sites									
Biloxi River at Wortham (BLWM6) (30.56N 89.12W)									9.90
Jourdan River at Kiln (KLNM6) (30.39N 89.44W)									5.80
East Pearl River near Stennis (NAPM6) (30.34N 89.64W)									5.19
NWS COOP Sites									

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)				
Ocean Springs (OCSM6) (30.41N 88.79W)									11.08
Long Beach (LNGM6) (30.35N 89.16W)									9.14
Pascagoula 3 NE (PGLM6) (30.40N 88.48W)									7.90[l]
Saucier Experiment Forest (SCRM6) (30.63N 89.05W)									7.69
Remote Automated Weather Sites (RAWS)									
Grand Bay / Orange Grove (GRBM6) (30.44N 88.43W)									5.44
Louisiana									
ICAO Sites									
New Orleans Lakefront Airport (KNEW) (30.04N 90.03W)	21/2231	1004.4	21/0507	38	43				2.50
New Orleans Louis Armstrong Intl Airport (KMSY) (29.98N 90.25W)	21/2329	1005.1	21/0617		39				3.56
Belle Chasse NAS (KNBG) (29.82N 90.03W)	21/2155	1004.9	21/0243		37				
Boothville (KBVE) (29.33N 89.40W)	20/2310	1005.4	20/1928		42				4.84
Galliano (KGAO) (29.44N 90.26W)			20/2355		36				
Lake Charles (KLCH) (30.13N 93.23W)	22/0650	996.6	22/0620	35	45				2.78
Lafayette (KLFT) (30.21N 91.98W)	22/0640	1002.0	22/1159		36				1.81
New Iberia/Acadiana (KARA) (30.03N 91.88W)	21/2253	1002.0	22/1453		40				
Sulphur/Southland Field (KUXL) (30.13N 93.38W)	22/1135	994.2							2.43
Chennault Air Park (KCWF) (30.21N 93.14W)	22/1155	997.0	22/1155		44				0.20

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)				
Jennings Airport (K3R7) (30.24N 92.67W)	22/0615	999.7	22/1255		36				2.14
Abbeville (KIYA) (29.98N 92.08W)	22/0650	1001.4	22/1250		39				0.84
Opelousas (KOPL) (30.56N 92.10W)	22/0935	1002.4	22/1635		34				0.78
Cameron (KCVW) (29.78N 93.30W)	22/0635	995.3	22/0725		35				
Ft. Polk - Fullerton (KBKB) (31.02N 92.91W)									3.85
C-MAN Sites									
Southwest Pass (BURL1) (28.91N 89.43W)	20/2200	1003.7	20/2010	45 (38 m, 10 min)	57				
Frenier Landing (FREL1) (30.11N 90.42W)	21/2224	1004.0	21/0536	32 (10 m, 2 min)	39				
LSU Coastal Studies Institute Sites									
Grand Isle Blocks (GRBL1) (29.10N 89.98W)	21/0000	1003.4	21/0000	43 (10 m, 2 min)	55				
South Timbalier Block 52 (SPLL1) (28.87N 90.48W)			20/1800	44 (40 m)	51				
Marsh Island (MRSL1) (29.44N 92.06W)			22/0400	35 (23 m)	44				
NOS Sites									
Shell Beach (8761305) (29.87N 89.67W)	21/2212	1005.3	21/0218	40 (16 m)	46	6.02		4.8	
Freshwater Canal Locks (8766072) (29.55N 92.31W)	21/2330	999.7	22/1354	32 (17 m)	41	4.14		4.2	
I-10 Bonnet Carre Floodway (8762483) (30.07N 90.39W)						4.35		3.9	
New Canal Station (NWCL1) (30.03N 90.11W)	21/2142	1005.0	21/0500	39 (10 m)	45	3.59		3.5	
LAWMA, Amerada Pass (8764227) (29.45N 91.34W)	21/2142	1001.7				3.28		3.5	
Eugene Island (8764314) (29.37N 91.38W)	21/2130	1001.1	21/0506	37	47	3.18		3.3	

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)				
Berwick, Atchafalaya River (8764044) (29.67N 91.24W)	21/2200	1002.5	21/0342	25 (13 m)	36	2.61		3.2	
Lake Charles (8767816) (30.22N 93.22W)	22/1148	996.0				3.08		3.2	
Lake Charles Bulk Terminal (8767961) (30.19N 93.30W)						3.06		3.0	
Calcasieu Pass (8768094) (29.77N 93.30W)	22/1030	993.1	22/1036	45 (12 m)	58	3.33		3.0	
Pilots Station East, SW Pass (8760922) (28.93N 89.41W)	20/2136	1004.8	20/2136	52 (24 m)	62	2.64		2.4	
Pilottown (8760721) (29.18N 89.26W)	20/2254	1005.0	22/1324	34 (10 m)	42	2.94		2.1	
Grand Isle (8761724) (29.26N 89.96W)	21/0830	1004.6	20/2342	34 (7 m)	44	2.60		1.9	
Port Fourchon, Belle Pass (8762075) (29.11N 90.20W)						2.14		1.9	
USGS Sites									
Northeast Bay Gardene near Point-a-la-Hache (BGNL1) (29.59N 89.61W)						5.5[E]	6.18		
Black Bay						4.4[E]	5.21		
Caillou Bay SW of Cocodrie (CCOL1) (29.16N 90.87W)						4.0[E]	5.62		
Bayou Liberty near Slidell (LBSL1) (30.30N 89.83W)						3.4[E]	4.93		
Caillou Lake (Sister Lake) SW of Dulac (DCLL1) (29.25N 90.92W)						2.9[E]	4.58		
Gulf Intracoastal Waterway at Bayou Lafourche at Larose (IWLL1) (29.58N 90.38W)						2.4[E]	3.62		
Amite River at Hwy 22 near Maurepas (MAUL1) (30.31N 90.61W)						2.4[E]	3.56		

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)				
Lafitte						2.2[E]	3.15		
West of Port Sulphur						1.0[E]	2.50		
Gulf Intracoastal Waterway at Houma						1.1[E]	2.30		
US Army Corps of Engineers (USACE) Sites									
Lake Pontchartrain near Mandeville (LPML1) (30.37N 90.09W)						3.4[E]	4.29		
Lake Pontchartrain at Rigolets (RIGL1) (30.17N 89.74W)						3.3[E]	3.67		4.41
New Orleans West End						1.5[E]	2.25		
Ponchatoula						1.5[E]	2.17		
Weatherflow Sites									
New Orleans Lakefront (XLKF) (30.04N 90.02W)			21/0612	35 (10 m, 1 min)	41				
East Bay Tower (XEBT) (29.06N 89.30W)			20/2132	36 (15 m)	48				
Lake Pontchartrain Causeway (XPTN) (30.20N 90.12W)	21/2203	1004.1	21/0618	34 (13 m, 1 min)	44				
Fourchon Heliport (KXPY) (29.12N 90.20W)			21/0015	30 (30 m, 8 min)	45				
Dulac (XDUL) (29.35N 90.73W)			21/0254	27 (10 m, 1 min)	40				
Bayou Bienvenue (XBYU) (30.00N 89.90W)			21/1838	38 (27 m, 1 min)	46				
CoCoRaHS Sites									
St. Bernard 2.7 E (St. Bernard Pa.) (LA-SB-2) (29.87N 89.81W)									6.52
Slidell 4.4 E (St. Tammany Pa.) (LA-ST-17) (29.87N 89.70W)									6.38
Slidell 2.2 NE (St. Tammany Pa.) (LA-ST-6) (30.30N 89.75W)									4.82

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)				
Lacombe 1.4 N (St. Tammany Pa.) (LA-ST-8) (30.30N 89.75W)									4.63
Metairie 1.6 ESE (Jefferson Pa.) (LA-JF-13) (29.99N 90.16W)									4.46
Abita Springs 1.9 NE (St. Tammany Pa.) (LA-ST-9) (30.50N 90.01W)									4.44
Chauvin 1.0 SSW (Terrebonne Pa.) (LA-TR-10) (29.43N 90.60W)									4.42
Covington 4.0 NNE (St. Tammany Pa.) (LA-ST-11) (30.32N 90.09W)									4.41
Sulphur 2.2 E (Calcasieu Pa.) (LA-CC-6) (30.22N 93.32W)									4.30
Ponchatoula 1.6 NNW (Tangipahoa Pa.) (LA-TG-11) (30.46N 90.45W)									4.29
Westlake 0.7 WNW (Calcasieu Pa.) (LA-CC-5) (30.25N 93.27W)									4.22
Ponchatoula 0.7 SW (Tangipahoa Pa.) (LA-TG-12) (30.43N 90.42W)									3.83
Abita Springs 2.2 SSW (St. Tammany Pa.) (LA-ST-7) (30.45N 90.05W)									3.82
Ponchatoula 4.9 E (Tangipahoa Pa.) (LA-TG-10) (30.43N 90.36W)									3.24
Hammond 2.3 WSW (Tangipahoa Pa.) (LA-TG-1) (30.44N 90.51W)									3.18

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)				
HADS Sites									
Bundick Creek near De Ridder (BUNL1) (30.82N 93.23W)									3.23
Neches River near Evadale (EVDT2) (30.36N 94.09W)									3.10
NWS COOP Sites									
Ponchatoula (PONL1) (30.46N 90.45W)									6.09
Slidell (SISL1) (30.27N 89.77W)									4.47
Meraux (MERL1) (29.93N 89.93W)									4.05
Cocodrie 6 N (CODL1) (29.34N 90.64W)									4.02
Dulac 3 N (DLCL1) (29.43N 90.70W)									3.70
Remote Automated Weather Sites (RAWS)									
Lacassine (LACL1) (30.00N 92.89W)			22/1146		38[l] (6.1 m)				3.44
Sabine (HAKL1) (29.89N 92.85W)									3.77
Dove Field (VRNL1) (31.03N 92.98W)									3.68
Vernon (LEVL1) (31.02N 93.19W)									3.30
Citizen Weather Observer Program (CWOP) Sites									
St. Martinville (AP774) (30.05N 91.81W)									7.82
Lake Charles (D6036) (30.15N 93.23W)									3.29
Rayne (C1478) (30.27N 92.26W)									3.09
Other Sites									
Lake Charles 2.0 W (CCBL1) (30.21N 93.24W)									4.85
Sulphur 3 ENE (CMFL1) (30.24N 93.31W)									4.57
Sulphur 1 ENE (CBBL1) (30.23N 93.34W)									4.57
Lake Charles 3 S (CCAL1) (30.16N 93.20W)									4.29

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)				
Starks 2 NE (CBHL1) (30.33N 93.64W)									4.22
Sulphur 4 SE (CAAL1) (30.18N 93.31W)									4.14
Texas									
ICAO Sites									
Galveston Scholes Field (KGLS) (29.27N 94.87W)	22/0652	999.1	22/0452		36				1.45
Houston/Bush Intercontinental Airport (KIAH) (29.97N 95.35W)	22/0853	1001.0							0.29
Houston Hobby Airport (KHOU) (29.65N 95.28W)	22/0753	1001.0							
C-MAN Sites									
Sabine Pass (SRST2) (29.68N 94.03W)	22/0800	995.7	22/0150		40 (9 m)				
NOS Sites									
Texas Point, Sabine Pass (TXPT2) (29.69N 93.84W)	22/0930	995.2	22/0130	32 (13 m)	39	3.05		2.8	
Galveston Pier 21 (GTOT2) (29.31N 94.79W)	22/0706	996.5				2.97	3.89	2.6	
Eagle Point (EPTT2) (29.48N 94.92W)	22/0712	999.1	21/0436	21 (6 m)	29	2.70		2.5	
Galveston Bay Entrance (North Jetty) (GNJT2) (29.36N 94.72W)	22/0706	997.1	22/0424	32 (12 m)	41	2.98		2.5	
Sabine Pass North (SBPT2) (29.73N 93.87W)	22/0930	996.6	22/0042	25 (6 m)	39	3.03		2.4	
Freeport (FCGT2) (28.94N 95.30W)	22/0600	1000.3	21/2148	23 (8 m)	28	2.67		2.1	
Rainbow Bridge (8770520) (29.98N 93.88W)						1.89		1.8	
Matagorda Bay Entrance Channel (MBET2) (28.43N 96.33W)	21/2248	1001.5	21/2148	24 (12 m)	28	2.44		1.8	

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)				
Morgans Point (MGPT2) (29.68N 94.99W)	22/0800	999.3	21/2300	23 (3 m)	29	1.64	2.79	1.6	
Rockport (RCPT2) (28.02N 97.05W)	21/2254	1002.2	22/2218	20 (6 m)	25	1.55	2.80	1.5	
Texas Coastal Ocean Observing Network (TCOON) Sites									
San Luis Pass (LUIT2) (29.08N 95.13W)	22/0606	1003.4	21/2200	25	29	2.73		2.7	
Galveston Railroad Bridge (GRRT2) (29.30N 94.90W)	22/0724	998.9	21/1106	28 (11 m)	35	2.77		2.5	
Port Arthur (PORT2) (29.87N 93.93W)	22/0948	996.0	22/0206	25 (11 m)	32	2.22		1.9	
Rollover Pass (RLOT2) (29.52N 94.51W)	22/0336	996.8	22/0330	36 (11 m)	45	2.56		1.9	
Aransas, Aransas Pass (ANPT2) (27.84N 97.04W)	21/2300	1001.9	22/0054	23 (4 m)	26	2.29		1.9	
High Island (HIST2) (29.59N 94.39W)	22/0730	997.1	22/0248	25	33	2.38		1.8	
Port Aransas (RTAT2) (27.84N 97.07W)	21/2254	1002.6	22/0054	19 (11 m)	24	2.29		1.8	
Seadrift (SDRT2) (28.41N 96.71W)	21/2224	1002.9	22/2354	22 (10 m)	26	1.62		1.7	
Port O'Connor (PCNT2) (28.45N 96.39W)	21/2300	1002.6	21/2142	23 (9 m)	27	2.18		1.7	
Matagorda City (EMAT2) (28.71N 95.91W)	21/2212	1002.0	21/1812	23 (8 m)	29	1.67		1.6	
Port Lavaca (VCAT2) (28.64N 96.60W)	21/2242	1003.0	22/2106	19	25	1.74		1.6	
Sargent (SGNT2) (28.77N 95.62W)	22/0606	1001.3	21/2042	22	29	1.90		1.5	
Copano Bay (CPNT2) (28.12N 97.02W)	21/2254	1004.5	21/2330	19	24	1.54		1.5	
Lynchburg Landing (LYBT2) (29.77N 95.08W)	22/0806	1000.0	21/2212	19	26	1.59		1.4	
Manchester (NCHT2) (29.73N 95.27W)	22/0818	999.7	21/2106	14	20	1.64		1.3	
Aransas Wildlife Refuge (AWRT2) (28.23N 96.80W)	21/2300	1002.5	21/1912	20	27	1.55		1.3	
Weatherflow Sites									
Crab Lake (XCRB) (29.47N 94.62W)	22/0709	994.0	22/0339	37 (20 m, 1 min)	44				

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)				
Galveston Bay (XGAL) (29.54N 94.91W)	22/0633	999.0	22/0330	26 (5 m, 1 min)	32				
CoCoRaHS Sites									
Buna 1.4 N (Jasper Co.) (TX-JS-6) (30.46N 93.96W)									4.60
Port Arthur 9.1 NNW (Jefferson Co.) (TX-JJ-10) (30.01N 93.99W)									3.28
HADS Sites									
Hamshire 5 SSW (JYST2) (29.79N 94.34W)									5.36
Sabine Pass 3 NW (JKJT2) (29.79N 93.97W)									5.32
Port Arthur 7.5W (JYGT2) (29.89N 94.05W)									4.33
McFaddin (FADT2) (29.71N 94.12W)									3.96
Jasper (JWRT2) (30.87N 94.01W)									3.30
RAWS Sites									
Southern Rough (WRRT2) (30.54N 94.35W)									5.76
Kirbyville (KRBT2) (30.63N 93.83W)									4.70
NWS COOP Sites									
Camp Pickett (CAPV2) (37.04N 77.96W)									2.09
CWOP Sites									
Silsbee (DW9101) (30.40N 94.18W)									8.86
Arkansas									
ICAO Sites									
Monticello (KLLQ) (33.64N 91.75W)									4.25

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)				
Pine Bluff (KPBF) (34.18N 91.93W)									3.35
CoCoRaHS Sites									
Monticello 1.6 WNW (Drew Co.) (AR-DR-9) (33.63N 91.82W)									6.38
Crosett 2.5 NNE (Ashley Co.) (AR-AS-1) (33.16N 91.95W)									5.63
White Hall 0.8 SE (Jefferson Co.) (AR-JF-2) (34.27N 92.09W)									4.87
De Witt 0.2 N (Arkansas Co.) (AR-AR-2) (34.29N 91.34W)									4.86
Marvell 4.1 W (AR-PH-6) (34.56N 90.99W)									4.75
Star City 4.3 SW (Lincoln Co.) (AR-PH-6) (33.89N 91.89W)									4.26
Mountain View 2.3 N (Stone Co.) (AR-ST-6) (35.90N 92.12W)									3.84
Paragould 2.2 NNW (Greene Co.) (AR-GN-15) (36.08N 90.53W)									3.73
Beebe 0.4 ESE (White Co.) (AR-WH-2) (35.07N 91.89W)									3.20
Bauxite 8.2 ESE (Saline Co.) (AR-SL-33) (34.49N 92.40W)									3.18
Camden 8.9 NNE (Ouachita Co.) (AR-OC-11) (33.68N 92.77W)									3.07
NWS COOP Sites									
Sparkman (SPKA4) (33.92N 92.84W)									3.23

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)				
Sheridan 1 SE (SHDA4) (34.30N 92.40W)									3.20
Tennessee									
HADS Sites									
Petros (PTST1) (36.10N 84.45W)									4.16
Millington (MLLT1) (35.33N 89.92W)									3.07
Kentucky									
CoCoRaHS Sites									
Versailles 5.8 SSW (Woodford Co.) (KY-WF-3) (37.97N 84.76W)									4.38
Elizabethtown 1.8 SE (Hardin Co.) (KY-HD-5) (37.69N 85.85W)									4.21
Lexington 3.7 WSW (Fayette Co.) (KY-FY-3) (38.02N 84.52W)									4.20
Lawrenceburg 5.2 SSE (Anderson Co.) (KY-AN-1) (37.97N 84.85W)									4.03
Bardstown 4.6 NW (Nelson Co.) (KY-NL-1) (37.85N 85.53W)									4.02
HADS Sites									
Glensboro (GNBK2) (38.00N 85.07W)									6.33
Boston (BSNK2) (37.77N 85.70W)									4.67
Taylorsville (TLRK2) (38.03N 85.35W)									4.00
Offshore									
NOAA Buoys									

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)				
Luke Offshore Test Platform (42040) (29.21N 88.23W)	20/2300	1006.8	20/2029	41 (4 m, 1 min)	45				
Mid Gulf (42001) (25.90N 89.67W)	20/2210	999.3	20/0219	37 (4 m, 1 min)	41				
Orange Beach (42012) (30.06N 87.55W)	21/0950	1009.2	20/2353	37 (5 m, 1 min)	41				
Pensacola (42039) (28.79N 86.01W)	20/2250	1009.3	21/0526	35 (5 m, 1 min)	39				
Galveston (42035) (29.23N 94.41W)	22/0650	995.5	21/1835		37 (5 m)				
West Gulf (42002) (26.09N 93.76W)	21/1150	1002.4	21/0909		37 (5 m)				
University of Southern Mississippi Buoys									
USM3M01 (42067) (30.04N 88.65W)	21/0840	1008.1	20/2029	33 (4 m, 8 min)	37				
Texas A&M Buoys									
GERG Flower Gardens Buoy V (42047) (27.90N 93.60W)	21/2300	993.6	21/2300	40 (3.4 m)	51				
Oil Platforms									
High Island 376B (KHQI) (27.93N 93.67W)	21/2255	991.9	21/2255	56	65				
Viosca Knoll 786 / Petronius (KVOA) (29.23N 87.78W)			20/2155	48 (160 m, 8 min)	53				
Auger – Garden Banks 426 (42361) (27.55N 92.49W)	21/1030	995.9	21/0430	48 (122 m)					
Louisiana Offshore Oil Port (LOPL1) (28.89N 90.03W)	20/2334	1002.1	20/2234	46 (58 m, 8 min)	57				
Main Pass 298C (KVKY) (29.25N 88.44W)			20/2115	46 (115 m, 8 min)	55				
Mississippi Canyon 474 / Na Kika FPU (KIKT) (29.25N 88.44W)			20/1735	46 (124 m, 8 min)	53				
Mississippi Canyon 311A (KMDJ) (28.64N 89.79W)			20/1855	43 (90 m, 8 min)	52				
Viosca Knoll 956 (42364) (29.06N 88.09W)	20/2030	1006.8	20/2030	41 (122 m, 8 min)					

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)				
West Delta 27A (KDLP) (29.12N 89.55W)			20/1900	40 (35 m, 8 min)	47				
MP 104B AWOS (KMIS) (29.30N 88.84W)			20/2235	38 (85 m, 8 min)	50				
Mississippi Canyon 809 (42365) (28.20N 89.12W)			21/0030	37 (122 m, 8 min)					

[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).
[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.
[l] Incomplete data
[E] Estimated

Table 4. 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%)	96	174
Medium (40%-60%)	66	132
High (>60%)	48	84

Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Cindy, 20–23 June 2017. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	**17.2**	**28.5**	**46.5**	**68.8**			
OCD5	46.0	109.1	190.3	222.3			
Forecasts	8	8	6	4			
OFCL (2012-16)	24.9	39.6	54.0	71.3	105.8	155.4	208.9
OCD5 (2012-16)	47.3	103.9	167.8	230.3	343.1	442.6	531.0

Table 5b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Cindy, 20–23 June 2017. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 5a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	16.3	28.3	49.0	73.6			
OCD5	50.9	107.9	210.5	245.4			
GFSI	29.1	53.6	68.1	95.9			
EMXI	20.1	**26.8**	**44.7**	**66.6**			
EGRI	20.4	32.5	**42.2**	**62.3**			
NVGI	30.8	47.0	49.2	78.9			
CMCI	26.1	54.0	49.4	89.3			
HWFI	**13.5**	**22.1**	**32.1**	**33.6**			
CTCI	24.0	38.1	**38.9**	74.1			
TCON	19.7	35.4	**43.9**	**60.7**			
TVCA	17.9	**28.0**	**34.1**	**55.3**			
TVCX	18.3	**27.8**	**35.2**	**55.4**			
GFEX	22.5	37.0	53.6	81.7			
HCCA	25.3	38.1	**48.9**	**60.1**			
FSSE	21.3	42.0	52.2	**67.6**			
AEMI	29.0	51.2	66.4	83.1			
TABS	34.9	43.7	49.7	**53.2**			
TABM	32.3	48.1	81.0	143.4			
TABD	42.7	74.3	94.5	235.3			
Forecasts	6	6	5	3			

Table 6a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Cindy, 20–23 June 2017. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	**2.5**	**1.3**	**2.5**	**2.5**			
OCD5	4.5	4.4	4.5	7.3			
Forecasts	8	8	6	4			
OFCL (2012-16)	5.5	8.2	10.5	12.0	13.4	14.0	14.5
OCD5 (2012-16)	7.1	10.5	13.0	15.1	17.4	18.2	20.6

Table 6b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Cindy, 20–23 June 2017. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 6a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	2.1	0.7	2.5	2.5			
OCD5	4.9	4.6	4.5	7.3			
DSHP	4.0	2.3	**1.3**	**0.8**			
LGEM	5.3	3.4	**2.2**	**1.3**			
HWFI	6.0	5.0	4.7	4.3			
CTCI	5.1	6.7	8.8	10.0			
ICON	4.6	3.1	**2.3**	**1.5**			
IVCN	4.7	3.6	3.7	3.5			
HCCA	5.1	4.6	6.5	5.5			
FSSE	4.0	3.4	5.3	7.5			
GFSI	5.6	5.9	5.3	6.3			
EMXI	5.3	3.9	4.3	3.5			
Forecasts	7	7	6	4			

Table 7. Watch and warning summary for Tropical Storm Cindy, 20–23 June 2017.

Date/Time (UTC)	Action	Location
19 / 2100	Tropical Storm Watch issued	Intracoastal City to High Island
19 / 2100	Tropical Storm Warning issued	Pearl River to Intracoastal City
20 / 0900	Tropical Storm Watch modified to	Cameron to High Island
20 / 0900	Tropical Storm Warning modified to	Pearl River to Cameron
20 / 1500	Tropical Storm Watch modified to	High Island to San Luis Pass
20 / 1500	Tropical Storm Warning modified to	Pearl River to High Island
20 / 2100	Tropical Storm Watch discontinued	All
20 / 2100	Tropical Storm Warning modified to	Pearl River to San Luis Pass
21 / 0300	Tropical Storm Warning modified to	Alabama/Florida border to San Luis Pass
21 / 1500	Tropical Storm Warning modified to	Mouth of the Mississippi River to San Luis Pass
22 / 0300	Tropical Storm Warning modified to	Grand Isle to San Luis Pass
22 / 0900	Tropical Storm Warning modified to	High Island to Morgan City
22 / 1500	Tropical Storm Warning discontinued	All

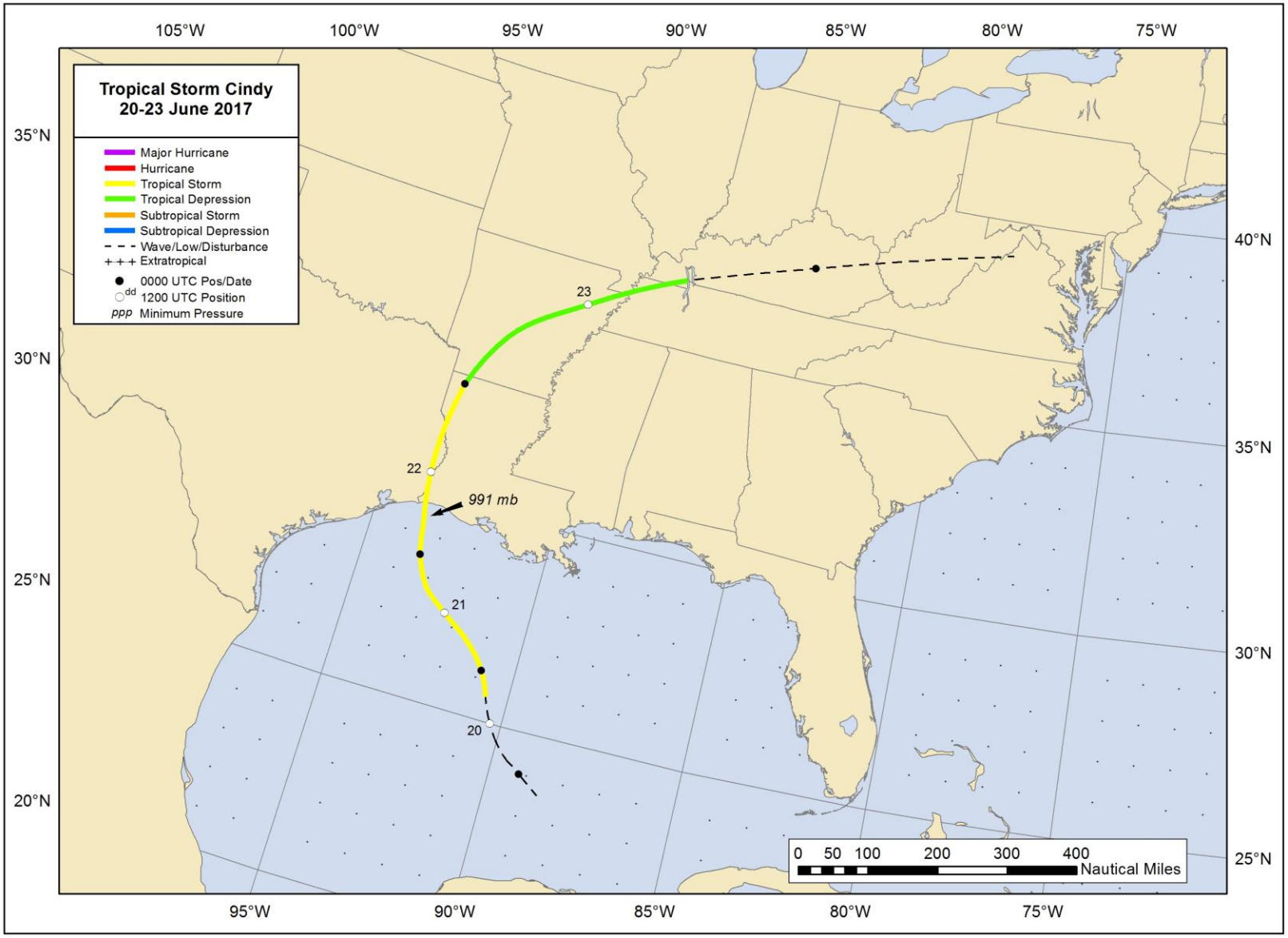

Figure 1. Best track positions for Tropical Storm Cindy, 20–23 June 2017.

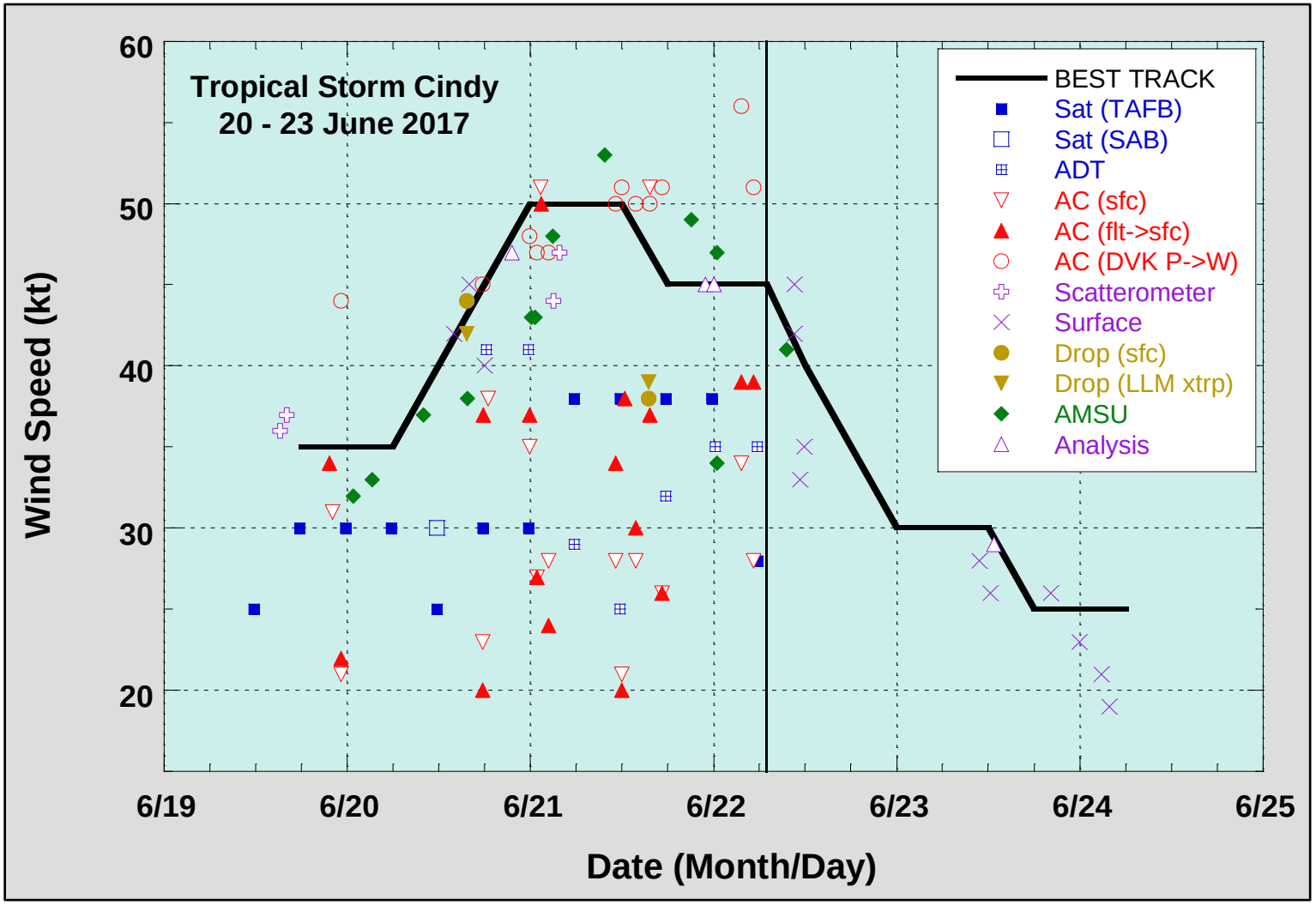

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Cindy, 20–23 June 2017. Aircraft observations have been adjusted for elevation using 80% adjustment factors for observations from 850 mb and 1500 ft. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM). Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC, and the solid vertical line corresponds to landfall.

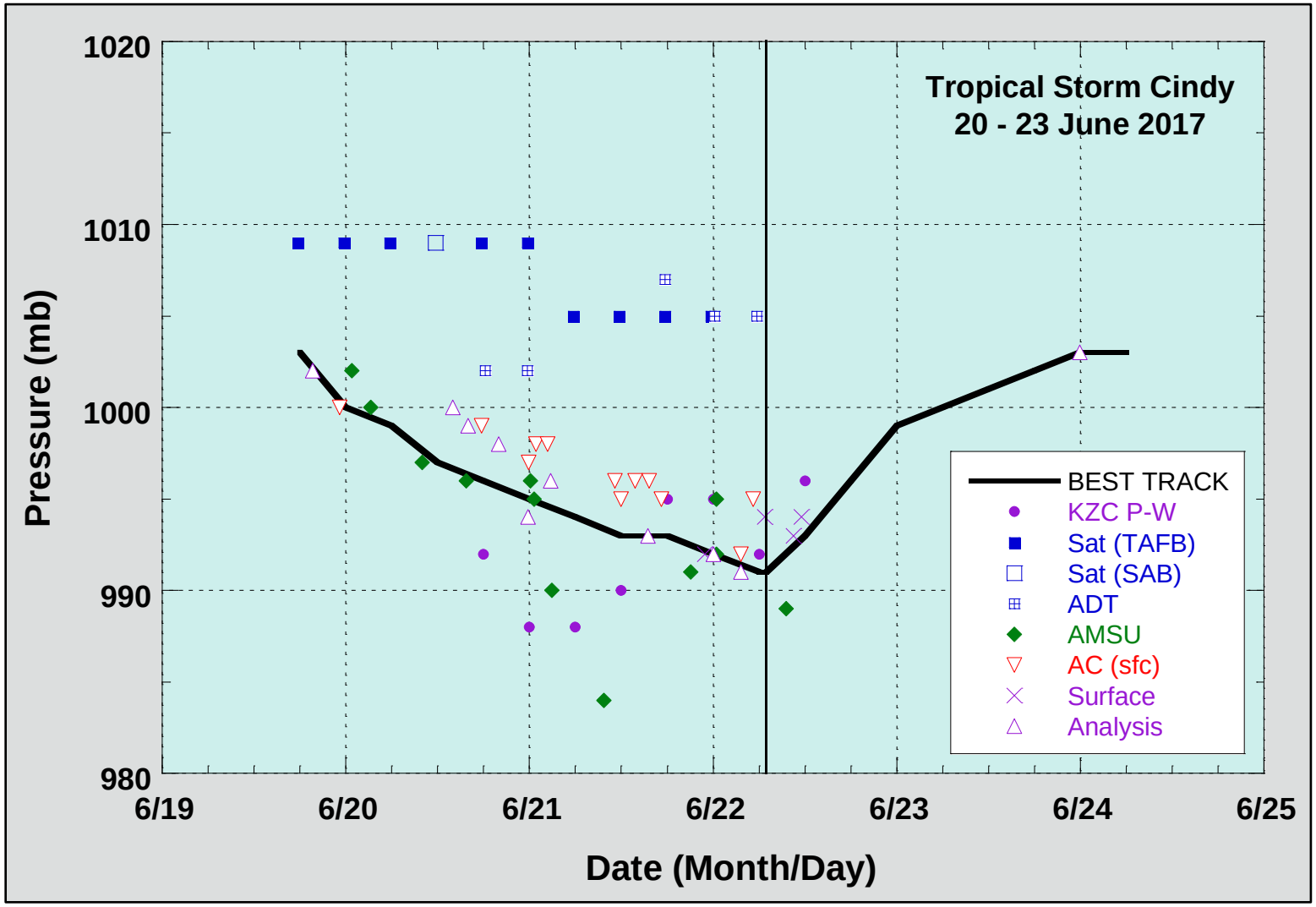

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Cindy, 20–23 June 2017. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC, and the solid vertical line corresponds to landfall.

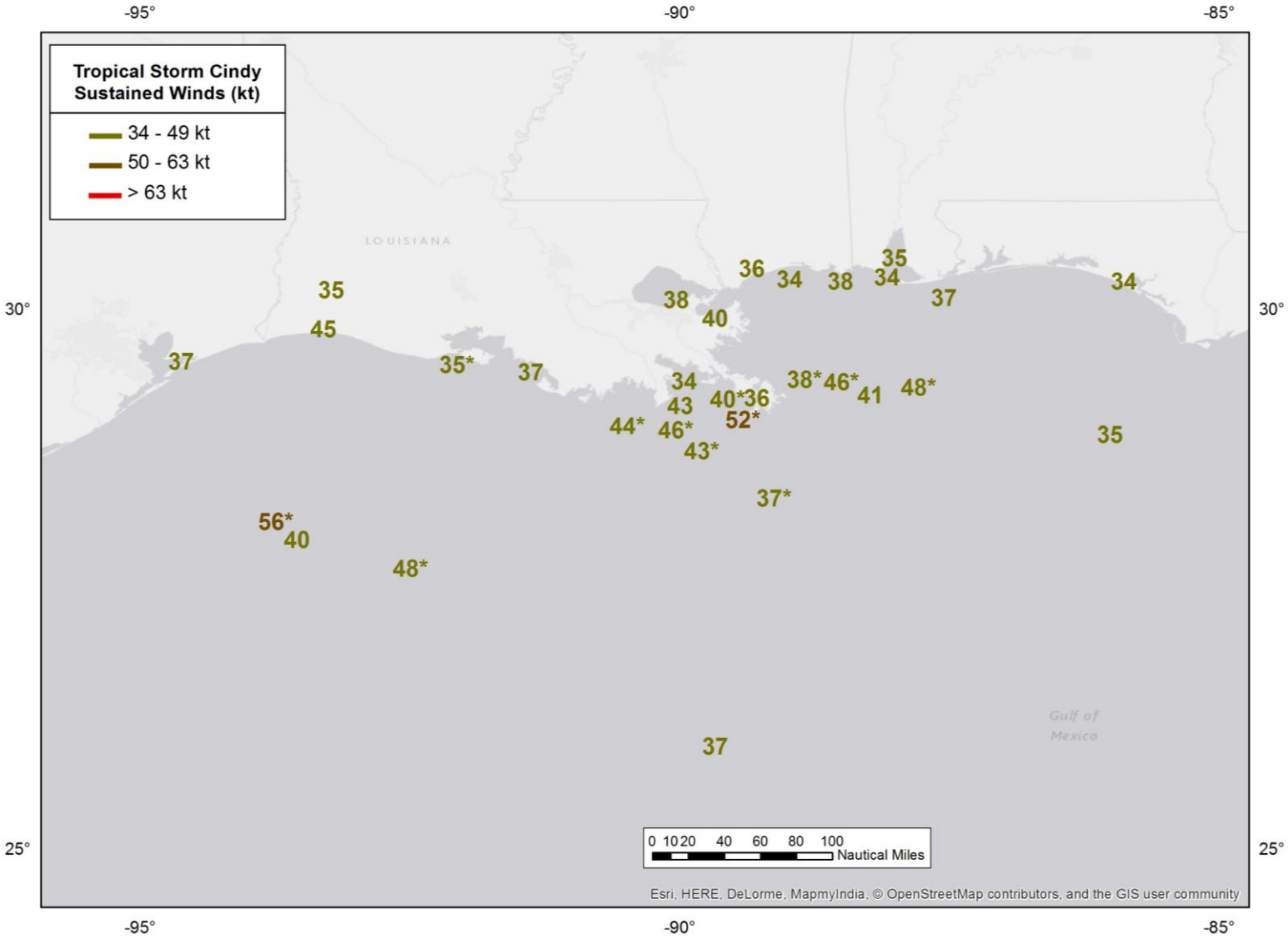

Figure 4. Selected peak sustained winds (kt) reported during Tropical Storm Cindy, 20–23 June 2017. An asterisk denotes observations that were elevated more than 20 m above the surface.

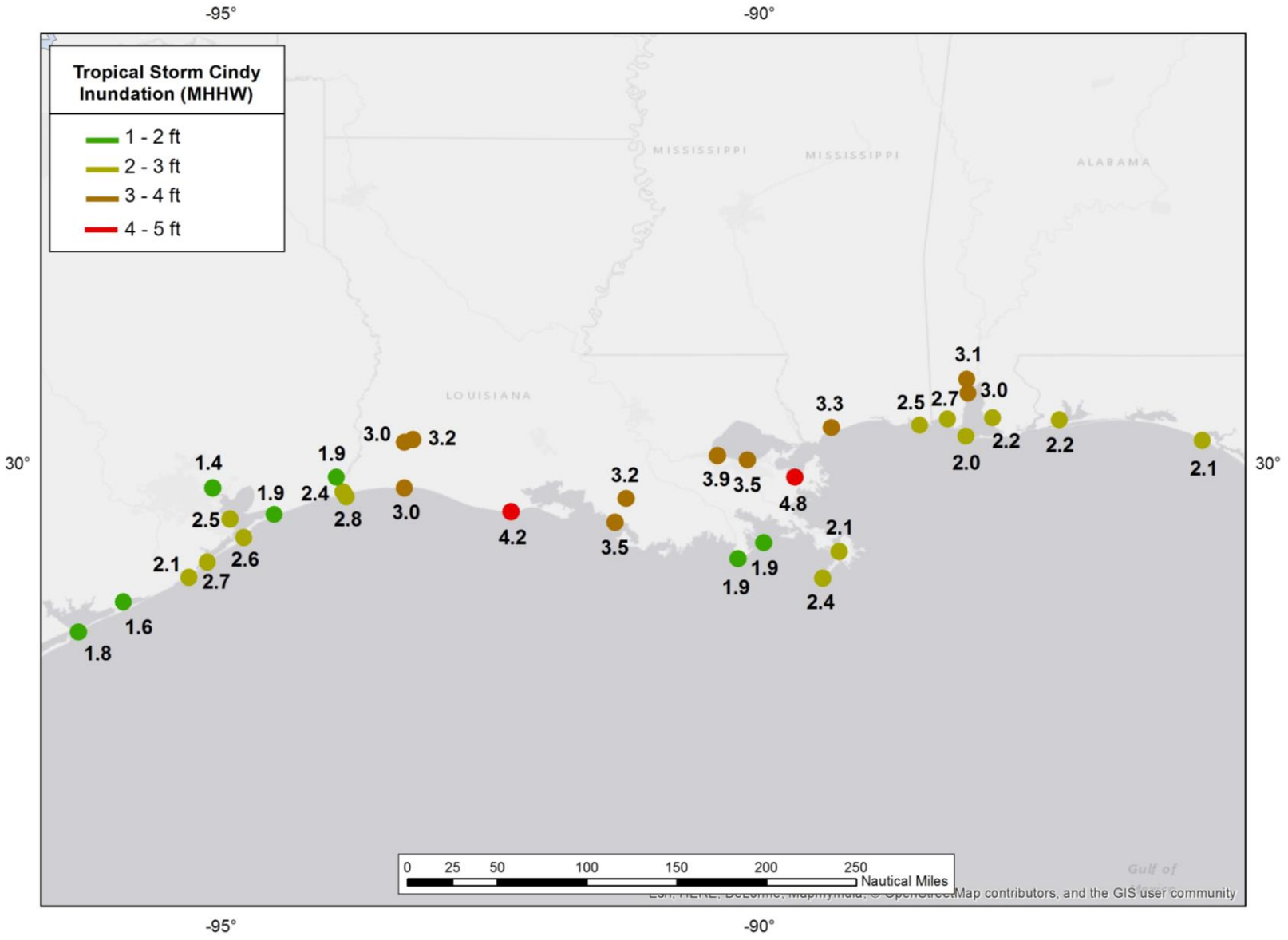

Figure 5. Storm tide measurements (ft) above Mean Higher High Water (MHHW) from NOS and TCOON gauges from Tropical Storm Cindy, 20–23 June 2017. MHHW is used as a proxy for inundation, or storm surge covering normally dry ground.

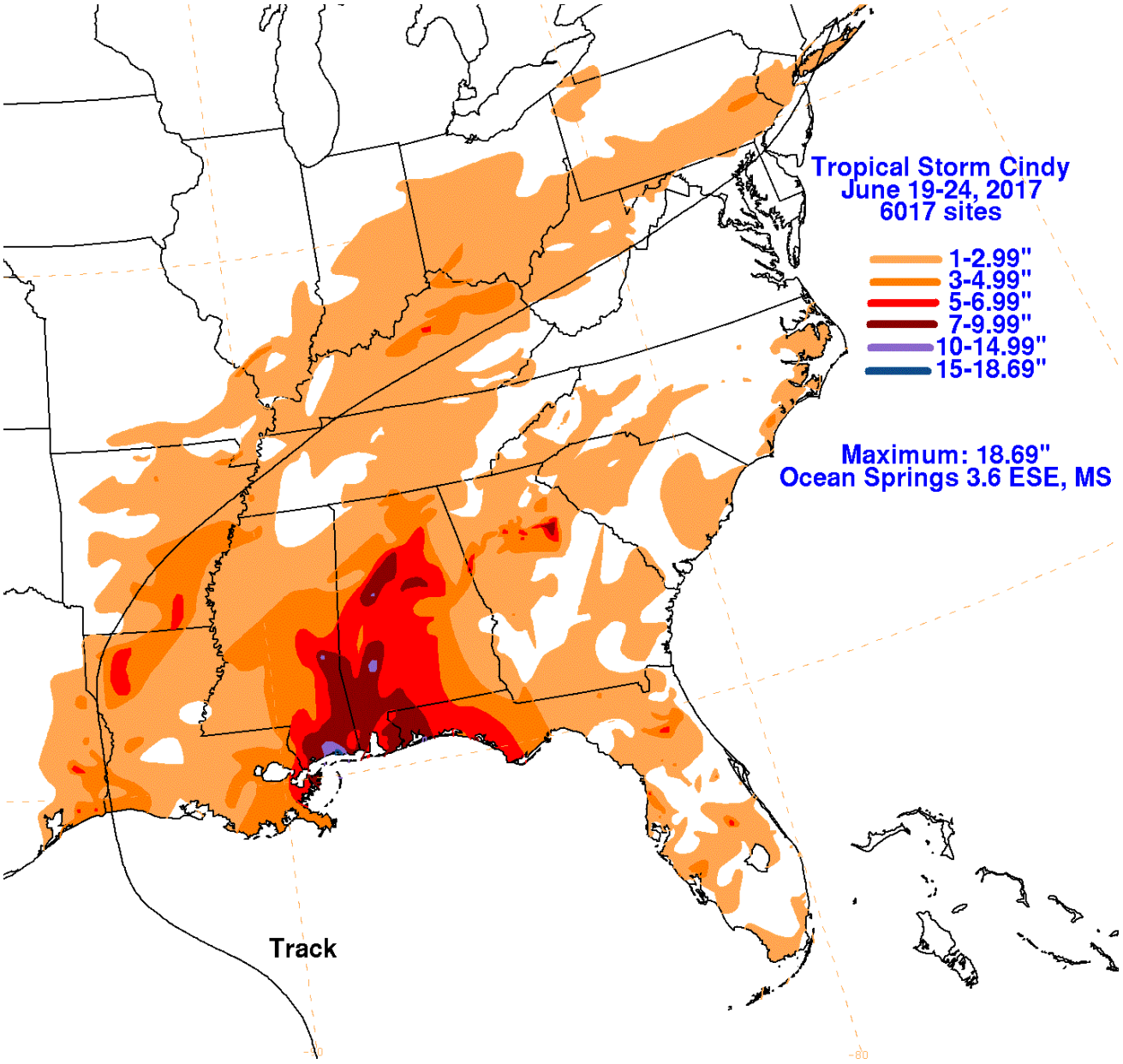

Figure 6. Rainfall accumulations (inches) between 19–24 June 2017 from Tropical Storm Cindy, including its precursor and remnants. Image courtesy of the NOAA Weather Prediction Center.

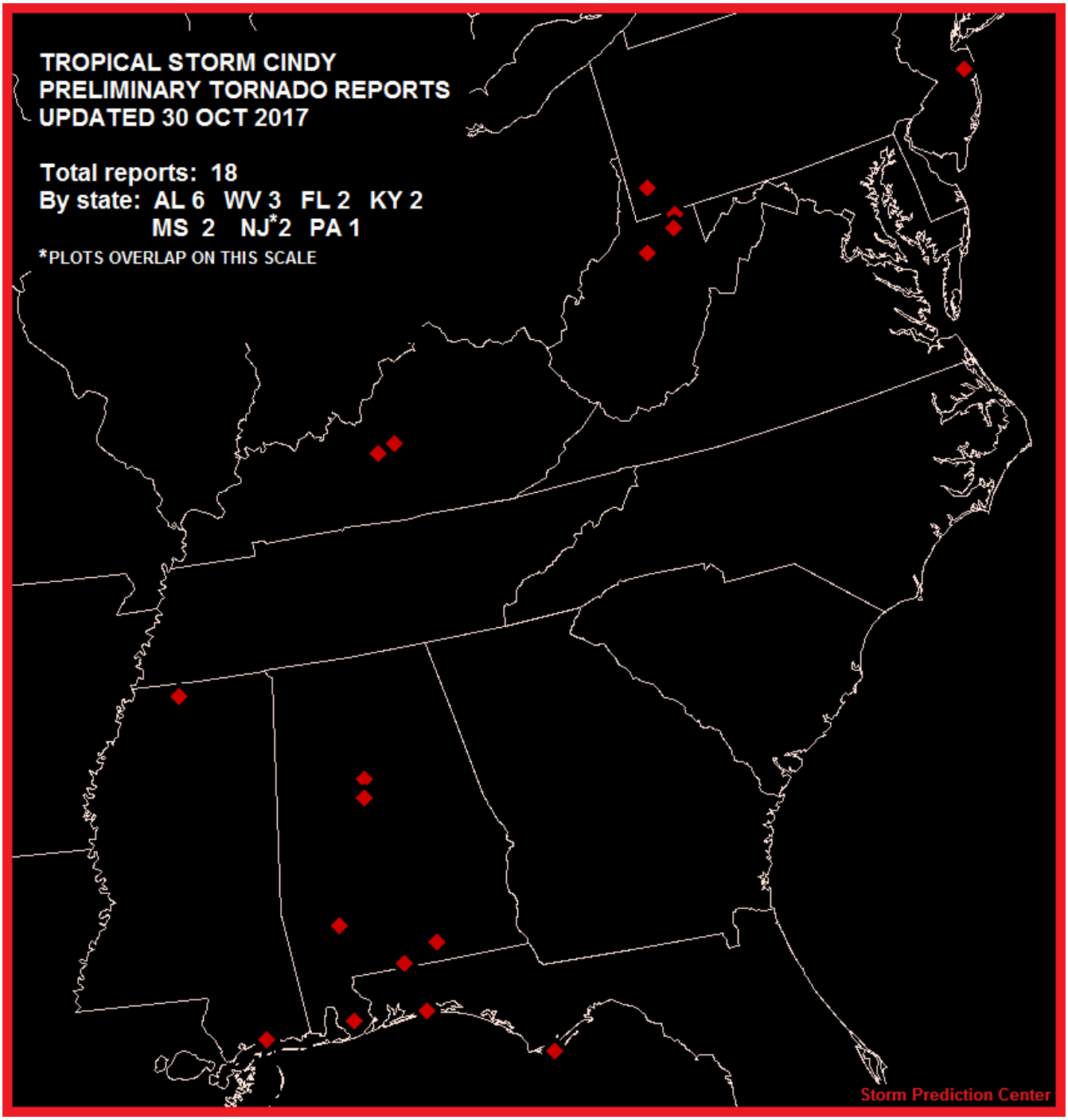

Figure 7. Tornadoes reported between 21–24 June 2017 from Tropical Storm Cindy and its remnants. Image courtesy of the NOAA Storm Prediction Center.