

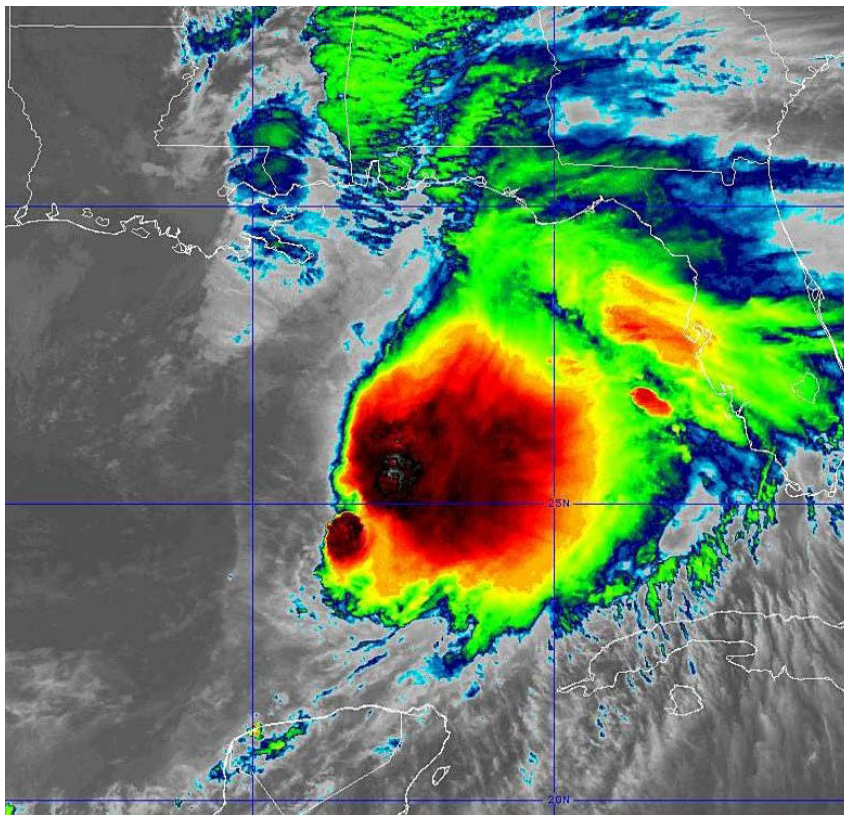


# NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

## TROPICAL STORM NESTOR (AL162019)

18–19 October 2019

Andrew B. Hagen, Eric Blake, and Robbie Berg  
National Hurricane Center  
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GOES-16 INFRARED SATELLITE IMAGE OF TROPICAL STORM NESTOR AT 1800 UTC 18 OCTOBER.

Nestor was a short-lived tropical storm that formed over the central Gulf of Mexico. The cyclone became extratropical and weakened before moving inland along the coast of the Florida Panhandle. Nestor produced a few damaging tornadoes in Florida along with localized flooding, causing an estimated \$125 million in damage.

# Tropical Storm Nestor

18–19 OCTOBER 2019

## SYNOPTIC HISTORY

Nestor originated from a tropical wave that emerged off the west coast of Africa on 3 October. Convection slightly increased in association with the westward-moving wave on 8–9 October when it entered the eastern Caribbean Sea. A larger increase in thunderstorm activity occurred while the wave moved across Central America on 13–14 October, partially due to the tropical wave interacting with a Central American Gyre over northern Central America and southeastern Mexico. The southern portion of the wave was designated as Potential Tropical Cyclone Seventeen-E at 0000 UTC 16 October in the eastern Pacific basin near the Gulf of Tehuantepec while the northern portion of the wave was over the Bay of Campeche. Later that day, after the potential tropical cyclone moved inland over southern Mexico, moderate-to-deep convection increased in coverage over the southwestern Gulf of Mexico near the northern portion of the wave, and a broad area of low pressure formed the next day. At the same time, a strong mid- to upper-level trough was moving eastward over southern Texas and northern Mexico, and a frontal system was also located over the northern and northwestern Gulf of Mexico. A large but disorganized area of thunderstorms formed near and east of the now gale-force low over the southwestern and central Gulf of Mexico on 17 October. Early the next day, as the disturbance moved northeastward toward the central Gulf of Mexico, the convective structure improved, with thunderstorms wrapping around the east side of the elongated but intensifying low-level wind circulation. Based on surface observations and aircraft data, it is estimated that the center became sufficiently well-defined by 1800 UTC 18 October for the system to be designated as a tropical storm (cover image). At the time of genesis, maximum sustained winds were already near 50 kt. The “best track” chart of Nestor’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<sup>1</sup>.

The upper-level environment over Nestor quickly became less favorable for any further intensification, and the cyclone never developed a classic tropical cyclone structure. The approaching mid- to upper-level trough was located almost directly over Nestor late on 18 October and early on 19 October. The trough and its associated frontal system over the northern Gulf induced extratropical transition. Nestor looked much more asymmetric by 0900 UTC 19 October, as the convection took on a more linear frontal structure spanning a large distance in the eastern semicircle, with little deep convection near the center. It is estimated that Nestor completed extratropical transition around 1200 UTC that day, about 5 h before the center moved inland along the Florida Panhandle. Maximum sustained winds had decreased to 40 kt by the time Nestor

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<sup>1</sup> 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 *bt* directory, while previous years’ data are located in the *archive* directory.

became extratropical. Within a few hours after post-tropical Nestor moved inland, the winds over land fell below gale force. However, at the same time, winds began to increase over the Atlantic waters off the southeast U.S. coast as the extratropical low moved northeastward over southern Georgia early on 20 October. Post-Tropical Nestor moved through the Carolinas and eastern Virginia before turning eastward and moved offshore of the Virginia coast late that day. The cyclone maintained an intensity of 40 kt through 0000 UTC 21 October when it was centered just offshore of Virginia. Satellite imagery and ASCAT data indicate that the extratropical low degenerated into an open trough shortly thereafter, while a separate low approached from the north and became the dominant circulation in the area.

## METEOROLOGICAL STATISTICS

Observations in Tropical Storm Nestor 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 and satellite consensus (SATCON) 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 by three flights from the 53<sup>rd</sup> Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command and two flights from the NOAA Aircraft Operations Center. 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 tracking the center of Nestor. The National Weather Service WSR-88D radar network provided data for tracking Nestor across the northern Gulf of Mexico.

Ship reports of winds of tropical storm force with Nestor are given in Table 2, and selected surface observations from land stations and data buoys are given in Table 3.

### *Winds and Pressure*

Nestor reached its estimated peak intensity of 50 kt prior to it becoming a tropical cyclone, but maintained that intensity as a tropical cyclone. The 50-kt peak intensity is based on flight-level winds and SFMR measurements from the NOAA and Air Force planes. The NOAA P-3 measured SFMR winds as high as 52 kt at 0230 UTC on 19 October. The Air Force plane found 850-mb flight-level winds of 61 kt at 0024 UTC on 19 October, which reduces to 49 kt at the surface using the standard 0.80 reduction factor. An earlier NOAA flight during the morning of 18 October measured 49-kt winds from the SFMR at 1342 UTC, which is the reason for the 50-kt intensity at 1200 UTC that day. An ASCAT pass from around 1500 UTC on 18 October showed a large area of 45-kt wind vectors east of the center, supporting the analyzed intensity given the coarse resolution of that instrument. A 700-mb flight-level wind of 72 kt during the NOAA flight on the morning of 18 October occurred in deep convection that was transient, and the wind is not

believed to be representative of the system's overall intensity. Furthermore, the system was not yet a tropical cyclone at the time of this observation, and it is possible that a greater reduction factor would be needed to obtain a surface wind from 700 mb, rather than utilizing the standard 0.90 reduction factor for hurricane eyewalls.

Nestor was designated as a tropical storm because of its warm core and highly convective nature. The cyclone possessed some characteristics of a subtropical cyclone, however, including asymmetric convection, strong winds only on the east side of a large and elongated circulation, and the proximity of an upper-level trough. Thus, there is greater than normal uncertainty as to whether Nestor was a tropical or subtropical storm.

The minimum pressure of 996 mb is based on a dropsonde observation near 0000 UTC 19 October that had a splash pressure of 997 mb with a 16-kt wind. There were also several surface observations over water and at the coast of Florida in the 998–1000 mb range, supporting the analyzed central pressure.

## Tornadoes

During the evening of 18 October through the next morning, at least three tornadoes occurred over western portions of the Florida peninsula. The most damaging was an EF-2 tornado in Polk County (Fig. 4) that began near Interstate-4 (I-4) and traveled northward near Lakeland and through the city of Kathleen. Figure 5 shows the well-defined hook echo and debris ball in Doppler radar reflectivity and correlation coefficient data, respectively, near Kathleen. An EF-1 tornado occurred in Cape Coral in Lee County on the morning of 19 October, and an EF-0 tornado was confirmed in Pinellas County the previous evening.

## Storm Surge

Elevated water levels occurred along much of the U.S. Gulf coast during Nestor (Fig. 6), but many locations were already running about a foot or two above normal since about mid-September due to seasonal oceanographic factors. According to the NOAA September 2019 Global Climate Report<sup>2</sup>, the Gulf of Mexico had its warmest September on record (0.99°C above average). The resultant thermal expansion of the water column likely led to these high water levels along much of the Gulf of Mexico coastline during the fall season. Storm surge<sup>3</sup> flooding related to Nestor itself occurred along portions of the Florida Panhandle and Apalachee Bay, with the highest measured storm surges being 3.60 ft and 3.55 ft above normal tide levels at National Ocean Service (NOS) gauges at Cedar Key and Apalachicola, Florida, respectively.

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<sup>2</sup> NOAA Global Climate Report – September 2019: <https://www.ncdc.noaa.gov/sotc/global/201909>

<sup>3</sup> 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).

The combined effect of surge, tide, and pre-existing elevated water levels produced inundation levels of 2 to 3 ft above ground level, with isolated areas up to 4 ft above ground level, along Apalachee Bay. Gauges from the United States Geological Survey (USGS), NOS, and the Northwest Florida Water Management District (NFWFMD) measured water levels of 3.7 ft, 3.3 ft, and 3.0 ft above Mean Higher High Water (MHHW) at Spring Creek, Apalachicola, and St. Marks, respectively (Fig. 7). Water levels of 2 to 3 ft MHHW were recorded at numerous other sites along the U.S. Gulf Coast between Tampa Bay, Florida, and South Padre Island, Texas.

### **Rainfall and Flooding**

Storm total rainfall amounts as high as 7.77 inches were recorded in Baskin in Pinellas County, Florida (Fig. 8). Heavy rain caused several roadways to flood in the St. Petersburg area. Elsewhere across the remainder of the southeastern United States, minor street flooding was reported from the rainfall associated with Nestor's extratropical stage. Rainfall amounts of 2 to 4 inches associated with the storm covered a fairly large area of central and northern Florida and into Georgia, but these rains were largely beneficial since most of the area had been experiencing drought conditions.

## **CASUALTY AND DAMAGE STATISTICS**

There were no reports of direct deaths<sup>4</sup> associated with Tropical Storm Nestor. Three indirect deaths occurred in a two-vehicle car collision on the evening of 19 October in Greenville County, South Carolina, that may have partially been influenced by wet roads due to rain from Post-Tropical Cyclone Nestor. Total damage in the United States is estimated to be about \$125 million by the NOAA National Centers for Environmental Information. The majority of the damage was caused by the tornadoes in Florida, and some of the damage was due to storm surge.

The most significant damage produced by Nestor was from tornadoes in the outer rain bands on the evening of 18 October through the next morning over the Florida peninsula. The hardest hit area was in and around Kathleen, where the aforementioned EF-2 tornado caused extensive damage to numerous structures, including over 50 homes, a church and a middle school. That same tornado began just west of Lakeland, south of I-4. When it crossed the interstate highway, the tornado overturned a tractor trailer and an 18-wheeler, which blocked the road. The EF-1 tornado in Cape Coral the morning of 19 October also caused damage to multiple structures, with one home sustaining substantial roof damage. Several vehicles were also damaged. The EF-0 tornado in Pinellas County the evening of 18 October produced minor damage in the Twelve Oaks Mobile Home Park. At one point, more than 10,000 customers in Florida were without power.

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<sup>4</sup> 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.



Nestor's storm surge produced minor flood damage over a limited area along the coast of Franklin County and Wakulla County in Florida. One restaurant in St. Marks had less than 1 ft of water inside. A few coastal roads were reported washed out.

## FORECAST AND WARNING CRITIQUE

### *Genesis*

The Tropical Weather Outlook (TWO) first highlighted a low chance of tropical cyclone formation over the Gulf of Mexico at 1800 UTC 13 October, five days prior to genesis. The Five-day chance was raised to the medium category (40–60%) 72 h prior to genesis and to the high category (>60%) 36 h before formation. Two-day probabilities were initiated in the low category 72 h prior to genesis. The two-day chance was increased to the medium category 48 h prior to genesis, and to the high category 36 h prior to formation.

### *Track and Intensity*

Nestor was a short-lived tropical cyclone, and there was only one verifying forecast at 12 h, so a comprehensive verification of model forecasts is not included. Nestor ended up being slightly weaker than anticipated when it reached the coastline of Florida. The one verifying intensity forecast had an error of 5 kt. Low-end tropical-storm force winds of 35–40 kt likely only affected a small stretch of the immediate coastline of Florida between the Big Bend and the eastern Florida panhandle.

### *Storm Surge*

The NWS issued storm surge warnings for a portion of the northern Gulf coast from Indian Pass to Clearwater Beach, Florida. Water level observations indicate that more than 3 ft of inundation (which NHC uses as a first-cut threshold for the storm surge watch/warning) occurred within the western part of the warning area along portions of the Florida Panhandle (Fig. 7).

The NWS issued the initial storm surge watch from Indian Pass to Clearwater Beach at 1500 UTC 17 October when advisories were initiated on Potential Tropical Cyclone Sixteen, which was about 42 h before sustained tropical-storm-force winds began near that portion of the coastline. The storm surge watch was upgraded to a storm surge warning six hours later at 2100 UTC, which was 36 h before sustained tropical-storm-force winds began near the coast.

NHC's forecast for maximum storm surge heights was 3 to 5 ft above ground level from Indian Pass to Chassahowitza, Florida. These forecasts were slightly high, particularly for the eastern section of that coastal segment, since the maximum inundation levels were 2 to 4 ft above ground level mainly between Indian Pass and the Aucilla River.

## ***Watches and Warnings***

Potential tropical cyclone advisories were initiated for the disturbance that became Nestor at 1500 UTC 17 October in order to issue tropical storm and storm surge watches and warnings from the Louisiana Gulf coast to the Florida Gulf coast (Tables 5 and 6). Initially, the tropical storm warnings included portions of southeastern Louisiana and Alabama that did not receive those winds. Tropical storm-force-winds began along the coast near the Apalachicola area around 0900 UTC 19 October, about 42 h after the tropical storm warning was issued. The tropical storm warning was extended eastward to Yankeetown, Florida at 0300 UTC 18 October, and tropical storm-force-winds began along the coast in this area around 1500 UTC 19 October, about 36 h later. Therefore, all areas of the Florida coast that received tropical-storm-force winds had at least 36 h of lead time on the tropical storm warning.

## ***Impact-Based Decision Support Services (IDSS) and Public Communication***

The NHC provided support to emergency managers on 17–18 October as Nestor developed and approached the Florida Panhandle. The decision support services included calls and briefings coordinated through the FEMA Hurricane Liaison Team at the NHC, most notably teleconferences with the states of Florida and Mississippi and a federal video-teleconference with FEMA Headquarters and FEMA Region 4. NHC's Tropical Analysis and Forecast Branch provided four briefings for U.S. Coast Guard District 7 and two briefings for District 8 in support of their life-saving mission and operations during Tropical Storm Nestor.

## **ACKNOWLEDGMENTS**

Data in Table 3 were compiled from Post Tropical Cyclone (PSH) Reports issued by the NWS Weather Forecast Offices (WFOs) in Tampa Bay, Tallahassee, Mobile and New Orleans. Storm surge data was provided by the National Ocean Service (NOS) Center for Operational Oceanographic Products and Services and the United States Geological Survey.



Table 1. Best track for Tropical Storm Nestor, 18–19 October 2019.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
17 / 1200	22.2	95.7	1007	35	disturbance
17 / 1800	22.6	95.2	1005	35	"
18 / 0000	23.2	94.5	1003	40	"
18 / 0600	24.1	93.0	1002	45	"
18 / 1200	25.2	91.2	1001	50	"
18 / 1800	26.4	89.4	1000	50	tropical storm
19 / 0000	27.8	87.8	996	50	"
19 / 0600	28.6	87.1	996	50	"
19 / 1200	29.3	86.4	996	40	extratropical
19 / 1800	30.2	85.4	999	40	"
20 / 0000	31.2	84.2	1000	35	"
20 / 0600	33.1	81.7	1002	40	"
20 / 1200	35.1	79.1	1002	40	"
20 / 1800	37.0	76.7	1002	40	"
21 / 0000	37.5	74.5	1001	40	"
21 / 0600					dissipated
19 / 0000	27.8	87.8	996	50	minimum pressure and maximum winds



Table 2. Selected ship reports with winds of at least 34 kt for Tropical Storm Nestor, 18–19 October 2019, including the extratropical stage. 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)
18/1400	H3VR	24.0	90.4	230 / 40	1001.0
18/1500	H3GS	24.7	88.9	200 / 45	999.6
18/1500	3EMB9	24.2	90.6	250 / 45	1004.8
18/1800	2IYG9	24.1	87.8	180 / 35	1006.2
18/1900	3FOB5	22.8	85.6	190 / 35	1009.3
18/2300	C6FM8	23.5	83.1	130 / 40	1009.8
19/0300	3EBL5	24.0	87.0	200 / 45	1006.9
19/1500	TBWUK6	30.8	80.6	090 / 40	1012.2
19/2200	9HA373	32.1	79.4	130 / 35	1011.5
20/0000	3FOC5	28.0	79.7	180 / 39	1009.7
20/0000	PBIG	28.1	78.9	110 / 37	
20/0500	C6FN4	30.7	80.5	240 / 40	1006.5
20/1200	DGZL	31.3	80.3	250 / 45	1007.9
20/1600	WKPM	34.3	76.1	180 / 45	1005.9



Table 3. Selected surface observations for Tropical Storm Nestor, 18–19 October 2019.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) <sup>c</sup>	Storm tide (ft) <sup>d</sup>	Estimated Inundation (ft) <sup>e</sup>	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) <sup>a</sup>	Sustained (kt) <sup>b</sup>	Gust (kt)				
<b>Buoys</b>									
41004 NOAA (32.50N 79.10W)	20/0800	1003.9	20/0520	39 (4 m, 1-min)	49				
42001 NOAA (25.96N 89.65W)	18/1900	1001.2	18/1404	35 (4 m, 1-min)	43				
42003 NOAA (25.93N 85.62W)	18/2310	1004.2	19/0342	37 (4 m, 1-min)	43				
42012 NOAA (30.06N 87.55W)	19/0930	1002.2	19/0941	31 (4 m, 1-min)	35				
42013 COMPS (27.17N 82.93W)	19/0930	1006.3	19/1630	31 (3 m, 8-min)	39				
42036 NOAA (28.50N 84.52W)	19/1030	1002.9	19/0636	35 (4 m, 1-min)	41				
42039 NOAA (28.79N 86.01W)	19/0820	998.2	19/0428	39 (4 m, 1-min)	45				
42040 NOAA (28.88N 88.84W)	19/0850	1001.8	19/0109	37 (4 m, 1-min)	41				
42360 (26.69N 90.46W)	18/2100	1001.9	18/1000	25 (3 m)	29				
<b>Offshore Oil Platforms</b>									
Louisiana Offshore Oil Port (LOPL1) (28.89N 90.03W)	18/2038	1005.1	18/2343	30 (58 m, 2-min)	37				
Main Pass 289C (KVKY) (29.25N 88.44W)	19/0735	1003.7	19/0135	42 (115 m, 2-min)	47				
MP 140B (KMIS) (29.30N 88.84W)	18/2335	1002.0	18/2315	36 (85 m, 2-min)	50				
Viosca Knoll 786 (KVOA) (29.23N 87.78W)			19/0155	45 (160 m)	52				
<b>United States</b>									
<b>Florida</b>									
<b>International Civil Aviation Organization (ICAO) Sites</b>									
Apalachicola (KAAF) (29.73N 85.02W)	19/1815	1000.7	19/1810	25	32				
Destin (KDTS) (30.40N 86.47W)	19/1253	1002.0	19/1910	20	25				
St Petersburg/Clearwater (KPIE) (27.91N 82.69W)	19/2053	1006.7	19/1853	30	39				
<b>Coastal-Marine Automated Network (C-MAN) Sites</b>									
Tyndall AFB Tower C (SGOF1) (29.41N 84.86W)	19/1100	1001.5	19/0730	43 (35 m, 10-min)	52				
Venice (VENF1) (27.07N 82.45W)	19/1000	1007.8	19/1530	34 (12 m, 10-min)	45				
<b>National Ocean Service (NOS) Sites</b>									
Apalachicola (APCF1) (29.72N 84.98W)	19/1748	1000.7	19/1200	26 (7 m)	32	3.55	4.18	3.3	



Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) <sup>c</sup>	Storm tide (ft) <sup>d</sup>	Estimated Inundation (ft) <sup>e</sup>	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) <sup>a</sup>	Sustained (kt) <sup>b</sup>	Gust (kt)				
Cedar Key (CKYF1) (29.14N 83.03W)	19/2048	1003.9				3.60	3.82	2.3	
Clearwater Beach (CWBF1) (27.98N 82.83W)	19/2042	1006.3	19/1912	30 (7 m)	37	2.60	3.21	2.2	
Fort Myers (FMRF1) (26.65N 81.87W)	19/1100	1008.2				2.10	2.03	1.8	
Key West (KYWF1) (24.56N 81.81W)	19/0848	1009.5				1.13	1.48	1.4	
Mckay Bay Entrance (MCYF1) (27.91N 82.43W)						3.32	3.06	2.1	
Middle Tampa Bay (MTBF1) (27.66N 82.60W)	19/2042	1006.8	19/1648		36 (7 m)				
Naples (NPSF1) (26.13N 81.81W)	19/0630	1008.6	19/1442		35 (7 m)	2.10	2.44	1.8	
Old Port Tampa (OPTF1) (27.86N 82.55W)	19/2100	1007.2				2.91		2.0	
Panama City (PACF1) (30.15N 85.67W)						2.19	2.69	1.9	
Panama City Beach (PCBF1) (30.21N 85.88W)	19/1806	999.8	19/1848	24 (9 m)	26	2.52	3.15	2.2	
Pensacola (PCLF1) (30.40N 87.21W)	19/1000	1003.0				1.91	2.81	1.9	
Port Manatee (PMAF1) (27.64N 82.56W)	19/2030	1007.2				2.31	2.43	1.8	
St. Petersburg (SAPF1) (27.76N 82.63W)	19/2100	1007.3	19/1718		36 (7 m)	2.66	2.70	1.9	
Vaca Key, Florida Bay (VCAF1) (24.71N 81.11W)	19/0730	1009.9				1.18	1.15	1.5	
<b>WeatherSTEM</b>									
Shell Point Beach (0742W) (30.06N 84.29W)	19/1920	1002.0	19/1520	34	38				
St. George Island Bridge (0569W) (29.71N 84.89W)	19/1830	1002.3	19/1040	40	43				1.54
<b>Coastal Ocean Monitoring and Prediction System</b>									
Big Carlos Pass (BGCF1) (26.40N 81.88W)	19/0642	1009.1	19/1454	36 (17 m)	44				
Shell Point (SHPF1) (30.06N 84.29W)	19/1924	1000.2	19/1054	36 (6 m)	40				
<b>United States Geological Survey (USGS) Sites</b>									
Aucilla River near Nutall Rise (NUTF1) (30.11N 83.98W)							4.45	2.6	
Spring Creek (SBIF1) (30.07N 84.33W)							5.32	3.7	
Suwannee River (SUWF1) (29.34N 83.09W)							3.64	2.2	
<b>Northwest Florida Water Management District (NFWMD) Sites</b>									
Intracoastal Waterway at White City (SEWF1) (29.88N 85.22W)							2.77	1.9	
St. Marks River at St. Marks (MRKF1) (30.15N 84.21W)							4.87	3.0	



Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) <sup>c</sup>	Storm tide (ft) <sup>d</sup>	Estimated Inundation (ft) <sup>e</sup>	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) <sup>a</sup>	Sustained (kt) <sup>b</sup>	Gust (kt)				
<b>Suwanee River Water Management District (SRWMD) Sites</b>									
Steinhatchee River at Steinhatchee (STIF1) (29.67N 83.38W)							3.46	1.8	
<b>National Estuarine Research Reserve System</b>									
East Bay Apalachicola Reserve (APXF1) (29.79N 84.88W)	19/1815	1001.0	19/1845	22 (5 m)					
<b>Citizen Weather Observer Program</b>									
Eastpointe (CW8103) (29.62N 84.93W)	19/1813	1000.3	19/1153		35				
<b>Other</b>									
Baskin (27.89N 82.81W)									7.77
Seminole (27.84N 82.79W)									5.03
Shell Point (SHLPT) (30.06N 84.29W)	19/1902	1002.1	19/1054	36 (8 m)	39				
St. George Island Bridge (SGIBR) (29.66N 84.88W)	19/1757	1001.6	19/0908	42 (10 m)	43				
Valrico (27.95N 82.26W)									6.04
<b>Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) Sites</b>									
Bloomington 8 ESE (FL-HB-33) (27.83N 82.15W)									5.35
Seminole 3 WNW (FL-PN-77) (27.89N 82.81W)									5.62
<b>Alabama</b>									
<b>NOS Sites</b>									
Bayou La Batre (BLBA1) (30.41N 88.25W)						2.06	2.82	1.9	
Chichasaw Creek (CIKA1) (30.78N 88.07W)						1.82	2.89	1.5	
Coast Guard Sector Mobile (MCGA1) (30.65N 88.06W)	19/0924	1004.8				1.93	2.94	1.8	
Dauphin Island (DILA1) (30.25N 88.08W)	19/0918	1003.6				2.01	2.73	2.0	
Dog River Bridge (BYSA1) (30.57N 88.09W)						1.72		1.8	
East Fowl River Bridge (EFRA1) (30.44N 88.11W)						1.74	2.66	1.8	
Mobile State Docks (OBLA1) (30.70N 88.04W)	19/0924	1004.7				1.65	2.85	1.7	
Weeks Bay, Mobile Bay (WBYA1) (30.42N 87.83W)						1.89		1.8	
West Fowl River Bridge (WFRA1) (30.38N 88.16W)						2.05	2.68	1.8	



Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) <sup>c</sup>	Storm tide (ft) <sup>d</sup>	Estimated Inundation (ft) <sup>e</sup>	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) <sup>a</sup>	Sustained (kt) <sup>b</sup>	Gust (kt)				
<b>Mississippi</b>									
<b>NOS Sites</b>									
Bay Waveland Yacht Club (WYCM6) (30.33N 89.33W)						2.04	3.13	2.1	
Pascagoula NOAA Lab (PNLM6) (30.37N 88.56W)						2.01	2.96	2.1	
Petit Bois Island, Port of Pascagoula (PTBM6) (30.21N 88.56W)	19/0842	1004.0			34 (5 m)				
<b>Louisiana</b>									
<b>Coastal-Marine Automated Network (C-MAN) Sites</b>									
Southwest Pass (BURL1) (28.91N 89.43W)			18/2050	35 (38 m, 10-min)	38				
<b>NOS Sites</b>									
Berwick, Atchafalaya River (TESL1) (29.67N 91.24W)	19/0848	1007.1				1.88		0.9	
Calcasieu Pass (CAPL1) (29.77N 93.30W)	19/2148	1006.4				2.09		2.1	
Eugene Island (EINL1) (29.37N 91.38W)	18/2230	1006.8				2.20		1.9	
Freshwater Canal Locks (FRWL1) (29.55N 92.31W)	18/2142	1007.4				2.22		2.2	
Grand Isle (GISL1) (29.26N 89.96W)						1.64		1.7	
I-10 Bonnet Carre Floodway (BCFL1) (30.07N 90.39W)						2.11		2.3	
Lake Charles Bulk Terminal (BKTL1) (30.19N 93.30W)						2.15		1.8	
Lake Charles (LCLL1) (30.22N 93.22W)	19/2048	1006.6				1.93		1.8	
LAWMA, Amerada Pass (AMRL1) (29.45N 91.34W)	18/2230	1006.9				2.24	2.67	1.8	
New Canal Station (NWCL1) (30.03N 90.11W)	19/0848	1005.4				2.04		2.3	
Pilots Station East (PSTL1) (28.93N 89.41W)	18/2100	1003.2	18/2042	34 (20 m, 2-min)	40	2.30		2.7	
Pilottown (PILL1) (29.18N 89.26W)	18/2106	1003.1				2.22		2.2	
Port Fourchon, Belle Pass (PTFL1) (29.11N 90.20W)						1.48		1.8	
Shell Beach (SHLB1) (29.87N 89.67W)	19/0842	1005.9				2.62	3.35	2.6	
<b>Texas</b>									
<b>NOS Sites</b>									
Bob Hall Pier, Corpus Christi (MQTT2) (27.58N 97.22W)	19/0942	1005.5				1.86	3.50	2.3	
Eagle Point (EPTT2) (29.48N 94.92W)	19/2042	1005.7				2.07		2.6	



Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) <sup>c</sup>	Storm tide (ft) <sup>d</sup>	Estimated Inundation (ft) <sup>e</sup>	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) <sup>a</sup>	Sustained (kt) <sup>b</sup>	Gust (kt)				
Freeport (FCGT2) (28.94N 95.30W)						2.07		2.3	
Galveston Bay Entrance, North Jetty (GNJT2) (29.36N 94.72W)	19/2236	1005.5				2.12		2.3	
Galveston Pier 21 (GTOT2) (29.31N 94.79W)	19/2054	1006.4				2.15	3.31	2.2	
Matagorda Bay Entrance (MBET2) (28.43N 96.33W)	19/1012	1004.5				2.40		2.1	
Morgans Point (MGPT2) (29.68N 94.99W)	19/2206	1005.9				1.84	3.26	2.1	
Port Isabel (PTIT2) (26.06N 97.22W)	19/0936	1006.3				1.84	2.59	2.1	
Rainbow Bridge (RBBT2) (29.98N 93.88W)						1.88	2.58	2.0	
Rockport (RCPT2) (28.02N 97.05W)	19/0948	1005.7				1.47	3.15	1.9	
Sabine Pass North (SBPT2) (29.73N 93.87W)	19/2136	1008.5				2.16		2.1	
Texas Point, Sabine Pass (TXPT2) (29.69N 93.84W)	19/2136	1005.6				2.21		2.1	
<b>Texas Coastal Ocean Observing Network (TCOON) Sites</b>									
Aransas Pass (ANPT2)	19/0954	1005.0				1.92		2.1	
Freeport Harbor (FPST2) (28.94N 95.29W)	19/1012	1006.2				1.97		2.2	
Galveston Railroad Bridge (GRRT2) (29.30N 94.90W)	19/2142	1006.0				1.95	3.16	2.2	
High Island (HIST2) (29.59N 94.39W)	19/2218	1006.3				1.97		2.2	
Manchester (NCHT2) (29.73N 95.27W)	19/2142	1005.2				1.81		2.0	
Matagorda City (EMAT2) (28.71N 95.91W)	19/0948	1005.7				2.04	2.91	2.0	
Port Aransas (RTAT2) (27.84N 97.07W)	19/1000	1006.0				2.20	2.87	2.0	
Port Arthur (PORT2) (29.87N 93.93W)	19/2042	1007.2				1.91	2.59	2.0	
Port Lavaca (VCAT2) (28.64N 96.61W)	19/0936	1005.7				2.08		2.0	
Port O'Connor (PCNT2) (28.45N 96.40W)	19/1000	1005.6				2.11		2.1	
Rollover Pass (RLOT2) (29.52N 94.51W)	19/2206	1006.8				2.37	3.11	2.5	
San Luis Pass (LUIT2) (29.08N 95.13W)	19/1000	1007.7				1.98	3.04	2.2	
SPI Brazos Santiago (BZST2) (26.07N 97.15W)	19/0924	1005.7				1.81		2.1	
SPI CG Station (PCGT2) (26.07N 97.17W)	19/0924	1005.5				1.78	2.45	2.1	

<sup>a</sup> Date/time is for sustained wind when both sustained and gust are listed.

<sup>b</sup> Except as noted, sustained wind averaging periods for C-MAN and land-based reports are 2 min; buoy averaging





- periods are 8 min.
- <sup>c</sup> Storm surge is water height above normal astronomical tide level.
  - <sup>d</sup> For most locations, storm tide is water height above the North American Vertical Datum of 1988 (NAVD88).
  - <sup>e</sup> Estimated inundation is the maximum height of water above ground. For some USGS storm tide pressure sensors, inundation is estimated by subtracting the elevation of the sensor from the recorded storm tide. For other USGS storm tide sensors and USGS high-water marks, inundation is estimated by subtracting the elevation of the land derived from a Digital Elevation Model (DEM) from the recorded and measured storm tide. For NOS tide gauges, the height of the water above Mean Higher High Water (MHHW) is used as a proxy for inundation.
  - <sup>l</sup> Incomplete record.

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%)	72	120
Medium (40%-60%)	48	72
High (>60%)	36	36

Table 5. Tropical storm watch and warning summary for Tropical Storm Nestor, 18–19 October 2019.

Date/Time (UTC)	Action	Location
17 / 1500	Tropical Storm Warning issued	AL/MS border to Ochlockonee River
17 / 1500	Tropical Storm Warning issued	Grand Isle to Pearl River
17 / 1500	Tropical Storm Watch issued	Ochlockonee River to Yankeetown
17 / 2100	Tropical Storm Warning modified to	AL/MS border to Aucilla River
17 / 2100	Tropical Storm Watch modified to	Aucilla River to Yankeetown
18 / 0300	Tropical Storm Watch discontinued	All
18 / 0300	Tropical Storm Warning modified to	AL/MS border to Yankeetown
18 / 2100	Tropical Storm Warning discontinued	Grand Isle to Pearl River
18 / 2100	Tropical Storm Warning modified to	Navarre to Yankeetown
19 / 0900	Tropical Storm Warning modified to	Okaloosa/Walton county line to Yankeetown
19 / 1500	Tropical Storm Warning modified to	Indian Pass to Yankeetown
19 / 1800	Tropical Storm Warning modified to	Ocklockonee River to Suwanee River
19 / 2100	Tropical Storm Warning discontinued	All



Table 6. Storm Surge watch and warning summary for Tropical Storm Nestor, 18–19 October 2019.

<b>Date/Time (UTC)</b>	<b>Action</b>	<b>Location</b>
17 / 1500	Storm Surge Watch issued	Indian Pass to Clearwater
17 / 2100	Storm Surge Warning issued	Indian Pass to Clearwater
19 / 1800	Storm Surge Warning discontinued	All

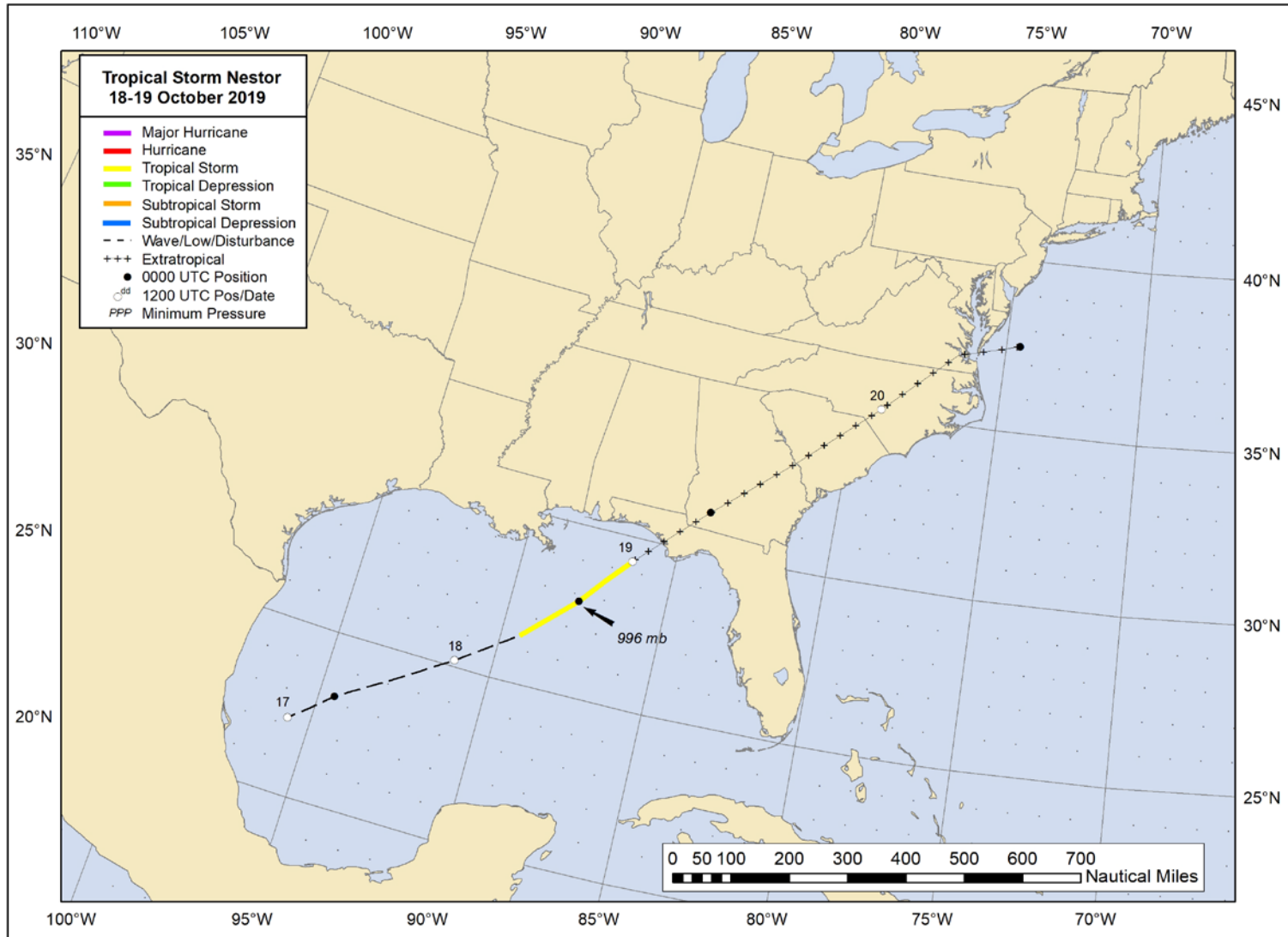


Figure 1. Best track positions for Tropical Storm Nestor, 18–19 October 2019. The track over the United States is partially based on analyses from the NOAA Weather Prediction Center.

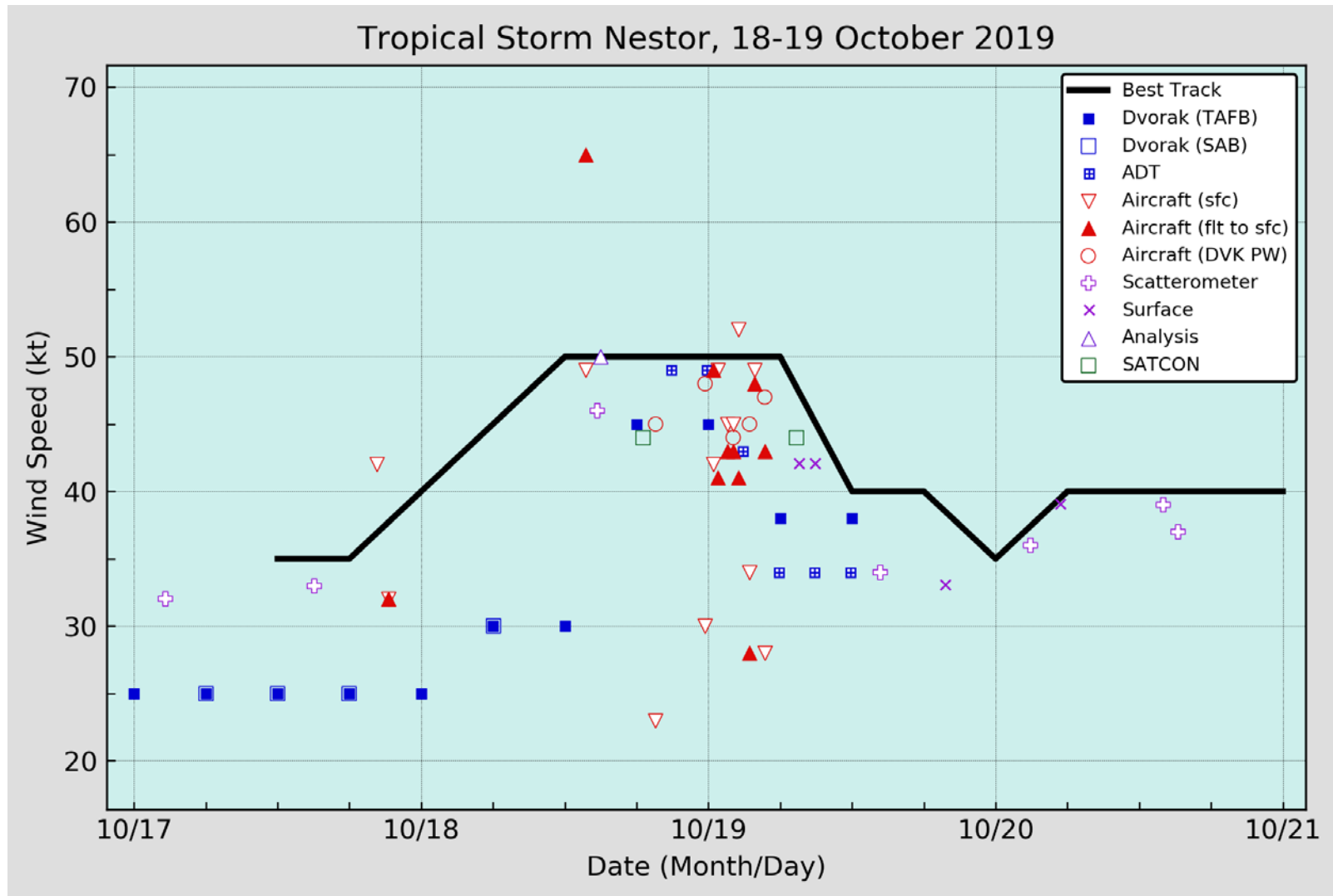


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Nestor, 18–19 October 2019. Aircraft observations have been adjusted for elevation using 90% and 80% adjustment factors for observations from 700 mb and 850 mb respectively. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies.

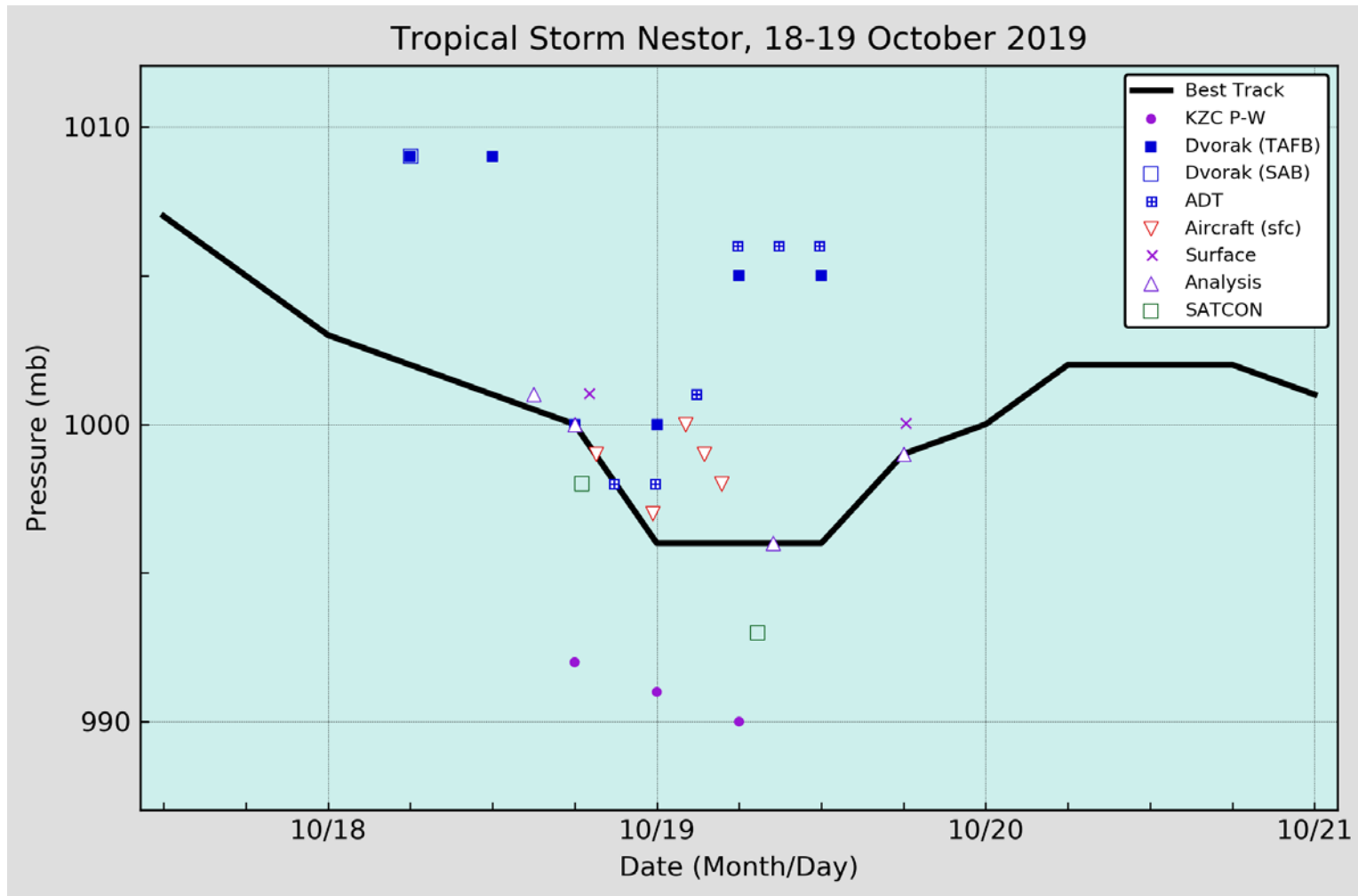


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Nestor, 18–19 October 2019. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.





Figure 4. Tornado damage to a home in western Polk County, Florida (Courtesy NWS WFO Tampa Bay).

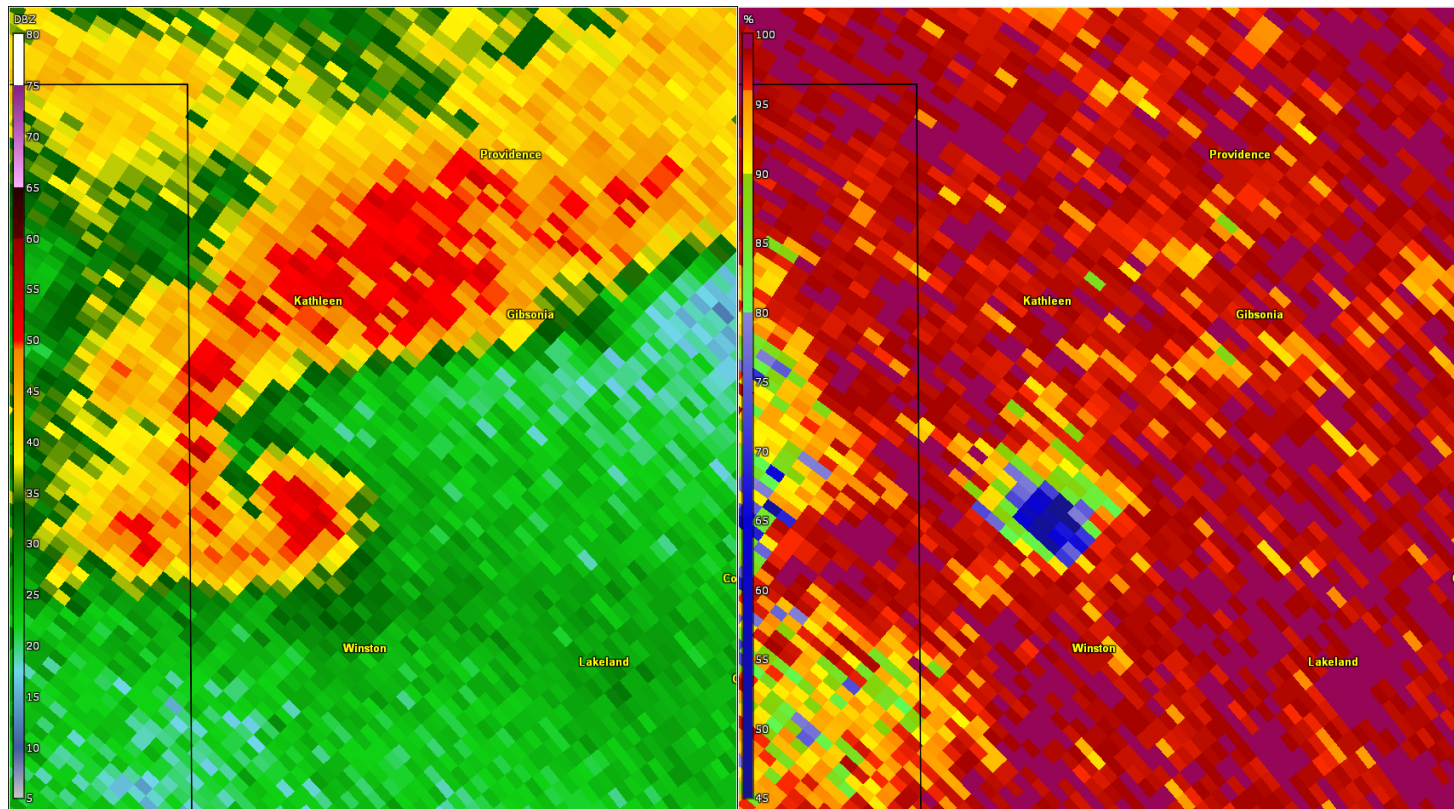


Figure 5. Polk County EF-2 tornado showing a well-defined hook echo and reflectivity “debris ball” on the left and a radar-indicated debris ball using correlation coefficient (CC) data on the right. Dark blue colors in CC product indicate debris lofted into the air by the tornado. (Courtesy NWS WFO Tampa Bay)

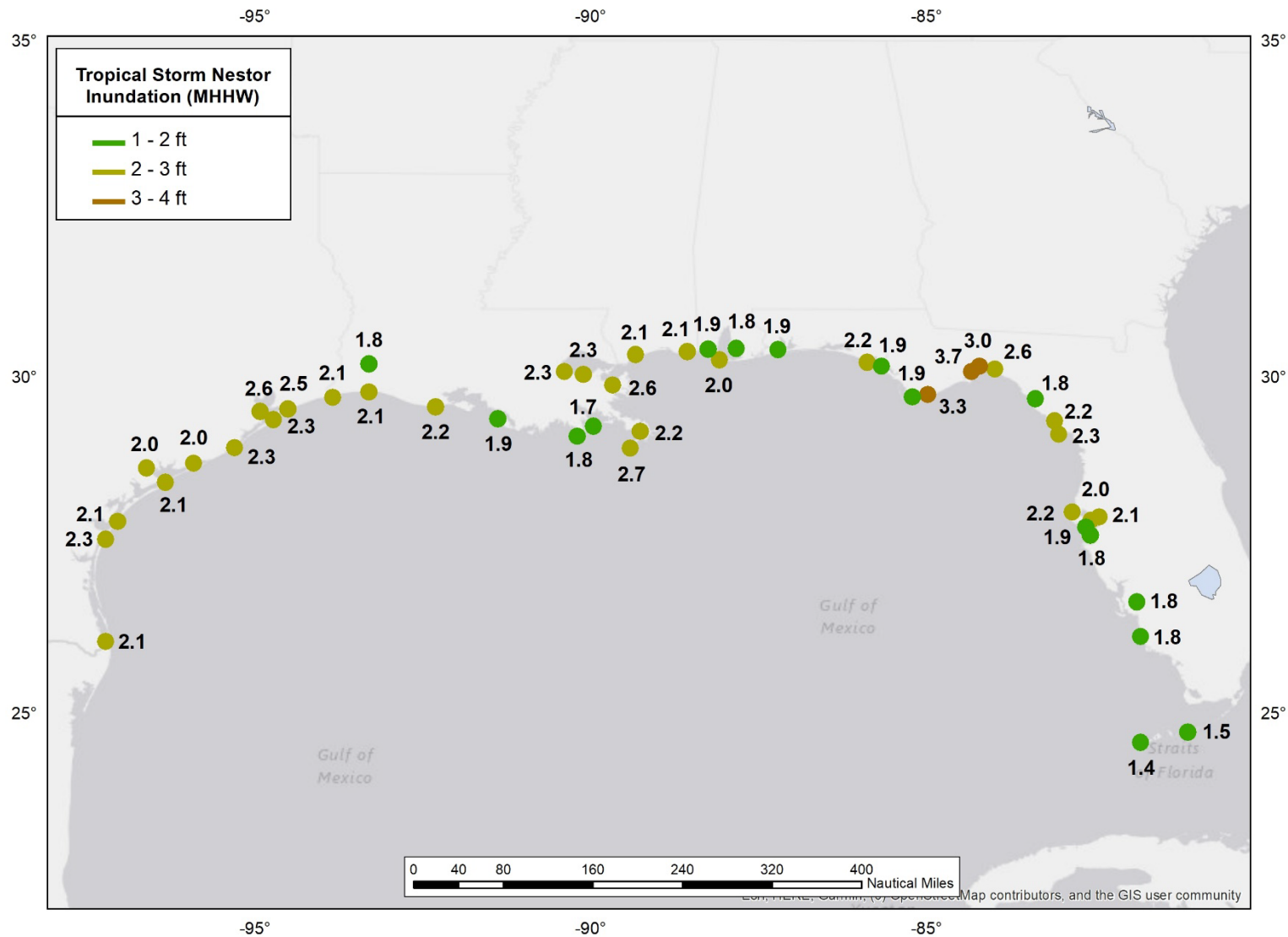


Figure 6. Maximum water levels measured from tide gauges along the northern Gulf Coast during Tropical Storm Nestor. Water levels are referenced as feet above Mean Higher High Water (MHHW), which is used as a proxy for inundation (above ground level) on normally dry ground along the immediate coastline. Note that oceanographic factors in place before Nestor formed contributed to high water levels along much of the U.S. Gulf Coast outside of the areas directly affected by Nestor.

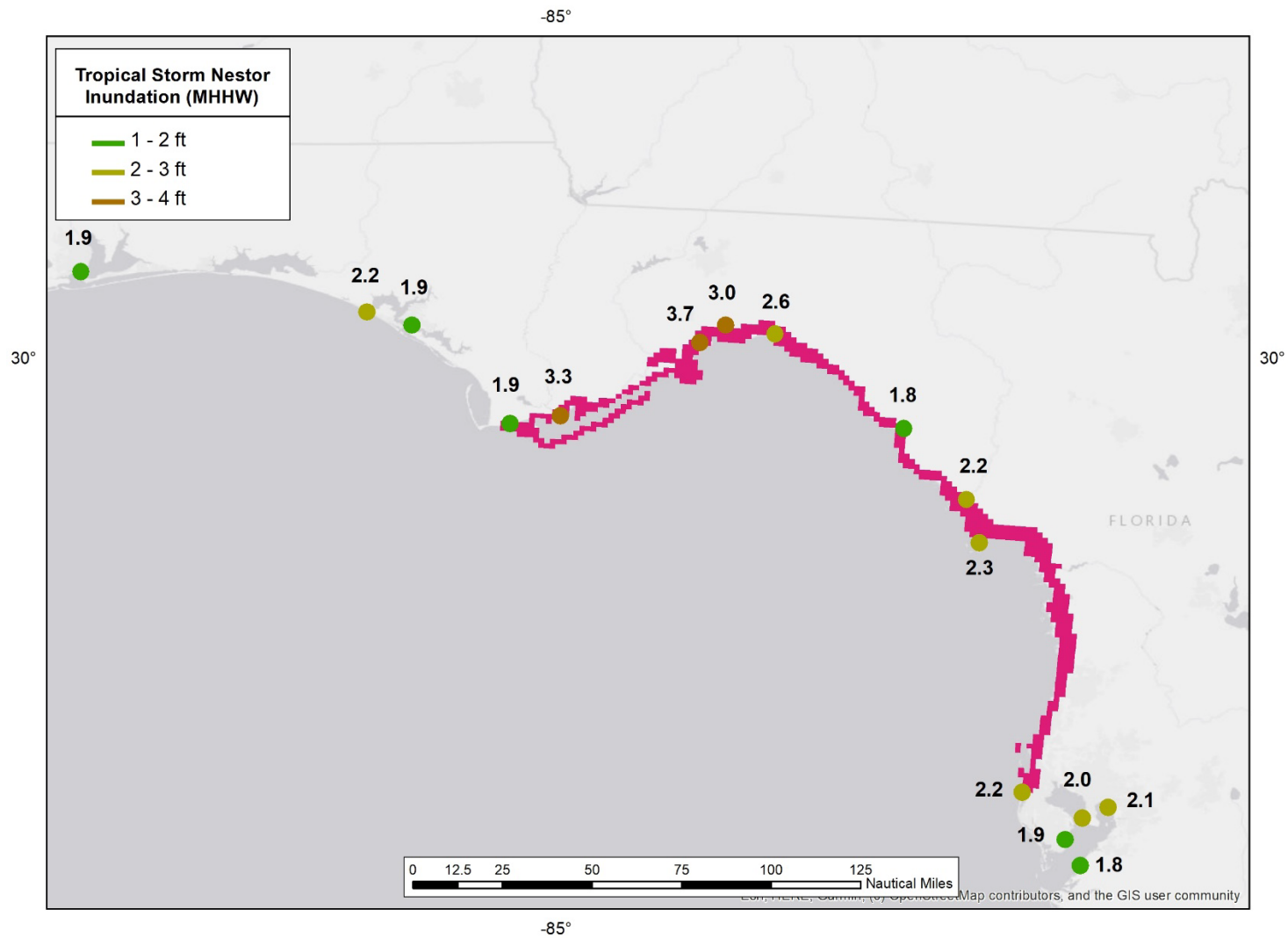


Figure 7. Maximum water levels measured from tide gauges along the northeastern Gulf Coast during Tropical Storm Nestor and areas covered by storm surge warnings (magenta). Water levels are referenced as feet above Mean Higher High Water (MHHW), which is used as a proxy for inundation (above ground level) on normally dry ground along the immediate coastline.

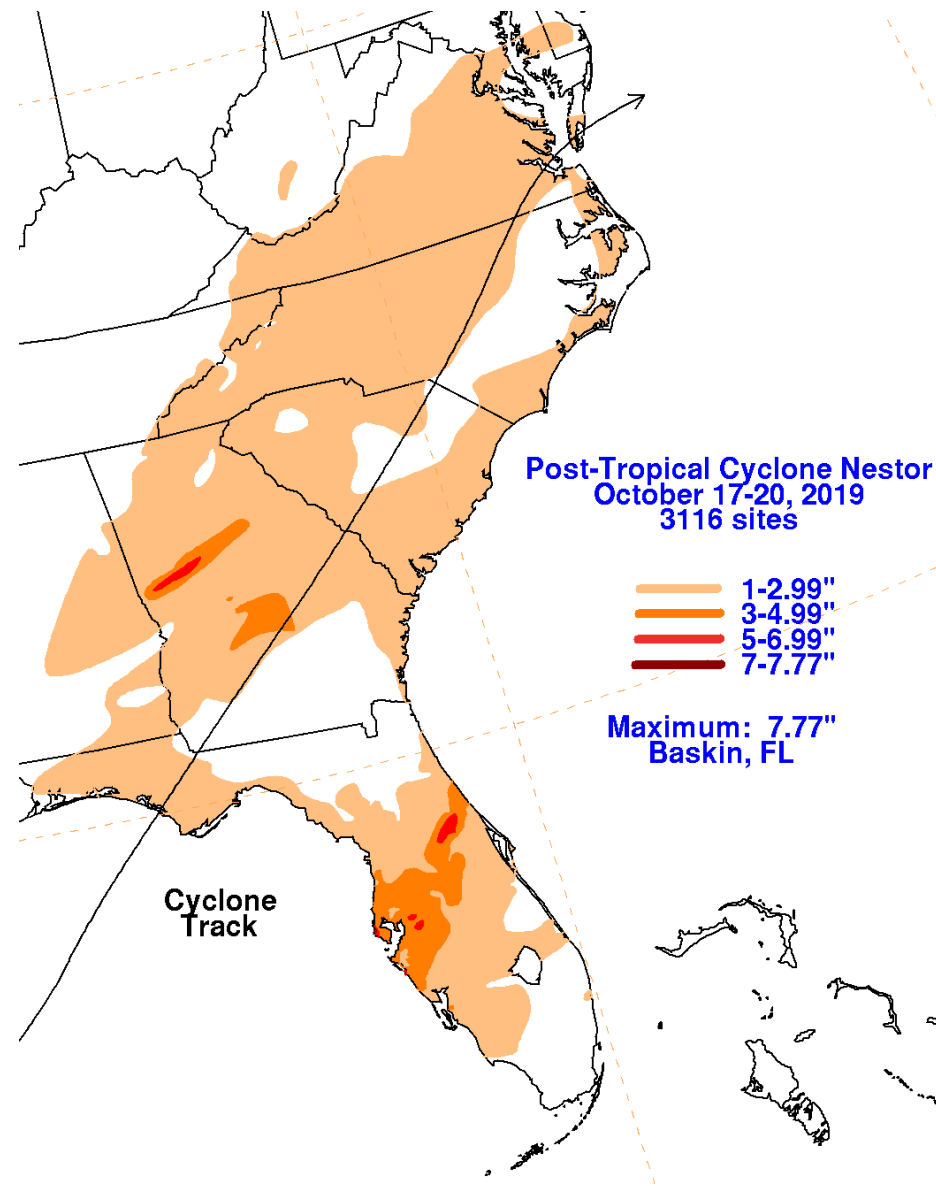


Figure 8. Rainfall from Tropical Storm Nestor and its post-tropical remnants, 17–20 October 2019. Figure courtesy David Roth of the NOAA Weather Prediction Center.

