NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE MATTHEW

(AL142016)

28 September – 9 October 2016

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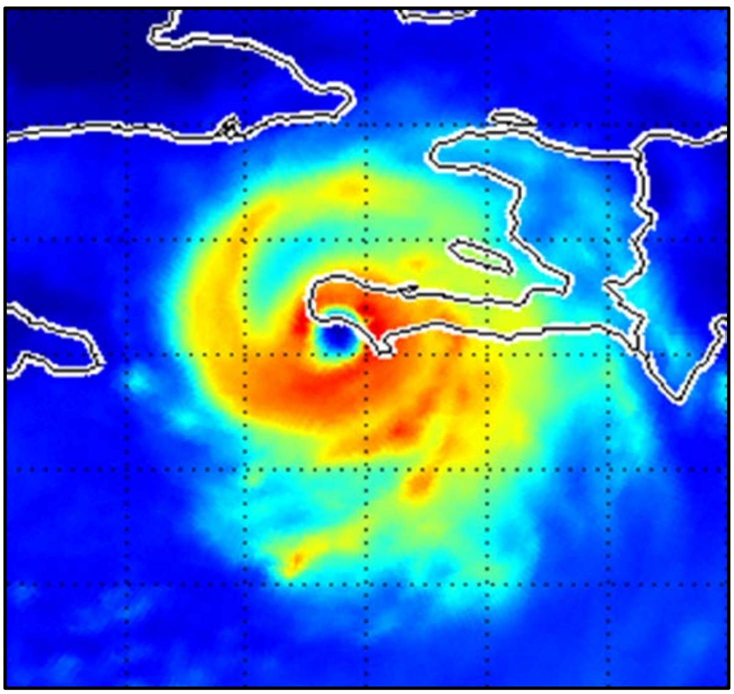
National Hurricane Center
7 April 2017[1]



MIMIC MICROWAVE SATELLITE IMAGE OF MATTHEW AS THE EYE OF THE POWERFUL HURRICANE WAS MAKING LANDFALL NEAR LES ANGLAIS, HAITI, AT 1100 UTC 4 OCTOBER 2016. IMAGE COURTESY OF UW-CIMSS WISCONSIN.

Matthew was a category 5 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that later made landfalls as a major hurricane along the coasts of southwestern Haiti, extreme eastern Cuba, and western Grand Bahama Island, and as a category 1 hurricane along the central coast of South Carolina. Matthew was responsible for 585 direct deaths, with more than 500 deaths occurring in Haiti, making it the deadliest Atlantic hurricane since Hurricane Stan in 2005. Matthew reached category 5 intensity at the lowest latitude ever recorded in the Atlantic Basin.

[1] Original report date 3 April 2017. Revised on 7 April 2017 to update United States and North Carolina casualties.

Hurricane Matthew

28 SEPTEMBER – 9 OCTOBER 2016

SYNOPTIC HISTORY

A vigorous tropical wave exited the west coast of Africa early on 23 September and moved westward across the tropical Atlantic at forward speeds of 20-25 kt for the next three days. The fast-moving, low-latitude disturbance generally remained south of 10^{O} N latitude until 26 September, when it slowed down and turned toward the west-northwest. Over the next couple of days, the disturbance's satellite cloud pattern gradually acquired the appearance of a tropical cyclone, an indication of the system's well-defined mid- and upper-level circulations. However, scatterometer wind data indicated that the tropical wave did not possess a closed surface circulation. This open-wave wind flow pattern was confirmed on 27 September when a U.S. Air Force Reserve Unit reconnaissance aircraft was unable to close off a surface circulation during its investigative mission. However, aircraft data indicated that surface winds of near 40 kt were occurring on the north side of the wave. Early on 28 September when the system was passing just north of Barbados, radar imagery in the Lesser Antilles indicated that thunderstorm activity was becoming better organized, including pronounced curved convective bands near and to the north and northeast of the well-defined mid-level circulation center. Another Air Force Reserve Hurricane Hunter aircraft found a closed surface circulation and 50-kt surface winds around 1400 UTC that day. Based on the aircraft wind data and microwave satellite imagery (not shown), it is estimated that a tropical storm formed around 1200 UTC 28 September about 15 n mi west-northwest of Barbados. The "best track" chart of the tropical cyclone's path is given in Fig.1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1[2].

Under the influence of a strong deep-layer ridge to its north, Matthew turned westward and moved across the Windward Islands, passing midway between St. Lucia and St. Vincent around 1800 UTC 28 September, and moved into the eastern Caribbean Sea 6 h later. The unusually large wind field on the east side of Matthew's asymmetric circulation resulted in tropical-storm-force winds occurring on Barbados as late as 0000 UTC 29 September. These conditions spread northward across most of the Lesser Antilles, with tropical-storm-force wind gusts occurring as far north as the U.S. Virgin Islands and Puerto Rico. As Matthew continued to move over the deep, warm waters of the Caribbean Sea, the tropical cyclone gradually strengthened within an environment of west-southwesterly 850−200-mb vertical wind shear of about 20 kt, and reached hurricane status by 1800 UTC 29 September about 165 n mi northeast of Curaçao.

Over the next 48 h, the ridging increased to the north and west of Matthew, forcing the hurricane towards the west-southwest. Despite moderate vertical wind shear of 15-20 kt, Matthew

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

underwent a 24-h period of rapid intensification (RI) between 0000 UTC 30 September and 0000 UTC 1 October, during which time Matthew's eye diameter contracted from roughly 30 n mi to 5 n mi (Fig. 4). The hurricane strengthened an extraordinary 75 kt, reaching an estimated peak intensity of 145 kt at 0000 UTC 1 October when located less than 80 n mi north of Punta Gallinas, Colombia. This intensity made Matthew the southernmost category 5 hurricane in the Atlantic basin, surpassing a record previously set by Hurricane Ivan in 2004.

Almost immediately after Matthew reached its peak intensity, the powerful category 5 hurricane began a slow weakening trend. Passive microwave satellite imagery never indicated that an eyewall replacement cycle (ERC) occurred during that weakening phase, and reconnaissance aircraft wind data confirmed that a secondary wind maximum or ERC did not develop. However, upwelling was occurring beneath the hurricane as indicated by satellite-derived sea-surface temperature (SST) data and also SST data from NOAA buoy 42058. The eye of Matthew passed directly over the buoy at approximately 0747 UTC 3 October, which recorded a pressure measurement of 942.9 mb. However, the buoy's SST data (Fig. 5) indicate that upwelling and mixing reduced the SSTs beneath the hurricane by more than 3°C. Oceanic cooling occurred at the buoy more than 12 h before Matthew's eye passage, as a result of both the strength and size of the hurricane's wind field.

The western portion of the subtropical ridge across Cuba and Hispaniola weakened early on 2 October, and the hurricane made a small counter-clockwise loop and turned slowly northwestward within weak steering currents. During that time, Matthew weakened to an estimated intensity of 125 kt by 0600 UTC 2 October, when the cyclone was located about 300 n mi south-southwest of Port-au-Prince, Haiti.

It is worth noting that during Matthew's post-peak-intensity weakening phase, the innermost RMW remained fairly steady at about 5-7 n mi for more than 48 h (Fig.4). Maintenance of the small RMW may have contributed to the re-intensification phase that the hurricane underwent between 0600 UTC and 1800 UTC on 2 October when Matthew was moving northward around the western periphery of a broad deep-layer ridge located over the central subtropical Atlantic. During this time, the deep-layer vertical wind shear had decreased to less than 10 kt while mid-level humidity values had increased to more than 70 percent (Fig. 6). Now moving away from the region of upwelling and over deeper warm water containing a higher oceanic heat content, Matthew reached a secondary peak intensity of 135 kt by 1800 UTC 2 October when the powerful category 4 hurricane was located about 105 n mi south of Tiburon, Haiti. During this re-intensification phase, Matthew's central pressure decreased to its lowest value of 934 mb while the RMW increased to 10-15 n mi. Matthew moved slightly east of due north with some minor fluctuations in intensity, and was at an intensity of 130 kt when the center of the eye made landfall along the southwestern coast of Haiti near Les Anglais around 1100 UTC 4 October (Fig. 7a). Matthew was the first major hurricane, and also the first category 4 hurricane, to make landfall on Haiti since Cleo of 1964.

Matthew continued moving northward across the western end of Haiti's Tiburon Peninsula and into the western Gulf of Gonâve by 1800 UTC (Figs. 7b,c). The mountainous terrain disrupted the hurricane's low-level circulation, and Matthew's sustained winds weakened to 115 kt by the time the category 4 hurricane moved through the Windward Passage and made landfall near Juaco, Cuba, around 0000 UTC 5 October (Fig. 7d). While an upper-level trough lifted out to the northeast, the ridge to the north of Matthew built westward, forcing the hurricane on a northwestward track across the eastern end of Cuba and into the Atlantic Ocean between Cuba and the Bahamas early on 5 October. Additional disruption by the mountainous terrain of eastern Cuba caused the hurricane to weaken to category 3 status.

Little change in intensity occurred during the next 18 h; by 1200 UTC 6 October, however, Matthew had completed a brief re-strengthening period, regaining category 4 status with an intensity of 125 kt when the hurricane was located about 25 n mi south-southwest of Nassau, Bahamas. Matthew then began a slow but steady weakening trend due to an ERC, increasing vertical wind shear, and decreasing mid-level moisture (Fig. 6) ahead of an approaching mid-latitude trough. Matthew's eyewall passed over the extreme western portion of New Providence Island, bringing hurricane-force winds and flooding rains to most of the central and northwestern Bahamas. Continuing on a northwestward track, the category 4 hurricane made landfall near West End, Grand Bahama Island, around 0000 UTC 7 October, bringing category-3 winds to that area.

A broad, eastward-moving mid-latitude trough located over the central United States gradually eroded the ridge to the north and east of Matthew, allowing the major hurricane to turn toward the north-northwest on 7 October. Over the next 24 h, Matthew completed an ERC, causing the eye diameter to increase to 30-40 n mi. Remaining about 30 n mi offshore of the Florida east coast, the western edge of Matthew's eyewall barely clipped NASA's Cape Canaveral launch facility, likely producing sustained category 2 winds at the extreme northeastern portion of the launch complex. Matthew weakened to a category 3 hurricane around 0600 UTC 7 October about 35 n mi east of Vero Beach, Florida, and became a category 2 hurricane by 0000 UTC 8 October about 50 n mi east-northeast of Jacksonville Beach, Florida.

Hurricane Matthew moved northward around the western periphery of a subtropical ridge early on 8 October, remaining about 50 n mi offshore of the Georgia coast. As Matthew gained latitude, its wind field expanded, spreading hurricane-force wind gusts across the coastal regions of southeastern Georgia and southern South Carolina, especially on the barrier islands where category 2 wind gusts occurred. The approaching mid-latitude trough eroded the subtropical ridge further, causing the category 2 hurricane to make a sharp turn toward the northeast and weaken further. The now category 1 hurricane took a track nearly parallel to the coast of South Carolina, making landfall around 1500 UTC 8 October just south of McClellanville, South Carolina, in the Cape Romain Wildlife Sanctuary. Matthew was the first hurricane since Hurricane Hazel in 1954 to make landfall in the United States north of Florida during the month of October. The center of the hurricane moved back offshore of the coast of South Carolina by 1800 UTC, and remained just offshore of the coast of North Carolina through 9 October. Baroclinic interaction associated with the mid-latitude trough caused Matthew's cloud shield and rainfall pattern to steadily shift from the southeastern to the northwestern side of the circulation, resulting in deep moisture and heavy rainfall to spread well inland over the southeastern United States.

The northwestern edge of Matthew's large eyewall extended well inland and brought hurricane-force wind gusts and heavy rains to coastal regions of the Carolinas. While Matthew was moving east-northeastward to the south of eastern North Carolina early on 9 October, a combination of the cyclone undergoing extratropical transition and an increasing pressure gradient from an approaching cold front caused sustained hurricane-force winds over the Outer Banks and significant sound-side storm-surge flooding. Matthew maintained its east-northeastward motion and lost its tropical characteristics by 1200 UTC 9 October, as southwesterly vertical wind shear in excess of 40 kt stripped away all of the deep convection near

Matthew's center. The extratropical low merged with a frontal system by 0000 UTC 10 October about 200 n mi east of Cape Hatteras, North Carolina. Still possessing hurricane-force winds, the elongated cyclone turned northeastward within the deep tropospheric southwesterly flow ahead of a mid-latitude low located over the eastern United States and moved along the frontal boundary, brushing the coast of eastern Nova Scotia late on 10 October. The broad cyclone eventually merged with a larger extratropical low pressure system near Atlantic Canada on 11 October.

METEOROLOGICAL STATISTICS

Observations in Matthew (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 19 flights made by the 53rd Weather Reconnaissance Squadron (53WRS) of the U. S. Air Force Reserve Command and from 8 flights conducted by NOAA/AOC "Hurricane Hunter" reconnaissance aircraft; those flights yielded a total of 120 center fixes (96 from the 53WRS and 24 from the NOAA/AOC). Additional dropwindsonde observations were obtained from flights conducted by the NASA AV-6 Global Hawk unmanned aircraft as part of the Hurricane and Severe Storms Sentinel (HS3) research program. Data from Doppler weather radars located at NOAA WFOs Miami, Melbourne, Jacksonville, Charleston, Wilmington, and Morehead City, along with 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 Matthew.

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

Winds and Pressure

Matthew's estimated peak intensity of 145 kt at 0000 UTC 1 October is based on SFMR-measured surface winds of 143 kt at 0010 UTC. Post-storm quality control checks made by the NOAA Hurricane Research Division (HRD) suggest that was a reliable report. These peak wind speeds were observed at the end of the rapid intensification cycle, during which time Matthew's radius of maximum winds had contracted down from 30 n mi to approximately 5 n mi.

Matthew's estimated minimum central pressure of 934 mb, which was first observed at 0000 UTC 4 October, is based on a dropwindsonde surface pressure measurement of 934 mb at 2343 UTC 3 October, which was accompanied by a surface wind of 4 kt. The estimated central pressure of 942 mb at the time of Matthew's 145-kt peak intensity is based on a dropwindsonde surface pressure measurement of 944 mb at 0125 UTC 1 October, which was accompanied by a surface wind of 18 kt.

The eastern portion of Matthew’s eye passed over NOAA Buoy 42058 in the central Caribbean Sea (Fig. 8) at approximately 0656 UTC 3 October, during which time a pressure of 942.9 mb and a 5-meter wind speed of 10 kt were measured. About 2 h prior to the eye’s passage, a 1-minute sustained wind of 74 kt and a gust to 83 kt were measured (Table 3). However, the buoy stopped reporting 1-minute wind speed data from 0510-0650 UTC 3 October 2016, which means that the peak wind speed during Matthew’s traversal of the buoy likely was missed.

In the Dominican Republic, the highest recorded wind gust was 43 kt at Las Américas International Airport (MDSD) in Santo Domingo on 3 October.

In Haiti, there were no wind reports received from the area where the category 4 hurricane made landfall along the western end of the Tiburon Peninsula. The only official wind measurement was a sustained wind of 30 kt and a gust to 45 kt at Toussaint Louverture International Airport (MTPP) in Port-au-Prince, which is protected by a mountain range about 80 n mi east-northeast of where Matthew made landfall.

Across eastern Cuba, the highest winds measured were a 1-minute sustained wind of 108 kt at Punta de Maisí (MUMA), which was accompanied by a gust of 132 kt. However, the wind equipment failed at 0156 UTC 5 October, making it possible that stronger winds might have gone undetected. A sustained wind of 103 kt and a gust of 151 kt were observed along the northeast coast in Jamal.

In the Bahamas, the highest recorded winds occurred at the Bahamas Department of Meteorology’s (BDM) upper-air site located at the Nassau airport, where a sustained wind of 100 kt and a gust to 111 kt were measured. A sustained wind of 84 kt was measured at the BDM’s Weather Forecast Office, which is also located on the airport complex. However, a window in the forecast office was blown-out, forcing the staff to evacuate the premises. Hence, wind records at that location were not recorded beyond 0100 UTC 7 October. Farther north, a sustained 69-kt wind and a gust to 91 kt were reported at Settlement Point on Grand Bahama Island as the eastern edge of Matthew’s eyewall passed to the west of that location. Moreover, the BDM stated that their Doppler weather radar velocity data, along with surface wind observations, indicated that tropical-storm-force winds affected New Providence island, including the capital of Nassau, for approximately 19 h from 0700 UTC 6 October to 0200 UTC 7 October, and that hurricane-force winds lasted for about 8 h from 1130 UTC to 1930 UTC on 6 October.

Across the southeastern United States, sustained tropical-storm-force winds spanned a large portion of coastal regions from Palm Beach County in southeastern Florida northward to the North Carolina Outer Banks. In addition, tropical-storm-force wind gusts reached inland at least 80 n mi from the Atlantic coasts of Florida, Georgia, South Carolina, and North Carolina. Sustained gale-force winds occurred across portions of the Virginia Tidewater area, with hurricane-force wind gusts occurring well offshore. The U.S. Army Corps of Engineers’ Virginia Beach buoy (44014), located about 65 n mi east-southeast of the mouth of the Chesapeake Bay, measured a 10-minute average wind of 52 kt (equivalent to a 55-kt 1-minute wind) and a peak gust of 110 kt. However, that peak gust was almost double the sustained wind values that had been measured 1 h prior to and 3 h after the occurrence of the gust, during a period in which the pressure gradient was increasing between Matthew and a high pressure system located over the Great Lakes. Since a cold front had passed over and moved south of the buoy a few hours earlier, it is possible that the wind gust was due to local accelerations behind the frontal zone in a convection-free area offshore of the Delmarva Peninsula, and was not directly associated with Matthew's circulation.

Sustained hurricane-force/category 1 winds were confined mainly to the immediate coastal areas and barrier islands of east-central and northeastern Florida, and the barrier islands of Georgia, South Carolina, and North Carolina, including the Outer Banks. The strongest winds measured along the U.S. southeast coast are as follows: sustained winds of 64-74 kt with gusts of 91-93 kt on the Kennedy Space Center (KSC) complex at Cape Canaveral, Florida; sustained wind of 65 kt and a gust to 83 kt on Tybee Island, Georgia; sustained 58-kt wind at Beaufort, South Carolina, and a gust of 90 kt at Winyah Bay, South Carolina; sustained wind of 67 kt and a gust of 84 kt at Nags Head, North Carolina. Furthermore, an NWS damage survey indicated that category-2 sustained winds likely occurred over mostly unpopulated coastal areas of northern Brevard County, Florida, from the northernmost portion of the KSC and extending northward across Mosquito Lagoon to the Brevard/Volusia County border.

The aforementioned remarkable RI period, which has only been exceeded a few times in the Atlantic historical record, occurred during apparently unfavorable environmental conditions consisting of west-southwesterly 850−200-mb vertical wind shear of 18-22 kt. Such strong shear conditions generally result in only slow or no strengthening. However, post-storm shear recalculations of the SHIPS model by decreasing the default areal diameter of 1000 km down to 400 km, and using observed positions instead of forecast positions, did yield significantly smaller vertical wind shear values of roughly 10-15 kt during the RI period. It is also interesting to note that Matthew was unusually electrically active with numerous lightning strikes having occurred in the eyewall, especially inside of the RMW, during most of the hurricane's time over the Caribbean Sea. However, the role that this lightning played in the evolution of the hurricane, especially during the RI period, is unknown.

Landfall Intensity Estimates

Haiti: 130 kt near Les Anglais at 1100 UTC 4 October is based on a flight-level-to-surface wind conversion value of 126 kt, an SFMR surface wind of 128 kt, a Dvorak satellite intensity of T6.5/127 kt from both TAFB and SAB, and ADT satellite intensity estimates of 135-139 kt.

Cuba: 115 kt near Juaco at 0000 UTC 5 October is based on an SFMR surface wind value of 117 kt just prior to landfall, and an ADT estimates of 117 kt. A 1-minute sustained surface wind of 108 kt was measured at Punta de Maisí, which was located east of the landfall location and near or just outside the RMW. In addition, a wind gust to 132 kt was observed at Punta de Maisí at 0156 UTC 5 October, just prior to the equipment failing. A sustained wind of 103 kt and a gust to 151 kt were recorded northwest of the landfall location at Jamal. The swath of calm winds observed during eye passage was about 8-10 n mi wide (Fig. 9). Wind measurements were acquired from Dines pressure-tube anemometers.

Bahamas: 115 kt near West End, Grand Bahama Island, at 0000 UTC 7 October is based on an SFMR surface wind value of 118 kt, a Dvorak satellite intensity of T6.0/115 kt from both TAFB and SAB, and an ADT estimate of 125 kt. A sustained wind of 84 kt was observed in the capital of Nassau; a sustained wind of 69 kt and a gust of 91 kt were measured at Settlement Point as the eastern edge of Matthew's eyewall passed just west of that location.

South Carolina: 75 kt just south of McClellanville is based on a flight-level-to-surface wind conversion value of 77 kt around the time of landfall, and Dvorak satellite intensity estimates of T4.5/77 kt from TAFB and T4.0/65 kt from SAB.

Storm Surge[3]

Dominican Republic − Specific storm surge values are not available, but media reports, along with information from the Dominican Republic government, indicate that considerable inundation occurred due to a combination of a significant storm surge and large waves along the southern coast from La Romana westward to the border with Haiti. Extremely rough surf conditions caused 8 Marines and 6 civilians to be stranded on Beata Island, which is located just south of the Barahona Peninsula.

Haiti − Although no specific storm surge values from the coasts of Haiti's Tiburon Peninsula are available, official and media reports indicate that considerable wave action and coastal inundation was caused by Matthew's storm surge.

Cuba – Reports from the Meteorological Institute of Cuba indicate that a storm surge of 10-13 ft was observed along the southern coast of Guantánamo Province, resulting in saltwater inundation that extended inland more than 300 ft, affecting the towns of Imías, San Antonio de Sur, and Maisí. The surge was also accompanied by large, battering waves of 20-26 ft all along the coast, with a maximum wave height of about 30 ft occurring at Maisí. Along the northern coast of the province, a storm surge exceeding 11 ft, accompanied by waves of 15-20 ft, resulted in inundation that penetrated 1000-1500 ft inland. Storm surge heights of 5-6 ft, along with waves up to 16 ft high, occurred along the north coast of Santiago de Cuba Province. Inundation extended more than 200 ft inland, which briefly cut off the road between the cities of Santiago de Cuba and Guantánamo. In Holguin Province, the storm surge was estimated at 3-5 ft, resulting in coastal flooding that pushed inland about 300 ft in some areas. Large waves up to 20 ft occurred on top of the surge at Cabo Lucrecia, while wave heights of 16 ft were observed at Gibara. Along the north coast of Camagüey Province, a lesser storm surge of about 3 ft occurred, along with waves of 6-13 ft. This combination resulted in minor saltwater inundation that extended up to 200 ft inland at Cayo Sabinal.

Bahamas − Storm surge heights up to 8 feet inundated the south coast of New Providence and Grand Bahama Island. The east coast of Andros Island also experienced large and powerful surge and wave action, causing inundation that completely destroyed many coastal structures and infrastructure.

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

United States –

The maximum storm surge measured by a tide gauge in the United States was 7.70 ft above normal tide levels at a NOS gauge at Fort Pulaski, Georgia. Matthew also produced storm surges of 6.96 ft at Fernandina Beach, Florida, 6.20 ft at Charleston, South Carolina, and 6.06 ft at Hatteras, North Carolina. Several NOS tide gauges from Mayport, Florida, to Hatteras, North Carolina, as well as along the St. Johns River, measured their highest water levels on record during Matthew.

In Florida, the combined effect of the surge and tide produced maximum inundation levels of 5 to 7 ft above ground level along the coasts of Flagler, St. Johns, and Duval Counties (Fig. 10). A United States Geological Survey (USGS) storm tide pressure sensor deployed on Fort Matanzas Beach just north of Matanzas Inlet recorded a wave-filtered storm tide water elevation of 8.39 ft above the North American Vertical Datum of 1988 (NAVD88). This measurement converts to about 6.4 ft above Mean Higher High Water (MHHW), which suggests that maximum inundation of 6-7 ft above ground level occurred in the vicinity of Matanzas Inlet. A post-storm assessment conducted by the Weather Forecast Office (WFO) in Jacksonville also suggested that inundation could have been as high as 7 ft in several locations along the immediate coastline, particularly near Matanzas Inlet and Marineland. In Duval County, a record water level of 3.28 ft above MHHW was reported by the NOS gauge at Mayport (Bar Pilots Dock), exceeding the 2.48 ft above MHHW recorded on 27 September 2004 during Hurricane Jeanne. Farther north, maximum inundation levels were 3 to 5 ft above ground level in Nassau County, where the NOS gauge at Fernandina Beach measured a storm tide of 4.17 ft above MHHW. Inundation levels decreased south of Flagler County, with 4 to 6 ft above ground level estimated in Volusia County and 3 to 4 ft above ground level estimated in Brevard County. Maximum inundation levels along the southeastern coast of Florida south of Cape Canaveral were 1 to 2 ft above ground level.

Elsewhere in Florida, inundation occurred well inland from the coast along the banks of the St. Johns River due to locally induced surge in the river and freshwater input from rainfall. Data from NOS tide gauges along the river recorded 3 to 4 ft of storm surge, with a maximum surge of 4.6 ft above normal levels reported at Racy Point. Maximum inundation levels along the river bank were 2 to 4 ft above ground level, with the Racy Point gauge reporting a storm tide of 4.6 ft above MHHW. Record water levels were reported by the NOS gauges at Red Bay Point (3.24 ft above MHHW) and Dames Point (2.77 ft above MHHW).

Maximum inundations were 3 to 5 ft above ground level along the coast of Georgia. The NOS gauge at Fort Pulaski, to the east of Savannah, recorded a peak water level of 5.05 ft above MHHW, which is a record for that site. The previous record at the gauge was 3.40 ft above MHHW, set on 15 October 1947 during the 1947 Cape Sable (Florida) Hurricane. An NHC survey team measured a high water mark of 4.9 ft above ground level on National Park Service grounds at Fort Pulaski, substantiating the report from the nearby tide gauge.

In South Carolina, maximum inundation levels were also 3 to 5 ft above ground level. In addition to the 5.05 ft above MHHW reported at the Fort Pulaski, Georgia, NOS gauge, which lies very near the Georgia-South Carolina border, the NOS station at Oyster Landing (North Inlet

Estuary) near Georgetown recorded a peak water level of 4.69 ft above MHHW. Elsewhere, the tide gauge at Charleston measured a peak water level of 3.52 ft above MHHW.

Maximum inundation levels along the coast of North Carolina varied significantly by location. For the Atlantic coast between the North Carolina-South Carolina border to Cape Hatteras, maximum inundation levels were 2 to 4 ft above ground level. The highest reported storm tide in that area was 3.53 ft above MHHW (8.21 ft above MLLW) from the NOS gauge in Wilmington along the Cape Fear River. This was a record flood level at the downtown Wilmington gauge, eclipsing the old record of 3.47 ft above MHHW (8.15 ft above MLLW) set in 1954 during Hurricane Hazel. The highest coastal water levels in the state occurred farther up the coast on the sound side of the Outer Banks, where maximum inundation levels were estimated to be 4 to 6 ft above ground level. The NOS gauge at the United States Coast Guard station on Hatteras Island, which sits on Pamlico Sound, measured a peak water level of 5.76 ft above MHHW. This value was corroborated by several high water marks surveyed by the USGS, the highest of which was a mark of 5.1 ft above ground level in Hatteras. North of Cape Hatteras, maximum inundation levels were generally 1 to 3 feet above ground level. Along that section of the coast, the highest surveyed high water mark was 3.0 ft above ground level on the sound side of Nags Head, and the highest measured water level was 2.39 ft above MHHW by the tide station at Oregon Inlet Marina.

Some coastal flooding also occurred along the coasts of Virginia, Maryland, and Delaware, but the highest inundations of 2 to 4 ft above ground level occurred primarily in the Hampton Roads area. The NOS gauge at Money Point reported a peak water level of 3.43 ft above MHHW, and the gauge at Sewells Point measured a water level of 3.10 ft above MHHW. Matthew caused severe flooding in coastal parts of southeastern Virginia, with Virginia Beach officials reporting very significant flooding and that almost every road in the city had become impassable.

Rainfall and Flooding

Matthew produced locally heavy rainfall across portions of the Lesser Antilles, but especially on Martinique (Fig. 11). That island nation received the brunt of Matthew's heavy rainfall with 8.19 inches occurring in the southern portion of the island at Rivière-Pilote Stade, while 7.94 inches of rainfall was measured in the northern portion at Fond-Denis-Cadet. Rainfall totals of 5-6 inches were common over the interior and western portions of Martinique due to the orographic lift created by the island's mountains, which also resulted in a sharp rainfall gradient along and just inland of the east coast where rainfall amounts less than 2 inches occurred.

Tremendous rainfall occurred across the central and western portions of the Tiburon Peninsula, and also over northwestern Haiti, with some locations receiving more than 20 inches. Along the north-central coast of the Tiburon Peninsula, immediately to the east of where Matthew's eye made landfall, an official rainfall total of 23.80 inches was measured at Anse-à-Veau, while 20.10 inches of rainfall was observed at Petit-Trou-de-Nippes. Elsewhere across the peninsula, rainfall totals in excess of 15 inches were common. The fury with which Matthew lashed the Sud and Grand'Anse Departments (regions) resulted in the collapse of the rainfall monitoring system in almost all areas along or near the path of Matthew's eye. For this reason, no rainfall data for these departments (regions) are available due to the instruments either having been damaged, washed away, or simply destroyed.

In the adjacent Dominican Republic, rainfall amounts of 6-10 inches were common across the southern third of the country, with several areas receiving more than 12 inches. A peak rainfall total of 16.92 inches was measured at the María Montez International Airport in Barahona along the south-central coast of the Dominican Republic. Over the central third of the country, lesser rainfall amounts of 2-5 inches occurred. A distinct ‘rain shadow’ of an inch or less of rainfall occurred over the northern third of the Dominican Republic due to the east-west oriented mountain ranges blocking the northward transport of significant moisture and rain showers in the eastern portion of Matthew’s circulation.

Jamaica, being located in the drier western portion of Mathew’s circulation, received very little rainfall. However, the eastern portions of Cuba felt the brunt of the hurricane’s heavy rains, even after Matthew had weakened due to traversing the mountainous terrain of southwestern Haiti. Rainfall amounts exceeding 10 inches were common across Guantanamo Province, with Punta de Maisí airport (MUMA) receiving 26.04 inches of rain.

Across the Bahamas, a sharp west-to-east rainfall gradient was evident, with amounts near 20 inches measured from Inagua to Bimini in the western portion of the archipelago to less than 3 inches in the easternmost portion of the country from Long Island to eastern Grand Bahama Island. A maximum storm total amount of 19.70 inches was measured in Matthew Town, Inagua, and 16.82 inches was reported on South Bimini.

In the United States, torrential rains occurred over much of east-central and northeastern Florida, extending northward across coastal sections of Georgia, much of eastern South Carolina, central and eastern North Carolina, and the Virginia Tidewater. Rainfall amounts exceeding 10 inches were common in this region (Fig. 12). The heaviest rain in eastern North Carolina resulted from a contribution of Matthew’s tropical moisture, the ongoing extratropical transition that caused the cyclone’s rains to favor the northwestern quadrant, and a pre-existing frontal boundary over the far eastern portions of the state. The maximum reported storm-total rainfall was near Evergreen in Columbus County, North Carolina, where 18.95 inches was measured on 8-9 October. Other notable rainfall amounts measured were 17.48 inches at Hunter Army Air Field in Savannah, Georgia, 17.05 inches at Hope Mills in southeastern North Carolina, 17.01 inches at Cape Canaveral Air Station in east-central Florida, 16.90 inches on Edisto Island in southern South Carolina, and 14.21 inches at Chesapeake in extreme southeastern Virginia.

During Matthew’s extratropical stage, rainfall amounts were generally less than 3 inches from the northern Delmarva to Massachusetts due to the large cyclone moving away from the U.S. east coast.

Tornadoes

Because the right-front quadrant of the hurricane’s circulation remained mostly offshore, atmospheric conditions conducive for the generation of tornadoes did not extend very far inland over of the southeastern United States. Only two weak tornadoes were reported − an EF0 tornado occurred in Horry County, South Carolina, when a waterspout moved on shore in North Myrtle Beach and another EF0 tornado occurred in Wayne County, North Carolina, near Walnut Creek.

CASUALTY AND DAMAGE STATISTICS

Matthew was responsible for 585 direct deaths[4]: 546 in Haiti, 34 in the United States, 4 in the Dominican Republic, and 1 in St. Vincent and the Grenadines. An additional 18 indirect deaths occurred in the United States, and 128 persons are missing and 439 persons were injured in Haiti. More than 3 million residents in the United States were evacuated from coastal areas, at least 380,000 people were evacuated in Cuba, 340,000 people evacuated in Haiti, and more than 8,500 persons evacuated from the southern regions of the Dominican Republic.

Lesser Antilles − No official damage estimates have been received. On St. Vincent, media reports indicate that a 16-year-old boy died in the town of Layou during a rain-induced mudslide as he was cleaning a drain behind his house. On St. Lucia, tropical-storm-force winds downed trees and power lines, leaving about 70% of the island's residents without power. Floods and mudslides damaged many homes and roads, and the country's banana crop suffered significant damage; at least 85% of the island's farms incurred losses. Two homes were destroyed, one each in Bisée and Gros Islet; several other homes on the island were damaged. On the north end of St. Lucia, mudslides and other debris rendered many roads impassable from Castries and Gros-Islet. On Dominica, some minor damage was reported, which temporarily left many people without water and electricity. Heavy rains in Grenada disrupted the water supply on that island. On Martinique, strong wind gusts of more than 75 kt knocked down numerous trees and powerlines, resulting in more than 55,000 people temporarily losing power. Rain-induced flooding forced closure of the main road connecting Fort-de-France to the southern portion of the island and also caused 4,000 people to lose their water supply.

Dominican Republic – No official damage estimates have been received. Tropical-storm-force winds occurred over the southwestern and south-central portion of the country, causing trees and power lines to be blown down in several communities. In the capital city of Santo Domingo, severe flooding caused by the heavy rainfall caused the wall of a building to collapse and fall on four people, killing two adults and two children. At least 8,500 people were evacuated from southwestern portions of the country.

Widespread flash floods, mudslides, and river floods were common across the southern third of the country, rendering many roads impassable for several days and even affecting some of the country's prisons. Floodwaters adversely affected at least 50% of the aqueducts supplying water to Santo Domingo and also contaminated water wells in many outlying communities. Fast-moving floodwaters destroyed 26 homes, and also damaged an additional 16 homes and 2

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

bridges. The southern slope of the central mountain range and the southwestern portion of the country experienced very heavy rains, which generated severe floods and mudslides, causing damage to many roads and making them impassable, collapsing bridges, and severely damaging agriculture.

Haiti – Widespread damage to beachfront structures occurred from Tiburon eastward to Saint-Louis-du-Sud in Sud Department (region). Media reports indicate that numerous well-constructed structures were knocked down by the pounding surf and then swept out to sea. However, in Les Cayes on the southern coast of the Tiburon Peninsula, the Haitian Government estimated that more than 10 h of hurricane-force winds and heavy rains blasted all the crops in the community's fields. At least 80% of crops were lost in some areas, according to the United Nations Office for the Coordination of Humanitarian Affairs. Grand'Anse Department (region), located in the northern portion of the peninsula, was hit particularly hard, with hundreds of poorly constructed homes having been completely destroyed by Matthew’s category 4 winds. In the city of Jérémie, nearly all of the corrugated-metal homes were destroyed, with only a few concrete buildings left standing. Thousands of large coconut, breadfruit, and plantain trees were blown down by the intense winds.

Official reports from the Government of Haiti and the United States Agency for International Development (USAID) indicated that heavy rainfall across most of the country resulted in widespread flash flooding, river floods, and mudslides. Travelling west of Les Cayes in the Sud Department, roads were impassable for several days after Matthew made landfall due to flooding and resultant severe damage to roads and bridges throughout the region. Some communities in Grand’Anse Department were completely cut off due to flood waters. Destruction of the La Digue Bridge in Petit Goave complicated transportation of relief supplies to the hardest-hit areas. The flooding ravaged large swaths of farmland and also drowned livestock.

Haitian officials indicated that at least 29,000 houses had been destroyed or heavily damaged in Grand’Anse and Sud Departments, and 17 schools were also damaged. The downing of power and telephone lines by the high winds was widespread throughout the aforementioned regions. The effects of Matthew’s intense winds and rainfall-induced flooding and mudslides resulted in the deaths of at least 546 persons.

At least 210,000 homes were either destroyed or severely damaged, with about 90% of the houses along the southern coast of the Tiburon Peninsula having been destroyed. In the same general location, about 90% of coconut trees were knocked down by Matthew’s category-4 winds, and entire coffee and cocoa plantations were destroyed. More than 350,000 animals in the area were also killed. Matthew's intense winds knocked down power lines across most of the Tiburon Peninsula, leaving about 80% of residents without power. Cell phone towers were also knocked down by the high winds, which interrupted communications and inhibited rescue efforts in the days following the storm. According to the Haitian government, more than 85% of buildings suffered serious damage in this region, with some having been completely destroyed. More than 80% of sheet metal roofs were damaged. More specifically, in rural areas, traditional buildings constructed of timber framing and roofing made of sheet metal or hemp were completely destroyed. In urban areas, numerous mixed houses (i.e., concrete, chipboard, and sheet metal roofing construction) were partially destroyed.

During the aftermath, an outbreak of cholera developed due to the significant damage that Haiti's life support infrastructure incurred, resulting in nearly 10,000 cases according to the Pan American Health Organization (PAHO). The PAHO also reported that more than 2.4 million Haitians were directly affected by Hurricane Matthew. According to the Caribbean Disaster Emergency Management Agency (CDEMA), at least 120,000 families had their homes destroyed by Matthew.

The World Bank and the Inter-American Development Bank estimated total damage in Haiti to be about $1.9 billion USD. According to RMS, a catastrophe risk management company, those losses are equal to more than 10 percent of the country's GDP.

Cuba – No direct deaths were reported. The most significant damage occurred in the easternmost province of Guantánamo, which was primarily confined to buildings along the immediate coastal areas due to storm surge flooding. In the city of Baracoa, which was traversed by Matthew's western eyewall, widespread structural damage to homes and other buildings resulted from the category 3 winds and storm surge. According to media reports, hundreds of homes were damaged across eastern Cuba, especially in Guantánamo Province, which received the brunt of Matthew's winds. In Baracoa, 90% of the homes there were damaged or completely destroyed. Extensive damage to trees and utility poles occurred across much of Guantánamo Province, and the eastern portion of Holguin Province. Strong winds also knocked down a communication tower in Majayara, and a bridge spanning the Toa River was destroyed by flood waters, leaving several communities isolated.

The combination of high storm surge and wave action destroyed a guard post building at the Boca de Jauco Bridge. Media reports from Baracoa also indicate that hundreds of homes were damaged or destroyed by the storm surge flooding, including more than 30 houses washed away, and that the coastal highway on the south side of the city was completely eroded and made impassable in large stretches. Some flooding of streets occurred in the town of Malecón due to saltwater inundation. Media reports quoting government officials indicate that damages in Cuba are estimated be around $2.58 billion USD, with the majority of the damage having occurred in Guantánamo Province.

Bahamas − Tropical-storm-force winds affected all of the Bahamas, with hurricane-force winds occurring over the western portion of the country from the Exumas and Andros northward to western Grand Bahama Island. Category 3 winds barely missed New Providence and Andros islands, but damage surveys by the Government of the Bahamas suggested that at least category 3 winds occurred on Berry Islands and western Grand Bahama Island. Numerous trees and power lines were knocked down, rendering many roads impassable. Storm surge-induced flooding occurring on the backside of the storm affected much of the western half of the island. Matthew's long-duration winds down trees along with utility poles and lines throughout most of the country, and also caused severe structural damages to many homes and buildings. On New Providence, North and Central Andros, and Grand Bahama islands, the primary wind effects were to roofs, with damage ranging from pealed shingles to total destruction. Severe damage to vegetation occurred in the Northwest Bahamas. On western Grand Bahama Island, it is estimated that 95% of the homes in the townships of Eight Mile Rock and Holmes Rock sustained severe damage. By the time Matthew's circulation had cleared the Bahamas on 8 October, some portion of the country had been affected by tropical-storm-force winds for three days.

The narrow swath of torrential rainfall across the westernmost Bahamas island chain caused severe flooding in many low-lying communities of Exuma, Andros, New Providence and western Grand Bahama Island. In Nassau, roads near and surrounding the airport were flooded to a depth of about 2 feet.

Media reports quoting government officials indicate that damage in the Bahamas is estimated to be at least $600 million USD.

United States – A breakdown of the 34 direct deaths by state is as follows: Florida – 2, Georgia – 2, South Carolina – 4, North Carolina – 25, and Virginia – 1. Although the southeastern U.S. was spared the full brunt of Matthew's strongest winds as the core of the powerful hurricane remained just offshore, widespread wind damage to roofs, along with downed trees and utilities lines, still occurred from the Florida peninsula northward through the Carolinas. Matthew's wind field caused some structural damage to homes and businesses, and widespread downing of trees, utility lines, and poles, which caused massive power outages. However, most of the structural damage caused by Matthew's wind was described as minor, which is a stark contrast to the moderate to severe structural damage that was associated with the storm surge.

The combination of storm surge inundation and inland freshwater flooding caused by excessive rainfall resulted in more than 1 million structures having been impaired or damaged by Hurricane Matthew, forcing businesses from Florida to North Carolina to close, and temporarily putting thousands out of work. More than 3.5 million customers from Florida to Virginia lost electrical power due to Hurricane Matthew's effects.

The NOAA National Centers for Environmental Information (NCEI) estimates that wind and water damage caused by Matthew totaled approximately $10.0 billion, with a 90% confidence interval of ±$2.0 billion. This makes Matthew the tenth-most-destructive hurricane to affect the United States.

Loss of life and specific damage by state are as follows:

Florida: Direct fatalities (2) – one woman was killed in Crescent City in Putnam County when a tree fell on the camper where she was residing, and a 63-year-old woman was killed in the city of DeLand in Volusia County when a tree fell on her while she was outside feeding her animals. There were also nine indirect deaths, which included two persons succumbing to carbon monoxide poisoning caused by operating gas-powered electrical generators in their homes and two deaths due to cessation of medical devices when electrical power was lost. More than 1.2 million customers lost electrical power across the state.

Much of Florida east of Interstate 75 and highway US27, and north of Lake Okeechobee and West Palm Beach experienced downed trees, trees falling onto homes, roof damage, and downed powerlines, along with stripped off awnings, siding, and other non-structural building features such as billboards and facades. The combination of high storm surge and wave action eroded beaches along coastal areas of east-central and northeastern Florida, and washed away boats and automobiles. Beach erosion was described as moderate from Palm Beach County northward to Indian River County, and was moderate to severe in many locations from Brevard County to the St. Mary's River. Damage to beaches and dunes are estimated to be $29 million in Palm Beach County.

In Brevard County, which was the portion of Florida closest to Matthew's center, 11 homes were destroyed, 140 sustained major damage, 549 experienced minor damage, and 939 additional homes were adversely affected in some way. High water levels, wave run-up, and large breaking waves caused major beach erosion, extensive escarpment of sand dunes, and damage to numerous pedestrian crossovers along the coastline. Foundations of several beachfront properties between Satellite Beach and Melbourne Beach were compromised and weakened due to the damaged dunes and berms. Damage to the beaches is estimated to be $25 million. Saltwater intrusion also affected NASA's rocket launch facility at the Kennedy Space Center, Cape Canaveral, causing several million dollars-worth of damage. The roof of NASA's Operations Support Building II (OSB-II) broke and rainwater damaged the interior of the structure. Air conditioning was lost throughout Launch Complex 39 as well. NASA had to deploy its Damage Assessment and Recovery Team (DART) to KSC to quickly effect repairs to the roof in order to prevent further damage to the OSB-II. Portable chillers mounted on trailers had to be brought in to provide cooling and ventilation to buildings that had lost air conditioning, including the Launch Control Center. Many other facilities also had roof damage, broken windows or lost power. Almost every stoplight on the KSC had been blown over or broken, and water intrusion also was a common occurrence. Ironically, the damage that Matthew inflicted on the facility delayed the scheduled launch of NOAA's GOES-R advanced geostationary weather satellite that will be used to monitor future tropical cyclones.

Significant damage occurred in Volusia County where 69 homes were destroyed, 467 homes sustained major damage, 1,494 incurred minor damage, and additional 10,041 experienced some sort of adverse effects. Structural damage to homes and businesses due to wind were mainly confined to the barrier islands, as well as those properties exposed to larger bodies of water. High water levels, wave run-up, and large breaking waves caused major beach erosion, extensive escarpment of sand dunes, and damage to numerous pedestrian crossovers along the entire coastline. In Ormond-By-The-Sea, surging waters eroded much of the protective barrier along highway A1A, resulting in the collapse of several sections of the highway.

Farther north along the northeast Florida coast, major to extreme beach erosion occurred from Flagler Beach to Micklers Landing in St. Johns County. In many areas, the dune lines were cut back 30-40 ft, leaving vertical cliffs that were 12-16 ft high. Large rocks that were uncovered on the beach were forced backward 150 ft to highway A1A, and the highway was washed out in numerous locations up and down the Flagler County coastline. The rough surf conditions also knocked down the end of the Flagler Beach pier and produced significant sand overwash on roads in Marinaland, Summerhaven, Vilano, and Ponte Vedra. Severe storm surge flooding produced inundation of 6-7 ft above ground level, causing a new inlet to be cut in the barrier island between Marineland and Matanzas Inlet. Severe damage was reported in Summerhaven and Matanzas Inlet, with many houses and businesses inundated by saltwater that was at least 3 ft high. Storm surge flooding was reported at the sea walls in St. Augustine Beach and at the Castillo de San Marcos National Monument. Water heights up to 4 ft above ground level occurred in the city of St. Augustine, especially near the bayfront and the San Sebastian River. More than 2 ft of saltwater intrusion occurred on Anastasia Island. In Ponte Vedra Beach, storm surge inundation moved the sand dune line back 30-40 ft, carved out 12-16 ft cliffs, and undermined numerous structures along the beachfront.

In Duval County, several communities in the east side of the Jacksonville metropolitan area incurred extensive damage due to water and numerous massive oak trees having been knocked down. Major to locally extreme beach erosion occurred in Jacksonville Beach, resulting in some sand dunes being completely swept away. Battering waves knocked down and washed away part of the Jacksonville Beach Pier. The combination of storm surge and freshwater flooding of the St. Johns River destroyed many properties and knocked out electrical power for nearly 250,000 customers in the Jacksonville metropolitan area.

Moderate beach erosion occurred in Nassau County, resulting in several washouts along Ocean Boulevard. Hurricane-force wind gusts caused widespread tree and powerline damage, along with some structural damage, mainly across the eastern portion of the county.

Georgia: Direct fatalities (2) – two males, ages 68 and 41 were killed in Statesboro and Savannah, respectively, after trees fell on their homes and crashed through the roofs. One indirect death resulted when a man in Statesboro drove his car into a tree that had fallen across Burkhalter Road.

More than 12 inches of rainfall in many locations across southeastern portions of the state left roads, homes, and businesses inundated by freshwater flooding more than 4 ft deep at times. Downed trees and powerlines were common throughout the coastal areas of the state. On Sapelo Island in McIntosh County, several thousand trees were reported knocked down by category 1 wind gusts. At least 300,000 customers in the state were left without electrical power.

Chatham County received the brunt of Matthew's storm surge effects in the state. On Tybee Island, where record storm surge was recorded at the Ft. Pulaski National Monument, a dune escarpment 7-10 ft high was noted on 19th Street. Storm surge inundation also penetrated as far inland as Lovell Avenue and points south, with minor erosion occurring from near the Tybee Island Pier to Center Street. Debris lines also indicated that highway US80 on the north side of the island had been inundated by saltwater in a few locations, resulting in 3 ft of water in a few homes located several blocks inland from the shoreline. In Savannah, storm surge inundation flooded the parking lot of the Hyatt Regency Hotel and also flooded a ballroom with up to 18 inches of saltwater. Floodwaters from the Savannah River inundated a restaurant on the east end of River Street and there were eyewitness reports of the hulls of boats tied up at the River Street Bridge rising to the level of the railings along the river. Storm surge pushed into river inlets and low-lying areas near Savannah, causing saltwater damage to many estuaries and bird refuges in and around the Savannah National Wildlife Refuge. Wind gusts in Savannah, especially in residential neighborhoods, knocked down large majestic oak trees, most dating back more than a century.

In Liberty County, storm surge caused some property damage on St. Catherine Island, including the destruction of three docks. Sand overwash was evident in several locations on the island and dunes were breached or completely destroyed in many spots. Saltwater inundation was noted along St. Catherines Sound Margin and some creeks were partially flooded by transported sand. At least 10% of the sea turtle nesting habitat was destroyed due to the beach erosion. In the southeastern part of the county, freshwater flooding forced Interstate 95 to be closed between exits 58-67.

Although Glynn County escaped major storm surge damage, significant flooding of all roads around Brunswick still occurred, rendering them impassable to St. Simons Island. Hurricane-force wind gusts along the coastal areas and tropical-storm-force wind gusts extending at least 60 n mi inland knocked down trees and powerlines, and caused damage to the roofs of homes and businesses.

South Carolina: Direct fatalities (4) – In Florence County, 2 females were drowned when their car was swept away by rain-induced floodwaters. In Marion County, a 40-year old male was drowned in his flooded home; in Richland County, a 66-year old male was found pinned face-down in floodwaters outside his home. One indirect death occurred in Dillon County when a 70-year old man was struck by a cable while cleaning up tree debris. The combination of strong wind gusts and freshwater floods downed trees and powerlines more than 50 n mi inland from the coast, forcing the closure of many roads. In the town of Nichols in Marion County, more than 100 people spent the night on the third floor of the town hall due to rising floodwaters. However, the bulk of the damage associated with Matthew occurred in the counties of Beaufort, Berkeley, Charleston, Dorchester, Georgetown, and Horry. At least 800,000 homes and businesses lost power across the state.

In Beaufort County, significant storm surge caused inundation at several locations along highway US21 and eight boats were driven aground along the north side of the highway. An additional four boats were driven aground onto the Beaufort County Airport runway. An NWS site survey indicated extensive tree damage had occurred on Dataw Island, including trees knocked down onto several homes, which was consistent with wind gusts of at least 85 kt. Storm surge inundation on the island destroyed several boats and washed out the northbound lane of the Harbor Island Bridge. The survey further confirmed that some of the structural damage on Harbor Island was consistent with wind gusts of 85-95 kt. The combination of the strong winds and high surge badly damaged several waterfront homes along North Harbor Drive, and Hunting Island State Park was rendered inaccessible due to large number of trees that were knocked down. Sand overwash occurred in many locations on Hunting Island, and a pier was damaged on the south end of the island. Saltwater inundation was also evident on Fripp Island, including the deposition of boulders and large amounts of sand across roads located on the northeastern side of the island. Two waterfront homes on the eastern end of the island near Fripp Inlet incurred major structural damage. Damage to roofs of homes elsewhere on the island was consistent with wind gusts of at least 85 kt. On Hilton Head Island, an NWS site survey indicated that storm surge inundation reached the Harbour Town Golf Course, which is located more than 500 ft inland from the small harbor and more than 1000 ft from the coast. Several marinas on the island were also damaged by the combination of storm surge and wave action.

The downing of trees and powerlines by category 1 wind gusts was widespread throughout much of Charleston County. Storm surge inundation occurred along the entire coast, including much of downtown Charleston where many roads were closed during the storm due to high water. Several communities and many businesses near the Cooper River also experienced saltwater inundation more than 10 n mi inland from the coast. The combination of the high surge and wave action sunk one boat and drove another one aground on Ashley River just north of the I-526/Westmoreland Bridge. Another large boat was driven aground along a tree line just west of the Intracoastal Waterway near Isle of Palms. Significant escarpment of more than 6 ft was noted along the sand dune line north of the Isle of Palms Pier.

Farther south in Colleton County, numerous trees and powerlines were knocked down throughout the area. Flooding occurred along the Edisto River well inland, with a height of 14.90 ft measured near Givhans Ferry, which was the 12th-highest flood stage ever recorded. Edisto Island was hit particularly hard by Hurricane Matthew. A majestic oak tree 90 ft tall and 3 ft in diameter was uprooted and one home was completely destroyed. For a while, there was no electricity or water on the island, and all roads were impassable; Main Road was flooded and closed at the intersection with highway US17. An NWS survey team reported that the combination of surge and wave action damaged at least 70 beachfront homes along a 1.5-mile stretch of Palmetto Boulevard on Edisto Beach. The most significant damage occurred along the northern end of the beach, with most concrete home foundations and driveways severely undercut by as much as 6 ft or completely destroyed by the rushing waters. Complete destruction of wooden decks up to 15 ft tall was common. Up to 5 ft of saltwater inundation occurred on parts of the island, and sand up to 5-ft deep was pushed onshore and covered more than a 1-n-mi stretch of Palmetto Boulevard near the beach. Widespread debris was mixed with the sand, including gas tanks, refrigerators, and HVAC units. It is estimated that the beachfront of Edisto Beach moved inland as much as two city blocks.

Up the coast in Georgetown County, moderate flooding occurred on the Black River and Pee Dee River, which spread into parts of the city of Georgetown. Two boats were run aground in the city, and several other boats were washed out to sea. Numerous roads were closed across Georgetown due to floodwaters and downed trees and powerlines. Inland freshwater flooding resulted in numerous evacuations throughout the county.

In Horry County, the combination of storm surge and large waves caused significant beach erosion in beachfront communities along most of the coastal areas, including Myrtle Beach. Heavy rainfall, combined with storm surge moving upstream, caused major flooding of the Waccamaw and Little Pee Dee Rivers. The Waccamaw River reached a record crest of 17.90 ft in Conway, toppling the old record set in 1928 that was caused by Hurricane Okeechobee, which is listed as one of the state's "storms of the century" by the South Carolina Department of Natural Resources. Most of Socastee was inundated by knee-deep water caused by the convergence of floodwaters where the Intracoastal Waterway meets the Waccamaw River just west of the city. Small rivers and creeks surrounding the Conway-Horry County Airport overflowed their banks, flooding portions of the runway complex. High water rendered roads, bridges, and railways impassible, and more than 1,000 people had to seek shelter to escape the floodwaters. More than 170 roads were closed in the county due to freshwater flooding, including highway US501, a main line of communication leading out of Myrtle Beach. The combination of storm surge and wave action tore away 900 ft of the 1,000-ft Springmaid Pier in Myrtle Beach, according to city officials, leaving splintered, weather-beaten boards scattered across the beach where the pier once stood. In addition, the pier in Surfside Beach suffered substantial damage due to significant storm surge, and city officials shut down all roads from Dogwood Drive to the ocean due to the flooding. An EF0 tornado in North Myrtle Beach damaged a couple of businesses and also caused minor damage to a few homes.

In upland portions of the state, widespread freshwater flooding of streets, highways, streams, and rivers occurred across the counties of Darlington, Dillon, Florence, Marion, and Marlboro. Fast-moving floodwaters completely destroyed a bridge in Scranton and numerous water rescues were required across Florence County. In Marlboro County, floodwaters caused a

CSX Railroad train derailment in Wallace. One locomotive and four cars came off the track in a washed-out area just north of the large overpass on Highway 9. The South Carolina Department of Health and Environmental Control responded and found no evidence of any hazardous materials cargo or any fuel leakage that might have posed a threat to surrounding areas.

In Dillon County, major flooding resulted in the closure of Interstate 95 between mile-markers 181 and 193. Moderate flooding of the Lumber and Pee Dee Rivers in the southern part of the county forced closure of Highway 9 from Dillon to Lakeview. Both the Squires Lake Dam and Little Pee Dee State Park Dam failed due to flooding. An unregulated dam in Lexington County also failed.

North Carolina: Direct fatalities (25) – Of the direct deaths reported, 24 of them were flood related. Unfortunately, 19 of those drowning deaths occurred when people drove their vehicles or walked into hazardous floodwaters and were swept away by the swift currents. Some of the victims encountered flood waters after driving around posted barricades. None of the flood-related deaths were associated with storm surge.

Two males, ages 44 and 22, drowned when their vehicle plunged into floodwaters covering a washed-out road in Bladen County. A 70-year-old male was found drowned about 50 yards from his abandoned vehicle. In Cumberland County, a male (age 54) was found drowned near his abandoned vehicle, and a female driver was drowned when her car plunged into rushing flood waters across highway US301. In Gates County, a 75-year old male was found in his car after floodwaters had receded. A 74-year old man was drowned after he drove his car around barriers and into a rain-swollen creek in Harnett County. Four deaths occurred in Johnston County; a driver's car was swept away after attempting to cross a flood-covered bridge, a female driver's car was swept away in floodwaters near I-95 mile-marker 85, a 51-year-old male was swept away while walking through floodwaters, and another driver was found submerged car in a car in Cleveland. Three people were killed in Lenoir County when a 71-year-old male was drowned while attempting to rescue a horse, a female drowned after driving her car around barricades and into floodwaters near LaGrange, and a 55-year-old man was found drowned in a shed in Kinston. A female driver drowned in Pitt County when her car was swept away by rushing floodwaters. Four flood-related deaths occurred in Robeson County when a man's car was washed away by floodwaters near highway NC130, a man relying on oxygen drowned while attempting to escape floodwaters in his home in Fairmont, a 76-year-old man in Lumberton fell into water in his flooded home and drowned, and a female passenger drowned after her husband drove their car into floodwaters. Two people were killed in Wayne County when a male (age 54) had his car swept away by rushing floodwaters, and a 47-year-old female was found in her car after floodwaters had receded. In Wilson County, two people drowned after their cars were swept away submerged by freshwater floods. In Robeson County, a man fell into a large hole caused by an uprooted tree and was unable to climb out of the hole as it filled with floodwaters, resulting in an apparent drowning death.

One additional direct death that was not flood related occurred when a man in Wake County was killed after a tree fell on the truck that he was driving.

There were also six indirect deaths in North Carolina associated with Matthew. A 63-year-old male collapsed from apparent heart failure after getting out of his vehicle in Cumberland County, a person died from apparent heart failure in Lenoir County while walking around after the hurricane had passed, a female was killed in a fire in Rowan County, a 30-year-old male was killed when his car hydroplaned and crashed on a wet road in Sampson County, two evacuees died in shelters due to health-related issues.

Wind damage was limited primarily to the immediate coastal areas, but flood-producing rainfall exceeding 10 inches was widespread, occurring along and well inland from the coast. Freshwater flooding of major rivers, low-lying areas, roads, and several municipalities was common. Flooding forced closure of Interstate 95 at exit 73 (US421) through exit 58 (NC295) and at exit 31 (NC20) through exit 13 (I-74). In addition, Interstate 40 was closed westbound from exit 341 (NC55) to exit 334 (NC96) between Newton Grove and Benson.

In New Hanover County, at least 4 ft of storm surge produced a record flood level at the downtown Wilmington gauge along the Lower Cape Fear River. The storm surge flooding not only pushed northward up the Cape Fear River, but also spread eastward, producing saltwater inundation in Carolina Beach and low-lying dune areas elsewhere along the immediate coast.

Flooding of the Black River Basin in the western part of Pender County resulted in evacuation and rescues of several neighborhoods in the days following Matthew.

In Brunswick County, major flooding occurred near the confluence of the Black River and the Cape Fear River in the days following Matthew's passage. This caused water to back up into the Lockwood Folly River in Shallotte, forcing several water rescues by local emergency responders.

Major freshwater flooding occurred in the western part of Columbus County along the Lumber River, especially in the town of Fair Bluff where 85% of the town was submerged under water, resulting in massive evacuations. Highways 701 and 74, as well as highway NC130, experienced lengthy closures due to freshwater inundation.

Several of the highest rainfall amounts occurred in Bladen County, resulting in major freshwater flooding along the Cape Fear River at Lock #1 near the town of Kelly. Major flooding was reported in Clarkton, Elizabethtown, White Oak, and Tar Heel, forcing evacuations and water rescues in the latter two municipalities. Floodwaters inundated much of downtown Bladenboro and caused the closure of numerous roads, including major state highways NC210, NC242, NC41, NC53, and NC87. Gauges on the Cape Fear River at the William O. Huske Dam and Lock #1 near East Arcadia recorded their highest flood stages since 1945.

In Robeson County, major and record-breaking flood levels were observed along the Lumber River at Lumberton. Devastating floods occurred in and around Lumberton and Pembroke, causing significant monetary damage and loss of property, and forcing the closure of many roads. Offices in the *Robesonian Newspaper* in Lumberton were also flooded. A levee was believed to have broken in Lumberton, forcing the emergency evacuation of nearly 1,500 people stranded by the rising waters. On 10 October, two days after Matthew had passed, those people were still stranded and awaiting rescue. Most of them were in knee-deep water, but some fled to rooftops to escape the floodwaters. Numerous water rescues were required at many locations along the Lumber River. This was one of the hardest hit counties in the state due to the historic flooding that occurred.

Heavy rainfall and resultant freshwater flooding extended well inland from the state capital of Raleigh eastward to the Outer Banks, resulting in numerous evacuations and water rescues. One notable evacuation included the removal of nearly 800 inmates at the minimum-security Neuse Correctional Institute in Goldsboro in order to escape rising water from the Neuse and Little rivers. More than 700 swiftwater rescues were required in Cumberland County alone. Extensive flooding along the Tar, Cape Fear, Neuse and Lumber rivers produced dangerous conditions beyond drowning – the waters were toxic from sewage, chemicals, and dead animals that were caught up in the floods.

Although Matthew remained well offshore of the Outer Banks, winds coming out of a high pressure system located over the Great Lakes were accelerated into Matthew's circulation, resulting in widespread tree and powerline damage in Currituck, Dare, Hyde, and Tyrrell Counties. These winds also drove water onshore on the sound side of the barrier islands that combined with storm surge coming in from the Atlantic, producing significant saltwater inundation across much of the Outer Banks. Portions of Highway NC12 were closed or impassable. The section of highway NC12 from Kitty Hawk Road to Lillian Street was once again hit hard by overwash, causing new damage to the dunes and pavement. That area was closed and repaired in 2015 after Hurricane Arthur caused damage to the road in 2014. According to the North Carolina Department of Transportation, the barrier island highway was also closed from Old Oregon Inlet Road in Nags Head southward to Hatteras Village due to "very high standing water throughout the area, especially in Hatteras and Avon, with deep standing water covering much of NC12 for the entire length of Hatteras Island."

Elsewhere on the Outer Banks, a large volume of tree debris in Southern Shores had to be removed from the town's streets to allow for emergency vehicles to reach residents. However, overall damage to structures was limited. The town of Kitty Hawk experienced freshwater flooding from the heavy rains between highways US158 and NC12, and pumps had to be invoked in an effort to relieve the standing water. Beach Road (NC12) received damage in front of the Sea Dunes condominiums and had to be closed, while the eastern portion of highway was eroded away by the ocean. Although some homes were damaged from flooding and high winds, property damage overall was described as minor by city officials. The town of Duck's damage estimate indicated that a total of 543 properties were affected. City officials reported that, although many properties were damaged, the damage was relatively minor in nearly all cases. The most common types of damage identified were missing or damaged roof shingles and damaged siding, fascia, and soffits. Storm-surge flooding damaged dozens of additional residences throughout Duck. However, most of the flooded areas were enclosed storage areas, not finished rooms. Several beach structures, such as stairways and decks, were damaged by wave action caused by Matthew. Nags Head officials indicated the town experienced significant flooding on Beach Road (NC12) and between the highways on the north end of Nags Head. Significant flooding also occurred in some of the west side neighborhoods such as Nags Head Pond and Nags Head Acres.

An EF0 tornado touched down near Walnut Creek in Wayne County, uprooting numerous trees, causing minor roof damage to several buildings, and destroying at least one billboard. In addition, a camper was uplifted and rotated around an adjacent building, and subsequently sustained damage. Several privacy fences were also knocked down and blown away. No injuries or deaths resulted from the tornado.

Across the southeastern and eastern portions of the state, Matthew caused at least $1.5 billion in property damage to 100,000 buildings, left 900,000 people without electrical power, and caused environmental problems.

Virginia: Direct fatalities (1) – A 53-year-old man was swept out to sea and drowned; his body was later found near Constant's Wharf Park & Marina in Suffolk. One indirect death occurred when a 38-year-old male rear-ended a semi-tractor trailer that had stopped at a downed tree across the road.

Strong northerly winds accelerating down the Chesapeake Bay caused widespread power outages across much of the Virginia Tidewater area, especially in the cities of Chesapeake, Hampton Roads, Virginia Beach, and Norfolk. Numerous traffic lights were knocked out, causing confusion and frustration on area roadways. Many streets were rendered impassable either due to floodwaters, downed trees, or downed power lines. In Virginia Beach, flooding and power outages stressed the sewer system so much that city officials asked residents to cut back on unnecessary water use due to the system's inability to handle excessive wastewater flows. Furthermore, city officials indicated that saltwater inundation from storm surge flooding likely got into a 30-inch pressurized line, adding stress to it and exposing a weak spot, which caused a break in a major sewer line along Laskin Road. This resulted in about 2 million gallons of raw sewage spilling into a tributary of Linkhorn Bay. In Suffolk, Matthew's winds and rains damaged some City Hall offices, forcing them to be moved elsewhere within the building.

Many roads were flooded and rendered impassable, especially in Chesapeake, Elmwood Landing, Mill Creek, and Culpepper Landing neighborhoods, and pumps had to be installed to help increase the drainage. More than 100 road closures were reported throughout southeastern Virginia due to freshwater flooding.

Although Matthew's center passed more than 100 n mi southeast of Virginia, the hurricane's effects still caused nearly 350,000 households to lose electrical power. The Virginia Department of Transportation estimated that damage from Hurricane Matthew to state-maintained roads and bridges, along with debris cleanup, was at least $2 million.

Mid-Atlantic and Northeast: Matthew lost its tropical characteristics early on 9 October as it moved eastward and then northeastward away from the United Sates. However, the large circulation of the extratropical low pressure system still managed to produce some flooding rains across the Delmarva Peninsula, along with minor beach erosion from Delaware to Long Island. In Snow Hill, Maryland, located in the east-central portion of the Delmarva, freshwater flooding led to a water rescue, but no injuries were reported.

FORECAST AND WARNING CRITIQUE

The genesis of Matthew was forecast extremely well. 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 precursor disturbance was introduced in the TWO and given a low (<40%) chance of genesis during the next five days 138 hours before Matthew formed.

It was given a medium (40-60%) chance 96 h before genesis occurred, followed 12 h later by a high chance (>60%) of formation. For the shorter term 48-h forecasts, the disturbance was given low, medium, and high chance of genesis 96 h, 54 h, and 42 h, respectively, before formation occurred.

A verification of NHC official track forecasts (OFCL) for Matthew is given in Table 5a. Official forecast track errors were significantly lower than the mean official errors for the previous 5-yr period at all forecast times, especially at 12 h and 24 h where OFCL forecasts were about 40% better than average. At 72-120 h, the climatology and persistence model (OCD5) errors were larger than their 5-yr averages, which suggests that Matthew was a more difficult hurricane to forecast at those longer time periods. Figure 13 shows OFCL forecasts plotted against the best track for Matthew for 0-72 h and 0-120 h. The NHC 72-h forecasts verified exceptionally well with very little bias. The OFCL 120-h forecasts verified quite well over the Caribbean Sea and the Bahamas. However, once Matthew emerged over the southwestern Atlantic north of the Greater Antilles, there was a sharp right-of-track bias due to expectations that Matthew would turn southward around a ridge that was expected to build over the southeastern United States instead of recurving into the mid-latitude westerlies.

A homogeneous comparison of the official track errors with selected guidance models during Matthew's tropical and post-tropical phases is given in Table 5b. Overall, the European Centre for Medium-Range Weather Forecasting model (EMXI) and the United Kingdom Met Office model (EGRI) had the lowest errors, which were mostly lower than the NHC official forecast errors. Many of the model consensus aids also had lower errors than the official forecasts, especially between 12 h and 96 h, including the new NOAA HFIP Corrected Consensus Approach (HCCA) model.

A verification of NHC official intensity forecasts (OFCL) for Matthew is given in Table 6a. OFCL intensity errors were greater than the mean official errors for the previous 5-yr period at all forecast times and contained a pronounced low bias. The early OFCL forecasts missed Matthew's 24-h period of significant strengthening that occurred from 30 September to 1 October, resulting in the low bias. However, after Matthew completed that RI period, OFCL intensity forecast were quite good. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 6b. Overall, the NOAA Hurricane Weather Research and Forecasting model (HWFI) had the best statistics, but only narrowly outperforming the NHC official intensity forecasts at 36-96 h. However, none of the available intensity models, including the consensus model IVCN and its individual members – HWFI, GHMI, CTCI, DSHP, and LGEM – predicted Matthew's RI period either before or during the episode (Fig. 14).

In addition to Hermine earlier in the season, Matthew provided another opportunity for the National Weather Service to issue the Prototype Storm Surge Watch/Warning Graphic (Fig. 17), a depiction of areas that would qualify for inclusion under a storm surge watch or warning under development by the agency. Once operational, the storm surge watch and warning will be issued to delineate areas in which there is a possibility and danger, respectively, of life-threatening inundation of normally dry areas near the coast due the combination of storm surge and the tides. Prototype Storm Surge Watch/Warning Graphics were issued for Matthew beginning at 2100 UTC 4 October, with a possibility of life-threatening inundation within the next 48 hours indicated for the east coast of Florida from North Palm Beach to the Volusia/Brevard County line. A danger of life-threatening inundation within the next 36 h was first conveyed at 0300 UTC 5 October from

North Palm Beach to Sebastian Inlet, Florida. The Prototype Storm Surge Warning was then extended northward on successive advisories.

Storm surge observations and analyses indicate that at least 3 ft of inundation (the current threshold for the prototype watch/warning) occurred from the east-central coast of Florida northward to North Carolina and the Hampton Roads area of Virginia within most of the Prototype Storm Surge Warning areas (Figs. 10 and 15). In general, locations within the southern portion of the warning area (south of Cape Canaveral) did not experience at least 3 ft of inundation, but only a slight westward shift in Matthew's track would have caused worse storm surge flooding in that area. Conversely, a Prototype Storm Surge Warning was not depicted north of Duck, North Carolina, yet some locations in the Hampton Roads area of Virginia may have experienced 3 ft of inundation. NHC's highest explicit storm surge inundation forecasts indicated that 7 to 11 ft above ground level was expected somewhere between Sebastian Inlet, Florida, and Edisto Beach, South Carolina. Inundation heights that were observed along the coasts of Flagler, St. Johns, and Duval Counties in Florida appear to have been very close to the 7-ft threshold.

Coastal watches and warnings associated with Matthew are given in Table 7. A hurricane watch was first issued for the southeastern and east-central coasts of Florida from Deerfield Beach to the Volusia/Brevard County line at 1500 UTC 4 October. Since sustained tropical-storm-force winds first reached the southeast Florida coast within the hurricane watch area in Palm Beach County around 1800 UTC 6 October, a lead time of 51 h was provided. A hurricane warning was issued for the southeastern and east-central Florida coastal areas from Golden Beach to Sebastian Inlet at 0300 UTC 5 October, and was subsequently extended northward to the Flagler/Volusia County line at 1500 UTC 5 October. Sustained hurricane-force winds first reached the northern portion of the hurricane warning area at Cape Canaveral, Florida, around 0900 UTC 7 October, resulting in a lead time of 42 h. However, the southern portion of the hurricane warning south of Sebastian, Florida, did not verify. Tropical storm and hurricane watches and warnings were subsequently issued at various times for the remainder of the southeastern coast of the United States from the Volusia/Brevard County border northward to Duck, North Carolina. However, the segment of the North Carolina Outer Banks from Surf City to Duck was only covered by a tropical storm warning and a hurricane watch. Surface observations indicate that sustained hurricane-force winds occurred near Nags Head, North Carolina, on the morning of 9 October, an area that was not covered by a hurricane warning.

NHC does not issue warnings for inland flooding, but coordinates with the Weather Prediction Center (WPC) on hazard statements for inclusion in NHC public products. The risk of flooding and flash flooding from central Florida to eastern North Carolina was first mentioned in the NHC Public Advisory at 5 AM Friday 7 October, when Matthew's center was east of Cape Canaveral. The threat of inland flooding was included as a "Key Message" in NHC's Tropical Cyclone Discussion beginning at 11 AM that day, and Public Advisories began describing the anticipated flooding as "life-threatening" beginning at 5 PM.

ACKNOWLEDGMENTS

Data in Table 3 were compiled from Post-Tropical Cyclone Reports issued by the NWS Forecast Offices (WFOs) in Miami, Melbourne, Tampa Bay/Ruskin, Jacksonville, Charleston, Wilmington, and Newport/Morehead City. Data from the Weather Prediction Center, National Data Buoy Center, NOS Center for Operational Oceanographic Products and Services, United States Geological Survey, the Cuban Meteorological Service (INSMET), the Bahamas Department of Meteorology, the Dominican Republic National Meteorological Office, and Meteo-France were also used in this report. Situation Reports (SITREP) from the Government of Haiti and USAID, along with reports from the St. Vincent and the Grenadines National Emergency Management Office were used to compile casualty and damage information for their respective countries. Mark Sudduth of *HurricaneTrack.com* contributed detailed wind and pressure observations, along with eyewitness accounts of conditions in New Smyrna Beach, Florida, during Matthew's passage. Special thanks to Hurricane Specialist Robbie Berg and the NHC Storm Surge Unit for providing valuable analysis and figures concerning U.S. coastal flooding caused by Matthew's storm surge. Brad Klotz of the NOAA/AOML Hurricane Research Division (HRD) provided the post-storm quality control checks of SFMR surface wind speed data.

Table 1. Best track for Hurricane Matthew, 28 September – 9 October 2016.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
28 / 1200	13.4	59.8	1009	50	tropical storm
28 / 1800	13.6	61.2	1008	50	"
29 / 0000	13.9	62.6	1004	55	"
29 / 0600	14.0	64.0	1002	55	"
29 / 1200	14.1	65.5	995	60	"
29 / 1800	14.2	66.9	993	65	hurricane
30 / 0000	14.2	68.1	987	70	"
30 / 0600	14.0	69.3	979	85	"
30 / 1200	13.8	70.4	968	100	"
30 / 1800	13.5	71.2	955	120	"
01 / 0000	13.4	71.9	942	145	"
01 / 0600	13.4	72.5	942	140	"
01 / 1200	13.4	73.1	944	135	"
01 / 1800	13.4	73.3	942	130	"
02 / 0000	13.5	73.5	940	130	"
02 / 0600	13.7	73.9	941	125	"
02 / 1200	14.0	74.3	947	130	"
02 / 1800	14.2	74.7	945	135	"
03 / 0000	14.5	75.0	944	130	"
03 / 0600	14.9	75.0	942	125	"
03 / 1200	15.4	75.0	941	125	"
03 / 1800	15.9	74.9	938	125	"
04 / 0000	16.6	74.6	934	130	"
04 / 0600	17.5	74.4	934	130	"
04 / 1100	18.3	74.3	935	130	"
04 / 1200	18.4	74.3	937	125	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 1800	19.3	74.3	947	120	"
05 / 0000	20.1	74.3	949	115	"
05 / 0600	20.7	74.4	960	110	"
05 / 1200	21.4	74.8	962	105	"
05 / 1800	22.2	75.4	963	105	"
06 / 0000	23.0	76.0	960	105	"
06 / 0600	23.8	76.7	952	110	"
06 / 1200	24.7	77.5	937	120	"
06 / 1800	25.7	78.3	937	120	"
07 / 0000	26.7	79.0	937	115	"
07 / 0600	27.7	79.7	939	110	"
07 / 1200	28.9	80.3	944	105	"
07 / 1800	29.7	80.7	946	100	"
08 / 0000	30.7	80.6	949	95	"
08 / 0600	31.6	80.6	953	85	"
08 / 0900	32.1	80.5	957	85	"
08 / 1200	32.5	79.9	963	80	"
08 / 1500	33.0	79.5	967	75	"
08 / 1800	33.5	79.0	973	70	"
09 / 0000	33.9	77.3	981	70	"
09 / 0600	34.7	76.0	983	70	"
09 / 1200	35.0	74.5	984	65	extratropical
09 / 1800	35.2	72.8	987	60	"
10 / 0000	35.3	71.1	990	55	"
01 / 0000	13.4	71.9	942	145	maximum winds
04 / 0000	16.6	74.6	934	130	minimum pressure

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 1100	18.3	74.3	934	130	landfall near Les Anglais, Haiti
05 / 0000	20.1	74.3	949	115	landfall near Juaco, Cuba
07 / 0000	26.7	79.0	937	115	landfall near West End, Grand Bahama Island
08 / 1500	33.0	79.5	963	75	landfall 5 n mi south of McClellanville, South Carolina

Table 2. Selected ship reports with winds of at least 34 kt for Hurricane Matthew, 28 September – 10 October 2016, while it was a tropical and extratropical cyclone.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
29 / 0100	3ETA8	19.2	67.1	070 / 35	1014.0
05 / 0000	J8PE4	20.1	71.2	170 / 40	1006.0
07 / 1000	WMKA	31.6	77.8	080 / 40	1007.0
07 / 1800	DFDG2	29.8	76.0	130 / 36	1007.2
08 / 1100	3FFL8	25.8	79.5	230 / 38	1009.9
08 / 1354	WTER	32.8	79.9	330 / 40	980.2
09 / 0000	WAIU	37.0	70.9	140 / 37	1007.0
09 / 0700	H3GR	30.3	80.3	020 / 35	1012.0
09 / 1600	C6VV8	40.4	69.3	050 / 52	1011.0
09 / 1800	D5FR8	37.6	73.1	350 / 60	999.0
09 / 1800	BUZM3	41.4	71.0	020 / 35	1011.9
09 / 2100	WCE506	41.0	70.9	030 / 45	1010.3
10 / 0000	3EFD9	40.5	71.5	020 / 45	1011.9
10 / 0000	BUZM3	41.4	71.0	010 / 37	1011.4
10 / 0100	BATFR2	41.3	69.3	020 / 55	1005.4
10 / 0600	A8XY2	39.7	69.5	360 / 56	1009.0

Table 3. Selected surface observations for Hurricane Matthew, 28 September – 9 October 2016.

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)				
Antigua									
International Civil Aviation Organization (ICAO) Sites									
V. C. Bird IAP (TAPA) (17.14N 61.79W)	28/2300	1013.0	28/1800	22 (10 min)	43				
Bahamas									
ICAO Sites									
Lynden Pindling (Nassau) IAP (MYNN) (25.04N 77.47W)	06/1300	975.7	06/1300	50 [H] (10 min)	84				
Rock Sound IAP (MYER) (24.89N 76.18W)	06/1200	1000.0	06/1200	31 (10 min)					
San Salvador Airport (MYSM) (24.06N 74.52W)	06/0000	1004.3	06/0000	28 (10 min)					
South Bimini Airport (MYBS) (25.70N 79.26W)	06/1800	987.5	06/1800	38 (10 min)					16.82
West End IAP (MYGW) (26.69N 78.98W)	07/0100	943.1	07/0100	63 (11 m/1 min)					3.88
Coastal-Marine Automated Network (C-MAN) Sites									
Settlement Point, GBI (SPGI7) (26.70N 78.99W)	06/2300	972.3	06/2230	68 (10 m/10 min)	91				
Other									
Coco Cay/Berry Islands (ITHBAHAS) (25.82N 77.94W)	06/1927	970.6	06/1959	78	88				
George Town 1.0 ESE (BHS-EX-1) (23.51N 75.77W)									8.36
Matthew Town, Inagua (20.94N 73.67W)	05/0000	996.5	05/0000	21 (10 min)					19.70
Moss Town, Exuma (23.56N 75.87W)	06/0000	993.0	06/0600	35 (10 min)					6.30
Nassau 4.4 SW (BHS-NP-6) (25.04N 77.35W)									6.94

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)				
Nassau Upper-Air Station (MYNN) (25.05N 77.46W)			06/1400	100	111				
Paradise Island (25.08N 77.30W)			06/1139	57 (10 min)					
Ragged Island (22.18N 75.73W)	05/0000	989.0	05/1800	40 (10 min)					
Stella Maris, Long Island (23.58N 75.27W)									2.82
West End 1.1 ESE (BHS-WG-1) (26.68N 78.96W)									1.01
Barbados									
ICAO Sites									
Grantley-Adams IAP (TBPB) (13.07N 59.49W)	28/0800	1007.8	28/2200	37 (10 min)	53				2.69
Cuba									
ICAO Sites									
Frank País/Holguin Arpt (MUHG/78372) (20.79N 76.32W)	05/1800	1002.2	05/1700	17 (1 min/10 m)	27				2.51
Hermanos Ameijeiras/ Las Tunas Arpt (MUVT/78357) (20.99N 76.94W)	05/2100	1003.1	04/1740	24 (1 min/10 m)	30				2.51
Mariana Grajales/ Guantánamo Arpt (MUGT/78368) (20.09N 75.16W)	04/2010	991.6	04/1950	9 (1 min/10 m)	---				4.67
Punta de Maisí Arpt (MUMA/78369) (20.24N 71.50W)	05/0150	968.8	05/0120	108 (1 min/10 m)	132				26.04
Sierra Maestra/ Manazillo Arpt (MUMZ/78359) (20.29N 77.09)	05/0800	1004.3	05/2215	22 (1 min/10 m)	29				1.00
U.S. Naval Station, Guantánamo Bay (MUGM) (19.90N 75.21W)	04/2156	996.9	04/1356	24 (1 min/10 m)	34[F]				3.16

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)				
Other									
Cabo Cruz (78360) (19.85N 77.23W)	04/2100	1004.0	04/1745	24 (1 min/10 m)	31				0.32
Caujeri (78319) (20.22N 74.81W)	04/2200	989.7	05/2010	75 (1 min/10 m)	---				15.75
Guaro (78370) (20.67N 75.78W)	05/0800	994.0	04/1500	19 (1 min/10 m)	32				3.61
Jaucarito (78361) (20.67N 76.90W)	05/2100	1004.6	05/2200	10 (1 min/10 m)	40				0.60
Jamal (78356) (20.28N 74.43W)	05/0230	958.6	04/2200	103 (1 min/10 m)	151				7.55
Jiquima (78362) (22.03N 79.74W)	05/0700	1002.1	04/1930	15 (1 min/10 m)	---				3.87
Palenque de Yatera (78334) (20.35N 74.92W)	05/0500	992.0	05/0250	76 (1 min/10 m)	---				14.87
Pinares de Mayari (78371/elev. 646 m) (20.48N 75.80W)	05/0700	933.0							4.61
Punta Lucrecia (78365) (21.07N 75.62W)	05/0940	997.4							0.94
Puerto Padre (78358) (21.20N 76.60W)	05/2140	1002.3	04/1830	24 (1 min/10 m)	35				2.89
Velazco (78378) (21.92N 78.32W)	05/2045	1001.0	04/1930	31 (1 min/10 m)	33				2.31
Veguitas (78377) (20.32N 76.88W)	05/0807	1004.8[f]	04/1930	4 (1 min/10 m)	18				0.47
Dominica									
ICAO Sites									
Canefield IAP (TDCF) (15.34N 61.39W)	28/2100	1008.0	29/0000	15[F] (10 min)	37				
Douglas–Charles IAP (TDPD) (15.55N 61.30W)	28/2100	1011.0[f]	28/1500	29[F] (10 min)	46				
Dominican Republic									
ICAO Sites									
Arroyo Barril Airport/ Samaná (MDAB) (19.20N 69.43W)	03/2100	1008.4							4.48

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
La Isabela IAP/ Higuero (MDJB) (18.58N 69.98W)	03/2000	1008.5							6.31
La Romana IAP (MDLR) (18.45N 68.91W)	03/2000	1008.5							5.72
Las Américas IAP/ Santo Domingo (MDSD) (18.43N 69.67W)	03/2100	1008.0	04/0800	12 (10 min)	43				7.15
María Montez IAP/ Barahona (MDBH) (18.25N 71.12W)	04/0900	1006.2	04/0800	30 (10 min)	40				16.92
Other									
Bayaguana (78473) (18.75N 69.34W)	03/2100	1007.3							7.94
Jimani (78480) (18.49N 71.85)	04/1400	1005.0							6.02
Sabana de la Mar (78467) (19.07N 69.39W)	03/2100	1008.2							5.79
Santo Domingo - Central (78486) (18.49N 69.98W)	03/0900	1008.2							9.17
Guadeloupe									
ICAO Sites									
Pointe-à-Pitre IAP (TFFR) (16.26N 61.52W)	28/1900	1010.0	28/1700	23 (10 min)	40				
Haiti									
ICAO Sites									
Toussaint Louverture IAP (MTPP) (18.58N 72.95W)	04/0800	1001.7	04/0500	30 (10 min)	45				
Other									
Anse-à-Veau/ Nippes Department (18.52N 73.35W)									23.80
Belle-Anse/ Sud-Est Department (18.23N 72.07W)									16.73

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)				
Bombardopolis/ Nord-Ouest Dep't (19.70N 73.33W)									15.74
Carrefour/ Ouest Department (18.53N 72.40W)									6.30
Fonds-Parisien/ Ouest Department (18.52N 71.98W)									4.13
Gros-Morne/ Artibonite Department (19.67N 72.68W)									3.94
Jean-Rabel/ Nord-Ouest Dep't (19.85N 73.20W)									17.72
La Vallée-de-Jacmel/ Sud-Est Department (18.27N 72.67W)									15.83
Mombin-Crochu/ Nord-Est Department (19.37N 71.98W)									1.20
Petit-Trou-de-Nippes/ Nippes Department (18.45N 73.35W)									20.10
Plaisance/ Nord Department (19.60N 72.47W)									3.74
Verrettes/ Artibonite Department (19.05N 72.47W)									3.93
Martinique									
ICAO Sites									
Martinique Aimé Césaire IAP (TFFF) (14.59N 60.99W)	28/1900	1007.9 [F]	28/2107	38 (10 min)	61				
Other									
Daimant (elev. 366 m) (14.48N 61.00W)			28/2107	44 (10 min)	66				
Fond-Denis-Cadet (elev. 493 m) (14.73N 61.14W)			28/1856	39 (10 min)	87				7.94

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)				
Fort De Frances Desaix (elev. 143 m) (14.63N 60.07W)			28/2023	35 (10 min)	60				
Lorrain Vallon (elev. 83 m) (14.81N 61.07W)			28/2213	32 (10 min)	63				
Rivière-Pilote Stade (elev. 80 m) (14.48N 60.91W)									8.19
Sainte-Anne (elev. 22 m) (14.44N 60.87W)			28/1927	32 (10 min)	61				5.65
Sainte-Luce (elev. 44 m) (14.59N 60.99W)			28/1935	32 (10 min)	60				
Sainte-Pierre (elev. 27 m) (14.74N 61.18W)			28/1917	31 (10 min)	60				
Trinite Caravel (elev. 26 m) (14.71N 60.97W)			28/2201	52 (10 min)	75				
Vauclin (elev. 12 m) (14.54N 60.84W)			28/2113	51 (10 min)	68				4.96
Montserrat									
ICAO Sites									
John A. Osborne IAP (TRPG) (16.79N 62.19W)	28/2100	1012.0 [F]	28/1807	31 [F] (10 min)	42				
Puerto Rico									
ICAO Sites									
Luis Muñoz Marín (San Juan) IAP (TJSJ) (18.44N 66.00W)	29/0756	1013.5	29/1109	25 (2 min/10 m)	36 [F]				
St. Croix									
ICAO Sites									
Henry E. Rohlsen IAP (TISX) (17.70N 64.80W)	28/1935	1013.5	28/2153	27 [F] (10 min)	43				
St. Lucia									

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)				
ICAO Sites									
George F. L. Charles IAP (TLPC) (14.02N 60.99W)	28/1900	1006.0	29/0000	19 (10 min)	43				
Hewanorra IAP (TLPL) (13.73N 60.95W)	28/2100	1007.0	29/0000	31 [F] (10 min)	41				
St. Maarten & St. Martin									
ICAO Sites									
Princess Juliana IAP (TNCM) (18.04N 63.11W)	28/1942	1012.8 [F]	28/2200	21 (10 min)	33				
United States									
Florida									
International Civil Aviation Organization (ICAO) Sites									
Brooksville-Tampa Bay Reg. Arprt (KFHB) (28.47N 82.45W)	07/1053	1001.8	07/1853	22 (2 min, 10 m)	34				
Cape Canaveral Air Force Station (KXMR) (28.50N 80.75W)									17.01
Daytona Beach IAP (KDAB) (29.18N 81.05W)	07/1537	974.3	07/1045	45 (2 min, 10 m)	62				5.06
Deland Municipal Airport (KDED) (29.06N 81.28W)	07/1655	984.7	07/1415	36 (2 min, 10 m)	54				
Fernandina Beach Muni. Airport (KFHB) (30.61N 81.46W)	07/2235	984.6	08/0155	38 (2 min, 10 m)	52				
Ft. Lauderdale Exec. Arpt (KFXE) (26.20N 80.17W)	07/0053	996.9	07/0126	26 (2 min, 10 m)	38				1.61
Ft. Lauderdale-Hollywood IAP (KFLL) (26.07N 80.15W)	06/2305	996.7	07/0453	21 (2 min, 10 m)	29				1.19
Ft. Myers-Page Field Airport (KFMY) (26.58N 81.97W)	07/0753	1001.9	06/1907	21 (2 min, 10 m)	41				

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)				
Gainesville Regional Airport (KGNV) (29.69N 82.27W)	07/1953	996.5	07/1917	29 (2 min, 10 m)	42				1.49
Jacksonville-Cecil Field Airport (KVQQ) (30.22N 81.88W)			07/2215	32 (2 min, 10 m)	48				8.91
Jacksonville Exec./Craig (KCRG) (30.34N 81.51W)	07/2053	986.1	07/2006	41 (2 min, 10 m)	60				8.91
Jacksonville IAP (KJAX) (30.48N 81.70W)	07/2156	989.8	07/1920	39 (2 min, 10 m)	56				8.32
Jacksonville Naval Air Station (KNIP) (30.22N 81.67W)	07/2053	988.5	07/1909	42 (2 min, 10 m)	59				6.71
Keystone Heights Airpark (K42J) (29.85N 82.05W)	07/1535	999.3	07/1535	24 (2 min, 10 m)	36				
Lake City Gateway Airport (KLCQ) (30.18N 82.58W)	07/2135	999.3	07/2015	24 (2 min, 10 m)	36				
Leesburg IAP (KLEE) (28.82N 81.81W)	07/1550	995.9	07/1825	27 (2 min, 10 m)	42				1.69
Mayport Naval Station/ Jacksonville (KNRB) (30.40N 81.43W)									1.47
Northeast Florida Reg. Airport/St. Augustine (KSGJ) (28.78N 81.24W)	07/1858	982.1	07/1721	44 (2 min, 10 m)	59				8.81
North Perry-Hollywood Airport (KHWO) (26.00N 82.24W)	06/2253	998.0	07/0353	23 (2 min, 10 m)	36				
Ocala IAP (KOCF) (29.18N 82.22W)	07/1850	997.6	07/1650	20 (2 min, 10 m)	34				3.00
Okeechobee County Airport (KOBE) (27.27N 80.85W)	07/0615	994.2	07/1115	27 (2 min, 10 m)	34				
Opa Locka-Miami Exec. Aprt (KOPF) (25.91N 80.28W)	06/2300	998.5	07/0045	24 (2 min, 10 m)	35				
Orlando-Melbourne IAP (KMLB) (28.10N 80.65W)	07/0937	980.0	07/0646	46 (2 min, 10 m)	61				6.17

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)				
Orlando IAP (KMCO) (28.42N 81.33W)	07/1058	991.5	07/1444	40 (2 min, 10 m)	53				2.48
Orlando Exec. Airport (KORL) (28.55N 81.33W)	07/1229	991.5	07/1521	36 (2 min, 10 m)	50				3.01
Orlando-Sanford IAP (KSFB) (28.78N 81.24W)	07/1508	987.1	07/1512	41 (2 min, 10 m)	55				8.22
Palm Beach IAP (KPBI) (26.68N 80.09W)	07/0353	992.8	06/2253	29 (2 min/10 m)	44				
Pompano Beach Airpark (KPMP) (26.25N 80.12W)	07/0200	996.0	07/0322	33 (2 min/10 m)	41				
Sarasota-Bradenton IAP (KSRQ) (27.40N 82.55W)	07/0853	1002.8	07/1153	24 (2 min/10 m)	34				
St. Pete.-Clearwater IAP (KPIE) (27.91N 82.69W)	07/0853	1002.2	07/0953	21 (2 min/10 m)	35				
The Villages Airport (KVVG) (28.96N 81.97W)	07/1815	993.0	07/1815	26	35				
Treasure Coast IAP/ Ft. Pierce (KFPR) (27.49N 80.37W)	07/0711	982.7	07/0715	29 (2 min, 10 m)	59				4.18
Vero Beach Regional Airport (KVRB) (27.65N 80.42W)	07/0725	980.7	07/0650	48 (2 min/10 m)	64				3.55
Williston Municipal Airport (KX60) (27.35N 82.47W)	07/1835	999.0	07/1935	28	39				
Witham Field Airport/ Stuart (KSUA) (27.18N 80.22W)	07/0615	985.1	07/0615	36 (2 min/10 m)	53				2.45
United States Geological Survey (USGS) Storm Tide Pressure Sensors									
Fort Matanzas Beach (FLSTJ03126) (29.72N 81.23W)							8.39	6.4	
Everglades National Park Water Quality Stations									
Blackwater Sound Key (BWSF1) (25.18N 80.44W)							2.03 (MLLW)		

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)				
Butternut Key (BNKF1) (25.09N 80.52W)							2.06 (MLLW)		
Duck Key (DKKF1) (25.18N 80.49W)							2.19 (MLLW)		
Little Blackwater Sound (LSBF1) (25.21N 80.43W)							2.16 (MLLW)		
Coastal-Marine Automated Network (C-MAN) Sites									
Blount Island Command (BLIF1) (30.39N 81.52W)	07/2124	986.4	07/2000	36 (10 min, 17 m)	56				
Cedar Key (CDRF1) (29.14N 83.03W)	07/1854	1002.4	06/1624	29 (10 min, 10 m)	45				
Fowey Rocks (FWYF1) (25.59N 80.10W)	06/2200	999.0	06/2250	38 (6 min,4 4 m)	49				
Molasses Reef (MLRF1) (25.01N 80.38W)			06/1109		37 (16 m)				
St. Augustine (SAUF1) (29.86N 81.27W)	07/1900	978.9	07/1730	57 (10 min, 17 m)	75				
National Ocean Service (NOS) Sites									
Clearwater Beach (8726724) (27.98N 82.83W)	07/0918	1003.2	07/1154	33 (6 min, 7 m)	39				
Dames Point (8720219) (30.39N 81.56W)						3.68	4.18[I]	2.8	
Fernandina Beach (8720030) (30.67N 81.47W)	08/0012	987.4[F]	08/0318	34 (6 min, 7 m)	51	6.91	6.96	4.2	
Lake Worth Pier (8722670) (26.61N 80.03W)			06/2130	40 (6 min, 6 m)	52	1.69	1.97	1.4	
Mayport-Bar Pilots Dock (8720218) (30.40N 81.43W)	07/2112	985.3	07/2006	46 (6 m)	65	4.69	5.22[I]	3.3	
I-295 Bridge, St. Johns River (8720357) (30.19N 81.69W)	07/2036	988.3	07/1800	28 (10 m)	42	3.08	3.44	3.1	
Racy Point, St. Johns River (8720625) (29.80N 81.55W)						4.58	5.19	4.6	
Red Bay Point, St.[J] Johns River (8720503) (29.98N 81.64W)	07/2012	986.9	07/1824	44 (10 m)	60	3.38	3.66[i]	3.2	

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)				
South Bank Riverwalk, St. Johns River (8720226) (30.32N 81.66W)						3.37	2.76	2.1	
Trident Pier (8721604) (28.42N 80.59W)	07/1100	973.5	07/0948	45 (6 min, 7 m)	64	4.09	2.82	1.8	
Vaca Key (8723970) (24.71N 81.10W)	06/1930	1003.5	06/2230	26 (7 m)	30	0.98	0.60	1.0	
Virginia Key (8723214) (25.73N 80.16W)	06/2206	998.4	07/0506	26 (10 m)	33	1.01	1.30	1.1	
Weatherflow Sites									
Altamonte Springs-Spring Lake (XSPR) (28.66N 81.41W)			07/1221	33	41				
Anna Maria Island 6 NNW (XEGM) (27.61N 82.76W)			07/1116	32	38				
Boca Grande 2 S (XBCG) (26.72N 82.26W)			06/2010	23	36				
Buck Island - Jacksonville (XJAK) (30.39N 81.48W)	07/2048	979.4	07/1943	51 (2 min, 10 m)	71				
Carysfort Reef Light-Key Largo (KCFL) (25.23N 80.21W)	06/1955	997.3	06/2230	33	42				
Cocoa Beach Club (XCOA) (28.31N 80.63W)			07/1245	43	56				
Cocoa Beach Pier (XCCO) (28.37N 80.60W)			07/0845	52	67				
Crescent Beach - Summerhouse (XHSE) (29.71N 81.23W)	07/1815	977.6	07/1725	49 (2 min, 5 m)	67				
Hobe Sound (XHOB) (27.05N 80.17W)			07/0529	37	50				
Horizon West-Reedy Lake (XRDY) (28.44N 81.63W)			07/1326	31	39				
Huguenot Park - Jacksonville (XHUP) (30.42N 81.41W)	07/2048	979.4	07/1943	51 (2 min, 10 m)	71				

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Jacksonville Beach Pier (XJAX) (30.29N 81.39W)	07/2105	983.6	07/1735	53 (2 min, 12 m)	66				
Jensen Beach (XJEN) (27.22N 80.20W)			07/0400	45	63				
Jensen Beach-St. Lucie Pwr Plnt (XSTL) (27.35N 80.24W)			07/0207	50	58				
Jupiter (XJUP) (26.89N 80.06W)			06/2315	49 (6 m, 5 min)	58				
Lewis - St. Johns (XLWS) (29.91N 81.33W)	07/1929	976.9	07/1659	39 (2 min, 15 m)	58				
Malabar-Rocky Point (XRPT) (27.98N 80.55W)			07/0648	52	63				
Melbourne-Dairy Road (XDAI) (28.04N 80.64W)			07/0747	38	62				
Melbourne Beach-Aquarina R&D Lab (XDAI) (27.94N 80.49W)			07/0749	35	53				
Merritt Island-Banana River at SR520 (XCCB) (28.36N 80.65W)			07/0919	55	70				
Merritt Island-Banana River at SR528 (XMER) (28.40N 80.66W)			07/1130	37	60				
New Smyrna Beach (XNSB) (29.04N 80.90W)			07/1202	61	72				
Palmetto 7 NW (XSKY) (27.60N 82.65W)			07/1532	30	36				
Sarasota 1 WNW (XSRB) (27.34N 82.56W)			06/2002	28	36				
Tamarac (XCVN) (26.19N 80.30W)			07/0038		37 (10 m)				
Titusville-Parrish Park North (XPAR) (28.63N 80.81W)			07/1110	50	65				

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Vero Beach - City Hall (XVER) (27.63 80.39W)			07/0459	35	57				
Weeki Wachee 1 NNE (XWKI) (28.52N 82.57W)			07/1715		37				
Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) Sites									
Aberdeen 4.2 NNW (FL-PB-12) (26.61N 80.17W)									2.43
Apopka 2.9E (FL-OR-16) (28.69N 81.47W)									6.14
Astatula 1.0 E (FL-LK-25) (28.71N 81.72W)									3.84
Boynton Beach 6.2 WNW (FL-PB-72) (26.55N 80.18W)									2.38
Chuluota 0.9 N (FL-SM-8) (28.65N 81.12W)									5.78
Daytona Beach Shores 1.8 SSE (FL-VL-42) (29.15N 80.97W)									6.35
DeLand 5.7 NW (FL-VL-9) (29.10N 81.36W)									6.75
DeLeon Springs 1.3 NNW (FL-VL-24) (29.13N 81.36W)									7.10
East Palatka 3.5 NNW (FL-PT-8) (29.70N 81.63W)									9.96
Fernandina Beach 6.3 SW (FL-NS-14) (30.60N 81.53W)									9.51
Fleming Island 1.7 SE (FL-CY-1) (30.08N 81.70W)									9.45
Fleming Island 2.2 S (FL-CY-37) (30.06N 81.71W)									10.55

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Florahome 4.1 NNE (FL-PT-12) (29.78N 81.85W)									6.30
Fruit Cove 4.0 NE (FL-DV-67) (30.14N 81.57W)									7.37
Groveland 1.7 E (FL-LK-3) (28.57N 81.82W)									4.10
Haines City 6.0 ESE (FL-PK-46) (28.06N 81.55W)									2.11
Interlachen 10.4 NNE (FL-PT-1) (29.76N 81.84W)									6.64
Jacksonville 10.0 WSW (FL-DV-33) (30.30N 81.82W)									8.61
Jacksonville 10.3 SW (FL-DV-42) (30.24N 81.79W)									9.16
Jacksonville 11.4 ESE (FL-DV-32) (30.31N 81.47W)									9.60
Jacksonville 11.9 N (FL-DV-37) (30.50N 81.62W)									11.60
Jacksonville 12.0 SSE (FL-DV-51) (30.18N 81.57W)									11.41
Jacksonville 11.4 ESE (FL-DV-28) (30.32N 81.60W)									13.02
Jacksonville 9.6 SE (FL-DV-79) (30.23N 81.56W)									8.64
Keystone Heights 9.1 NE (FL-CY-14) (29.87N 81.92W)									5.91
Lakeside 2.9 S (FL-CY-4) (30.09N 81.76W)									8.97
Lakewood Park 0.5 SW (FL-SL-4) (27.53N 81.40W)									3.92

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Merritt Island 9.1 N (FL-BV-36) (28.48N 80.71W)									5.86
Middleburg 3.8 NW (FL-CY-40) (30.09N 80.95W)									4.84
Mount Plymouth 0.2 WSW (FL-LK-5) (28.80N 81.54W)									6.27
Oak Hill 2.8 WSW (FL-VL-38) (28.86N 80.87W)									7.98
Orange 11.2 NE (FL-OR-23) (28.59N 81.11W)									4.82
Orange Park 0.7 NNE (FL-CY-10) (30.18N 81.70W)									7.94
Orange Park 3.0 WNW (FL-CY-8) (30.18N 81.75W)									9.17
Orange Park 4.1 WSW (FL-CY-25) (30.15N 81.77W)									8.44
Orlando 7.4 WNW (FL-OR-25) (28.57N 81.50W)									5.67
Ormond Beach 3.5 SE (FL-VL-5) (29.27N 81.05W)									5.84
Oveido 4.0 W (FL-SM-12) (28.67N 81.25W)									6.08
Palm Bay 2.6 SSE (FL-BV-1) (27.95N 80.64W)									5.85
Palm Coast 5.9 S (FL-FL-25) (29.49N 81.23W)									6.32
Picolata 2 WSW (FL-CY-19) (29.90N 81.63W)									10.30
Sanford 1 WNW (FL-SM-18) (28.80N 81.31W)									7.07

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Satsuma 4.0 NE (FL-PT-7) (29.59N 81.61W)									7.11
St. Augustine 12.2 WNW (FL-SJ-16) (29.94N 81.51W)									13.60
St. Augustine South 2.1 SSW (FL-SJ-4) (29.81N 81.33W)									10.30
Stuart 3.7 SW (FL-MT-7) (27.13N 80.21W)									3.87
Winter Garden 6.1 SW (FL-OR-20) (28.50N 81.65W)									4.65
Hydrometeorological Automated Data System (HADS) Sites (NWS)									
Nerrs Meteorological Site at Mantanzas/St. Augustine (GTXF1) (29.66N 81.22W)	07/1845	979.0	07/1630	41 (2 m)					
NWS Cooperative Observer Program (COOP) Sites									
Bellair 3 W (D8274) (30.18N 81.81W)									5.34
Geneva 5 ESE (GNEF1) (28.72N 81.04W)									7.21
Lake Mary 5 WNW (LSPF1) (28.80N 81.39W)									7.26
Leesburg 7 NE (LSBF1) (28.87N 81.79W)									2.51
Melbourne (MLBF1) (28.11N 80.65W)									6.72
Melbourne Beach (TSUF1) (28.05N 80.55W)									4.66
Sanford 1 SSW (SFNF1) (28.80N 81.27W)									8.99
Titusville (TITF1) (28.63N 80.83W)									6.50

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Vero Beach 4 W (VRGF1) (27.69N 80.44W)									4.53
Other Sites									
AP837 - 3 SW Eagle Lake (27.95N 81.79W)			07/0748	24	38				
AR664 - 2 WNW Frostproof (27.76N 81.57W)			07/1929		36				
AR666 - 1 ESE Dundee (28.01N 81.60W)			07/0734	22	37				
Broad Key (Weatherstem) (25.35N 80.25W)			06/1043		36				
D1496 - 1 N Beverly Hills (28.93N 82.46W)			07/202		40				
D9045 - 1 NW Port Charlotte (26.99N 82.11W)			06/1935		37				
E6508 – Belleair (27.95N 82.81W)			07/0935	30	43				
Kennedy Space Center (KSC0021) – USAF Tower 2 (28.44N 80.56W)			07/1020	59 (1 min, 16.5 m)	88				
Kennedy Space Center (KSC0003) – USAF Tower 3 (28.46N 80.53W)			07/1026	74 (1 min, 16.5 m)	93				
Kennedy Space Center (KSC1102) – USAF Tower 110 (28.57N 80.59W)			07/1121	65 (1 min, 16.5 m)	91				
Kennedy Space Center (KSC3132) – USAF Tower 313 (28.62N 80.66W)			07/1130	60 (1 min, 16.5 m)	86				
Kennedy Space Center (KSC0020) – USAF Tower 108 (28.44N 80.56W)			07/1020	58 (1 min, 16.5 m)	85				

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)				
Kennedy Space Center (KSC0108) – USAF Tower 2 (28.54N 80.57W)			07/1046	64 (1 min, 16.5 m)	83				
Kennedy Space Center (KSC0061) – USAF Tower 6 (28.51N 80.56W)			07/1127	53 (1 min, 16.5 m)	81				
Kennedy Space Center (KSC0303) – USAF Tower 303 (28.46N 80.57W)			07/1037	60 (1 min, 16.5 m)	80				
Kennedy Space Center (KSC1101) – USAF Tower 1101 (28.57N 80.59W)			07/1230	70 (1 min, 16.5 m)	80				
Kennedy Space Center (KSC3131) – USAF Tower 3131 (28.63N 80.66W)			07/1130	58 (1 min, 16.5 m)	80				
Kennedy Space Center (KSC0403) – USAF Tower 403 (28.46N 80.59W)			07/1050	60 (1 min, 16.5 m)	80				
Kennedy Space Center (KSC0001) – USAF Tower 1 (28.43N 80.57W)			07/1129	59 (1 min, 16.5 m)	77				
Kennedy Space Center (KSC0415) – USAF Tower 415 (28.66N 80.70W)			07/1104	56 (1 min, 16.5 m)	73				
KFLDAYTONA014- Daytona Beach (Embry Riddle) Weatherstem (29.19N 81.05W)			07/1527	62	73				
New Smyrna Beach *Hurricanetrack.com* (29.02N 80.91W)	07/1457	969.9	07/1440	56 (26 m, 1 min)	82				
Ortega 1 SSE (C0639) (30.26N 81.70W)			07/1948		34				6.87

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)				
Palm Coast (E0808) (29.57N 81.21W)			07/1456		43				6.52
Peterson Key-Everglades NPWQS (24.92N 80.75W)									1.59
Satellite Beach C1819 (28.43N 80.57W)			07/1050	60	80				
Silver Springs Shores 2 WNW (E8915) (29.12N 81.05W)			07/1437		49				
Stuart-South Fork HS (Weatherstem) (28.67N 80.43W)			07/0802	40	47				
Tarpon Springs 3 W (FHPF1-COMPS) (28.15N 82.80W)			07/1048	31 (10 m, 6 min)	38				
Vero Beach-Dodgertown Elem. (Weatherstem) (28.67N 80.43W)			07/0802	40	47				
Welaka 3 SE (E1959) (29.44N 81.63W)									3.89
Georgia									
ICAO Sites									
Augusta Regional Airport (KAGS) (33.37N 81.96W)									2.17
Brunswick Golden Isles Airport (KBQK) (31.15N 81.47W)	08/0535	986.0	07/2015	28 (10 m, 2 min)	47				
Bacon County/Alma Airport (KAMG) (31.54N 82.50W)	08/0653	998.8	08/0210	24 (10 m, 2 min)	36				2.88
Claxton-Evans Co. Airport (KCWV) (32.20N 81.88W)			08/0355	28 (10 m, 2 min)	49				
Jesup-Wayne County Airport (KJES) (31.55N 81.88W)	08/0450	993.0	08/0335	29 (10 m, 2 min)	50				
McKinnon-St. Simons Island Airport (KSSI) (31.15N 81.39W)									6.08

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)				
Plantation Airpark/ Sylvania (KJYL) (32.64N 81.60W)			08/0830	30 (10 m, 2 min)	45				
Savannah-Hilton Head IAP (KSAV) (32.13N 81.20W)	08/0750	983.1	08/0834	43 (10 m, 2 min)	62				11.51
Savannah-Hunter Army Air Field (KSVN) (32.01N 81.13W)			08/0958	46 (10 m, 2 min)	59				17.49
Statesboro-Bulloch Co. Airport (KTBR) (32.49N 81.74W)			08/0315	30 (10 m, 2 min)	43				
Waycross-Ware County Airport (KAYS) (31.25N 82.40W)	08/0555	998.1	08/0455	27 (2 min/10 m)	39				
Wright Army Airfield/ Fort Stewart (KLHW) (31.89N 81.56W)			07/2358	26 (10 m, 2 min)	40				5.42
NOS Sites									
Fort Pulaski (8670870) (32.03N 80.90W)	08/0812	973.3	08/0806	51 (7 m)	68	7.70	8.46[I]	5.1	
Weatherflow Sites									
Jekyl Island (XJEK) (31.05N 81.41W)	07/0311	983.7	07/2216	36 (10 m, 2 min)	56				6.52
Tybee Island North (XTYB) (32.02N 80.84W)	08/0819	964.0	08/0819	62 (10 m)	82				
Tybee Island South (XTYE) (31.99N 80.85W)	08/0818	964.0	08/0848	65 (9 m)	83				
CoCoRaHS Sites									
Belleview 2.8 N (GA-EV-1) (31.19N 81.97W)									5.97
Country Club Estates 2.8 SSW (GA-BR-?) (31.18N 81.48W)									10.29
Darien 4.2 NNE (GA-MI-3) (31.43N 81.40W)									11.42
Garden City 1.2 NNE (GA-CT-28) (32.12N 81.15W)									13.86

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)				
Garfield 2.7 N (GA-EM-3) (32.69N 82.10W)									4.69
Jesup 7.1 N (GA-WY-2) (31.70N 81.90W)									6.14
Marlow 0.0 S (GA-EM-3) (32.27N 81.39W)									9.14
Metter 7.0 N (GA-CD-2) (32.50N 82.05W)									5.52
Midway 3.3 ENE (GA-LB-4) (31.82N 81.37W)									11.47
Midway 3.8 NE (GA-LB-6) (31.84N 81.38W)									12.00
Nahunta 6 S (GA-BY-1) (31.12N 81.93W)									6.29
Newington 0.5 SSE (GA-SV-5) (32.58N 81.50W)									6.74
Pooler 0.4 ENE (GA-CT-70) (32.11N 81.25W)									12.05
Pooler 1.2 NNE (GA-CT-1) (32.12N 81.25W)									10.03
Richmond Hill 0.5 NE (GA-BR-2) (31.95N 81.30W)									11.09
Rincon 1.5 SSE (GA-EF-1) (32.27N 81.23W)									11.09
Savannah 1.7 W (GA-CT-55) (32.03N 81.16W)									10.75
Savannah 2.7 ENE (GA-CT-25) (32.04N 81.09W)									13.10
Skidaway Island 1.3 ENE (GA-CT-17) (31.94N 81.03W)									12.97

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)				
Statesboro 2.2 N (GA-BU-7) (32.47N 81.78W)									7.13
Townsend 5.5 SE (GA-MI-5) (31.57N 81.36W)									10.15
Waynesboro 3.3 SW (GA-BK-1) (33.06N 82.06W)									4.38
HADS Sites									
Millhaven 9 ENE (BFYG1) (32.93N 81.50W)									
Remote Automated Weather Stations (RAWS)									
Metter (MTFG1) (32.39N 82.04W)			08/0703	22 (6 m)	49				
NWS COOP Sites									
Augusta 8 SSE (NSLG1) (33.37N 81.94W)									2.31
Baxley 5 SW (NSLG1) (31.71N 82.39W)									3.66
Eden 2 NW (EDEG1) (32.19N 81.41W)									9.31
Ellabell 7 SE (ELLG1) (32.08N 81.39W)									10.07
Fargo 15 NW (JONG1) (30.83N 82.36W)									2.76
Fort Stewart 8 NNE (FSBG1) (31.96N 81.46W)									9.51
Hilltonia 4 N (BRIG1) (32.93N 81.65W)									5.19
Hutchinson Island (SVDG1) (32.08N 81.08W)									14.81
McIntosh (MTHG1) (31.82N 81.54W)									5.41

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)				
Millhaven 9 ENE (BFYG1) (32.93N 81.50W)									5.28
Oliver 1 SW (OLVG1) (32.49N 81.56W)									6.49
Port Wentworth (PWNG1) (32.17N 81.15W)									9.02
Port Wentworth 6 N (PTWG1) (32.24N 81.15W)									9.18
Rincon 5 SE (ACRG1) (32.25N 81.18W)									12.81
Rincon 6 NE (HBNG1) (32.34N 81.15W)									13.17
Rincon 6 SE (ACMG1) (32.24N 81.15W)									12.26
Sapelo Island (SPIG1) (31.40N 81.28W)									12.96
Sapelo Island Reserve (SAXG1) (31.42N 81.30W)	08/0430	982.6	08/0530	50 (10 m)	65				10.94
Springfield 2 W (SRFG1) (32.35N 81.34W)									11.23
Sterling 3 SW (STRG1) (31.21N 81.61W)									9.65
Tybee Island 4 NW (FTBG1) (32.03N 80.90W)									8.24
South Carolina									
ICAO Sites									
Allendale County Airport (KAQX) (32.99N 81.27W)			08/0915	31 (10 m, 2 min)	47				
Beaufort County Airport (KARW) (32.41N 80.63W)			08/0835	45 (10 m, 2 min)	60				

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)				
Beaufort MCAS (KNBC) (32.49N 80.70W)	08/0456	980.6	08/0845	40 (10 m, 2 min)	62				13.97
Charleston Downtown Airport (KCXM) (32.70N 80.01W)			08/0335	32 (10 m, 2 min)	50				
Charleston Executive Airport (KJZI) (32.78N 79.93W)	08/1300	974.6	08/1300	36 (10 m, 2 min)	46				
Charleston IAP (KCHS) (32.90N 80.04W)	08/1316	981.7	08/1655	42 (10 m, 2 min)	60				10.48
Columbia Metropolitan Airport (KCAE) (33.95N 81.12W)									4.45
Curtis L. Brown Field/ Elizabethtown (KEYF) (34.60N 78.58W)	08/1920	993.9	08/2105	18 (10 m, 2 min)	37				
Florence Regional Airport (KFLO) (34.19N 79.72W)	08/1153	1011.5	08/1029	29 (10 m, 2 min)	38				6.75
Georgetown County Airport (KGGE) (33.31N 79.32W)	08/1335	990.5	08/0515	27 (10 m, 2 min)	41				
Hartsville Regional Airport (KHVS) (34.40N 80.12W)	08/1155	1002.0	08/1135	25 (10 m, 2 min)	35				
Hilton Head Island Airport (KHXD) (32.23N 80.69W)			08/0855	53 (10 m, 2 min)	76				
Marlboro County Jetport (KBBP) (34.62N 79.73W)	08/1155	1002.4	08/1155	24 (10 m, 2 min)	37				
McEntire JNG Base/ Columbia (KMMT) (33.92N 80.78W)									6.83
Mount Pleasant Reg. Airport (KLRO) (32.90N 79.78W)			08/1435	37 (10 m, 2 min)	48				
Berkeley Co. Arpt/ Moncks Crnr (KMKS) (33.19N 80.04W)			08/0555	23 (10 m, 2 min)	38				11.69
Grand Strand/N Myrtle Beach Airport (KCRE) (33.81N 78.72W)	08/1900	980.7	08/2114	33 (10 m, 2 min)	61				

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)				
Low Country Reg. Arpt /Walterboro (KRBW) (32.93N 80.64W)			08/1135	29 (10 m, 2 min)	43				
Myrtle Beach IAP (KMYR) (33.69N 78.93W)	08/1815	998.0	08/2115	42 (10 m, 2 min)	64				3.34
Williamsburg Regional Arpt/Kingstree (KCKI) (33.71N 79.86W)	08/1435	992.9	08/1435	18 (10 m, 2 min)	31				
C-MAN Sites									
Folly Island (FBIS1) (32.69N 79.89W)	08/1300	971.3	08/1120	45 (7 m, 10 min)	59				
NOS Sites									
Cooper River Entrance, Charleston (8665530) (32.78N 79.93W)	08/1248	975.6	08/0018	37 (9 m, 6 min)	51	6.20	6.15	3.5	
Oyster Landing (North Inlet Estuary) (8662245) (33.35N 79.19W)						5.51	7.11[I]	4.7	
Springmaid Pier [J] (8661070) (33.66N 78.92W)	08/1618	985.0	08/0700	41 (7 m, 6 min)	53	4.43	5.20	2.8	
National Estuarine Research Reserve System (NERRS)Sites									
Winyah Bay-S. Jetty (TEC2929) (33.18N 79.20W)			08/1950	56 (7 m, 6 min)	90				
Coastal Ocean Research and Monitoring Program (CORMP) Sites									
Fripp Nearshore – FRP2 (41033) (32.28N 80.41W)			08/1108	48 (3 m)	73				
Capers Nearshore – CAP2 (41029) (32.81N 79.63W)	08/1308	962.8	08/1308	41 (3 m)	57				
Weatherflow Sites									
Charleston-Battery Point (XCHA) (32.76N 79.95W)	08/1316	972.0	08/1401	46 (9 m)	63				
Beaufort (XBUF) (32.34N 80.59W)	08/0841	966.0	08/0841	58 (10 m)	72				

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Folly Beach Pier (XFOL) (32.65N 79.94W)	08/1241	968.0	08/1216	51 (13 m)	65				
Isle of Palms (XIOP) (32.78N 79.79W)	08/1315	971.0	08/1245	46 (9 m)	56				
Sullivans Island (XSUL) (32.10N 81.08W)	08/1306	969.0	08/1221	43 (13 m)	57				
Sumter/Charleston Harbor (XSUM) (32.75N 79.87W)	08/1256	971.0	08/1356	53 (12 m)	70				
CoCoRaHS Sites									
Beaufort 3.6 NNE (SC-BF-35) (32.48N 81.84W)									11.03
Branchville 2.5 SE (SC-OR-24) (33.23N 80.78W)									10.15
Canadys 0.4 NW (SC-CL-6) (33.06N 80.63W)									10.31
Charleston 5.0 WNW (SC-CR-97) (32.81N 80.08W)									10.92
Charleston 5.7 NW (SC-CR-45) (32.84N 80.07W)									11.00
Conway 4.4 SE (SC-HR-80) (33.79N 79.01W)									12.17
Cottageville 5.8 WSW (SC-CL-16) (32.90N 80.57W)									11.89
Darlington 7.3 SSW (SC-DR-4) (34.20N 79.91W)									12.71
Daufuskie Island 1.7 SW (SC-BF-23) (32.10N 80.88W)									14.10
Dillon 3.8 NW (SC-DL-4) (34.46N 79.41W)									13.88
Georgetown 4.9 NNE (SC-GT-13) (34.43N 79.26W)									11.83

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)				
Green Pond 1.3 S (SC-CL-14) (32.71N 80.61W)									11.68
Hilton Head Island 2.7 E (SC-BF-52) (32.19N 80.70W)									13.66
Hilton Head Island 4.0 N (SC-BF-2) (32.25N 80.74W)									16.58
Kingstree 7.9 NW (SC-WL-2) (33.74N 79.93W)									13.70
Loris 2.9 WSW (SC-HR-33) (34.04N 78.94W)									11.88
Myrtle Beach 8.4 WNW (SC-HR-27) (33.72N 79.03W)									12.69
North Charleston 3.1 ESE (SC-CR-78) (33.89N 79.99W)									11.02
NOAA-NWS Charleston (SC-CR-49) (32.90N 80.03W)									12.40
Parris Island 1.7 N (SC-BF-53) (32.35N 80.69W)									11.00
Reevesville 1.0 SSE (SC-DC-18) (33.19N 80.64W)									13.05
Ridgeland 6.0 ESE (SC-JS-3) (32.44N 80.89W)									12.46
Santee 6.9 WSW (SC-OR-22) (33.43N 80.59W)									10.84
Summerton 8.4 SE (SC-CD-1) (33.53N 80.24W)									11.72
Summerville 1.9 N (SC-CD-41) (33.03N 80.17W)									11.04
Yemassee 7.6 NE (SC-CL-1) (32.78N 80.77W)									10.70

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
HADS Sites									
Bennett's Point, Ace Basin Res. (ACXS1) (34.04N 78.94W)	08/1045	979.5	08/1300	19 (10 m)	36				11.36
Elba Island (ELBS1) (32.12N 81.05W)									12.45
Galivant's Ferry (GALS1) (34.06N 79.25W)									11.88
Pinopolis-Lake Moultrie (PNOS1) (33.25N 80.03W)	08/1330	985.4	08/1700	43 (10 m)	56				
Remote Automated Weather Stations (RAWS)									
Adams Run/Ace Basin (ABRS1) (32.66N 80.40W)			08/1255	27 (6 m)	63				10.58
Huger 3 NNE (HUGS1) (33.13N 79.78W)									11.50
Jamestown 2 NE-Santee River (JAMS1) (33.30N 79.67W)									11.00
Limehouse 4 SW-Little Black River (FWDS1) (32.17N 81.12W)									12.70
Mullins (MULS1) (34.19N 79.25W)									15.57
Savannah/Hardeeville NWR (SVNS1) (32.10N 81.08W)			08/0923	34 (6 m)	54				12.78
Walterboro (WTBS1) (32.92N 80.63W)			08/1407	15 (6 m)	37				9.62
Others									
Chadbourne 1.1 WNW (34.51N 79.42W)									12.90
Edisto Island Middleton (EDSS1) (32.60N 80.33W)									16.90
Florence 5 E (34.19N 79.67W)									11.95
Georgetown 1 ENE (33.37N 79.29W)			08/2000	39	65				

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)				
Marion (34.17N 79.40W)									14.52
Marion 4 E (34.18N 79.34W)									15.02
Quinby 5 N (34.30N 79.73W)									12.69
Wedgefield Plantation 5 SE (33.37N 79.18W)									14.36
North Carolina									
ICAO Sites									
Albert J. Ellis-Jacksonville Airport (KOAJ) (34.83N 77.62W)	08/2156	994.5	09/0156	26 (10 m, 2 min)	50				
Billy Mitchell-Hatteras Airport (KHSE) (35.22N 75.62W)	09/0258	989.0	09/0019	41 (10 m, 2 min)	54				
Bouge Field MCAF-Bouge Sound (KNJM) (34.69N 77.03W)	08/2357	992.8	06/1632	29 (10 m, 2 min)	50				
Burlington-Alamance Regional Arpt (KBUY) (35.05N 79.48W)									3.96
Cape Fear Regional Airport (KSUT) (33.93N 78.07W)	08/2105	984.0	09/0025	35 (10 m, 2 min)	51				
Charlotte Douglas IAP (KCLT) (35.21N 80.94W)									2.78
Cherry Point MCAS (KNKT) (34.90N 76.90W)	09/0054	993.4	09/0454	41 (10 m, 2 min)	54				
Coastal Carolina Reg. Arpt/New Bern (KEWN) (35.07N 77.04W)	08/2354	995.2	09/0513	33 (10 m, 2 min)	49				5.30
Columbus County Municipal Arpt (KCPC) (35.27N 78.72W)	08/1945	998.1	08/2045	20 (10 m, 2 min)	33				
Dare County Gunnery Range Airport (K2DP) (35.67N 75.90W)	09/0521	995.6	09/0051	28 (10 m, 2 min)	48				
Dare County Reg. Airport-Manteo (KMQI) (35.90N 75.70W)	09/0710	995.9	09/0910	43 (10 m, 2 min)	61				

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)				
Duplin County Airport-Kenansville (KDPL) (34.99N 77.98W)	08/2205	996.6	08/2220	28 (10 m, 2 min)	43				
Elizabeth City Regional Arpt (KECG) (36.26N 76.17W)									9.99
Fayetteville Regional Airport (KFAY) (34.99N 78.88W)									14.99
First Flight Airport-Kill Devil Hills (KFFA) (36.02N 75.67W)	09/0725	996.3	09/0945	31 (10 m, 2 min)	52				
Kingston Regional Jetport (KISO) (35.33N 77.62W)	08/2156	995.9	08/2256	32 (10 m, 2 min)	44				
Lumberton Municipal Airport (KLBT) (34.61N 79.06W)	08/1901	995.9	08/1929	35 (10 m, 2 min)	58				10.47
Michael J. Smith-Beaufort Aprt (KMBH) (34.72N 76.65W)	09/0258	992.1	09/0629	40 (10 m, 2 min)	61				
New River MCAS/ Jacksonville (KNCA) (34.72N 77.43W)	08/2256	992.7	09/0256	42 (10 m, 2 min)	63				5.35
Pitt-Greenville Airport (KPGV) (35.64N 77.38W)	08/2345	100.7	08/2345	39 (10 m, 2 min)	51				
Raleigh-Durham IAP (KRDU) (35.88N 78.79W)									6.96
Rocky Mount-Wilson Regional Arpt (KRWI) (35.85N 77.89W)									6.79
Washington-Warren Airport (KOCW) (35.57N 77.05W)	09/0015	998.3	09/0015	33 (10 m, 2 min)	39				
Wilmington IAP (KILM) (34.28N 77.92W)	08/2353	991.2	09/0017	39 (10 m, 2 min)	61				6.59
C-MAN Sites									
Cape Lookout (CLKN7) (34.62N 76.53W)	09/0400	989.8	09/0900	49 (10 m, 10 min)	66				
NOS 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)				
Duck Pier (8651370) (36.18N 75.75W)	09/0836	994.7	09/0830	60 (9 m, 6 min)	74	3.27	3.40	1.9	
Beaufort (8656483) (34.72N 76.67W)	09/0312	991.3	09/0600	39 (8 m, 6 min)	57	2.98	3.57	2.1	
Johnny Mercer Pier, Wrightsville Beach (8658163) (34.21N 77.79W)	08/2136	987.1	08/1054	45 (8 m, 6 min)	67	3.08	4.40	2.6	
Oregon Inlet Marina (8652587) (35.80N 75.55W)	09/0824	993.2	09/1006	46 (8 m, 6 min)	60	2.59	2.87	2.4	
USCG Station Hatteras (8654667) (35.21N 75.70W)	09/0706	988.8	09/0948	57 (8 m, 6 min)	73	6.06	4.15[i]	5.8	
Wilmington (8658120) (34.23N 77.95W)	08/2112	988.2				4.08		3.5	
Weatherflow Sites									
Alligator River Bridge (XALI) (35.90N 76.01W)	09/0749	993.1	09/0849	57 (12 m, 1 min)	73				
Avon Sound (XAVN) (35.37N 75.51W)	09/0902	988.1	09/1017	41 (12 m, 1 min)	56				
Jennettes Pier-Nags Head (XJNP) (35.91N 75.59W)	09/0755	993.9	09/0900	67 (18 m, 1min)	84				
Jockey's Ridge (XJNP) (35.95N 75.63W)	09/0828	996.0	09/0844	35[K] (5 m, 1 min)	47				
North River (XNRV) (34.77N 76.62W)	09/0334	991.7	09/0609	40 (6 m, 1 min)	59				
Ocracoke Sound (XOCR) (35.14N 76.01W)	09/0615	990.0	09/0820	55 (8 m, 1 min)	73				
Palmico Sound (XPM2) (35.43N 75.83W)	09/0814	983.4	09/0959	61 13 m, 1 min)	76				
Real Slick-Waves (XSLK) (35.90N 76.01W)	09/0905	990.8	09/1010	58 6 m, 1 min)	70				
CoCoRaHS Sites									
Apex 2.2 N (NC-WK-77) (35.76N 78.84W)									7.69
Apex 3.4 ESE (NC-WK-4) (35.71N 78.79W)									8.68

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)				
Aurora 1.6 SE (NC-BF-24) (35.29N 76.77W)									8.70
Ayden 3.7 S (NC-PT-37) (35.42N 77.43W)									7.85
Bath 6.6 ESE (NC-BF-16) (35.43N 76.71W)									7.45
Battleboro 7.2 W (NC-NS-20) (36.04N 77.88W)									12.86
Belvidere 5.4 N (NC-PR-2) (36.35N 76.55W)									10.13
Bladenboro 2.0 WNW (NC-BD-1) (34.57N 78.81W)									11.36
Bunn 1.2 N (NC-FK-7) (35.98N 78.25W)									8.03
Burgaw 0.3 NE (NC-PD-22) (34.55N 77.92W)									9.66
Calypso 1 N (NC-DP-3) (35.17N 78.10W)									12.19
Chadbourn 1.1 NNW (NC-CL-3) (34.34N 78.84W)									13.05
Clayton 2.9 W (NC-JH-5) (36.65N 78.51W)									10.21
Clayton 6.8 ESE (NC-JH-46) (35.62N 78.34W)									9.97
Clinton 0.8 NE (NC-SM-17) (35.01N 78.32W)									10.47
Coats 0.2 ESE (NC-HR-34) (35.41N 78.67W)									10.72
Corapeake 1.3 NE (NC-GT-5) (36.55N 76.56W)									12.00
Duck 1.1 SSE (NC-DR-24) (36.15N 75.75W)									10.31

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)				
Dunn 7.1 SSE (NC-SM-2) (35.22N 78.57W)									12.93
Edenton 2.0 W (NC-CW-22) (36.06N 76.64W)									12.25
Elizabeth City 2.6 W (NC-PS-1) (36.30N 76.27W)									10.87
Elizabethtown 6.2 NW (NC-BD-2) (34.69N 78.69W)									18.85
Elizabethtown 6.6 NW (NC-BD-15) (34.69N 78.70W)									13.00
Elm City 7.1 ESE (NC-WN-15) (35.76N 77.76W)									10.54
Evergreen 3.3 NE (NC-CL-21) (34.44N 78.86W)									18.95
Farmville 3.1 NW (NC-PT-47) (35.63N 77.63W)									11.43
Fayetteville 1.4 SW (NC-CM-68) (35.05N 78.91W)									13.87
Fayetteville 2.4 S (NC-CM-1) (35.04N 78.91W)									15.62
Fountain 0.1 NE (NC-PT-10) (36.68N 77.64W)									10.21
Four Oaks 5.7 NW (NC-JH-65) (35.51N 78.49W)									10.72
Garland 11.2 W (NC-BD-4) (34.81N 78.59W)									18.52
Godwin 2.1 SW (NC-CM-39) (35.20N 78.71W)									16.32
Goldsboro 4.4 E (NC-WY-1) (35.37N 77.90W)									13.31
Goldsboro 8.4 WNW (NC-WY-22) (35.42N 78.11W)									15.48

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Hertford 5.2 SSE (NC-PR-5) (36.12N 76.43W)									10.84
Hope Mills 4.8 SE (NC-CM-13) (34.93N 78.89W)									17.05
Hope Mills 8.0 SSE (NC-CM-34) (34.87N 78.88W)									15.89
Kill Devil Hills 0.9 WNW (NC-DR-10) (36.02N 75.68W)									12.31
Kinston 1.3 NNW (NC-LR-26) (35.29N 77.60W)									16.50
Lindon 4.2 S (NC-CM-56) (35.19N 78.74W)									12.18
Lumberton 2.3 NE (NC-RB-9) (34.66N 78.99W)									15.09
Mount Olive 2.4 SW (NC-DP-3) (35.18N 78.10W)									12.19
New Bern 7.0 E (NC-CN-64) (35.12N 76.96W)									7.66
Pikeville 6.2 WSW (NC-WY-2) (35.47N 78.09W)									15.12
Point Harbor 0.2 WSW (NC-CC-10) (36.08N 75.80W)									11.81
Raeford 9.6 E (NC-HK-3) (34.96N 79.06W)									12.91
Raleigh 3.8 SSW (NC-WK-90) (35.77N 78.68W)									9.40
Rocky Mount 9.2 SW (NC-NS-21) (35.85N 77.91W)									12.91
Roper 0.6 WSW (NC-WS-5) (35.88N 78.63W)									10.22
Salemburg 2.5 N (NC-SM-16) (35.05N 78.50W)									16.60

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)				
Snow Hill 3.1 NNE (NC-GN-7) (35.50N 77.66W)									12.00
Steadman 0.4 WSW (NC-CM-75) (35.00N 78.70W)									15.34
Steadman 0.4 WSW (NC-ED-11) (35.02N 78.71W)									15.34
Tarboro 5.9 SE (NC-CM-19) (35.84N 77.50W)									10.40
Wake Forest 1.9 NNE (NC-WK-18) (36.00N 78.51W)									7.84
Washington 7.6 SE (NC-BF-2) (35.48N 76.95W)									8.93
Williamston 0.9 SSW (NC-MT-6) (35.84N 77.06W)									10.27
Wilson 3.3 NNW (NC-WN-17) (35.78N 77.94W)									10.30
Zebulon 9.1 S (NC-JH-62) (35.69N 78.33W)									9.10
NWS COOP Sites									
Apex 2 ENE (APXN7) (35.74N 78.84W)									7.04
Aurora 6 N (AURN7) (35.39N 78.78W)									6.42
Elizabethtown 4 NNE (TURN7) (34.68N 78.58W)									14.97
Rocky Mount (RMBN7) (35.93N 77.83W)									11.17
Other									
Back Island (34.53N 77.72W)			08/2330	44	54				
Belville 2 WSW (34.22N 78.02W)									11.85

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)				
Duart 3 N (34.83N 78.82W)									16.87
Fort Fisher (33.97N 77.92W)			08/2350	48	71				
Long Beach (33.91N 78.12W)			08/2330	44	54				
Pembroke (34.68N 79.19W)									12.09
Plymouth 5 SE (35.80N 76.69W)									10.66
St. James Plantation (33.95N 77.98W)			08/2250	41	75				
Whiteville 1 W (34.33N 78.73W)									10.86
Florida Coastal Monitoring Program Sites									
Buxton – Hatteras High (WF73823) (35.26N 75.59W)	09/0816	987.9	09/1001	41 (10 m)	65				
Other									
Avon Sound (35.34N 75.50W)	09/0854	988.1	09/1014	52 (10 m)	68				
Fort Macon (34.70N 76.71W)	09/0338	988.8	09/0608	41 (10 m)	60				
Hatteras High (35.26N 75.55W)	09/0905	984.4	09/0905	55 (10 m)	75				
Jockeys Ridge (35.95N 75.63W)	09/0828	995.7	09/0844	35 (10 m)	47				
Kitty Hawk Kites Resort-Salvo NC (35.58N 75.47W)	09/0855	989.7	09/1050	49 (16 m)	70				
Oregon Inlet-Coast Guard (35.80N 75.54W)	09/0832	991.9	09/1103	63 (10 m)	78				
Waves (35.57N 75.49W)	09/0838	991.0	09/1005	50 (11 m)	68				
Virginia									
ICAO Sites									
Newport News/ Williamsburg IAP (KPHF) (37.13N 76.49W)									6.47
Norfolk IAP (KORF) (36.90N 76.19W)									9.28

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)				
Naval Station -Norfolk (KNGU) (36.83N 76.33W)									10.11
Richmond IAP (KRIC) (37.51N 77.32W)									4.14
Roanoke-Blacksburg Reg. Airport (KRIC) (37.33N 79.98W)									4.30
Wakefield Municipal Airport (KAKQ) (36.98N 77.01W)									5.39
Wallops Flight Facility Airport (KWAL) (37.93N 75.48W)									6.28
NOS Sites									
Chesapeake Bay Bridge Tunnel (8638863) (36.97N 76.11W)	09/0506	1002.7	09/0442	50 (6 m, 6 min)	58	3.40		2.8	
Kiptopeke (8632200) (37.17N 75.99W)			09/1542	38 (7 m, 6 min)	50	2.82	3.25	2.2	
Lewisetta (8635750) (38.00N 76.47W)	09/0624	1009.4	09/1300	26 (6 m, 6 min)	39	1.77	2.08	1.4	
Money Point (8639348) (36.78N 76.30W)	09/0454	1003.2	09/1000	27 (6 m, 6 min)	46	4.16		3.4	
Sewells Point (8638610) (36.94N 76.33W)	09/0448	1004.6				3.61	4.25	3.1	
Yorktown USCG Training Center (8637689) (37.23N 76.48W)	09/0518	1005.4	09/0524	32 (10 m, 6 min)	48	2.75		2.3	
Wachapreague (8631044) (37.61N 75.69W)	09/0706	1005.5	09/0136	31 (7 m, 6 min)	39	2.77	3.60	1.7	
Weatherflow Sites									
Virginia Beach - Chesapeake Light Tower (XCLT) (36.90N 75.71W)	09/0519	994.0	09/0529	63 (41 m, 1 min)	76				
Wachapreague (XWAC) (37.60N 75.69W)	09/0719	1002.0	09/0709	23 (10 m, 1 min)	37				

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)				
CoCoRaHS Sites									
Boones Mill 3.4 N (VA-RN-8) (37.17N 79.96W)									6.43
Bracey 6.0 ESE (VA-BR-2) (36.57N 78.04W)									5.20
Cape Charles 5.8 NNE (VA-NH-1) (37.35N 75.99W)									7.22
Chesapeake 3.9 NE (VA-CSC-5) (36.72N 76.26W)									14.21
Chesapeake 9.8 NW (VA-CSC-4) (36.79N 76.41W)									13.31
Chincoteague 1.3 SSW (VA-AC-10) (37.93N 75.37W)									7.17
Danville 5.5 N (VA-PT-3) (36.66N 76.42W)									6.48
Franklin 2.6 WNW (VA-ST-16) (36.70N 76.98W)									8.73
Hampton 7.2 W (VA-HMC-4) (37.05N 76.43W)									9.86
Ivor 1.0 SW (VA-ST-5) (36.89N 76.91W)									7.33
Metompkin 0.9 SE (VA-AC-16) (36.76N 75.59W)									6.99
Newport News 3.3 E (VA-NNC-4) (37.08N 76.45W)									9.59
Norfolk 3.0 S (VA-NRC-5) (36.88N 76.25W)									9.83
Portsmouth 4.1 SSE (VA-PRC-2) (36.80N 76.33W)									11.28
Roanoke 7.3 SSW (VA-RN-6) (37.18N 80.02W)									6.13

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)				
Sedley 3.7 N (VA-ST-2) (36.83N 76.99W)									7.06
Smithfield 3.6 SSE (VA-IW-10) (36.93N 76.60W)									10.67
Suffolk 13.9 NNE (VA-SFC-7) (36.89N 76.53W)									10.39
Virginia Beach 11.2 NNW (VA-VBC-2) (36.89N 76.11W)									11.26
Virginia Beach 2.4 N (VA-VBC-13) (36.78N 76.04W)									13.55
Virginia Beach 3.1 ENE (VA-VBC-21) (36.75N 76.99W)									11.90
Whitestone 8.0 SSW (VA-MX-1) (35.54N 76.44W)									5.70
Williamsburg 1.4 ENE (VA-WLC-2) (37.29N 76.68W)									5.63
Yorktown 0.5 SSE (VA-YR-8) (37.23N 76.51W)									6.87
Yorktown 6.9 SE (VA-YR-16) (37.17N 76.42W)									8.17
Zuni 1.5 NW (VA-ST-12) (36.88N 76.85W)									7.25
HADS Sites									
Chesapeake 7 SSW (DPCV2) (36.75N 76.34W)									8.75
Chesapeake 19 SSW (LKDV2) (36.60N 76.44W)									7.14
RAWS Sites									
Great Dismal Swamp NWR-Suffolk 8 S (GDSV2) (36.61N 76.55W)									11.39

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 COOP Sites									
Camp Pickett (CAPV2) (37.04N 77.96W)									
Maryland									
ICAO Sites									
Ocean City Municipal Airport (KOXB) (38.31N 75.12W)									4.85
Salisbury–Ocean City–Wicomico Reg. Airport (KSBY) (38.34N 75.51W)									3.34
NOS Sites									
Baltimore (8574680) (39.27N 76.58W)	09/0612	1013.5	09/1524	24 (7 m, 6 min)	34				
Bishops Head (8571421) (38.22N 76.04W)	09/0730	1009.6	09/1336	26 (7 m, 6 min)	37				
Cambridge (8571892) (38.57N 76.07W)	09/0800	1009.4	09/1342	29 (6 m, 6 min)	37				
Ocean City Inlet (8570283) (38.33N 75.09W)	09/0836	1007.8	09/1730	33 (9 m, 6 min)	41	2.03	2.30	1.5	
Tolchester Beach (8573364) (39.21N 76.25W)	09/0600	1013.6	09/1730	30 (7 m, 6 min)	35				
CoCoRaHS Sites									
Berlin 5.9 NNE (MD-WR-22) (38.40N 75.16W)									6.61
Bishopville 3.1 E (MD-WR-4) (38.45N 75.13W)									4.18
Deal Island 0.5 SSW (MD-SS-12) (38.15N 75.95W)									3.20
Leonardtown 0.6 NE (MD-SM-3) (38.40N 75.16W)									3.15
Ocean Pines 1.2 SSW (MD-WR-10) (38.37N 75.16W)									4.39

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)				
Princess Anne 4.4 WSW (MD-SS-4) (38.18N 75.77W)									4.09
Salisbury 2.5 WSW (MD-WC-2) (38.36N 75.63W)									3.73
Snow Hill 0.4 S (MD-WR-14) (38.17N 75.39W)									4.72
Westover 2.6 WNW (MD-SS-6) (38.14N 75.75W)									3.62
NWS COOP Sites									
Assateague Island (ASTM2) (38.24N 75.75W)									5.91
Weatherflow Sites									
Ocean City (XOCN) (38.33N 75.08W)	09/0828	1005.0	09/0527	37 (10 m, 1 min)	42				
Point Lookout (XPTL) (38.04N 76.32W)	09/0631	1007.0	09/0541	26 (11 m, 1 min)	40				
Delaware									
ICAO Sites									
Delaware Coastal Airport/Georgetown (KGED) (38.69N 75.36W)									2.90
Wilmington-New Castle Airport (KILG) (39.68N 75.61W)									1.26
NOS Sites									
Lewes (8557380) (38.78N 75.12W)	09/0836	1009.5	09/1700	40 (10 m, 6 min)	48	2.30	3.21	1.2	
Offshore									
NOAA Buoys									
E. Caribbean (42059) (15.25N 67.21W)	29/1850	1004.8	29/1850	53 (5 m, 10 min)					
C. Caribbean (42058) (14.92N 74.92W)	03/0656	942.9	03/0503	74 [g] (5 m, 10 min)	86				
Canaveral (42058) (28.52N 80.19W)	07/0820	975.4	08/0820	56 (5 m, 10 min)	68				

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)				
Diamond Shoals (41025) (35.01N 75.40W)	09/0750	984.9	09/0750	53 (54m, 10 min)	66				
Frying Pan Shoals, NC (41013) (33.43N 77.74W)	08/2220	982.4	09/0110	45 (4 m, 10 min)	63				
Onslow Bay Outer, NC (41064) (34.21N 76.95W)	09/0200	982.8	09/0400	45 (3 m, 60 min)	64				
Sunset Nearshore, NC (41024) (33.83N 78.48W)	08/2008	977.8	09/2008	41 (3 m, 60 min)	58				
Wrightsville Beach Offshore, NC (41037) (33.99N 77.36W)	08/2308	984.4	09/0308	43 (53m, 60 min)	64				
Wrightsville Beach Nearshore, NC (41038) (34.14N 77.72W)	08/2208	985.3	09/0308	43 (53m, 60 min)	62				
Virginia Beach (44014) (36.61N 74.84W)	09/1050	995.8	09/1210	52 (5 m, 10 min)	110				
South Hatteras (41002) (31.76N 74.84W)	08/2050	1004.8	09/0440	31 (5 m, 10 min)	41				
Edisto (41004) (32.50N 79.10W)	08/1350	981.7	08/1320	50 (5 m, 10 min)	64				
Grays Reef (41008) (31.40N 80.87W)	08/0350	957.6	08/0250	54 (5 m, 10 min)	68				
Canaveral 20 E (41009) (28.52N 80.19W)	07/0820	975.4	07/0820	56 (5 m, 10 min)	68				

[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.
[F] Last of several occurrences.

[G] Wind speed data missing 0510-0650 UTC 3 October 2016.

[H] All wind data missing 0800-1000 UTC 6 October 2016.

[I] Record water level.

[J] Sensor damaged or destroyed and likely did not record maximum water level.

[K] All wind data missing 1300 UTC 9 October – 0200 10 October 2016.

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	138
Medium (40%-60%)	54	96
High (>60%)	42	84

Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for forecasts issued on Hurricane Matthew, 28 September – 9 October 2016. 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	**17.6**	**27.6**	**42.4**	**58.8**	**87.2**	**135.1**	**170.8**
OCD5	34.6	82.1	141.3	202.8	343.7	451.5	486.4
Forecasts	42	40	38	36	32	28	24
OFCL (2011-15)	28.4	45.0	60.4	77.1	113.1	157.8	210.0
OCD5 (2011-15)	48.3	101.5	161.5	222.6	329.8	412.6	483.9

Table 5b. Homogeneous comparison of selected track forecast guidance models (in n mi) for forecasts issued on Hurricane Matthew, 28 September – 9 October 2016. 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	17.8	29.1	44.2	63.8	92.7	137.3	165.9
OCD5	34.7	82.1	139.8	199.6	351.4	459.7	472.6
GFSI	18.1	33.0	48.5	66.2	105.3	145.0	201.2
EMXI	**17.4**	29.2	**37.9**	**48.5**	**76.3**	**111.0**	**128.2**
EGRI	19.2	31.3	**36.2**	**47.3**	**67.4**	**100.8**	**120.8**
NVGI	25.6	44.7	70.1	110.9	187.3	262.4	348.2
CMCI	29.1	53.4	77.4	109.5	196.0	326.9	523.0
GHMI	21.2	40.6	63.6	88.9	148.4	226.3	334.5
HWFI	20.3	36.5	58.6	90.4	162.8	263.2	381.9
CTCI	18.8	36.6	59.8	89.5	144.6	200.9	237.1
GFNI	21.7	45.4	75.4	110.4	180.2	284.1	448.2
TCON	**16.7**	29.5	44.9	66.0	106.0	158.7	232.9
TVCA	**16.4**	**29.0**	44.7	63.9	100.2	149.0	203.9
TVCX	**16.1**	**28.9**	**42.9**	**60.5**	93.7	139.2	186.6
GFEX	**16.9**	29.4	**40.8**	**51.9**	**78.7**	**113.7**	**140.4**
HCCA	**15.3**	**26.8**	**34.9**	**47.4**	**78.2**	**119.0**	193.2
AEMI	18.7	32.9	49.6	69.0	113.6	159.5	228.4
BAMS	63.7	113.1	150.3	171.5	154.0	**121.9**	167.7
BAMM	35.9	68.3	102.2	127.3	146.9	**120.5**	**158.3**
BAMD	32.5	61.6	87.8	114.4	170.3	204.2	226.0
Forecasts	35	33	31	29	25	22	19

Table 6a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for forecasts issued on Hurricane Matthew, 28 September – 9 October 2016. 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	7.7	12.5	16.8	19.6	21.1	22.5	22.1
OCD5	11.6	15.8	16.6	18.4	22.0	27.9	55.5
Forecasts	42	40	38	36	32	28	24
OFCL (2011-15)	6.2	9.4	11.5	13.3	14.6	14.6	15.8
OCD5 (2011-15)	7.3	10.8	13.3	15.3	17.7	17.8	17.6

Table 6b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for forecasts issued on Hurricane Matthew, 28 September – 9 October 2016. 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	8.0	12.7	14.2	14.0	15.0	18.2	17.1
OCD5	12.6	16.4	**13.7**	**13.5**	18.5	24.5	55.7
DSHP	12.6	17.2	17.9	18.5	22.6	27.3	24.3
LGEM	13.0	17.5	19.9	19.2	17.6	19.0	**14.6**
GHMI	14.9	22.5	25.0	19.3	18.6	20.4	19.8
HWFI	11.7	13.8	**14.0**	**13.1**	15.1	18.9	**12.1**
CTCI	12.6	19.5	21.7	20.1	23.8	25.4	20.2
GFNI	14.0	21.8	24.3	21.4	16.0	**15.1**	**13.7**
ICON	12.3	16.7	16.9	15.3	16.4	**16.2**	**14.5**
IVCN	12.2	16.7	17.1	15.4	17.3	**17.1**	**15.0**
HCCA	12.4	17.4	18.7	15.8	18.2	19.3	**16.7**
GFSI	12.2	17.4	17.6	17.8	20.0	27.7	29.6
EMXI	9.8	15.6	17.1	18.0	19.5	25.5	30.2
Forecasts	35	33	31	29	25	22	19

Table 7. Watch and warning summary for Hurricane Matthew, 28 September – 9 October 2016.

Date/Time (UTC)	Action	Location
28 / 1500	Tropical Storm Warning issued	Guadeloupe and Martinique
28 / 1500	Tropical Storm Warning issued	St. Lucia
28 / 1500	Tropical Storm Warning issued	Barbados, Dominica, St. Vincent, and Grenadine Islands
28 / 2100	Tropical Storm Watch issued	Aruba, Bonaire, and Curacao
29 / 0300	Tropical Storm Warning discontinued	Barbados, Dominica, St. Vincent, and Grenadine Islands
29 / 0300	Tropical Storm Warning issued	Dominica, St. Vincent, and Grenadine Islands
29 / 0900	Tropical Storm Warning discontinued	Guadeloupe and Martinique
29 / 0900	Tropical Storm Warning discontinued	St. Lucia
29 / 0900	Tropical Storm Warning discontinued	Dominica, St. Vincent, and Grenadine Islands
29 / 0900	Tropical Storm Warning issued	St. Vincent and Grenadine Islands
29 / 1200	Tropical Storm Warning discontinued	All
29 / 2100	Tropical Storm Watch issued	Colombia/Venezuela border to Riohacha
30 / 0600	Tropical Storm Watch discontinued	Aruba, Bonaire, and Curacao
30 / 0600	Tropical Storm Watch issued	Aruba and Curacao
30 / 1200	Tropical Storm Watch discontinued	Aruba and Curacao
30 / 1200	Tropical Storm Watch issued	Aruba
30 / 1500	Tropical Storm Watch changed to Tropical Storm Warning	Colombia/Venezuela border to Riohacha
30 / 1500	Tropical Storm Watch discontinued	All
30 / 2100	Tropical Storm Watch issued	Southern border Haiti/Dominican Republic to Port-au-Prince
30 / 2100	Hurricane Watch issued	Jamaica
1 / 1500	Tropical Storm Watch discontinued	All
1 / 1500	Tropical Storm Warning discontinued	All
1 / 1500	Hurricane Watch issued	Southern border Haiti/Dominican Republic to Le Môle-St. Nicholas
1 / 2100	Hurricane Watch changed to Hurricane Warning	Jamaica
1 / 2100	Hurricane Watch changed to Hurricane Warning	Southern border Haiti/Dominican Republic to Le Môle-St. Nicholas

Date/Time (UTC)	Action	Location
1 / 2100	Hurricane Watch issued	Le Môle-St. Nicholas to northern border Haiti/Dominican Republic
1 / 2100	Hurricane Watch issued	Camagüey to Guantánamo
2 / 0600	Tropical Storm Watch issued	Puerto Plata to northern border Haiti/Dominican Republic
2 / 0600	Tropical Storm Warning issued	southern border Haiti/Dominican Republic to Barahona
2 / 0900	Hurricane Watch discontinued	Le Môle-St. Nicholas to northern border Haiti/Dominican Republic
2 / 0900	Hurricane Watch issued	Turks & Caicos and Southeastern Bahamas
2 / 0900	Hurricane Warning discontinued	southern border Haiti/Dominican Republic to Le Môle-St. Nicholas
2 / 0900	Hurricane Warning issued	Haiti
2 / 0900	Hurricane Warning issued	Las Tunas to Guantánamo
3 / 0300	Hurricane Watch changed to Hurricane Warning	Southeastern Bahamas
3 / 0300	Hurricane Watch issued	Turks & Caicos and Central Bahamas
3 / 2100	Hurricane Warning changed to Tropical Storm Warning	Jamaica
3 / 2100	Hurricane Watch discontinued	Turks & Caicos and Central Bahamas
3 / 2100	Hurricane Watch issued	Turks & Caicos
3 / 2100	Hurricane Watch issued	Northwestern Bahamas
4 / 0900	Hurricane Watch changed to Tropical Storm Warning	Turks & Caicos
4 / 0900	Hurricane Watch changed to Hurricane Warning	Southeastern Bahamas to Northwestern Bahamas
4 / 0900	Hurricane Warning modified to	Southeastern Bahamas to Northwestern Bahamas
4 / 1500	Tropical Storm Watch issued	Seven Mile Bridge to Deerfield Beach
4 / 1500	Tropical Storm Warning discontinued	Jamaica
4 / 1500	Hurricane Watch issued	Deerfield Beach to Volusia/Brevard County Line
4 / 2100	Tropical Storm Watch modified to	Seven Mile Bridge to Golden Beach
4 / 2100	Hurricane Watch modified to	Golden Beach to Volusia/Brevard County Line
5 / 0300	Tropical Storm Watch changed to Tropical Storm Warning	Seven Mile Bridge to Golden Beach
5 / 0300	Tropical Storm Warning issued	Chokoloskee to Ocean Reef

Date/Time (UTC)	Action	Location
5 / 0300	Hurricane Watch discontinued	Golden Beach to Volusia/Brevard County Line
5 / 0300	Hurricane Watch issued	Sebastian Inlet to Flagler/Volusia County Line
5 / 0300	Hurricane Warning issued	Golden Beach to Sebastian Inlet
5 / 0900	Hurricane Watch modified to	Sebastian Inlet to Fernandina Beach
5 / 1500	Hurricane Warning changed to Tropical Storm Warning	Haiti
5 / 1500	Tropical Storm Watch discontinued	All
5 / 1500	Tropical Storm Warning discontinued	southern border Haiti/Dominican Republic to Barahona
5 / 1500	Hurricane Watch modified to	Flager/Volusia County Line to Fernandina Beach
5 / 1500	Hurricane Warning modified to	Golden Beach to Flager/Volusia County Line
5 / 1800	Tropical Storm Warning discontinued	Turks & Caicos
5 / 2100	Tropical Storm Watch issued	Chokoloskee to Suwannee River
5 / 2100	Tropical Storm Warning discontinued	Haiti
5 / 2100	Hurricane Watch discontinued	Cuba
5 / 2100	Hurricane Warning discontinued	Cuba
5 / 2100	Hurricane Watch modified to	Flager/Volusia County Line to Savannah River
6 / 0300	Hurricane Watch discontinued	Flager/Volusia County Line to Savannah River
6 / 0300	Hurricane Watch issued	Fernandina Beach to Edisto Beach
6 / 0300	Hurricane Warning modified to	Golden Beach to Fernandina Beach
6 / 0900	Hurricane Watch discontinued	Fernandina Beach to Edisto Beach
6 / 0900	Hurricane Watch issued	Altamaha Sound to South Santee River
6 / 0900	Hurricane Warning modified to	Golden Beach to Altamaha Sound
6 / 1200	Hurricane Warning modified to	Central Bahamas to Northwestern Bahamas
6 / 1500	Tropical Storm Watch modified to	Chokoloskee to Anclote River
6 / 1500	Tropical Storm Warning issued	Anclote River to Suwanee River
6 / 1500	Hurricane Watch modified to	Edisto Beach to South Santee River
6 / 1500	Hurricane Warning modified to	Golden Beach to Edisto Beach
6 / 2100	Tropical Storm Warning issued	South Santee River to Surf City
6 / 2100	Hurricane Watch discontinued	All
6 / 2100	Hurricane Warning modified to	Golden Beach to South Santee River

Date/Time (UTC)	Action	Location
7 / 0000	Tropical Storm Watch modified to	Englewood to Anclote River
7 / 0000	Tropical Storm Warning discontinued	Chokoloskee to Ocean Reef
7 / 0000	Tropical Storm Warning modified to	Seven Mile Bridge to Boca Raton
7 / 0000	Hurricane Warning modified to	Boca Raton to South Santee River
7 / 0300	Tropical Storm Warning modified to	Ocean Reef to Boca Raton
7 / 0900	Tropical Storm Watch modified to	Anna Maria Island to Anclote River
7 / 0900	Tropical Storm Warning modified to	Boca Raton to Jupiter Inlet
7 / 0900	Hurricane Warning modified to	Jupiter Inlet to South Santee River
7 / 1200	Tropical Storm Warning modified to	Jupiter Inlet to Sebastian Inlet
7 / 1200	Hurricane Warning discontinued	Northwestern Bahamas
7 / 1200	Hurricane Warning modified to	Sebastian Inlet to South Santee River
7 / 1500	Tropical Storm Watch discontinued	All
7 / 1500	Tropical Storm Warning modified to	Surf City to Duck
7 / 1500	Tropical Storm Warning modified to	Sebastian Inlet to Cocoa Beach
7 / 1500	Tropical Storm Warning discontinued	Anna Maria Island to Anclote River
7 / 1500	Hurricane Watch issued	Surf City to Cape Lookout
7 / 1500	Hurricane Warning discontinued	Sebastian Inlet to South Santee River
7 / 1500	Hurricane Warning issued	Cocoa Beach to Surf City
7 / 2100	Tropical Storm Warning discontinued	Sebastian Inlet to Cocoa Beach
7 / 2100	Tropical Storm Warning issued	Volusia/Brevard County Line to Flagler/Volusia County Line
7 / 2100	Hurricane Warning modified to	Flagler/Volusia County Line to Surf City
8 / 0000	Tropical Storm Warning discontinued	Volusia/Brevard County Line to Flagler/Volusia County Line
8 / 0300	Tropical Storm Warning issued	Flagler/Volusia County Line to Fernandina Beach
8 / 0300	Hurricane Warning modified to	Fernandina Beach to Surf City
8 / 0900	Tropical Storm Warning discontinued	Flagler/Volusia County Line to Fernandina Beach
8 / 0900	Hurricane Warning modified to	Altamaha Sound to Surf City
8 / 1800	Hurricane Warning modified to	Edisto Beach to Surf City
8 / 2100	Hurricane Warning modified to	South Santee River to Surf City
9 / 0300	Hurricane Watch modified to	Surf City to Duck
9 / 0300	Hurricane Warning modified to	Little River Inlet to Surf City
9 / 0900	Tropical Storm Warning modified to	Cape Fear to Duck

Date/Time (UTC)	Action	Location
9 / 0900	Hurricane Warning discontinued	All
9 / 1500	Hurricane Watch discontinued	All
9 / 1800	Tropical Storm Warning modified to	Surf City to Duck
9 / 2100	Tropical Storm Warning discontinued	All

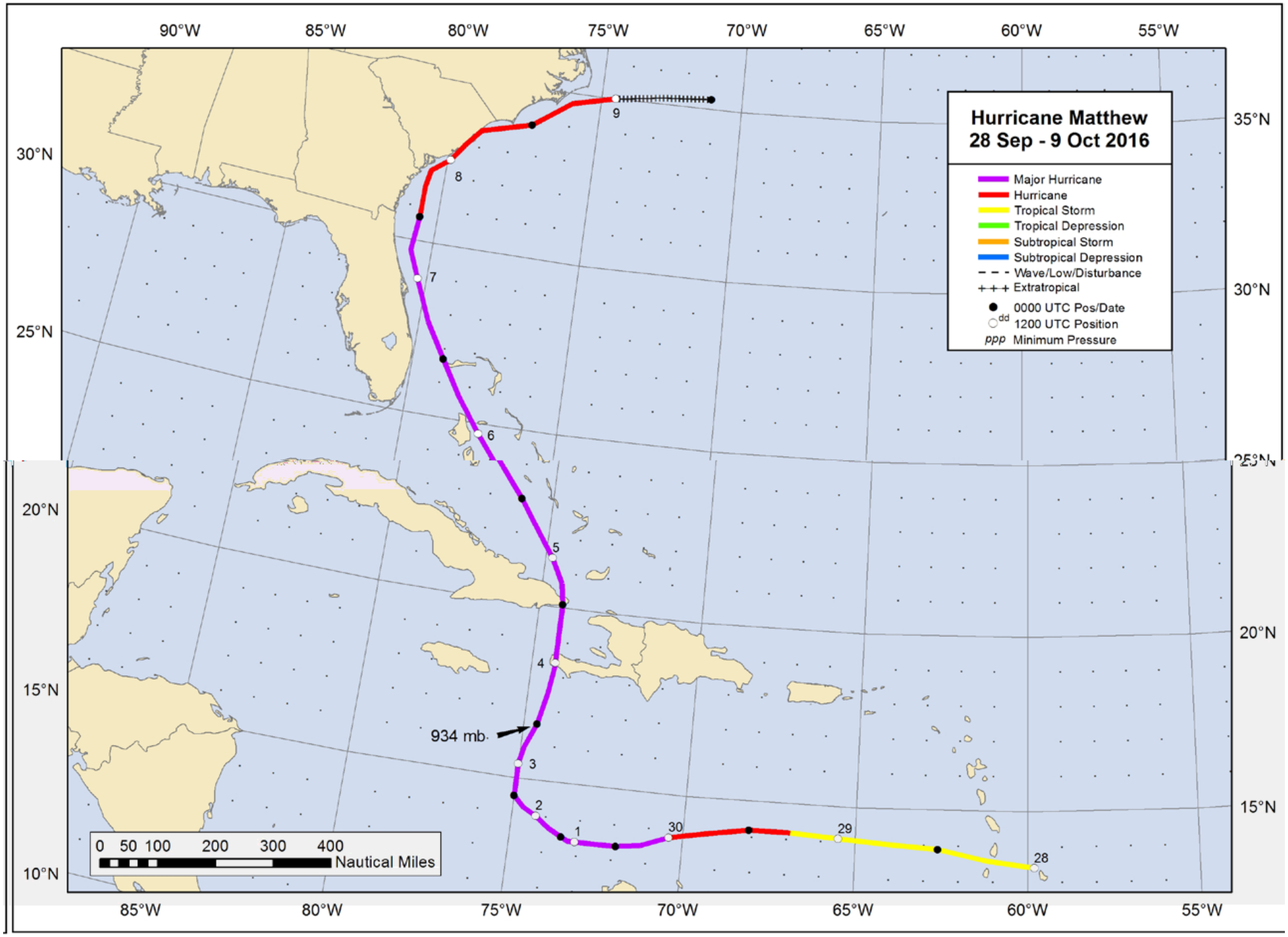

Figure 1. Best track positions for Hurricane Matthew, 28 September – 9 October 2016.

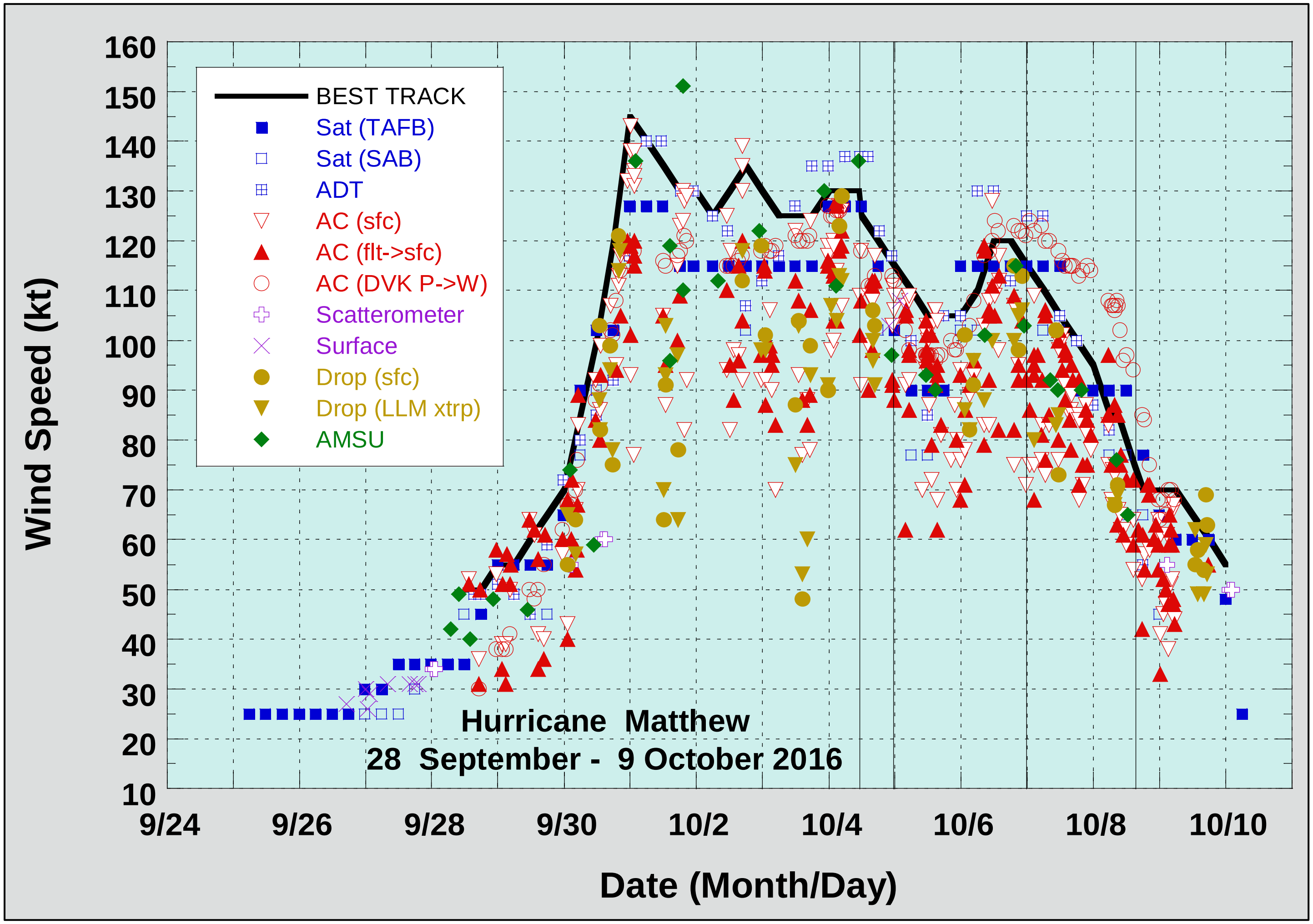

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Matthew, 28 September – 9 October 2016. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. 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 solid vertical lines correspond to landfalls.

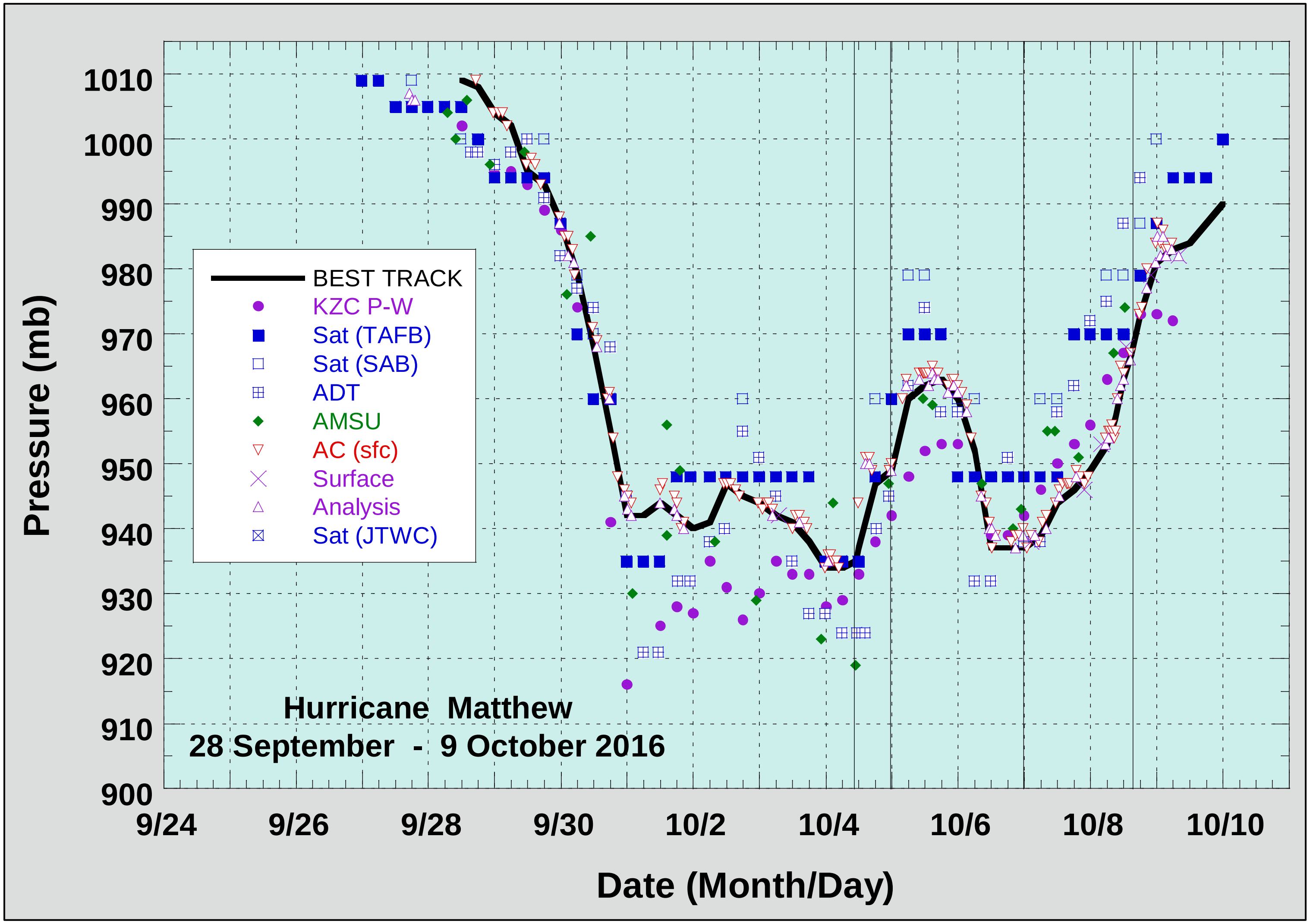

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Matthew, 28 September – 9 October 2016. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute 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 solid vertical lines correspond to landfalls.

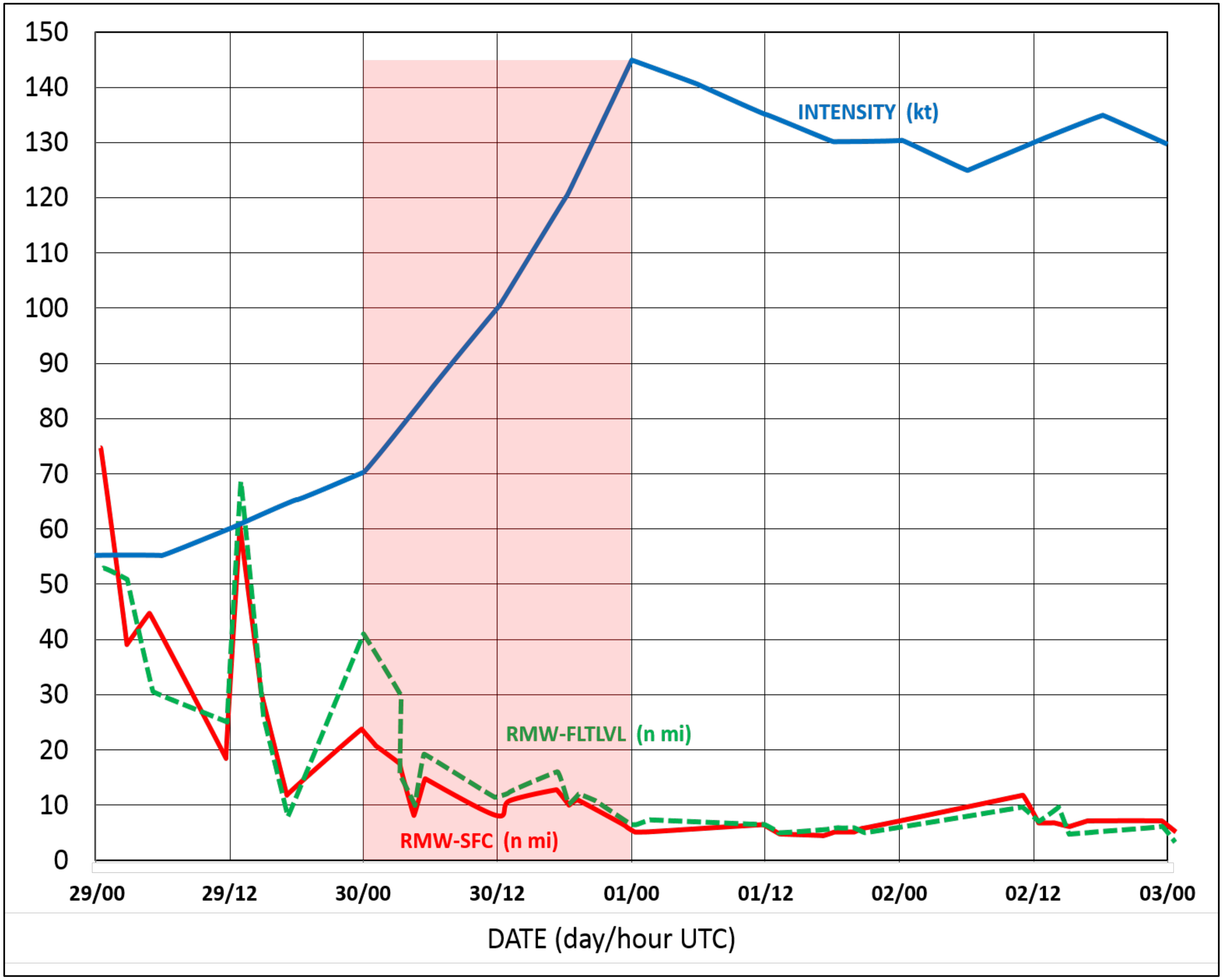

Figure 4. Plot of Hurricane Matthew's intensity versus SFMR-based surface (**RMW-SFC**) and 700-mb flight-level (**RMW-FLTLVL**) radius of maximum winds (RMW). Time period covered is from 0000 UTC 29 September to 0000 UTC 3 October 2016, which includes Matthew's rapid intensification period (red shading).

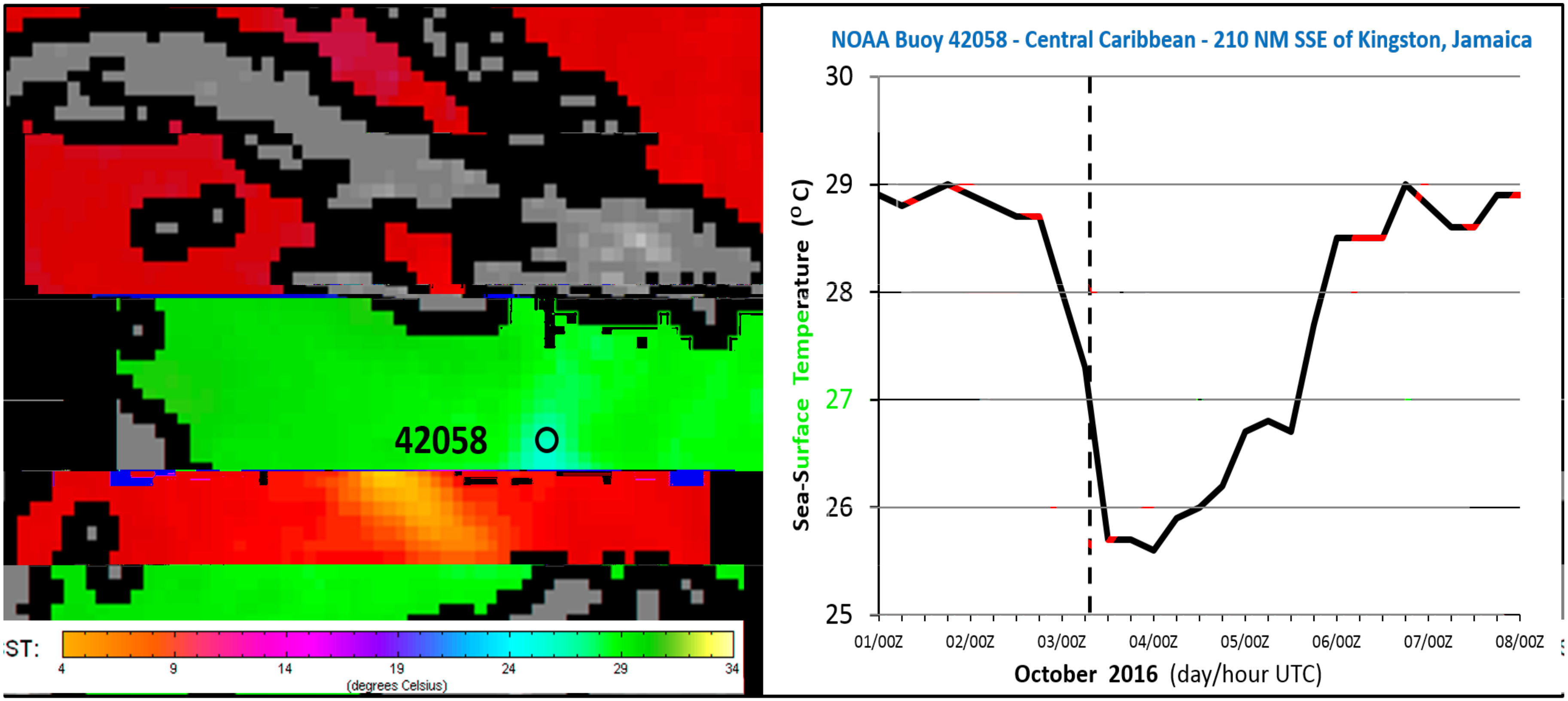

Figure 5. Satellite-derived sea-surface temperature analysis valid 1200 UTC 4 October showing cold wake (yellow shading) created by Hurricane Matthew. Buoy 42058 location is indicated by black circle (*left panel*). Time series plot of SST data (red line) recorded by NOAA Buoy 42058 during the period 1 - 8 October 2016 (*right panel*). The time of Hurricane Matthew's eye passage over the buoy is indicated by the black vertical dashed line. Upwelling began more than 12 h before eye passage and continued for almost 24 h after passage. Satellite-derived SST image courtesy Remote Sensing Systems (RSS), Santa Rosa, CA.

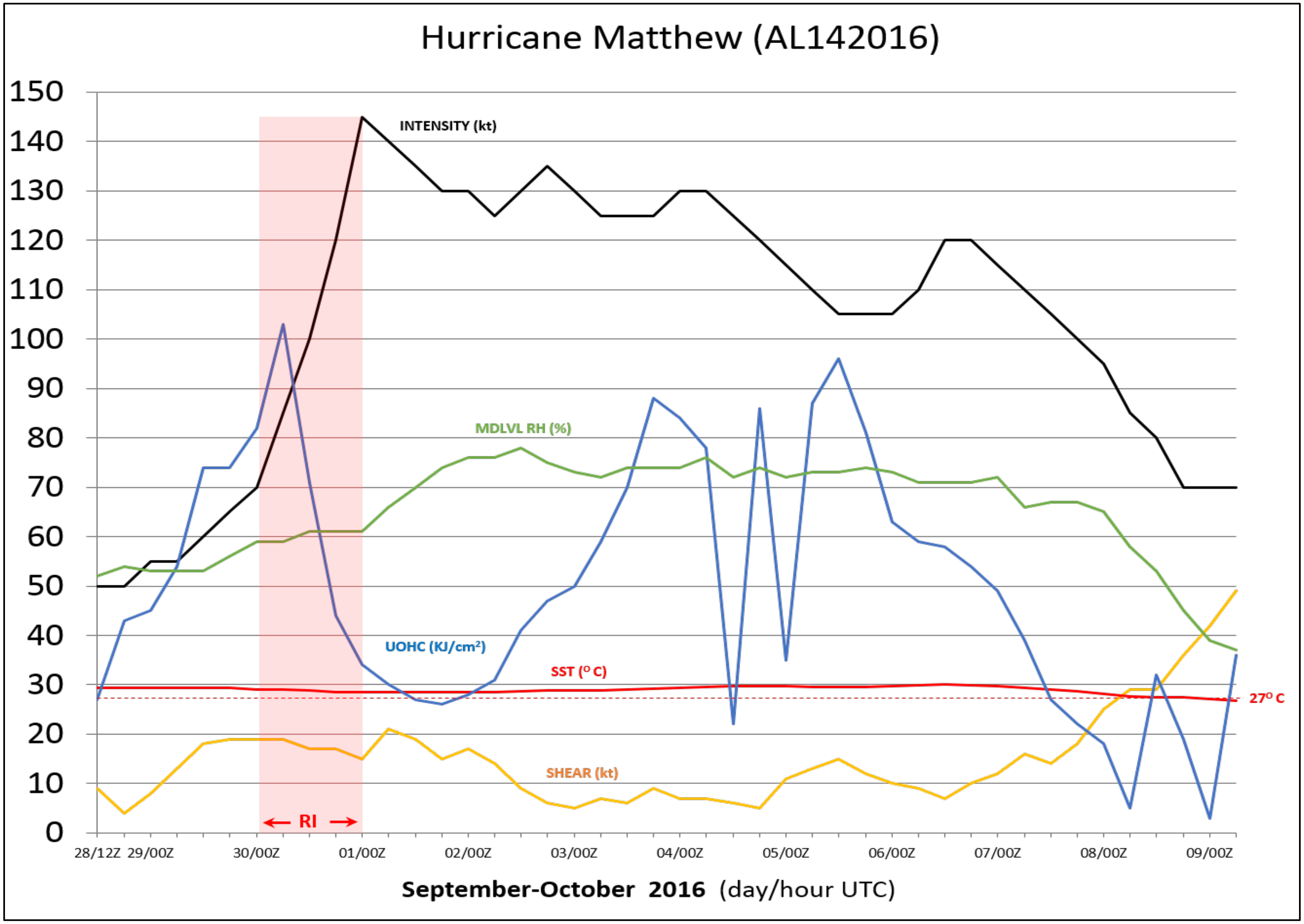

Figure 6. Plot of Hurricane Matthew's intensity versus GFS-based SHIPS model analyzed environmental parameters: 850−200-mb vertical wind shear (**SHEAR**), sea-surface temperature (**SST**), upper-ocean heat content (**UOHC**), and 700−500-mb average relative humidity (**MDLVLRH**). Time period covered is from 1200 UTC 28 September to 0600 UTC 9 October 2016, which includes the rapid intensification (**RI**/red shading) cycle.

Figure 7. U.S. Federal Aviation Administration ARSR-4 radar reflectivity data (dBZ) from Guantanamo Bay, Cuba, on 4 October 2016 when Matthew's eye was (a) approaching Les Anglais, Haiti, at 1017 UTC, (b) over the western Tiburon peninsula at 1324 UTC, (c) over the western Gulf of Gonâve at 1729 UTC, and (d) approaching Juaco, Cuba, at 2235 UTC. Range rings are 30 n mi.

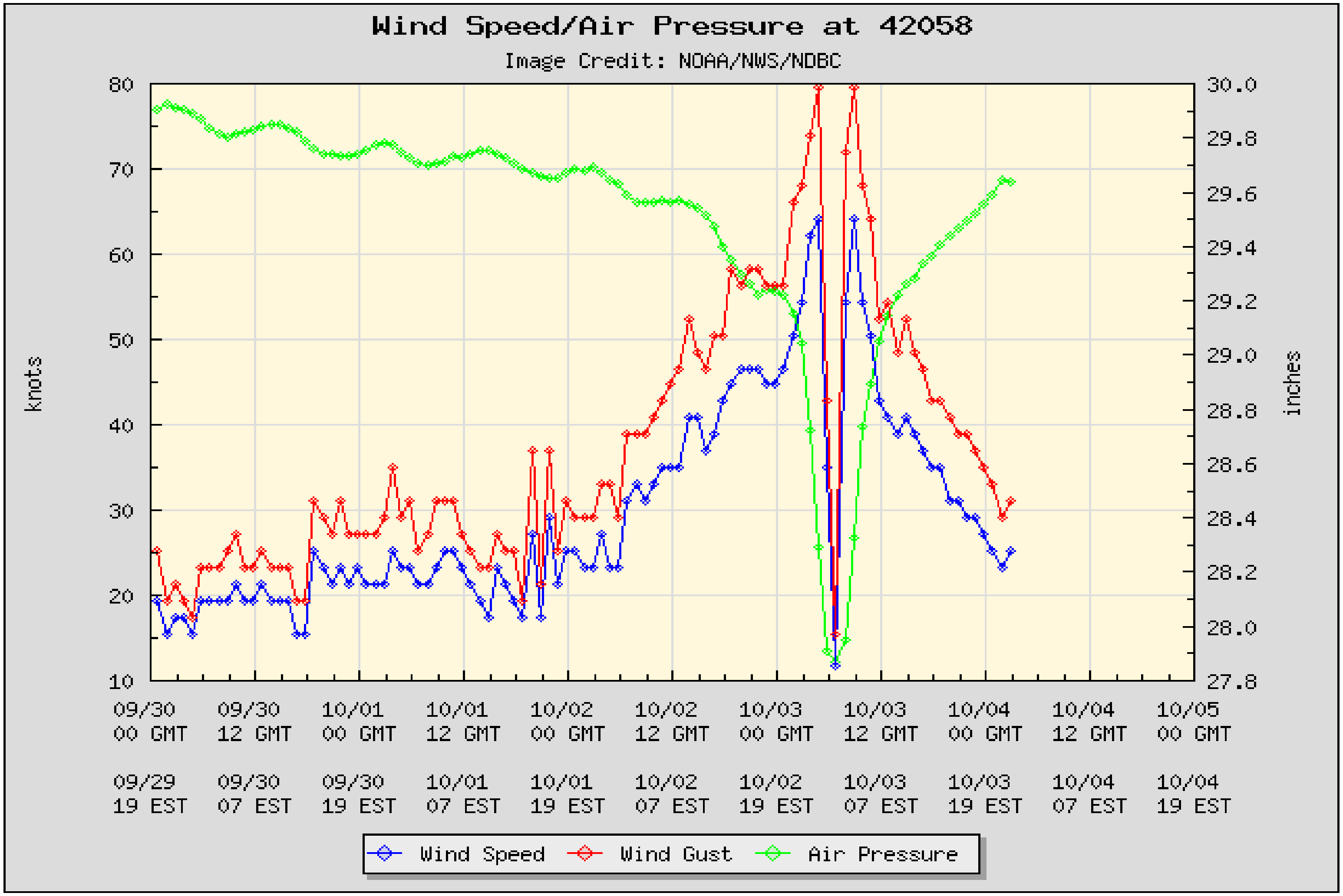

Figure 8. Times series plot of surface pressure (in Hg), 10-minute average wind speed (kt), and wind gusts (kt) associated with Hurricane Matthew's passage over NOAA Buoy 42058, located over the central Caribbean Sea about 220 n mi southeast of Kingston, Jamaica. Time plot is in Coordinated Universal Time/UTC (GMT) and Eastern Standard Time (EST). The minimum pressure of 27.84 inches measured during eye passage equals 942.9 mb.

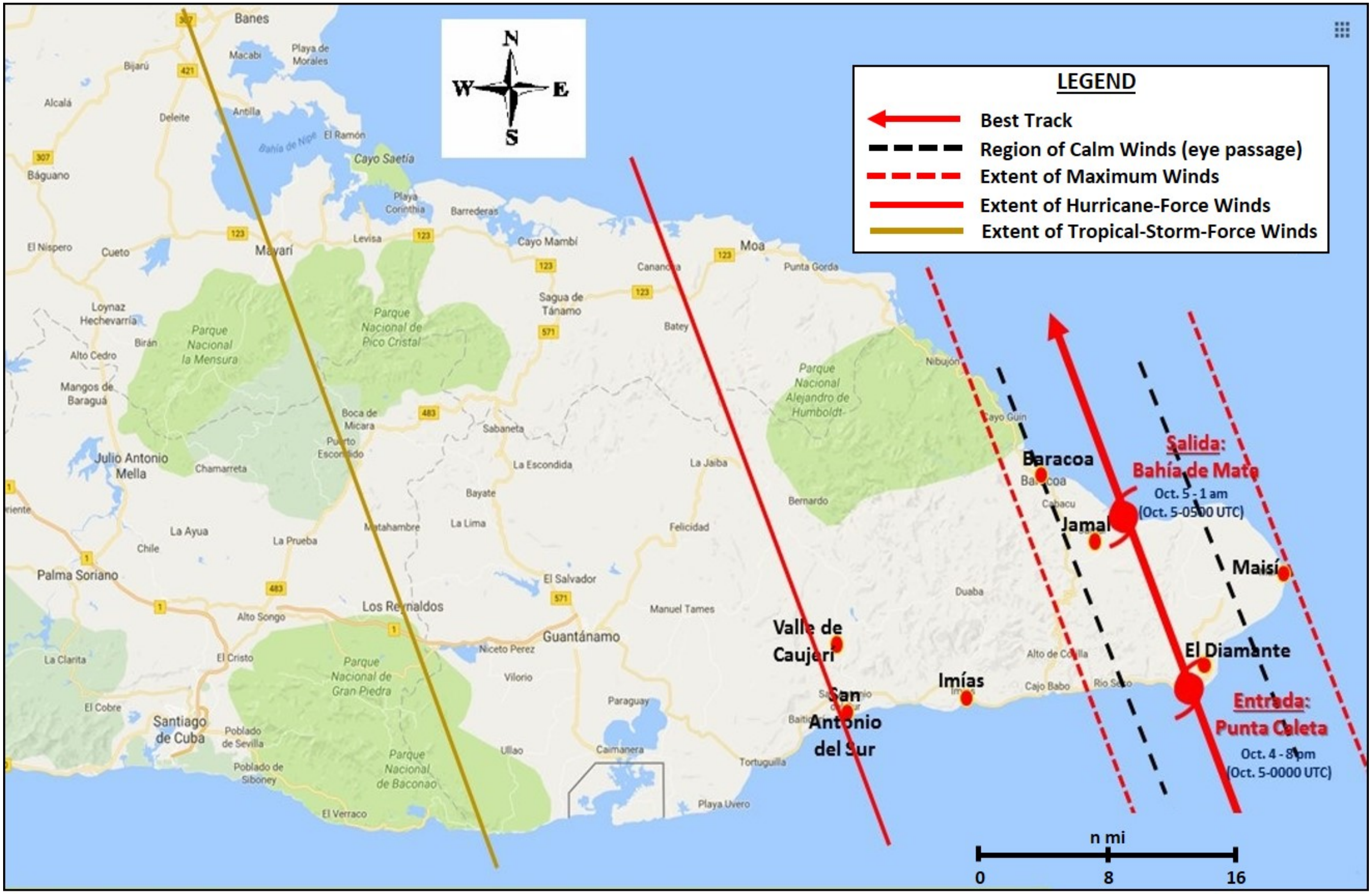

Figure 9. Matthew's track and wind fields during the hurricane's passage over eastern Cuba on 5 October 2016. Graphic is courtesy of the Instituto de Meteorología de Cuba/INSMET (Meteorological Institute of Cuba).

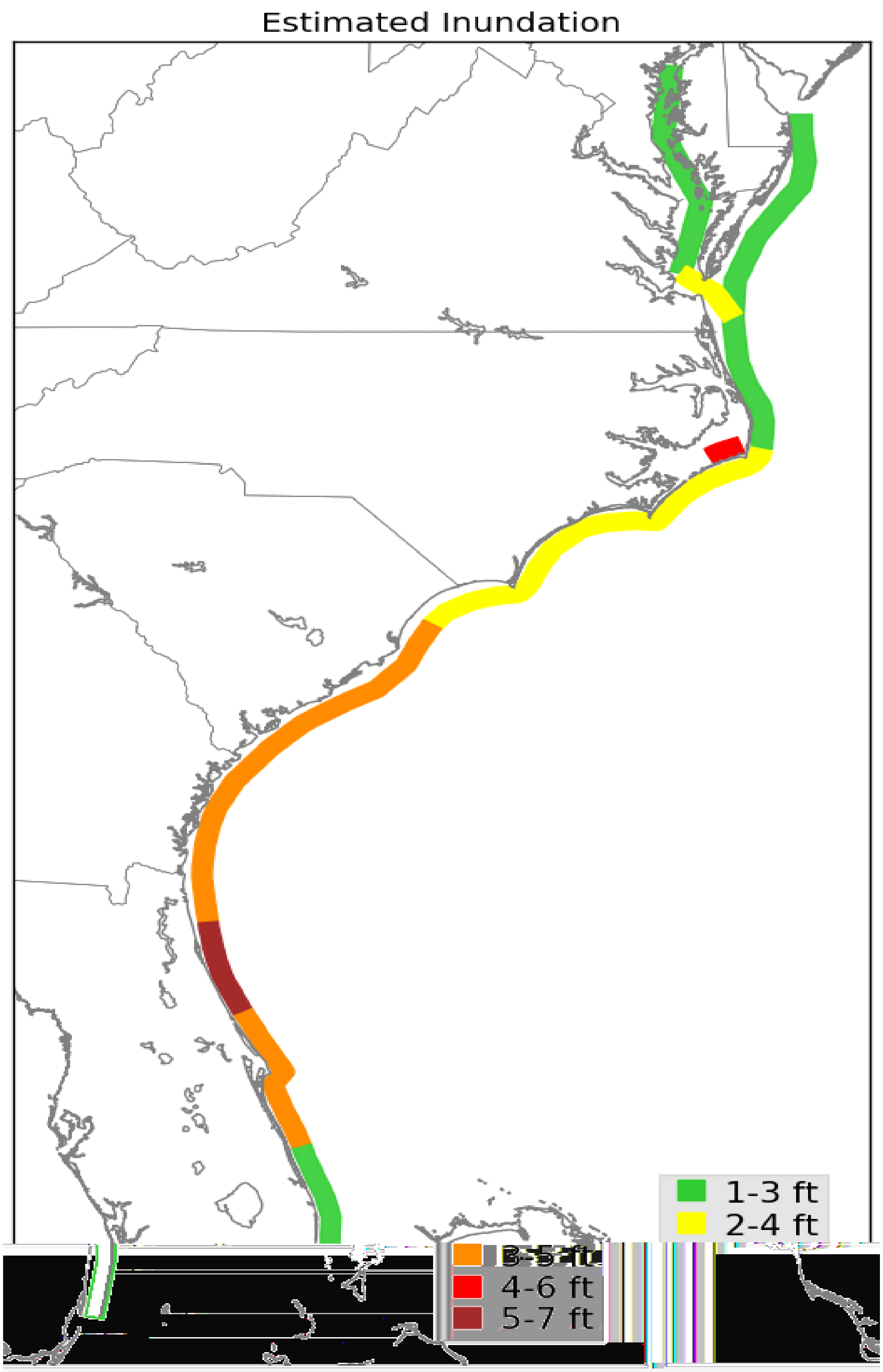

Figure 10. Estimated maximum storm surge inundation levels (ft above ground level) along the southeastern and mid-Atlantic coasts of the United States due to Hurricane Matthew. Estimates are based on USGS and NWS high water mark observations, NOS tide station observations above MHHW, and USGS storm tide pressure sensors. Image courtesy of the NHC Storm Surge Unit.

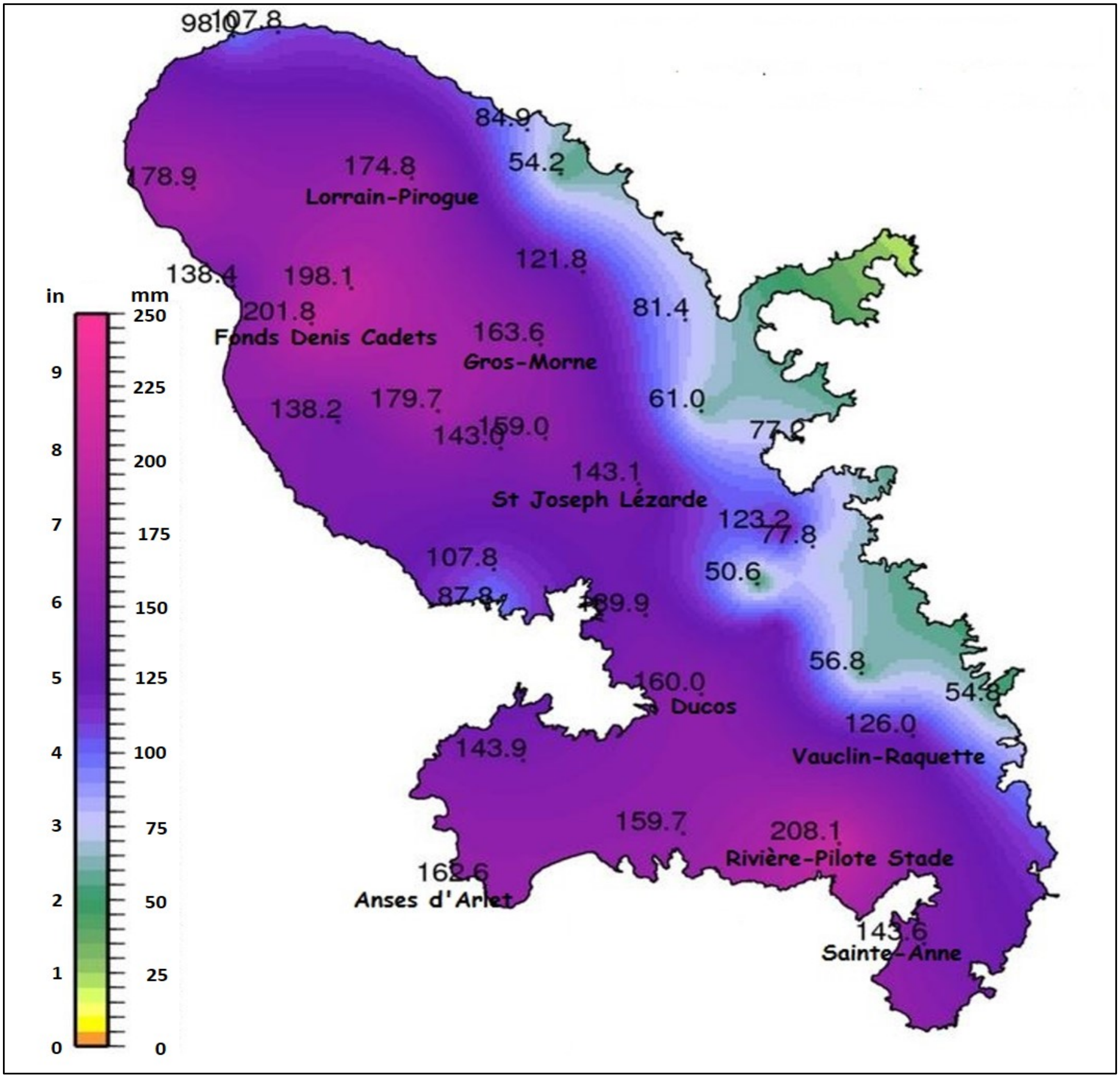

Figure 11. Total rainfall amounts in inches (in) and millimeters (mm) for Matthew during its passage over Martinique as a tropical storm during the period 28-29 October 2016. Graphic courtesy of Météo-France.

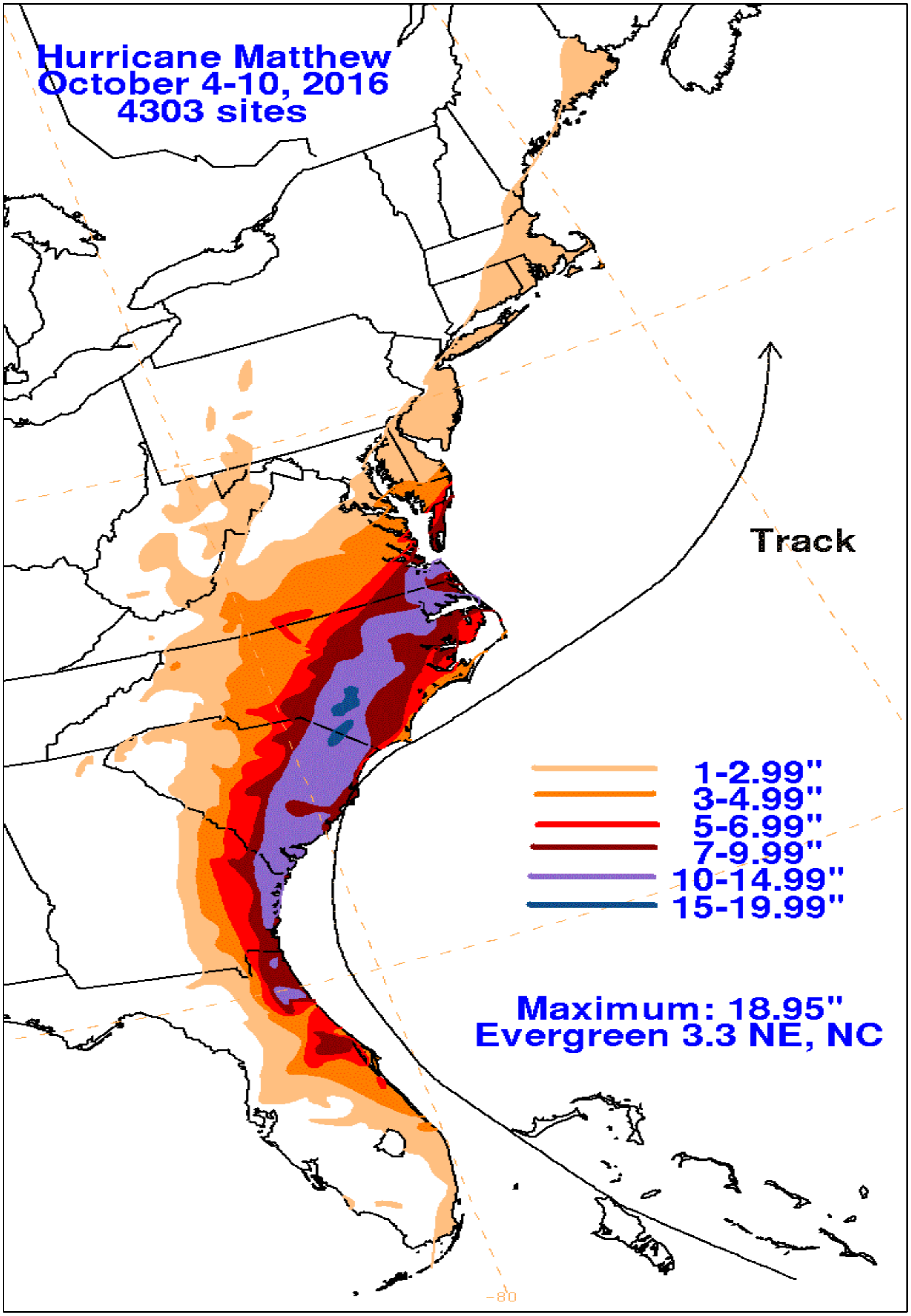

Figure 12. U.S. rainfall amounts (inches) for Hurricane Matthew during its tropical and post-tropical phases, which has been compiled from 4,303 sites during the period 4–10 October 2016. Graphic courtesy of David Roth at the NOAA/NWS Weather Prediction Center.

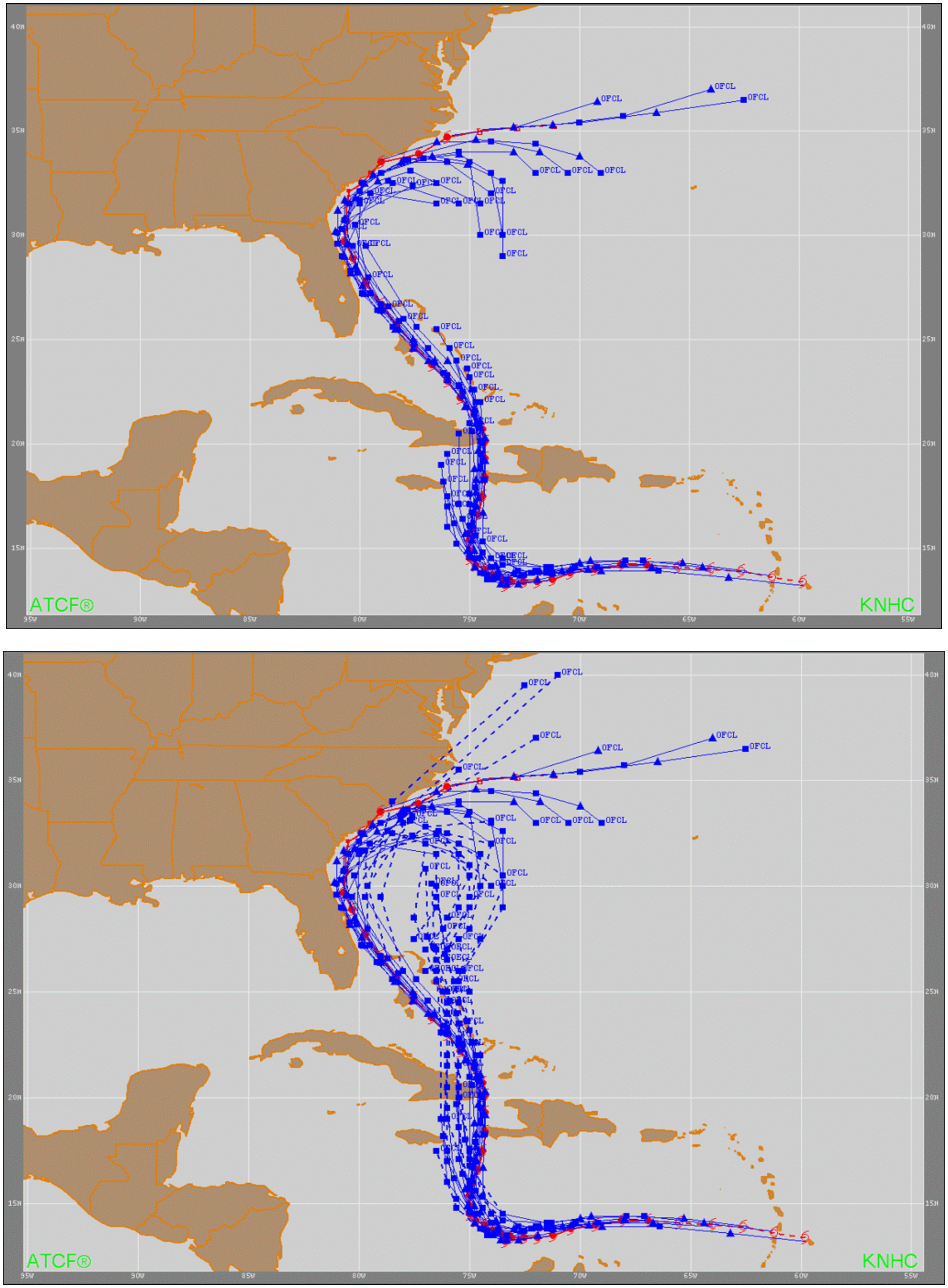

Figure 13. Selected official track forecasts with 0, 12, 24, 36, 48, and 72 h positions indicated (dashed blue lines, *top panel*) and 0, 12, 24, 36, 48, 72, 96, and 120 h positions indicated (dashed blue lines, *bottom panel*) for Hurricane Matthew, 28 September – 9 October 2016. The best track is given by the thick solid red line with positions given at 6 h intervals.

Figure 14. Hurricane Matthew 120-h intensity forecasts during the period 1200 UTC 28 September – 0000 UTC 8 October 2016 for (a) OFCL [*blue lines*], (b) the 5-member consensus model IVCN [*orange lines*], (c) the NOAA GFS model [*green lines*], and (d) the ECMWF model [*purple lines*]. The intensity best track is denoted by the solid black line at 6-h intervals (white dots).

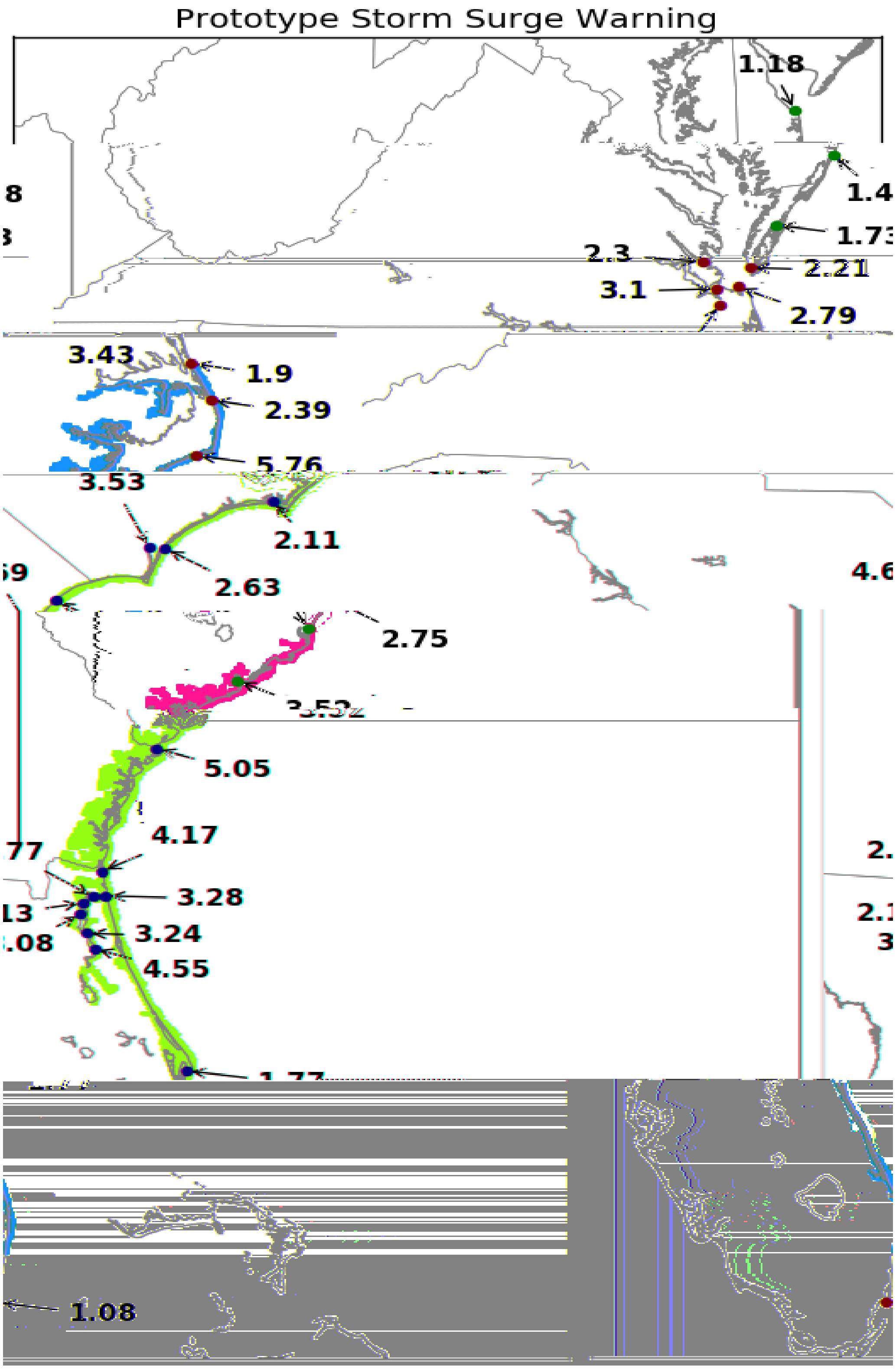

Figure 15. Areas along the East Coast of the United States that were depicted within a Prototype Storm Surge Warning (magenta) at any time during Hurricane Matthew, along with maximum NOS tide station observations (ft) above MHHW. Image courtesy of the NHC Storm Surge Unit.