NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE FLORENCE

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31 August–17 September 2018

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PANORAMIC VIEW OF FLORENCE WHEN THE HURRICANE WAS AT CATEGORY 4 STRENGTH ON 10 SEPTEMBER 2018. IMAGE FROM INTERNATIONAL SPACE STATION (ISS) COURTESY OF ESA/NASA ISS ASTRONAUT ALEXANDER GERST.

Florence was a long-lived, category 4 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that made landfall along the southeastern coast of North Carolina near the upper end of category 1. Florence caused devastating freshwater flooding across much of the southeastern United States and significant storm surge flooding in portions of eastern North Carolina. Florence resulted in 22 direct deaths and was also associated with 30 indirect fatalities.

[1] Original report dated 3 May 2019. Second version on 30 May 2019 corrected the discussion of fatalities in South Carolina, and included updated captions for Figures 15 and 16. This version corrects Table 1 and Figure 1.

Hurricane Florence

31 AUGUST–17 SEPTEMBER 2018

SYNOPTIC HISTORY

Florence originated from a convectively active tropical wave, which was accompanied by a broad low pressure system that moved off the west coast of Africa on 30 August. The low-latitude disturbance fractured early on 31 August, with the northern portion of the wave moving west-northwestward accompanied by a steady increase in convective organization. The southern portion of the wave moved westward during the ensuing 2.5 weeks, eventually developing into eastern North Pacific Tropical Depression 19-E on 19 September. After the fracture, the convective organization of the pre-Florence disturbance gradually increased and the associated low pressure system slowly became better defined over the next couple of days. It is estimated that a tropical depression formed around 1800 UTC 31 August about 90 n mi southeast of Santiago island in the southernmost Cabo Verde Islands. The depression strengthened into a tropical storm 12 h later when it was passing about 110 n mi west-southwest of the southernmost Cabo Verde archipelago. For the next several days, Florence maintained a steady west-northwestward motion at about 15 kt while moving around the southern periphery of a massive Bermuda-Azores ridge that extended from northwestern Africa and southern Europe westward to the east coast of the United States. 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].

Despite being embedded within a favorable vertical-wind-shear regime of about 5 kt, only slow strengthening occurred during the next 48 h due to Florence moving over marginal sea-surface temperatures (SST) around 26.5°C and entraining cooler and drier air from the north. However, intermittent bursts of deep convection developed near the center during this time, which caused the inner-core wind field to gradually contract. Florence became a 65-kt hurricane around 1200 UTC 4 September when the cyclone was located about 1200 n mi east-northeast of the Lesser Antilles. Now possessing a 30-n-mi-diameter eye, Florence underwent a period of rapid intensification (RI) over the next 30 h. Florence became a 115-kt, category 4 hurricane by 1800 UTC 5 September while centered over the central Atlantic about 1200 n mi east-southeast of Bermuda. Florence’s RI phase was quite remarkable considering that it occurred within an environmental regime characterized by deep-layer southwesterly vertical shear of 15–20 kt, SSTs <27°C, and mid-level relative humidity values < 50% — conditions that are typically not considered conducive for significant strengthening (Fig. 4).

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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.

Within 12 h after becoming a category 4 hurricane, Florence underwent a period of rapid weakening (RW) due to strong southwesterly vertical wind shear of near 25 kt, and became a tropical storm by 0000 UTC 7 September. The magnitude of Florence's weakening rate during the RW phase was nearly the same as during the RI phase despite SSTs being at least 1°C warmer during the RW period. The increase in the vertical shear was due to a mid- to upper-level shortwave trough passing just north of Florence. This trough also weakened the ridge, resulting in the cyclone slowing down and making a jog toward the northwest. After the shortwave passed Florence early on 7 September, the weakness in the ridge filled in, forcing the tropical storm on a westward track over the central Atlantic.

Although passive microwave and conventional satellite imagery indicated that the inner-core convection had been severely disrupted by the strong shear conditions, data from a NOAA Hurricane Hunter aircraft on 8 September revealed that the inner-core wind field remained intact and that Florence had retained its small 10–15 n mi RMW. Despite ongoing strong westerly to southwesterly vertical wind shear and the presence of dry mid-level air characterized by humidity values of around 45%, Florence slowly re-strengthened over the next 48 h. By early on 9 September, the vertical shear had decreased to 5–10 kt when the tropical storm moved into an upper-level col region, and a ring of deep convection formed in the inner core – a pre-cursor to the redevelopment of an eye. By 1200 UTC that day, Florence began moving toward the west-northwest and had regained hurricane status. Pronounced outflow jets formed in the northwestern and southeastern quadrants of the hurricane. These features enhanced the upper-level outflow across the hurricane's center, allowing to Florence to undergo a second RI period and strengthen 50 kt during the 24-h period ending at 1800 UTC 10 September (Figs. 3 and 4). Some minor inner-core fluctuations occurred for the next 24 h, with Florence reaching its peak intensity of 130 kt around 1800 UTC 11 September when the hurricane was located about 725 n mi east-southeast of Cape Fear, North Carolina.

Although the SSTs were quite warm (≥ 29.5°C), the depth of the warm water along Florence's track became fairly shallow, which promoted cold upwelling and mixing. This is indicated by the upper-ocean heat content reaching a maximum of about 56 kJ cm^{-2} when Florence was at its peak intensity, followed by a sharp decrease to less than 25 kJ cm^{-2} just 24 h later (Fig. 4). While maintaining a steady west-northwestward motion around the southwestern periphery of the Bermuda-Azores high pressure ridge, Florence began to slowly weaken, likely due to the effects of cold upwelling (Fig. 5) and the onset of an eyewall replacement cycle (ERC). Data from Air Force Reserve and NOAA reconnaissance aircraft, along with passive microwave satellite imagery (Fig. 6), indicated that the diameter of Florence's eye had increased to 25–30 n mi and eyewall convection had started to erode in the southeastern semicircle by late on 12 September. In addition, the hurricane's outer wind field expanded and Florence's peak winds dropped below major hurricane status by 1200 UTC 13 September when the cyclone was located about 150 n mi east-southeast of Wilmington, North Carolina. As the weakening hurricane approached the southeastern coast of North Carolina late on 13 September, steering currents collapsed as another shortwave trough weakened the ridge over the southeastern United States. This resulted in a very slow westward motion of around 5 kt, and Florence made landfall as an 80-kt hurricane near Wrightsville Beach, North Carolina, around 1115 UTC 14 September.

After landfall, Florence made a slight jog toward the west-southwest while maintaining a slow forward speed. This track allowed the center of the cyclone to remain close to the warm waters of the Gulf Stream just offshore, and the tropical cyclone gradually weakened during this period. Florence became a tropical storm by 0000 UTC 15 September when the cyclone was located over eastern South Carolina just north of Myrtle Beach. The tropical storm turned westward and moved slowly across central and northern South Carolina, weakening to a tropical depression by 1800 UTC 16 September while centered about 35 n mi south of Florence, South Carolina. The depression then accelerated northward around the western periphery of a narrow high pressure system centered just east of the North Carolina Outer Banks on 17 September, and passed over western North Carolina, eastern Tennessee, and western Virginia, before reaching western West Virginia by 1200 UTC that day where it became extratropical. The low turned northeastward ahead of an approaching frontal system and steadily weakened within an environment of strong westerly vertical wind shear. The system eventually dissipated over Massachusetts shortly after 1200 UTC 18 September.

METEOROLOGICAL STATISTICS

Observations in Florence (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 and Satellite Consensus (SATCON) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from 8 flights of the 53rd Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command and 3 flights by the NOAA Aircraft Operations Center (AOC), which resulted in a total of 31 center fixes and 12 center fixes, respectively. In addition to the *in situ* reconnaissance missions, nine synoptic surveillance flights surrounding Florence were flown by the NOAA AOC Gulfstream-IV aircraft, resulting in the release of 281 dropwindsondes. Data and imagery from land-based NOAA WSR-88D Doppler weather radars, along with 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 Florence.

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

Winds and Pressure

Florence's estimated peak intensity of 130 kt at 1800 UTC 11 September is based on peak reconnaissance aircraft 700-mb flight-level winds of 143 kt and 141 kt, which equate to an intensity of 127–129 kt at the surface. While these peak flight-level winds occurred at 1223 UTC, Florence had just completed an ERC around 1100 UTC that day (Fig. 6b). Based on passive microwave imagery that showed the eyewall contracting (Fig. 6) and an increase in organization in geostationary satellite imagery during the next few hours, it is estimated that Florence's peak intensity occurred about 6 h after the peak flight-level winds were measured.

The highest wind speed measured by a dropwindsonde released in Florence's eyewall was 160 kt at the 909-mb level at 2101 UTC 10 September, about 3 h after the hurricane had completed its second RI phase.

The estimated minimum pressure of 937 mb is based on the Knaff-Zehr-Courtney (KZC) and UW-CIMSS SATCON pressure-wind relationship estimate of 932 mb, but follows the slightly higher trend of reconnaissance dropsondes, which indicated that the KZC estimates were several mb too low. The minimum pressure occurred during a 13-h period when reconnaissance aircraft were not conducting flights into Florence, and the timing is based on eyewall trends noted in conventional and passive microwave satellite imagery during that time.

The landfall intensity of 80 kt at 1115 UTC 14 September is based on NOAA WSR-88D Doppler weather radar (0.5° elevation angle) Doppler velocity values of around 100 kt, which yield equivalent surface wind speeds of about 80 kt after adjusting for the radar beam height (Fig. 7). These winds persisted in three narrow bands approximately 1.20 n mi (2.25 km) long that were located within the northern eyewall. Air Force Reserve reconnaissance flight-level data between 0000–0900 UTC 14 September indicated that Florence's intensity had been slowly decreasing from about 90 kt down to 85 kt during that time. This slow weakening trend continued as noted in the Doppler radar velocity data. However, for safety reasons the aircraft was unable to fly into Florence's RMW in the northern quadrant where the strongest winds were located, since that portion of the hurricane's circulation was near the coast.

The estimated landfall pressure of 956 mb is based on a blend of pressure and wind data from a National Ocean Service (NOS) observing site located on Johnny Mercer Pier, Wrightsville Beach, North Carolina (JMPN7) and reconnaissance dropsonde pressure estimates of 958–959 mb during the 1-h period prior to landfall. At 1036 UTC 14 September, a minimum pressure of 959.2 mb was measured at the NOS site, which was accompanied by a 1-minute sustained wind speed of 43 kt at an elevation of 8 meters as the eye of Florence passed over or near the NOS site. The data from the NOS site yield a pressure estimate of around 955 mb, which was blended with the dropsonde data to arrive at the landfall estimate of 956 mb.

The highest land-based sustained wind measured in Florence was a 10-minute average wind of 72 kt recorded around 0200 UTC 14 September at Cape Lookout, North Carolina (CLKN7). Adjusting the 10-minute average wind to a 1-minute average results in an estimated wind speed of 79 kt. This wind was measured north of and well outside of Florence's eyewall and RMW at the time.

Storm Surge[3]

Maximum storm surge inundation heights produced by Florence are estimated to be 8 to 11 ft above ground level in North Carolina along the shores of the Neuse River and its tributaries, where they empty into Pamlico Sound. Pamlico Sound has very little tidal influence, but easterly winds from Florence raised water levels on the western side of the sound and backed up the normal flow of the Neuse River, causing significant shoreline inundation in Craven, Pamlico, and Carteret Counties. A United States Geological Survey (USGS) storm tide pressure sensor deployed across the Neuse River from downtown New Bern recorded a storm tide water elevation of 10.08 ft above the North American Vertical Datum of 1988 (NAVD88) (Fig. 8), which converts to about 10.4 ft above Mean Higher High Water (MHHW). Several other USGS sensors deployed downstream in Havelock, Arapahoe, and Oriental recorded storm tide elevations of 8 to 10 ft MHHW. A post-storm simulation of Florence's surge (Fig. 9b) suggests that the highest inundations—up to 11 ft above ground level—occurred just upstream of downtown New Bern along the Neuse and Trent Rivers. Figure 10 shows an analysis of estimated maximum storm surge inundation heights along the coasts of North and South Carolina from Florence, and storm surge measurements are provided in Table 4.

Elsewhere on the western side of Pamlico Sound, storm surge inundation levels of 5 to 7 ft occurred in parts of Pamlico, Beaufort, and Hyde Counties along the Pamlico and Pungo Rivers. USGS sensors in that area along the Pamlico River recorded water levels of 7.4 ft MHHW and 7.1 ft MHHW in Chocowinity Bay and near Washington, North Carolina, respectively. Inundation levels were generally 2 to 4 ft above ground level along the remainder of the western shore of Pamlico Sound and southern shore of Albemarle Sound, and 2 ft or less above ground level along the sound side of the Outer Banks.

On the Atlantic Ocean coastline, maximum storm surge inundation levels are estimated to be 5 to 8 ft above ground level along the North Carolina coast at Onslow Bay in parts of Carteret, Onslow, Pender, and northern New Hanover Counties. A USGS storm tide pressure sensor installed on the beach at the Johnnie Mercer Pier in Wrightsville Beach measured a wave-filtered water level of 8.98 ft NAVD88, which converts to about 7.2 ft MHHW. It is likely that this sensor, and in fact many sensors installed on or near the Atlantic Ocean beaches, measured a combination of storm surge and wave setup, the latter of which is a water rise due to successive breaking waves piling water up along the beachfront. A National Ocean Service gauge installed farther out on the pier, roughly 600 to 700 ft from the shore where wave setup would be less of a factor, recorded a storm tide elevation of 5.88 ft NAVD88, about three feet less than that measured by the USGS sensor installed on the beach. The NOS data converts to about 4.1 ft MHHW and

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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).

alone would indicate that about 4 ft of inundation occurred along the coast due to storm surge, but the USGS sensor suggests that another 3 ft of inundation on the beach was the result of wave setup. The combination of storm surge and wave setup resulted in a maximum inundation at the pier of 7 ft above ground level near the high tide line. Farther north, a USGS sensor installed in a wave-protected area on Emerald Isle on Bogue Sound measured a peak water level of 7.76 ft NAVD88, equating to about 7.0 ft MHHW. The nearby NOS gauge in Beaufort, North Carolina, measured a peak water level of 3.8 ft MHHW and had the highest storm surge recorded by a gauge at 5.51 ft above normal tide levels.

Elsewhere, maximum storm surge inundation levels are estimated to have been 3 to 5 ft above ground level from Wrightsville Beach southward to Cape Fear. Storm surge inundation heights of 2 to 4 ft above ground level occurred along the southern North Carolina coast west of Cape Fear and along the Grand Strand of the South Carolina coast north of South Santee River. In South Carolina, the highest water level observation was 6.03 ft NAVD88, which converts to about 3.8 ft MHHW, at a USGS sensor near Murrells Inlet on the Waccamaw River. Storm surge inundation of 2 to 4 ft above ground level also occurred along the ocean side of the North Carolina Outer Banks.

Rainfall and Flooding

Florence produced rainfall exceeding 10 inches across much of southeastern and south-central North Carolina and northeastern South Carolina, with totals exceeding 20 inches from the North Carolina-South Carolina border eastward across southeastern North Carolina, especially along and to the right of the track of the center. The slow forward speed of Florence prior to and after the hurricane made landfall resulted in persistent rainbands moving inland off of the Atlantic Ocean and training over the same area from Wilmington to Elizabethtown, North Carolina, resulting a narrow swath of rainfall totals exceeding 30 inches (Fig. 12). A maximum total rainfall of 35.93 inches was measured about 6 n mi northwest of Elizabethtown, North Carolina (Table 4; Fig. 12), which set a state record for tropical cyclone rainfall. The previous North Carolina rainfall record associated with a tropical cyclone was 24.06 inches in Southport, North Carolina, during Hurricane Floyd in 1999. In addition, a new state rainfall record for South Carolina was set by Florence with 23.63 inches of rain recorded at Loris. This exceeded the previous record total of 17.45 inches from a tropical cyclone measured near Lake Jocassee when Tropical Storm Beryl drenched South Carolina in 1994.

These excessive rains resulted in extensive low-land and river flooding across much of southeastern and south-central North Carolina and northeastern South Carolina, with many rivers exceeding flood stage records that were set during Hurricane Matthew in 2016 (which broke records previously set during Hurricane Floyd in 1999). According to a USGS report, 22 USGS streamgages in North Carolina and 11 in South Carolina measured record setting peak stages as a result of Florence. Of these, 18 in North Carolina and 10 in South Carolina also registered record-setting streamflows – the volume of water moving past a fixed point – called peaks of record. Of these 28 gages where streamflow records were broken, 14 had periods of record of 30 or more years. Another 45 streamgages in North Carolina and four in South Carolina recorded streamflows within the top five measured at those specific sites. These gauges all had water level records stretching back 10 years or more and recorded water levels during Hurricane Florence that were among the top five measured for that site.

Some sites with more than 70 years of historical data set new flood records. The Waccamaw River in Freeland, North Carolina, set a new peak of record on 19 September, with water levels at 22.61 ft, with data going back to 1940. In South Carolina, the Little Pee Dee River in Galivants Ferry set a new peak of record on 21 September, with water levels at 17.21 ft, the largest peak of record in the 77 years a streamgage has operated at that site. Based on a historical floodmark recorded by a resident of Galivants Ferry, it is likely that Hurricane Florence produced the greatest flooding in that area since 1928.

The data used in this analysis came from USGS streamgages affected by Hurricane Florence and from the work of dozens of USGS field crews in the aftermath of Florence. These specialists performed more than 100 streamflow measurements of flooded rivers and streams and collected hundreds of high-water marks across the Carolinas.

Tornadoes

During the period of 13–17 September, Florence's circulation spawned a total of 44 tornadoes across three states in the southeastern United States: North Carolina — 27, Virginia — 11, and South Carolina — 6 (Fig. 17).

Florence produced 27 EF-0 tornadoes (57–74 kt) and 16 EF-1 tornadoes (75–96 kt), which caused mostly minor damage. However, one EF-2 tornado (97–117 kt) occurred around 1938 UTC 17 September, touching down in Chesterfield County just south of Richmond, Virginia. The tornado caused significant damage to structures in the area — overturned cars, numerous downed power lines, and roofs ripped off of buildings. The tornado also caused a commercial building to collapse, resulting in the death of a male victim inside the structure. Another person inside the building incurred a minor injury and was transported to a local hospital.

CASUALTY AND DAMAGE STATISTICS

United States

Florence caused 22 direct deaths[4] in the United States: 15 in North Carolina, 4 in South Carolina, and 3 in Virginia. Of the direct deaths, 17 were due to freshwater flooding, four due to

[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.,

wind and one from the above-mentioned tornado. In addition, Florence was associated with 30 indirect fatalities: 25 in North Carolina and 5 in South Carolina.

The NOAA National Centers for Environmental Information (NCEI) estimates that wind and water damage caused by Florence totaled approximately $24 billion. This makes Florence the ninth-most-destructive hurricane to affect the United States. Approximately 1.1 million customers lost power due to Florence's effects, with 1 million customers having lost power in North Carolina and 100,000 customers experiencing power loss in South Carolina.

Loss of life and specific damage and impacts by state are provided below:

North Carolina

There were 15 direct fatalities in North Carolina due to Florence, 11 due to freshwater flooding and 4 due to wind.

All of the freshwater flooding fatalities in North Carolina involved motor vehicles. In Scotland County, a 73-year old man and a 65-year old man drowned in separate incidents when their cars were submerged. In Duplin County, a 65-year old man drowned in an automobile on NC Highway 111 in Goshen Swamp, a 79-year old woman drowned in a motor vehicle on North Williams Road, and an 81-year old man drowned in a car on Bowden Road near the Duplin/Sampson County line. In Pender County, a 71-year old man drowned when he drove into flood waters on Highsmith Road near Burgaw. In Robeson County, an 83-year old man drowned when he drove into a sinkhole, and a 51-year old woman drove into a washed out road and drowned. In Anson County, a 52-year old man was a passenger in a car that drove into a washed out road and stalled. The passenger drowned while driver escaped the car. In Union County, a 1-year old boy drowned when his parent drove a vehicle around a barricade and into a creek on NC Highway 218, and an 88-year old man drowned when he drove his vehicle into a tributary.

The wind fatalities in North Carolina were all due to falling trees. In New Hanover County, a 41-year old woman and her 7-month old son were killed when a tree fell on their home in Wilmington. In Lenoir County, a 77-year old man was killed when a tree fell on him while he was outside checking on his dogs in Kinston. In Gaston County, a 3-month old boy was killed when a tree fell on a mobile home in the town of Dallas.

Florence was also associated with 25 indirect fatalities in North Carolina. Of these, eight were associated with pre-existing medical conditions, and 17 deaths were due to a combination of carbon monoxide poisonings, accidents (vehicular and otherwise), fires, electrocutions, and cars hitting fallen trees.

Florence's hurricane-force winds uprooted numerous trees and caused widespread power outages throughout much of southeastern North Carolina. However, the primary damage to homes and commercial buildings was caused by freshwater flooding. Almost every major road and highway in the southeastern portion of the state experienced flooding, with large stretches of Interstates 40 and 95, and U.S. highway 70 being impassable for several days even after Florence

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.

had dissipated. At one point, the city of Wilmington was cut off entirely due to the floodwaters. An estimated 74,563 structures were flooded and 5,214 people were rescued from flooding in the state. Nearly 140,000 residents registered for disaster assistance after the storm.

Field crops, especially flue-cured tobacco, soybeans, sweet potatoes, corn, and cotton, accounted for most of the North Carolina's agricultural losses. The state's estimated agricultural losses include forestry and fishery losses, and damage to farm buildings, equipment, and infrastructure. Disposal of dead livestock was also factored in, and losses were at least $20 million (USD). Media reports indicate that Hurricane Florence killed 3.5 million poultry and 5,500 hogs.

Storm surge and exceptionally high rainfall totals produced catastrophic flooding across much of southeastern and eastern North Carolina. The hardest hit areas included New Bern, Newport, Belhaven, Oriental, North Topsail Beach and Jacksonville, along with portions of Carteret County. Florence also produced extensive wind damage along the North Carolina coast from Cape Lookout southwestward across Carteret, Onslow, Pender, and New Hanover counties. Thousands of downed trees caused widespread power outages to nearly all of eastern North Carolina. Gusty winds and heavy rainfall also caused significant impacts well inland across much of the remainder of the state.

In Pender County, Florence caused the worst flooding in local history. Widespread flash flooding on 14–15 September closed many roads and inundated neighborhoods, resulting in 350 rescues. Record river flooding inundated many homes and businesses outside of the 500-year floodplain with 3 to 4 feet of water. Over 1,000 people were rescued by boat, helicopter, or Humvee, and there were 3,882 flood-damaged structures across the county, including 96 completely destroyed. Interstate 40 was closed for several days, and NC Highway 53 was covered with seven feet of water. High water levels in the Cape Fear River backed up the Black River and Moores Creek, leading to exceptional flooding in the Currie and Canetuck communities. The town of Atkinson was isolated by high water. U.S. Highway 421 near the New Hanover County line was washed out over a 300-foot expanse as the Cape Fear River flowed into the Northeast Cape Fear River. High winds caused significant damage to trees and power lines, and around 97 percent of customers were without power.

In Surf City, dunes were destroyed and much of the sand was removed from the beach and deposited up to four feet deep over two blocks inland (Figure 13). At the north end of Surf City, some homes were filled with sand 4 to 5 feet deep. At least 75 percent of homes suffered some damage, but only 20 homes suffered severe damage. Approximately 150 feet at the end of the Surf City Ocean Pier was torn off. Many homes had damage to roofs and siding on Topsail Island, and commercial power was completely disrupted to the island.

In New Hanover County, widespread flash flooding on 14–15 September closed many roads and inundated neighborhoods. Up to 3 feet of water entered homes in the Northchase neighborhood and 350 water rescues were performed in Wrightsboro and Ogden. The Cape Fear River flooded portions of downtown Wilmington with water over two feet deep. New Hanover County and Wilmington were isolated from the outside world for several days as every access route including Interstate 40, and U.S. Highways 17, 74, 76, and 421 were closed due to flooding. Over 22 million gallons of untreated sewage overflowed into area waterways.

Strong winds blew down a large number of trees and power lines, cutting electricity to over 90 percent of the county. Many homes and businesses suffered wind damage to roofs, garage doors, and siding, and roads were blocked due to downed trees. There was damage to every school building in the county and the UNC-Wilmington campus suffered $140 million in damage. In Carolina Beach and Kure Beach, significant beach erosion cut escarpments up to 10 feet high into the dune face. The southern end of Masonboro Island was overwashed, and 15 to 20 feet of dunes were lost on the north end of the island.

In Brunswick County, widespread flash flooding resulted in flooded neighborhoods and closing many roads including portions of U.S. Highway 17 and NC Highway 87. Extremely high water in Town Creek flooded 30 homes in the Stoney Creek neighborhood. Sanford Dam at Boiling Spring Lakes, built in 1961, was breached, destroying Alton Lennon Drive and flooding one structure. NC Highway 133 was closed due to flooding in several locations. High winds downed trees and power lines across the area. In Southport, falling trees damaged homes, businesses, and churches. Caswell Beach suffered downed trees and a loss of water and sewer service. On Bald Head Island substantial beach erosion occurred, followed by longer-term flooding due to high water levels on the Cape Fear River. Power to the island was out for two weeks and ferry service was unavailable. Over 80 percent of the county was without power.

In Columbus County, the town of Fair Bluff was flooded by the Lumber River, separating the town into two isolated sections. NC Highways 87 and 11 in Riegelwood were closed due to flooding. The Coast Guard rescued 116 people from floodwaters in the Crusoe community on September 18. Homes on Tank Water Road were flooded up to the rooflines and swift water rescues were necessary. In Tabor City, 15 residents were rescued from flooding during the night of 16 September. On Lake Waccamaw, large waves and a seiche flooded homes along the lakefront. Numerous trees, boats, and docks broke loose in the high water and battered homes along the shoreline. Around 80 percent of homes suffered damage due to falling trees, flooding, or battering from floating debris in the water. Damage to trees from high winds was extensive, particularly in the eastern end of the County.

In Bladen County, flash flooding closed many roads and highways during and immediately after the hurricane. In Bladenboro store windows were broken by floodwaters, and a railroad track and its roadbed were washed away. The entire town of Kelly was evacuated whenwhen a 30-foot wide breach opened in a dike along the Cape Fear River. Many trees and power lines were blown down by the wind.

In Robeson County, flash flooding closed a 9-mile stretch of Interstate 95 on 16 September, and the closure expanded to nearly 60 miles by 19 September between Lumberton and Benson, North Carolina, with the intestate not reopening until 23 September. The Mayfair neighborhood just north of Lumberton was flooded with water up to eight feet deep. Significant flooding in Pembroke flooded many homes and isolated neighborhoods. Over 500 structures were damaged. Nearly two million gallons of sewage spilled in Lumberton and St. Pauls, affecting great Marsh Swamp and the Lumber River. Over 75 percent of customers lost power.

In Jones County, historic flooding occurred along the Trent River in Trenton and Pollocksville. Numerous water rescues were performed throughout the county, as water quickly inundated hundreds of homes. In Duplin County, heavy rainfall initially led to flash flooding and numerous road washouts. The northeast Cape Fear River rose rapidly, flooding countless roadways and homes along and far away from the river with numerous tributaries flooding as well. Portions of Interstate 40 were closed near Wallace due to flooding.

In Onslow County, devastating flooding in the upper reaches of the New River inundated hundreds of homes. In Lenoir County, U.S. Highway 70 was closed in Kinston for several days as floodwaters inundated numerous homes and businesses. In Craven County, many homes and roads were inundated on the north side of the Neuse River above New Bern (Fig. 14).

Rainfall across Carteret County led to flooding of the Newport River for the first time in recent history, as the river overflowed its banks and inundated many homes and businesses, resulting in hundreds of water rescues. U.S. Highway 70 was closed in numerous spots between Havelock and Morehead City due to floodwaters.

In central North Carolina, heavy rainfall caused widespread flooding, inundating cities such as Fayetteville, Smithfield, Goldsboro, Durham, and Chapel Hill, and causing major river flooding on the Neuse, Cape Fear, and Little rivers. Most major roads and highways in the area experienced some flooding, with large stretches of I-40 and I-95 remaining impassable for days after the storm passed. In Sampson County, 81 roads were flooded and multiple swift water rescues were conducted. Water rescues or evacuations also occurred in Anson, Randolph, Orange, and Guilford counties. Frequent wind gusts of 40–60 mph resulted in tree damage across much of the region, including to homes, cars, power lines, and other structures.

Heavy rainfall caused flash flooding across portions of west-central and northwest North Carolina, as Florence and its remnants moved through the southern Appalachians. In addition to the heavy rain and flooding, gusty winds combined with saturated ground caused numerous uprooted trees and scattered power outages.

Damage losses in North Carolina due to Florence's winds, freshwater flooding, and storm surge flooding totaled $22 billion.

South Carolina

In South Carolina, there were four direct fatalities from Florence, all from freshwater flooding and all vehicle related.

In Horry County, two medical patients, a 43-year old woman and a 45-year old woman, drowned while being transported in a van that was driven around a barricade into flooded waters, and an 81-year old man drowned when his vehicle was swept off the roadway. In Georgetown County, a 23-year old man drove into a flooded area and drowned.

There were also five indirect deaths associated with Florence in South Carolina due to carbon monoxide poisoning and auto accidents.

Due to Florence weakening after moving inland near Wrightsville Beach and Wilmington, North Carolina, wind damage across the extreme eastern portion of South Carolina was minimal and was mainly due to downed trees and powerlines. However, heavy rainfall over the eastern half of the state, including the mountains, produced significant lowland and river flooding.

South Carolina Emergency Management reported 11,386 homes with moderate or major damage across the state, 455,000 people evacuated, and 11 dams breached or failed.

In Horry County, over 100 people were rescued from flooded homes and cars in the town of Loris. Nearly 1,000 homes and businesses near the Waccamaw River in Conway were flooded. On 26 September, raw sewage flowed from the Conway Wastewater Treatment Plant into a tributary that feeds into the Waccamaw River. The community of Dongola in western Horry County was isolated for 10 days. The Silver Fox Landing Development near the Intracoastal Waterway had water up to eight feet deep in homes. A number of trees were blown down by high winds across the northern half of Horry County. Around 80,000 customers were without power across the Grand Strand area. Relatively minor damage was reported to roofs, awnings, siding, and fences.

Horry County Emergency Management reported that 361 homes in Conway and 1,580 homes in the rural portion of the county were damaged while 261 roads suffered damage or were washed out by flooding.

Flooding was particularly severe in the Britton's Neck and Gresham communities in Marlboro County where numerous evacuations occurred. In the town of Nichols approximately 150 homes recently rebuilt after flooding from Hurricane Matthew were damaged again. Generally minor damage occurred to trees. At the storm's peak around 3,400 customers were without power across Marlboro County. Emergency Management officials were aware of six buildings destroyed and approximately 200 more damaged across the county.

Flooding along the Lynches River in Florence County prompted the evacuation of 2,500 residents on 21 September. Flooding on the Great Pee Dee River shut down a portion of the city of Florence's municipal water system on September 24. In Darlington County, 23 county maintained roads were damaged due to the hurricane and a bridge on New Hopewell Road collapsed. Flooding damaged approximately 400 homes throughout Dillon County.

In Georgetown County, flood waves on the Waccamaw and Great Pee Dee rivers reached Georgetown almost two weeks after Hurricane Florence's landfall, causing flooding of low areas around downtown Georgetown across several tide cycles. Particularly high water levels on September 28 flooded Constitution Park along Orange Street and covered Front Street. There were some power outages during the storm, but buildings, piers, and beaches were largely undamaged.

Interstate 95 was closed in South Carolina for several days after the storm due to flooding from the Pee Dee River; before reopening on 21 September.

Damage losses due to Florence’s effects in South Carolina totaled $2 billion.

Virginia

In Virginia, there were three direct fatalities due to Florence, two from freshwater flooding and one from a tornado.

In Roanoke, a 53-year old woman drowned in the Roanoke River, while a male drowned in Louisa County when his pickup truck was caught in flood waters. A 60-year old male was killed in Chesterfield when a warehouse building where he worked collapsed in a tornado, which was rated EF-2 in that area.

Heavy rainfall across much of Virginia caused multiple incidents of flash flooding and minor to moderate flooding along portions of the Dan, Roanoke, and New rivers. Gusty winds combined with saturated ground caused numerous uprooting of trees and scattered power outages.

Florence caused $200 million in damage across Virginia.

Georgia

Florence had weakened significantly and was barely a tropical storm when the center passed near the Georgia-South Carolina border on 16 September. As a result, wind damage was minimal and was mainly confined to uprooted trees and downed powerlines in the extreme northeastern part of the state where wind gusts of around 45 kt were measured. Most of Georgia remained in the southwestern semicircle of Florence's circulation, which was the relatively dry side of the storm, limiting precipitation to isolated brief heavy rains in those counties along the border with South Carolina. The result was minor flooding there, especially in the mountains.

In Georgia, damages caused by Florence totaled $30 million.

Cabo Verde Islands

Florence's outer bands brought rainfall and gusty wind to portions of southern Cabo Verde while passing to the south of the archipelago as a tropical depression. While some landslides and flooding occurred, no major damage was reported, and no fatalities were reported.

FORECAST AND WARNING CRITIQUE

Genesis

The genesis of Florence was well forecast, especially for a system that developed so close to the west coast of Africa. The disturbance from which Florence developed was first introduced in the Tropical Weather Outlook 84 h prior to genesis (Table 2) with a low probability (<40%) of formation during the ensuing 120-h period. This occurred on 28 August when the system was located more than 600 n mi inland over southern Mali in western Africa and more than 900 n mi east of the Cabo Verde archipelago. The probabilities were increased into the medium (40%-

60%) and high (>60%) categories 54 h and 42 h, respectively, before formation of a tropical cyclone occurred. In the 48-h genesis period, the disturbance was mentioned as having low, medium, and high probabilities of formation 54 h, 42 h, and 30 h, respectively, before the cyclone developed into a tropical depression.

Potential Tropical Cyclone advisories were initiated at 1500 UTC 30 August when the pre-Florence disturbance was centered about 370 n mi east-southeast of the southernmost Cabo Verde Islands. The government of the Cabo Verde Islands issuing a Tropical Storm Warning for the southern islands of Santiago, Fogo, and Brava at that time.

Track

A verification of NHC official track forecasts (OFCL) for Florence is given in Table 5a. Official forecast track errors were much lower than the mean official errors for the previous 5-yr period at all forecast times, especially at 12, 48, and 72 h where OFCL errors were more than 20% better than average. Forecast track errors for the statistical-climatological model OCD5 were significantly larger than the 5-yr average errors, an indication that Florence was more difficult than normal to forecast. NHC track forecasts successfully predicted that Florence would not recurve through the subtropical ridge (Fig. 15) like a few of the 4-5 September ECMWF (EMXI) model runs indicated (not shown). Furthermore, OFCL track forecasts within 5 days of landfall were particularly skillful. Cross-track errors around the landfall point near Wrightsville Beach, North Carolina, were less than 120 n mi for the 78-120 h forecast times, but decreased to less than 60 n mi for the forecast cycles 6-72 h prior to landfall (Fig. 16). A homogeneous comparison of the official track errors with selected guidance models is given in Table 5b. NHC track forecast errors were comparable to or better than all of the global and regional dynamical models, and also the corrected consensus models HCCA and FSSE. OFCL forecasts were comparable to the simple consensus models TVCA, TVCE, TVCX, TCON, GFEX through 72 h, and were outperformed by those models at 96 h and 120 h.

Intensity

A verification of NHC OFCL intensity forecasts for Florence is given in Table 6a. Official forecast intensity errors were greater than the mean official errors for the previous 5-yr period at all times except for the 120-h period where OFCL errors were slightly lower than average. These errors were due to mixed biases — the early intensity forecasts had a low bias due to not predicting the first RI period, with post-RI forecasts having a high bias due to not anticipating the rapid weakening the followed that event. However, the second RI period was anticipated and thus better forecast, albeit the time of peak intensity was about 18h later and 10 kt higher than what occurred. Similar to the first post-RI weakening trend, the degree of weakening during the second post-RI period was not captured well, resulting in a pronounced high bias (Fig. 18). Unlike the weakening trend that followed the first RI episode where strong southwesterly vertical wind shear was the primary weakening factor (Fig. 4), the weakening that occurred after Florence's second RI event was due to an unanticipated eyewall replacement cycle. For comparison, forecast intensity errors for the statistical-climatological model OCD5 were significantly larger than the 5-yr average errors — by 20–30% at all times — indicating that Florence was more difficult than normal to forecast. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 6b. Although the OFCL intensity errors were larger than average, they were still skillful compared to the available model guidance. OFCL forecasts were comparable to or better than all of the models at all forecast times, except for the corrected consensus models HCCA and FSSE, and the simple consensus models ICON and IVCN.

Watches and Warnings

Coastal watches and warnings associated with Florence are given in Table 7. A hurricane watch was first issued for the coasts of South Carolina and North from Edisto Beach to the North Carolina-Virginia border at 0900 UTC 11 September. Since sustained tropical-storm-force winds first reached the North Carolina coast within the hurricane watch area around 1200 UTC 13 September, a lead time of 51 h was provided. A hurricane warning was issued for the South Carolina and North Carolina coastal areas from South Santee River to Duck at 2100 UTC 11 September, 39 h before the arrival of tropical storm force winds within the warning area. Tropical storm watches and warnings were issued at various times after 2100 UTC 11 September for the Virginia coast from North Carolina-Virginia border northward to the mouth of the Chesapeake Bay. Cape Henry, Virginia, reported sustained tropical-storm-force winds at 0836 UTC 14 September, resulting in a lead time of at least 59 h.

The NWS issued storm surge warnings from Duck, North Carolina, southward to South Santee River, South Carolina, as well as Pamlico Sound (and the adjacent Neuse and Pamlico Rivers) and western and southern Albemarle Sound (Fig. 11). Storm surge watches were in effect for other portions of the coast south of South Santee River to Edisto Beach, South Carolina, and north of Duck to the North Carolina/Virginia border, including northern portions of Albemarle Sound. The NWS issued the initial storm surge watch for Florence from the North Carolina/Virginia border to Edisto Beach, South Carolina (and the adjacent sounds) at 0900 UTC 11 September. Since sustained tropical-storm-force winds are estimated to have first arrived along the coast of North Carolina around 1200 UTC 13 September, the watch provided a lead time of about 51 h. The initial storm surge warning was issued 12 h later at 2100 UTC 11 September, providing a lead time of 39 h before the onset of tropical-storm-force winds. Water level observations, mainly from USGS storm tide pressure sensors and high water mark surveys, indicate that at least 3 ft of inundation (which NHC uses as a first-cut threshold for the storm surge watch/warning) occurred at locations within the bounds of the storm surge warning.

NHC's first forecast for maximum storm surge inundation heights (coincident with the issuance of the Storm Surge Watch at 0900 UTC 11 September) was 6 to 12 ft above ground level between Cape Fear and Cape Lookout, North Carolina, including Pamlico Sound near the Neuse and Pamlico Rivers. When the Storm Surge Warning was issued at 2100 UTC 11 September, the maximum storm surge inundation forecast was raised to 9 to 13 ft above ground level in the same area. Since Florence's intensity and the intensity forecast gradually decreased during the hurricane's later stages of approach to the North Carolina coast, NHC slightly lowered the maximum inundation forecast to 7 to 11 ft above ground level. However, the potential storm surge risk remained significant due to Florence's growing size and slow forward speed offsetting the decrease in intensity. Although the updated forecast on the afternoon of 11 September turned out to be slightly high, the maximum observed inundation height of 10.4 ft MHHW near New Bern and post-storm simulations of Florence's surge indicate that overall the storm surge forecasts were accurate.

The NHC Potential Storm Surge Flooding Map issued before Florence's arrival to the Carolina coast provided an accurate portrayal of the storm surge inundation risk in the area that received the worst coastal flooding. Figure 9a shows a portion of the Potential Storm Surge Flooding Map issued at 0900 UTC 11 September for western Pamlico Sound and the Neuse River (coincident with the initial Storm Surge Watch), conveying a "reasonable worst case scenario" of the type of flooding people in the area should have prepared for. When compared with the post-storm hindcast (Fig. 9b), the initial Potential Storm Surge Flooding Map's inundation values were slightly high (which is not unexpected), but the map provided an accurate representation of the ultimate storm surge footprint and a depiction of the areas most at risk of the highest storm surge despite the hurricane's evolving structure and intensity.

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

NHC began providing impact-based decision support services (IDSS) to emergency managers on 7 September when Florence was a tropical storm over the open waters of the Atlantic, a week before eventual landfall in North Carolina. The IDSS continued through 16 September when Florence had weakened to a tropical depression over inland South Carolina. NHC's IDSS included calls and briefings coordinated through the FEMA Hurricane Liaison Team (HLT) embedded at the NHC. These calls and briefings included the states of South Carolina, North Carolina, and Virginia; FEMA Headquarters, FEMA Region 4, and FEMA Region 3; as well as numerous federal and state video-teleconferences. On 7 September, prior to the availability of operational storm surge products, the NHC storm surge unit began working with the FEMA HLT to provide storm surge guidance to North Carolina, South Carolina, and Virginia. Direct support continued throughout the event and served as a resource to emergency managers ahead of landfall. In addition, there was a large-scale collaborative IDSS effort across the NWS and NOAA in response to the widespread freshwater flooding due to Florence.

NHC's Tropical Analysis and Forecast Branch provided IDSS briefings to District 7 of the U.S. Coast Guard on 10 September, when Florence was forecast to reach the District's Search and Rescue Regions. Five briefings were provided to the District through 13 September in support of their life saving mission.

The NHC media pool was in operation from 10–14 September for Florence. A limited pool opened on 10 September from 7:00 AM to 9:30 AM EDT, followed by the full media pool that opened at 7:00 AM EDT 11 September and closed at 12:05 PM EDT 14 September. Overall, NHC provided 256 live interviews through the pool, including 101 to national TV networks, 23 with local TV stations in the affected areas, 71 to Spanish language TV and via Skype, 59 generic summaries made available to all users, and 2 print interviews on site. Facebook Live was also used to provide 16 video updates during the event, which garnered more than 1.5 million views. On social media, NHC had nearly 6 million Facebook post engagements, while the @NHC_Atlantic Twitter account had more than 73 million impressions. Approximately 16.8 million users accessed the NHC website between 30 August and 18 September. A total of 257 million pages were viewed during this period, with a majority of the views going to graphical products such as the cone graphic, the wind speed probabilities, and the key messages.

Acknowledgements

Special thanks to Senior Hurricane Specialist John Cangialosi for the Florence 'best track' map, David Roth from NOAA-Weather Prediction Center (WPC) for providing the U.S. rainfall graphic, Hurricane Specialist Robbie Berg for the storm surge analysis and input,and the NHC Storm Surge Unit for providing valuable analysis and figures concerning U.S. coastal flooding caused by Florence's storm surge. Data in Table 3 were compiled from Post-Tropical Cyclone Reports issued by the NWS Forecast Offices (WFO) in Charleston, Greenville-Spartanburg, Blacksburg, Wilmington, Newport/Morehead City, Raleigh, and Wakefield. Data from the Weather Prediction Center, National Data Buoy Center, NOS Center for Operational Oceanographic Products and Services, United States Geological Survey, and the Storm Prediction Center were also included in this report.

Table 1. Best track for Hurricane Florence, 31 August–17 September 2018.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
30 / 0600	12.8	16.9	1008	20	low
30 / 1200	12.8	17.9	1007	25	"
30 / 1800	12.8	19.0	1007	25	"
31 / 0000	13.1	20.2	1006	30	"
31 / 0600	13.4	21.4	1006	30	"
31 / 1200	13.6	22.6	1006	30	"
31 / 1800	13.8	23.8	1006	30	tropical depression
01 / 0000	14.0	24.9	1006	30	"
01 / 0600	14.3	26.1	1005	35	tropical storm
01 / 1200	14.8	27.2	1004	35	"
01 / 1800	15.4	28.3	1002	40	"
02 / 0000	15.9	29.6	1000	45	"
02 / 0600	16.4	30.9	999	50	"
02 / 1200	16.8	32.4	998	50	"
02 / 1800	17.1	33.8	998	50	"
03 / 0000	17.6	35.2	997	50	"
03 / 0600	17.9	36.6	997	50	"
03 / 1200	18.2	38.0	996	55	"
03 / 1800	18.4	39.2	993	60	"
04 / 0000	18.7	40.2	990	65	hurricane
04 / 0600	19.1	41.2	989	65	"
04 / 1200	19.5	42.0	986	70	"
04 / 1800	20.0	42.7	982	75	"
05 / 0000	20.4	43.4	975	85	"
05 / 0600	21.1	44.3	968	95	"
05 / 1200	21.7	45.2	960	105	"
05 / 1800	22.4	46.2	950	115	"
06 / 0000	23.1	46.9	950	115	"
06 / 0600	23.8	47.6	958	105	"

06 / 1200	24.4	48.2	970	90	"
06 / 1800	24.8	49.0	980	75	"
07 / 0000	25.0	49.6	990	60	tropical storm
07 / 0600	25.0	50.3	992	55	"
07 / 1200	24.9	51.1	993	55	"
07 / 1800	24.8	52.0	993	55	"
08 / 0000	24.7	52.9	993	55	"
08 / 0600	24.6	53.6	993	55	"
08 / 1200	24.6	54.1	992	55	"
08 / 1800	24.6	54.5	989	60	"
09 / 0000	24.5	55.0	989	60	"
09 / 0600	24.4	55.5	988	60	"
09 / 1200	24.4	56.1	984	65	hurricane
09 / 1800	24.4	56.7	979	70	"
10 / 0000	24.5	57.3	973	80	"
10 / 0600	24.7	58.4	967	90	"
10 / 1200	24.9	59.5	954	105	"
10 / 1800	25.2	60.6	940	120	"
11 / 0000	25.6	61.8	944	115	"
11 / 0600	26.0	63.2	950	115	"
11 / 1200	26.5	64.7	947	125	"
11 / 1800	27.2	66.4	937	130	"
12 / 0000	27.9	68.1	943	120	"
12 / 0600	28.7	69.5	945	115	"
12 / 1200	29.4	70.7	945	115	"
12 / 1800	30.4	71.9	949	110	"
13 / 0000	31.5	73.2	955	105	"
13 / 0600	32.4	74.2	955	100	"
13 / 1200	33.1	75.1	954	95	"
13 / 1800	33.6	76.0	953	90	"
14 / 0000	34.0	76.5	952	90	"
14 / 0600	34.2	77.2	952	85	"
14 / 1115	34.2	77.8	956	80	"

14 / 1200	34.1	77.9	957	80	"
14 / 1800	34.0	78.4	969	65	"
15 / 0000	33.9	78.8	978	60	tropical storm
15 / 0600	33.7	79.3	986	55	"
15 / 1200	33.6	79.5	992	55	"
15 / 1800	33.6	79.8	997	50	"
16 / 0000	33.6	80.2	998	45	"
16 / 0600	33.6	80.8	999	40	"
16 / 1200	33.6	81.5	1002	35	"
16 / 1800	34.1	82.1	1006	30	tropical depression
17 / 0000	35.0	82.2	1007	25	"
17 / 0600	36.4	82.6	1008	25	"
17 / 1200	37.8	82.2	1008	25	extratropical
17 / 1800	38.8	82.0	1008	25	"
18 / 0000	39.5	80.5	1008	25	"
18 / 0600	41.3	76.8	1007	25	"
18 / 1200	42.2	73.3	1006	25	"
18 / 1800					dissipated
14 / 1115	34.2	77.8	956	80	landfall near Wrightsville Beach, North Carolina
11 / 1800	27.2	66.4	937	130	minimum pressure and maximum intensity

Table 2. 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%)	54	84
Medium (40%-60%)	42	54
High (>60%)	30	42

Table 3. Selected ship and buoy reports with winds of at least 34 kt or minimum pressures associated with Hurricane Florence, 31 August–17 September 2018.

Date/Time (UTC)	Ship/Buoy call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
13 / 0320	41002[a]	31.8	74.8	320 / 41	997.2
13 / 0450	41002[a]	31.8	74.8	310 / 45	992.2
13 / 0520	41002[a]	31.8	74.8	300 / 43	992.0
13 / 0600	41002[a]	31.8	74.8	290 / 45[d]	992.7
13 / 1220	41002[a]	31.8	74.8	220 / 35	1003.2
15 / 0224	41004[a]	32.5	79.1	240 / 35G47	
15 / 0530	41004[a]	32.5	79.1	240 / 35	1000.6
15 / 0730	41004[a]	32.5	79.1	239 / 31	1000.0[d]
14 / 0350	41013[c]	33.4	77.7	270 / 49	993.0
14 / 0400	41013[c]	33.4	77.7	280 / 49	993.1
14 / 0410	41013[c]	33.4	77.7	270 / 49	993.0
14 / 0420	41013[c]	33.4	77.7	270 / 49	992.9
14 / 0440	41013[c]	33.4	77.7	280 / 51G72	992.7
14 / 0450	41013[c]	33.4	77.7	280 / 49	992.9
14 / 0510	41013[c]	33.4	77.7	270 / 49	992.8
14 / 0530	41013[c]	33.4	77.7	270 / 49	992.7
14 / 0550	41013[c]	33.4	77.7	270 / 49	992.7
14 / 0600	41013[c]	33.4	77.7	270 / 49	992.3
14 / 1250	41013[c]	33.4	77.7	220 / 47	989.2
14 / 1300	41013[c]	33.4	77.7	220 / 47	989.4
14 / 1808	41024[a]	33.8	78.5	280 / 43	977.8
14 / 1908	41024[a]	33.8	78.5	270 / 39G60	977.6
14 / 2008	41024[a]	33.8	78.5	260 / 37	977.9
14 / 2108	41024[a]	33.8	78.5	240 / 37	977.4
14 / 2208	41024[a]	33.8	78.5	220 / 37	979.1
13 / 1910	41025[c]	35.0	75.4	070 / 43	1003.8
13 / 1920	41025[c]	35.0	75.4	070 / 45	1003.1
13 / 1930	41025[c]	35.0	75.4	070 / 45	1003.5
13 / 2020	41025[c]	35.0	75.4	080 / 45[d]G66	1004.8
13 / 2350	41025[c]	35.0	75.4	090 / 41	1003.4

15 / 0408	41029[a]	32.8	79.6	280 / 29G44	1000.6
15 / 0808	41029[a]	32.8	79.6		997.0
14 / 0108	41037[a]	34.0	77.4	020 / 47	992.6
14 / 0208	41037[a]	34.0	77.4	030 / 45	992.6
14 / 0308	41037[a]	34.0	77.4	350 / 47	992.6
14 / 0408	41037[a]	34.0	77.4	360 / 49	992.6
14 / 0508	41037[a]	34.0	77.4	230 / 51	992.6
14 / 0608	41037[a]	34.0	77.4	230 / 51[d]G84	992.6
14 / 0708	41037[a]	34.0	77.4	220 / 49	992.6
14 / 1308	41037[a]	34.0	77.4	170 / 45	982.5
14 / 0808	41038[a]	34.1	77.7	360 / 47	981.0
14 / 0908	41038[a]	34.1	77.7	360 / 49G74	976.4
14 / 1008	41038[a]	34.1	77.7	360 / 49[d]	976.4
14 / 1208	41038[a]	34.1	77.7	051 / 34	971.6
14 / 1308	41038[a]	34.1	77.7	170 / 37	964.4
14 / 1408	41038[a]	34.1	77.7	130 / 41	966.0
14 / 1508	41038[a]	34.1	77.7	140 / 39	976.6
14 / 1608	41038[a]	34.1	77.7	140 / 39	978.2
14 / 1708	41038[a]	34.1	77.7	140 / 39	976.7
14 / 1808	41038[a]	34.1	77.7	140 / 39	977.2
14 / 1908	41038[a]	34.1	77.7	140 / 43	977.3
14 / 2208	41038[a]	34.1	77.7	130 / 35	977.0
14 / 2008	41038[a]	34.1	77.7	140 / 37	981.2
14 / 2108	41038[a]	34.1	77.7	130 / 39	979.1
14 / 2308	41038[a]	34.1	77.7	130 / 37	984.8
15 / 0008	41038[a]	34.1	77.7	130 / 35	984.1
15 / 0108	41038[a]	34.1	77.7	130 / 35	980.6
15 / 0308	41038[a]	34.1	77.7	140 / 35	976.0
11 / 0900	41049[b]	27.5	62.9	100 / 35	1007.5[d]
11 / 1010	41049[b]	27.5	62.9	110 / 35[d]	1009.4
13 / 1800	41063[b]	34.8	75.9	100 / 45	
14 / 0000	41063[b]	34.8	75.9	120 / 47	
14 / 0100	41063[b]	34.8	75.9	130 / 51G62	

13 / 2308	41064[a]	34.2	76.9	060 / 47G97	981.8
14 / 0008	41064[a]	34.2	76.9	060 / 43	977.5
14 / 0108	41064[a]	34.2	76.9	060 / 45	972.7
14 / 0208	41064[a]	34.2	76.9	060 / 45	967.5
14 / 0408	41064[a]	34.2	76.9	140 / 33	956.0
14 / 0508	41064[a]	34.2	76.9	140 / 41	960.2
14 / 0608	41064[a]	34.2	76.9	166 / 37	956.1
14 / 0708	41064[a]	34.2	76.9	160 / 45	961.0
14 / 0808	41064[a]	34.2	76.9	170 / 41	972.6
14 / 0908	41064[a]	34.2	76.9	170 / 41	977.3
14 / 0100	H3WI	39.8	73.1	050 / 35	1021.2
14 / 0300	H3WI	39.4	72.5	050 / 35[d]	1021.2
18 / 1600	VCLM	46.9	70.8	060 / 38	1008.5

[a] Anemometer height 3 meters.
[b] Anemometer height 3.5 meters.
[c] Anemometer height 4 meters..
[d] Last of several occurrences.
Buoy averaging periods are 8 min unless noted otherwise.

Table 4. Selected surface observations for Hurricane Florence, 31 August–17 September 2018.

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)				
United States									
Connecticut									
ICAO Sites									
Sikorsky Memorial Airport/Bridgeport (KBDR) (41.16N 73.13W)									2.00
Tweed-New Haven Airport (KHVN) (41.26N 72.89W)									2.14
Other									
Norfolk 2 SW - NWS NEEP site (NFKC3) (41.97N 73.22W)									2.61
West Thompson - Quinebaug River (WTHC3) (41.94N 71.90W)									2.91
West Thompson (WTPC3) (41.95N 71.90W)									2.84
Delaware									
ICAO Sites									
Delaware Coastal Airport/Georgetown (KGED) (38.69N 75.36W)									1.11
Wilmington-New Castle Airport (KILG) (39.68N 75.61W)									0.44
District of Columbia									
ICAO Sites									
Reagan National Airport (KDCA) (38.85N 77.04W)									1.48

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)				
Other									
Washington 3 ENE (NARD2) (38.90N 76.97W)									1.55
Georgia									
ICAO Sites									
Daniel Field Airport – Augusta (KDNL) (33.47N 82.04W)									0.91
NOS Sites									
Fort Pulaski Tide Gage (8670870-FPKG1) (32.03N 80.90W)	15/2230	1005.0	15/1554	27 (7 m)	36	1.63	4.93	1.5	
Weatherflow Sites									
Tybee Island-South (GA) (XTYE) (31.99N 80.85W)	15/2037	1002.0	15/2037		36				
Other									
Clayton 1 SSW (CLNG1) (34.87N 83.40W)									1.38
Kentucky									
HADS									
Cumberland (CMBK2) (36.97N 82.99W)									1.79
Grayson (GYLK2) (38.25N 82.98W)									1.65
Willard (WLLK2) (38.18N 82.90W)									1.66
RAWS									
Davella 4 SW (BSAK2) (37.80N 82.63W)									1.62
Other									
Middletown (MDTK2) (38.15N 84.12W)									2.05

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)				
Maryland									
ICAO Sites									
Ocean City Municipal Airport (KOXB) (38.31N 75.12W)									0.84
Salisbury–Ocean City–Wicomico Reg. Airport (KSBY) (38.34N 75.51W)									1.06
CoCoRaHS Sites									
Baltimore 1.7S (MD-BC-6) (39.16N 76.61W)									4.46
Beltsville 1.4 NNW (MD-PG-82) (39.05N 76.93W)									3.57
Berlin 5.9 NNE (MD-WR-22) (38.40N 75.16W)									5.34
Catonville 1.2 NW (MD-BL-39) (39.28N 76.76W)									3.31
Columbia 0.7 W (MD-HW-42) (38.15N 75.95W)									3.18
Elkridge 1.8 W (MD-HW-3) (39.20N 76.78SW)									3.11
Elkton 6.8 N (MD-CC-18) (39.70N 75.84W)									4.83
Elkton 7.0 NNW (MD-CC-10) (39.70N 75.87W)									6.02
Kingsville 2.5 NNE (MD-CC-18) (39.70N 75.84W)									4.38
Laurel 2.7 E (MD-AA-3) (39.10N 76.81W)									3.62
Linthicum 0.4 NNE (MD-HR-6) (39.48N 76.39W)									4.96

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Mount Washington 0.5 N (MD-BC-3) (39.37N 76.66W)									3.05
Silver Spring 1.4 ENE (MD-MG-1) (39.00N 77.02W)									4.22
Silver Spring 2.1 NNE (MD-MG-1) (39.04N 77.00W)									4.05
White Oak 1.2 N (MD-MG-2) (39.06N 76.99W)									3.52
Other									
Maryland Science Center (DMH) (39.28N 76.61W)									4.47
Maine									
Other									
Eliot 2 S (ELTM1) (43.10N 70.76W)									3.13
York Village 6 N (NEDM1) (43.24N 70.64W)									1.71
Massachusetts									
ICAO Sites									
Fitchburg Municipal Airport (KFIT) (42.55N 71.76W)									3.49
Orange Municipal Airport (KORE) (42.57N 72.29W)									3.14
Norwood Memorial Airport (KOWD) (42.19N 71.17W)									3.22
HADS									
Barre Falls Dam (BRRM3) (42.43N 72.03W)									3.13
Royalson (RYLM3) (42.47N 72.13W)									3.44

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)C	Storm tide (ft)D	Estimated Inundation (ft)E	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)A	Sustained (kt)B	Gust (kt)				
Other									
Birch Hill Dam (BIRM3) (42.63N 72.12W)									3.41
Hubbardstown (BARM3) (42.43N 72.03W)									3.12
Lawrence (LWMM3) (42.70N 71.17W)									3.06
Sunderland (SDLM3) (42.45N 72.55W)									3.04
Tully Lake Dam USACOE (TLLM3) (42.63N 72.22W)									3.44
Walpole 1 NNE Co-Op (WALM3) (42.17N 71.25W)									3.57
New Hampshire									
ICAO Sites									
Jaffrey Municipal Arpt (KAFN) (42.80N 72.00W)									2.53
Manchester-Boston Regional Arpt (KMHT) (42.93N 71.43W)									3.87
Others									
Epping 1 WSW (EPPN3) (43.03N 71.08W)									4.01
Greenville (GREN3) (42.78N 71.80W)									2.95
Macdowell Dam (MACN3) (42.90N 71.98W)									2.65
Manchester 3 E (MNCN3) (42.98N 71.40W)									3.67
Otter Brook :Lake (OTTN3) (42.95N 72.23W)									2.16
Surrey Mountain Dam (SURN3) (43.00N 72.32W)									2.05

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)				
New Jersey									
ICAO Sites									
Aeroflex-Andover Arpt (K12N) (41.00N 74.74W)									1.03
Trenton-Robbinsville Airport (KN87) (40.21N 74.60W)									2.74
Trenton-Mercer Airport (KTTN) (40.27N 74.81W)									1.44
USGS									
Absecon Channel-Atlantic City (ATLN4) (39.38N 74.43W)									1.10
Belle Meade-Pike Run (BMDN4) (40.47N 74.65W)									1.60
Margate-Beach Thoroughfare (MGTN4) (39.34N 74.51W)									1.79
Others									
Ashokan 5 E (ASEN6) (41.95N 74.17W)									2.04
New York									
ICAO Sites									
Albany IAP (KALB) (42.74N 73.81W)									2.43
Elmira-Corning Reg. Airport (KELM) (42.16N 76.89W)									2.05
Greater Binghamton Airport (KBGM) (42.21N 75.98W)									3.11
New York-La Guardia Airport (KLGA) (40.78N 73.88W)									2.03
USGS									
Troy (TRYN6) (42.90N 73.68W)									2.30

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)				
Waverly 2 SE-Susquehanna River (WVYN6) (41.98N 76.50W)									2.83
Others									
Cobleskill 2 ESE (COBN6) (42.67N 74.43W)									2.99
Centerport (CTPN6) (40.88N 73.37W)									2.02
East Sydney Lake (ESDN6) (42.33N 75.23W)									2.69
Hunts Corners (HNTN6) (42.43N 76.12W)									3.20
Maryland 6 SW (MLDN6) (42.52N 74.97W)									2.03
Norwich (NRWN6) (42.53N 75.53W)									3.34
Phoenicia 2 SW (PHON6) (42.06N 74.34W)									2.97
Whitney Point Lake (WITN6) (42.35N 75.97W)									3.49
North Carolina									
ICAO Sites									
Beaufort Airport (KMRH) (34.72N 76.65W)	13/1958	1000.0	13/1829	35 (10 m, 2 min)	62				
Billy Mitchell-Hatteras Airport (KHSE) (35.22N 75.62W)	13/2225	1005.1	14/0321	37 (10 m, 2 min)	58				
Burlington-Alamance Regional Arpt (KBUY) (35.05N 79.48W)									3.96
Charlotte Douglas IAP (KCLT) (35.21N 80.94W)									2.78
Cherry Point MCAS (KNKT) (34.90N 76.90W)	14/1226	993.2	13/2354	54 (10 m, 2 min)	76				

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)				
Coastal Carolina Reg. Arpt/New Bern (KEWN) (35.07N 77.04W)									5.30
Duplin County Airport (KDPL) (34.99N 77.98W)	14/0945	995.9	14/0725	33 (10 m, 2 min)	49				
Edenton-Northeastern Regional Arpt (KEDE) (36.03N 76.57W)	14/0455	1009.5	14/0405		34				
Elizabeth City Regional Arpt (KECG) (36.26N 76.17W)	14/0654	1011.4	14/2154	33 (10 m, 2 min)					9.99
Fayetteville Regional Airport (KFAY) (34.99N 78.88W)	14/1930	998.6	14/2033	38 (10 m, 2 min)	56				10.26
Harnett Co. Airport (KHRJ) (35.38N 78.73W)	14/1840	1004.4	14/2000	28 (10 m, 2 min)	47				
Johnston Co. Airport (KJNX) (35.54N 78.39W)	14/1005	1004.4	14/1405	29 (10 m, 2 min)	45				
Kinston Regional Jetport (KISO) (35.33N 77.62W)	14/0845	1001.0	14/0745	33 (10 m, 2 min)	52				
Lumberton Municipal Airport (KLBT) (34.61N 79.06W)	14/2054	992.9	14/2025	38 (10 m, 2 min)	60				2.20
Mackall AAF (KHFF) (35.07N 79.05W)	14/2203	1002.7	14/2203	28 (10 m, 2 min)	43				
Moore Co. Airport (KSOP) (35.24N 79.39W)	14/1956	104.7	14/2308	27 (10 m, 2 min)	44				
New River MCAS/ Jacksonville (KNCA) (34.72N 77.43W)	14/0756	984.1	14/0615	49 (10 m, 2 min)	75				19.35
New Bern/Coastal Carolina Arpt (KEWN) (35.07N 77.04W)	13/2154	1003.7	13/1940	32 (10 m, 2 min)	48				15.17
Pope AFB (KPOP) (35.17N 79.01W)	13/2156	1012.5	14/2349	36 (10 m, 2 min)	48				
Raleigh-Durham IAP (KRDU) (35.88N 78.79W)	14/1837	1009.1	14/1651	26 (10 m, 2 min)	41				6.85
Rocky Mount-Wilson Regional Arpt (KRWI) (35.85N 77.89W)	14/0804	1007.1	14/0602	27 (10 m, 2 min)	39				7.34

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)				
Sanford-Lee Co. Arpt (KTTA) (35.58N 78.73W)	14/1850	1007.1	14/1830	26 (10 m, 2 min)	39				
Simmons AAF (KFBG) (35.13N 78.93W)	14/2340	1002.7	14/2356	29 (10 m, 2 min)	48				
Wilmington IAP (KILM) (34.28N 77.92W)	14/1015	965.5	14/1012	57 (10 m, 2 min)	91				21.70
C-MAN Sites									
Cape Lookout (CLKN7) (34.62N 76.53W)	14/0200	986.4	13/2320	72 (10 m, 10 min)	92				
NOS Sites									
Duck (DUKN7) (36.18N 75.75W)	14/0418	1011.4	13/1506	35 (9 m)	43	1.91	3.43	1.9	
Johnnie Mercer Pier-Wrightsville Beach (8658163-JMPN7) (34.21N 77.79W)	14/1036	959.2	14/1200	56 (8 m, 6 min)	75				
Beaufort, Duke Marine (8656483-BFTN7) (34.72N 76.67W)	14/0206	989.6	14/0618	51 (8 m, 6 min)	72	5.51	5.21	3.8	
Oregon Inlet (ORIN7) (35.80N 75.55W)	14/0030	1009.3	13/2012	29 (7 m)	44	2.01	2.26	1.8	
USCG Station Hatteras (8654667-HCGN7) (35.21N 75.70W)	13/2224	1004.0	14/0136	33 (8 m, 6 min)	56	1.91	2.00	1.8	
Wilmington (8658120-WLON7) (34.23N 77.95W)	14/1130	964.9				4.96	5.68	3.6	
Wrightsville Beach (JMPN7) (34.21N 77.79W)	14/1036	959.2	14/1200	56 (8 m)	76	4.34	5.88	4.1	
Weatherflow Sites									
Alligator Bridge (XALI) (35.90N 76.01W)	13/2340	1009.0	13/2215	41 (11.6 m)	54				
Avon Ocean (XAVO) (35.35N 75.50W)	13/2228	1003.3	13/2223	43 (11.9 m)	65				
Avon Sound (XAVN) (35.34N 75.50W)	13/2221	1006.0	13/2226	38 (10.4 m)	56				
Buxton (XBUX) (35.26N 75.59W)	13/2151	1006.1	13/2137	49 (10.4 m)	64				

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)				
Federal Point (XFED) (33.96N 77.94W)	14/1232	959.0	14/1208	68 (15 m, 1min)	86				
Fort Macon (XMAC) (34.70N 76.71W)	14/0403	984.5	14/0243	66 (10.4 m)	91				
Frisco Woods (XFRI) (35.24N 76.70W)	13/2320	1004.5	13/2240	40 (6 m)	69				
Jennettes Pier-Nags Head (XJNP) (35.91N 75.59W)	13/2350	1008.9	13/1925	35 (6 m)	45				
North River (XNRV) 34.77N 76.62W)	14/0201	991.0	14/0041	48 (5.5 m, 1 min)	68				
Oak Island (XOKI) 33.91N 78.12W)	14/1512	967.0	14/1718	50 (10 m, 1 min)	62				
Ocracoke Sound (XOCR) 35.13N 76.00W)	13/2327	1001.5	13.2347	52 (7.6 m, 1 min)	69				
Pamlico Sound (XPM2) 35.42N 75.83W)	13/2342	1003.2	13/2247	49 (13.1 m, 1 min)	62				
Real Slick-Waves (XWAV) 35.57N 75.49W)	13/2325	1007.1	13/1910	35 (6 m, 1 min)	45				
CoCoRaHS Sites									
Albertson 1.2 NW (NC-DP-25) (35.12N 77.84W)									26.26
Asheboro 1.3 SSE (NC-RN-23) (35.70N 79.80W)									10.52
Asheboro 7.6 SW (NC-RN-13) (35.56N 79.77W)									10.61
Ayden 3.7 S (NC-PT-37) (35.42N 77.43W)									11.02
Black Mountain 2.4 SE (NC-BC-76) (35.58N 82.30W)									10.91
Bolivia 7.8 SW (NC-BR-71) (34.00N 78.25W)									23.45
Burnsville 6.4 S (NC-YN-12) (35.82N 82.28W)									11.67

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)				
Burgaw 5.1 SE (NC-PD-33) (34.50N 77.85W)									12.10
Cameron 7.6 E (NC-HR-17) (35.33N 79.11W)									16.36
Cedar Point 0.9 WSW (NC-CR-10) (34.67N 77.09W)									22.19
Chadbourn 1.1 NNW (NC-CL-3) (34.33N 78.83W)									18.16
Chapel Hill 2.5 SE (NC-DH-33) (35.90N 79.00W)									10.98
Chapel Hill 4.9 SSE (NC-DH-36) (35.86N 78.99W)									10.42
Clinton 1.6 NW (NC-SM-19) (35.01N 78.35W)									16.43
Coats 0.7 W (NC-HR-2) (35.40N 78.68W)									12.01
Dunn 5.2 SSE (NC-SM-7) (35.21N 78.57W)									20.57
Dunn 7.1 SSE (NC-SM-2) (35.22N 78.57W)									10.57
Elizabethtown 6.2 NW (NC-BD-2) (34.69N 78.69W)									35.93
Emerald Isle 0.2 ENE (NC-CR-12) (34.66N 77.03W)									23.66
Farmville 3.1 NW (NC-PT-47) (35.63N 77.63W)									12.72
Fayetteville 1.4 SW (NC-CM-68) (35.05N 78.91W)									18.38
Fayetteville 2.4 S (NC-CM-1) (35.04N 78.91W)									17.41

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)				
Fayetteville 5.6 S (NC-CM-72) (35.07N 78.99W)									19.98
Fountain 0.1 NE (NC-PT-10) (36.68N 77.64W)									11.55
Goldsboro 4.4 E (NC-WY-1) (35.37N 77.90W)									14.42
Grantsboro 4.6 SSW (NC-PM-20) (35.08N 76.88W)									14.32
Greenville 2.2 WSW (NC-PT-89) (35.59N 77.41W)									11.66
Gurganus 0.5 N (NC-ON-70) (34.75N 77.65W)									31.58
Hampstead 0.3 NW (NC-PD-17) (34.37N 77.71W)									22.13
Hampstead 4.1 WNW (NC-PD-31) (34.38N 77.77W)									29.65
Havelock 1.9 SSE (NC-CN-93) (34.88N 76.88W)									15.28
Hope Mills 1.1 ENE (NC-CM-83) (34.87N 78.88W)									17.20
Hope Mills 4.8 SE (NC-CM-13) (34.92N 78.89W)									19.23
Hope Mills 6.3 SE (NC-CM-42) (34.91N 78.87W)									20.55
Hope Mills 8.0 SSE (NC-CM-34) (34.87N 78.88W)									19.00
Jacksonville 1.0 NW (NC-ON-19) (34.77N 77.42W)									30.65
Jacksonville 1.2 NE (NC-ON-58) (34.77N 77.39W)									21.18

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Jacksonville 6.8 NW (NC-ON-68) (34.84N 77.47W)									24.61
Kinston 4.4 WNW (NC-LR-23) (35.29N 77.66W)									13.61
Kinston 7.0 SW (NC-LR-22) (35.19N 77.66W)									18.92
Leland 3.5 SSW (NC-BR-76) (34.19N 78.03W)									20.55
Leland 5.7 WSW (NC-BR-2) (34.20N 78.09W)									22.46
Lillington 11.0 WSW (NC-HR-42) (35.32N 78.99W)									13.13
Linden 4.2 S (NC-CM-56) (35.19N 78.74W)									15.36
Linville 2.5 ENE (NC-AV-9) (36.09N 81.83W)									12.13
Lumberton 2.3 NE (NC-RB-9) (34.66N 78.99W)									22.76
Lumberton 2.6 ESE (NC-RB-7) (34.62N 78.97W)									21.41
Lumberton 8.6 SSE (NC-RB-17) (34.51N 78.97W)									18.54
Marston 2.3 SW (NC-RC-1) (34.96N 79.60W)									12.56
Maysville 3.4 SSW (NC-ON-12) (34.86N 77.26W)									23.14
Monroe 2.4 N (NC-UN-1) (35.02N 80.53W)									11.05
Morehead City 0.6 NW (NC-CR-12) (34.73N 76.74W)									21.39

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)				
Morehead City 2.4 WNW (NC-CR-45) (34.73N 76.77W)									18.39
Mount Olive 0.4 NW (NC-WY-21) (35.20N 78.07W)									25.18
Mount Olive 2.4 SW (NC-DP-3) (35.18N 78.10W)									19.98
New Bern 1.4 WSW (NC-CN-22) (35.11N 77.10W)									14.14
New Bern 8.8 W (NC-CN-31) (35.14N 77.23W)									13.94
New Bern 8.9 SSE (NC-CN-24) (35.01N 76.99W)									16.65
Newport 0.2 SW (NC-CR-1) (34.78N 76.86W)									23.89
Newport 1.7 SSE (NC-CR-53) (34.76N 76.85W)									19.96
Norman 0.4 SSE (NC-RC-8) (35.16N 79.72W)									15.09
Oak Island 0.9 ENE (NC-BR-56) (33.92N 78.14W)									26.98
Oriental 4.3 NNW (NC-PM-10) (35.09N 76.72W)									12.55
Pikeville 6.2 WSW (NC-WY-2) (35.47N 78.09W)									15.43
Pine Knoll Shores 0.3 NE (NC-CR-75) (34.70N 76.81W)									16.24
Pink Hill 2.5 NE (NC-LR-31) (35.08N 77.72W)									18.36

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)				
Pittsboro 5.4 WSW (NC-CH-23) (35.70N 79.26W)									11.53
Raeford 5.0 NE (NC-HK-13) (35.02N 79.16W)									13.27
Raeford 9.6 E (NC-HK-3) (34.96N 79.06W)									14.36
Raleigh 5.5 WSW (NC-WK-12) (35.80N 78.75W)									6.47
Raleigh 5.9 ENE (NC-WK-13) (35.86N 78.56W)									6.50
Raleigh 9.6 SSW (NC-WK-19) (35.69N 78.73W)									6.47
Rockingham 1.2 WSW (NC-RC-12) (34.93N 79.78W)									17.61
Rocky Mount 9.2 SW (NC-NS-21) (35.85N 77.91W)									8.56
Rose Hill 0.1 NNW (NC-DP-17) (34.82N 78.02W)									14.88
Roseboro 10.0 N (NC-SM-22) (35.10N 78.50W)									15.22
Sanford 6.6 S (NC-LE-3) (35.38N 79.16W)									12.07
Smith Creek 0.8 E (NC-NH-63) (34.26N 77.85W)									27.40
Snow Hill 3.1 NNE (NC-GN-7) (35.50N 77.66W)									11.40
Stanfield 4.5 SSE (NC-SN-2) (35.17N 80.39W)									10.14
Star 1.0 N (NC-MG-1) (35.41N 79.78W)									14.57

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)				
Stedman 1.0 NW (NC-CM-86) (35.02N 78.71W)									16.39
Sunset Beach 1.7WNW (NC-BR-6) (33.88N 78.53W)									10.44
Swansboro 1.4 N (NC-ON-86) (34.71N 77.13W)									34.15
Tarboro 5.9 SE (NC-CM-19) (35.84N 77.50W)									5.40
Trent Woods 1.2 ENE (NC-CN-89) (35.08N 77.08W)									11.86
Trent Woods 1.3 SSE (NC-CN-15) (35.05N 77.08W)									17.31
Wagram 4.5 W (NC-SC-7) (34.89N 79.44W)									19.66
Wallace 3.7 E (NC-DP-22) (34.74N 77.93W)									18.08
Waxhaw 4.1 ENE (NC-UN-17) (34.94N 80.67W)									8.41
Weddington 1.9 WSW (NC-UN-27) (35.02N 80.77W)									8.51
Whiteville 6.1 NW (NC-CL-25) (34.38N 78.79W)									25.91
Wilmington 3.0 SE (NC-NH-58) (34.18N 77.87W)									20.19
Wilmington 3.7 S (NC-NH-66) (34.16N 77.92W)									30.18
Wilmington 7.3 NE (NC-NH-68) (34.27N 77.81W)									26.93
Wilson 11.0 SW (NC-WN-25) (35.64N 78.08W)									10.82

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Winnabow 3.6 SE (NC-BR-12) (34.10N 78.05W)									27.45
Winterville 2.6 ENE (NC-PT-91) (35.54N 77.35W)									13.24
Yaupon Beach 0.2SSW (NC-BR-82) (33.90N 78.07W)									22.07
Florida Coastal Monitoring Program (FCMP) Sites									
Hampstead Kiwanis Park (FCMP T1) (34.40N 77.65W)	14/0955	966.0	14/0930	40 (15 m, 5 min)	68				
Scotts Hill-Pender EMS FS (FCMP T2) (34.33N 77.75W)	14/1016	962.0	14/1011	47 (15 m, 5 min)	80				
Holly RIdge (FCMP T3) (34.49N 77.55W)	14/0913	972.0	14/0908	37 (15 m, 5 min)	67				
NWS COOP Sites									
Bayboro (35.14N 76.77W)									12.57
Jacksonville EOC (34.76N 77.40W)									28.90
Elizabethtown 4 NNE (TURN7) (34.68N 78.58W)									23.00
NWS/WFO Newport-Morehead City (KMHX) (34.78N 76.86W)									25.62
Snow Hill (35.45N 77.67W)									12.50
RAWS									
Burgaw 11 E-Black Island (BKIN7) (34.53N 77.72W)									20.07
Croatan/Newport 3 SW (34.76N 76.89W)									21.67
Fort Bragg (NFBR) (35.14N 79.06W)			14/1400	28 (6 m)	54				
Green Swap-Nature Conservatory (34.05N 78.29W)			14/1622		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)				
Hofmann Forest 3 SW (34.82N 77.32W)									29.63
Holly Shelter Swamp-Back Island (34.53N 77.72W)			14/0718	31 (6 m)	62				
Lumberton (34.59N 79.08W)			14/2000		53				
Kure Beach 3 W (SUNN7) (34.00N 77.96W)									25.55
Sandy Run 2 NNW (34.61N 77.49W)									20.68
Shallotte 7 NE Green Swamp (NATN7) (34.05N 78.29W)									25.47
Whiteville 1 W (WHIN7) (34.34N 78.73W)									17.76
Texas Tech Stick Net (TTSN)									
Leland-US17-Village Rd Intrsctn (TTSN-101) (34.15N 78.09W)		965.5		40 (2 m, 1 min)	61				
Myrtle Grove-Veterans Park (TTSN-102) (34.10N 77.91W)		959.0		42 (2 m, 1 min)	66				
Potters Neck Elem. School (TTSN-103) (34.28N 77.78W)		959.4		43 (2 m, 1 min)	61				
I-140/1.5 SW Cape Fear River (TTSN-105) (34.27N 77.98W)		963.7		56 (2 m, 1 min)	73				
Fort Fisher Rocks-Parking Lot (TTSN-106) (33.96N 77.92W)		959.6		47 (2 m, 1 min)	67				
Wilmington-River City Ref. Church (TTSN-110) (34.17N 77.91W)		959.5		39 (2 m, 1 min)	57				
Castle Hayne-NE Ave. 0.5 W NC Hwy 133 (TTSN-111) (34.36N 77.91W)		968.6		35 (2 m, 1 min)	56				
Elizabethtown Airport (TTSN-224) (34.60N 78.58W)		985.3		30 (2 m, 1 min)	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)				
US Hwy 17-Longwood Rd. Intrsctn (TTSN-326) (33.88N 78.44W)		971.8		36 (2 m, 1 min)	51				
NC Hwy 211/906 Intrsctn (TTSN-327) (33.97N 78.13W)		967.0		32 (2 m, 1 min)	54				
Feedmill Rd-7 ENE Tabor City (TTSN-331) (34.20N 78.77W)		977.4		38 (2 m, 1 min)	58				
Ocean Isle Beach-West 3rd St (TTSN-332) (33.88N 78.44W)		973.5		42 (2 m, 1 min)	59				
Gaston Trail Rd-4 W Shallotte (TTSN-333) (33.88N 78.44W)		967.4		34 (2 m, 1 min)	53				
South Brunswick Mid. School (TTSN-334) (34.00N 78.05W)		962.4		39 (2 m, 1 min)	60				
Governors Rd SE-0.5 E Winnabow (TTSN-335) (34.15N 78.09W)		965.1		35 (2 m, 1 min)	56				
Waters Edge Rd-Great Oak Dr Intrsctn (TTSN-445) (34.34N 77.70W)		960.3		48 (2 m, 1 min)	66				
USGS									
Cape Fear Lock & Dam #1 (CFPN7) (34.40N 78.29W)									22.21
Oak Island-Middleton Bridge (33.93N 78.16W)	14/1545	968.8	14/1515	44					
Surf City-Intracoastal Highway 210 Bridge (34.43N 77.55W)	14/0942	966.1							
Wilmington-Isabel Holmes Bridge (34.25N 77.95W)			14/1124	58					
Wrightsville Beach-Banks Channel Bridge (34.20N 77.80W)	14/1042	958.3							
USGS High Water Marks									
New Bern (Craven Co.) (NCCAR26906) (35.10N 77.02W)							10.84	7.0	

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)				
Fairfield Harbour – Northwest Creek at Neuse River (Craven Co.) (NCCRA12509) (35.07N 76.97W)							10.05	6.2	
Chocowinity – Chocowinity Bay at Pamlico River (Beaufort Co.) (NCBEA26924) (35.50N 77.02W)							8.02	4.6	
Arapahoe – Beard Creek at Neuse River (Pamlico Co.) (NCPAM26918) (35.01N 76.86W)							9.91	4.3	
Hobucken – Jones Bay (Pamlico Co.) (NCPAM26995) (35.24N 76.56W)							6.36	3.9	
New Bern – Neuse River (Craven Co.) (NCCRA26912) (35.11N 77.04W)							10.00	3.8	
Blounts – Blounts Creek / Pamlico River (Beaufort Co.) (NCBEA26937) (35.43N 76.97W)							7.32	3.8	
Fairfield Harbour – Broad Creek at Neuse River (Craven Co.) (NCCRA26916) (35.06N 76.96W)							9.60	3.5	
Merritt – Ball Creek to Bay River (Pamlico Co.) (NCPAM26950) (35.14N 76.64W)							7.25	3.1	
Aurora – Pamlico River (Beaufort Co.) (NCBEA26962) (35.34N 76.66W)							7.42	3.1	
Oriental – Greens Creek at Neuse River (Pamlico Co.) (NCPAM13231) (35.02N 76.70W)							8.10	2.8	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Aurora – Goose Creek (Beaufort Co.) (NCBEA06909) (35.33N 76.63W)							6.41	2.7	
Winsteadville – Pungo River (Beaufort Co.) (NCBEA06921) (35.45N 76.61W)							5.78	2.3	
Carolina Beach (New Hanover Co.) (NCNEW27402) (34.05N 77.88W)							5.78	2.0	
Myrtle Grove – Masonboro Sound (New Hanover Co.) (NCNEW27471) (34.15N 77.86W)							7.18	1.9	
Surf City - AIW (Pender Co.) (NCPEN27330) (34.44N 77.55W)							4.84	1.6	
Davis – Core Sound (Carteret Co.) (NCCAR12128) (34.80N 76.46W)							5.32	1.2	
Morehead City – Calico Creek (Carteret Co.) (NCCAR27260) (34.73N 76.72W)							6.02	1.0	
Myrtle Grove – Masonboro Sound (New Hanover Co.) (NCNEW27475) (34.12N 77.87W)							6.87	0.9	
Wrightsville Beach – Sound Side near Mason Inlet (New Hanover Co.) (NCNEW13629) (34.24N 77.78W)								0.6	
USGS Storm Tide Sensors									
New Bern – Neuse River (Craven Co.) (NCCRA12508) (35.12N 77.02W)							10.08	10.4	

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)				
Havelock – Neuse River (Craven Co.) (NCCRV00003) (34.94N 76.81W)							9.08	9.4	
Arapahoe – Neuse River (Pamlico Co.) (NCPAM13230) (34.97N 76.81W)							8.98	9.3	
Oriental – Greens Creek at Neuse River (Pamlico Co.) (NCPAM13231) (35.02N 76.70W)							7.93	8.2	
Chocowinity – Chocowinity Bay / Pamlico River (Beaufort Co.) (NCBEA11788) (35.50N 77.05W)							7.55	7.4	
Wrightsville Beach (New Hanover Co.) (NCNEW00006) (34.21N 77.79W)	14/0535	956.6					8.98	7.2[WS]	
Washington – Pamlico River (Beaufort Co.) (NCBEA11808) (35.51N 77.01W)							7.21	7.1	
Emerald Isle – Piney Creek at Bogue Sound (Carteret Co.) (NCCAR12411) (34.67N 77.01W)							7.76	7.0	
Surf City (Pender Co.) (NCPEN13368) (34.42N 77.55W)	14/0447	964.9					8.81	6.8[WS]	
Carolina Beach (New Hanover Co.) (NCNEW00004) (34.06N 77.88W)							8.53	6.6[WS]	
Avon (Dare Co.) (NCDAR00003) (35.35N 75.50W)							7.89	6.4[WS]	
Aurora – Pamlico River (Beaufort Co.) (NCBEA11728) (35.38N 76.75W)							6.44	6.3	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Atlantic Beach (Carteret Co.) (NCCAR00006) (34.70N 76.78W)	14/0146	988.6					8.15	6.3[WS]	
Nags Head (Dare Co.) (NCDAR00009) (35.91N 75.60W)							7.38	5.9[WS]	
Swansboro – White Oak River (Onslow Co.) (NCONS00001) (34.69N 77.12W)	14/0203	982.4					6.30	5.8	
Hampstead - AIW near Rich Inlet (Pender Co.) (NCPEN00001) (34.31N 77.73W)							7.70	5.7	
Hubert – Bear Creek to AIW (Onslow Co.) (NCONS13228) (34.65N 77.21W)							6.74	5.7	
Topsail Beach (Pender Co.) (NCPEN00003) (34.37N 77.63W)							7.77	5.7[WS]	
Emerald Isle (Carteret Co.) (NCCAR12412) (34.66N 77.03W)							7.70	5.7[WS]	
Hampstead - AIW (Pender Co.) (NCPEN13408) (34.37N 77.66W)							7.17	5.5	
Holden Beach (Brunswick Co.) (NCBRU11868) (33.91N 78.29W)							7.76	5.5[WS]	
Belhaven – Pantego Creek / Pungo River (Beaufort Co.) (NCBEA13648) (35.53N 76.61W)							5.55	5.4	
Figure Eight Island / Wilmington (New Hanover Co.) (NCNEW00007) (34.27N 77.76W)							7.23	5.3	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Belhaven – Pamlico River at Pungo River (Beaufort Co.) (NCBEA11828) (35.39N 76.58W)							5.33	5.2	
Sneads Ferry – New River at AIW (Onslow Co.) (NCONS13168) (34.54N 77.36W)							5.44	5.2	
North River (Carteret Co.) (NCCAR00012) (34.79N 76.61W)							5.77	5.2	
Rodanthe (Dare Co.) (NCDAR12788) (35.59N 75.46W)							6.63	5.2[WS]	
Camp Lejeune - AIW (Onslow Co.) (NCONS13208) (34.57N 77.27W)							6.27	4.9	
Wrightsville Beach – AIW (New Hanover Co.) (NCNEW13008) (34.22N 77.81W)							6.84	4.9	
Davis – Core Sound (Carteret Co.) (NCCAR12128) (34.80N 76.46W)	13/2014	987.5					5.27	4.8	
Wilmington – Canal to AIW (New Hanover Co.) (NCNEW12848) (34.15N 77.86W)	14/0609	957.7					6.86	4.8	
Kitty Hawk (Dare Co.) (NCDAR12669) (36.10N 75.71W)							6.29	4.8[WS]	
Salter Path – Bogue Sound (Carteret Co.) (NCCAR12409) (34.69N 76.90W)							5.47	4.7	
Sneads Ferry – New River (Onslow Co.) (NCONS13128) (34.58N 77.40W)	14/0305	977.4					4.90	4.7	
Wilmington – AIW / Masonboro Sound (New Hanover Co.) (NCNEW12868) (34.11N 77.88W)							6.62	4.6	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[C]	Storm tide (ft)[D]	Estimated Inundation (ft)[E]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Emerald Isle – Bank Channel at Bogue Inlet (Carteret Co.) (NCCAR00005) (34.65N 77.10W)							6.02	4.5	
Wrightsville Beach – Shinn Creek / Masonboro Inlet (New Hanover Co.) (NCNEW00005) (34.19N 77.81W)							6.34	4.4	
Topsail Beach – Banks Channel to New Topsail Inlet (Pender Co.) (NCPEN00002) (34.37N 77.63W)							6.19	4.3	
Kure Beach (New Hanover Co.) (NCNEW00003) (34.00N 77.91W)	14/0733	958.4					6.19	4.3[WS]	
North Topsail Beach (Onslow Co.) (NCONS00002) (34.50N 77.40W)							6.30	4.3[WS]	
Kill Devil Hills (Dare Co.) (NCDAR13668) (36.04N 75.67W)							5.71	4.2[WS]	
Frisco - Beachside (Dare Co.) (NCDAR12729) (35.22N 75.64W)							5.63	4.2[WS]	
Swan Quarter – Swan Quarter Bay / Pamlico Sound (Hyde Co.) (NCHYD00001) (35.39N 76.33W)							3.97	4.1	
North Topsail Beach – AIW (Onslow Co.) (NCONS13189) (34.52N 77.37W)							4.32	4.1	
Beaufort – Taylor Creek (Carteret Co.) (NCCAR12228) (34.71N 76.63W)							5.24	4.1	

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)				
Atlantic Beach – Bogue Sound (Carteret Co.) (NCCAR12408) (34.70N 76.78W)							4.70	4.0	
Wilmington – Carolina Beach Inlet (AIW) (New Hanover Co.) (NCNEW12928) (34.08N 77.89W)	14/0703	957.6					6.00	4.0	
Straits – North River (Carteret Co.) (NCCAR12428) (34.72N 76.58W)	13/2121	983.1					4.47	3.8	
Beaufort – Harlowe Creek at Newport River (Carteret Co.) (NCCAR12288) (34.77N 76.67W)							5.03	3.6	
Beaufort – Taylor Creek (Carteret Co.) (NCCAR12248) (34.72N 76.67W)							5.07	3.6	
Atlantic Beach – Money Island Bay / Bogue Sound (Carteret Co.) (NCCAR12348) (34.70N 76.73W)							4.92	3.6	
Carolina Beach – Snows Cut (AIW) (New Hanover Co.) (NCNEW12888) (34.06N 77.89W)							5.58	3.6	
Atlantic Beach – Fort Macon Creek at Beaufort Inlet (Carteret Co.) (NCCAR00007) (34.70N 76.68W)							5.02	3.5	
Carolina Beach – Cape Fear River / Snows Cut (New Hanover Co.) (NCNEW12908) (34.06N 77.88W)							5.47	3.5	

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)				
Wilmington – Cape Fear River (New Hanover Co.) (NCNEW12948) (34.11N 77.93W)							5.58	3.4	
Harkers Island – Back Sound (Carteret Co.) (NCCAR00001) (34.68N 76.53W)							3.89	3.2	
Ocean Isle Beach (Brunswick Co.) (NCBRU00012) (33.89N 78.44W)							5.49	3.1[WS]	
Southport – Cape Fear River at AIW (Brunswick Co.) (NCBRU12068) (33.92N 78.02W)	14/0803	961.5					5.06	3.1	
Kure Beach – Cape Fear River (New Hanover Co.) (NCNEW00002) (33.96N 77.94W)							4.92	3.1	
Oak Island (Brunswick Co.) (NCBRU11888) (33.91N 78.15W)							4.96	2.7[WS]	
Caswell Beach – Elizabeth River at Cape Fear River (Brunswick Co.) (NCBRU12048) (33.90N 78.02W)							4.63	2.7	
Varnamtown – Lockwoods Folly River (Brunswick Co.) (NCBRU12082) (33.95N 78.22W)							4.89	2.6	
Oak Island - AIW (Brunswick Co.) (NCBRU11890) (33.93N 78.14W)							4.63	2.6	
Edenton – Chowan River (Chowan Co.) (NCCHO12448) (36.06N 76.68W)							2.58	2.5	

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)				
Oak Island (Brunswick Co.) (NCBRU11891) (33.90N 78.08W)							4.70	2.5[WS]	
Stumpy Point – Stumpy Point Bay / Pamlico Sound (Dare Co.) (NCDAR00010) (35.70N 75.77W)							2.53	2.3	
Sunset Beach – AIW (Brunswick Co.) (NCBRU11893) (33.88N 78.51W)	14/1413	973.6					4.56	2.2	
Shallotte - AIW (Brunswick Co.) (NCBRU11908) (33.91N 78.37W)							4.62	2.2	
Calabash – Calabash River (AIW) (Brunswick Co.) (NCBRU11848) (33.88N 78.57W)							4.57	2.2	
Kill Devil Hills – Albemarle Sound at Kitty Hawk Bay (Dare Co.) (NCDAR12668) (36.02N 75.73W)							2.18	2.2	
Holden Beach – AIW (Brunswick Co.) (NCBRU12008) (33.92N 78.27W)	14/1202	966.6					4.27	2.1	
Varnamtown – Lockwoods Folly Inlet (AIW) (Brunswick Co.) (NCBRU11909) (33.92N 78.24W)							4.40	2.1	
Ocean Isle Beach – AIW (Brunswick Co.) (NCBRU00014) (33.90N 78.44W)	14/1315	972.5					4.48	2.1	
Columbia – Albemarle Sound (Tyrrell Co.) (NCTYR13548) (35.99N 76.18W)							2.11	2.1	
Hertford – Albemarle Sound (Perquimans Co.) (NCPER13488) (36.10N 76.21W)							2.15	2.1	

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Sunset Beach – Bull Creek (AIW) (Brunswick Co.) (NCBRU11850) (33.87N 78.52W)							4.43	2.0	
Columbia – Alligator River (Tyrrell Co.) (NCTYR13568) (35.91N 76.03W)							2.02	2.0	
Nags Head – Oregon Inlet (Dare Co.) (NCDAR12688) (35.77N 75.53W)							2.71	2.0	
Hatteras – Hatteras Inlet at Pamlico Sound (Dare Co.) (NCDAR00001) (35.21N 75.70W)							1.93	1.8	
Rodanthe – Pamlico Sound (Dare Co.) (NCDAR12709) (35.58N 75.47W)							2.14	1.7	
Avon – Pamlico Sound (Dare Co.) (NCDAR00004) (35.35N 75.51W)							1.98	1.7	
Rodanthe – Canal to Pamlico Sound (Dare Co.) (NCDAR12708) (35.59N 75.47W)							2.08	1.6	
Nags Head – Motts Creek at Pamlico Sound (Dare Co.) (NCDAR00005) (35.80N 75.55W)							1.95	1.5	
Avon – Mill Creek at Pamlico Sound (Dare Co.) (NCDAR12711) (35.36N 75.50W)							1.78	1.5	
Buxton – Pamlico Sound (Dare Co.) (NCDAR00002) (35.27N 75.56W)							1.76	1.5	
Shallotte – Shallotte River (Brunswick Co.) (NCBRU11851) (33.95N 78.37W)							4.80	1.4	

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 – Currituck Sound (Dare Co.) (NCDAR00008) (36.22N 75.77W)							2.64	1.1	
Hampstead – AIW near Rich Inlet (Pender Co.) (NCPEN00001) (34.31N 77.73W)	14/0527	955.6					7.70		
Topsail Beach (Pender Co.) (NCPEN13388) (34.37N 77.63W)	14/0452	959.5							
North Topsail Beach (Pender Co.) (NCPEN00002) (34.50N 77.40W)	14/0302	971.2					6.30		
Emerald Isle (Carteret Co.) (NCCAR12412) (34.66N 77.03W)	14/0225	974.6					7.70		
Other									
Bald Head Island-ECONET (33.84N 77.97W)	14/1149	974.9	14/1855	47	58				
Benson 1 SSW CWOP (35.35N 78.55W)									12.48
Blenheim-Fire Dept. (34.51N 79.65W)	15/0800	999.7	14/2229		49				
Burgaw 4 E (34.55N 77.85W)	14/1017	979.0	14/1017		45				22.06
Caswell Beach (33.9N 78.05W)	14/1230	972.6	14/1230	43	54				22.57
Charlotte 12 SE (MHYN7) (35.11N 80.68W)									11.03
Charlotte 4 S (MATN7) (35.11N 80.72W)									11.06
Charlotte 7 SE (MALN7) (35.14N 80.77W)									10.21
Charlotte (PRVN7) (35.06N 80.81W)									10.42
Cherry Grove Beach (33.82N 78.66W)	14/1539	986.5	14/1514		67				

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)				
Elizabethtown 4.0 NNE (TURN7) (34.68N 78.58W)									23.00
Holly Ridge 3.7 E (NC-ON-124)									20.50
Horticultural Crops Research Stn (CLIN) (35.02N 78.28W)			14/1400	39 (10 m)	48				
Kelly 5 SE (CPFN7) (34.40N 78.29W)									26.02
Leland-Waterford Neighborhood (34.23N 78.03W)	14/1144	969.9							
Lumberton (LBRN7) (34.63N 79.02W)									26.71
Masonboro Island-Research Creek Res (NOXN7) (34.16N 77.85W)	14/1115	960.7							
Myrtle Beach-Waterford Neighborhood (33.78N 78.95W)	15/0059	980.7	14/1554		41				
New Bern (PYTN7) (35.06N 77.09W)									17.30
Socastee 3 NE (33.71N 78.96W)	15/0104	982.1	14/2014		48				
Trenton AFWS (35.06N 77.36W)									19.42
Vass 8 SE USGS (VASN7) (35.18N 79.18W)									14.58
Whiteville (WHIT) (34.33N 78.70W)									22.58
Whiteville-ECONET (34.41N 78.79W)	14/2010	985.1	14/1501		49				
Wilmington-Kings Grant Neighborhood (34.26N 77.87W)	14/1105	962.0							
Ohio									

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)				
USGS									
Marietta 1 ESE-Water Treatment Plant (MTAO1) (39.42N 81.43W)									1.61
Others									
Cadiz 2 SE-Sewage Plant (CAZO1) (40.25N 80.97W)									1.98
Gallipolis 1 NE (GPSO1) (38.82N 82.18W)									1.74
Tippecanoe-Stillwater Creek (TPPO1) (40.27N 81.29W)									1.88
Pennsylvania									
ICAO Sites									
Heritage Field Airport (Pottstown-Limerick) (KPTW) (40.24N 75.56W)									1.80
Middletown-Harrisburg IAP (KMDT) (40.20N 76.77W)									1.88
Northeast Philadelphia Municipal Arpt (KPNE) (40.08N 75.01W)									1.76
Pocono Mountains Municipal Arpt (KMPO) (41.14N 75.38W)									3.15
Wilkes-Barre IAP (KAVP) (41.33N 75.73W)									2.01
Williamsport Regional Airport (KIPT) (41.24N 76.92W)									1.87
USGS									
Cedar Run-Pine Creek (CEDP1) (41.52N 77.45W)									2.01

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)				
Others									
Galeton (GLTP1) (41.73N 77.63W)									2.45
Glencoe 1 E (GLNP1) (39.82N 78.85W)									2.49
Laughlintown 6 SE (LAUP1) (40.05N 79.22W)									1.84
Mansfield 1 S - Tioga River (MFDP1) (41.80N 77.08W)									2.79
Myersdale 1 W (MYRP1) (39.75N 79.04W)									2.02
Parryville-Beltzville Lake (PRYP1) (40.84N 75.62W)									1.89
Slate Run (SLRP1) (41.47N 77.57W)									2.60
Tamaqua-Little Schuylkill River (TQAP1) (40.80N 75.97W)									2.64
Tioga 6 N (CQDP1) (42.00N 77.15W)									2.77
Tioga –Tioga River (TGRP1) (41.90N 77.14W)									2.45
Westport-Bush Lake (BUSP1) (41.37N 77.93W)									2.24
Wellsboro 4 SW (WLLP1) (41.70N 77.39W)									2.43
Rhode Island									
ICAO Sites									
Newport State Airport (KUUU) (41.53N 71.28W)									0.87
T.F. Green Airport-Providence (KPVD) (41.72N 71.43W)									0.53
Westerly State Airport (KWST) (41.35N 71.80W)									1.40

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 Carolina									
ICAO Sites									
Beaufort County Airport (KARW) (32.41N 80.63W)	15/0835	1003.0	15/0235		37				
Camden/Woodward Airport (KCDN) (34.28N 80.57W)	15/1955	1002.0	15/0135		39				
Charleston Executive Airport (KJZI) (32.78N 79.93W)	15/0755	1000.0	15/0415		34				
Charleston IAP (KCHS) (32.90N 80.04W)	15/0756	998.7	14/2309		46				1.25
Columbia Metropolitan Airport (KCAE) (33.95N 81.12W)	16/0556	1001.1	15/0548		34				4.45
Darlington County Airport (KUDG) (34.44N 79.89W)	15/0856	1000.0	15/0856	28 (10 m, 2 min)	43				3.37
Florence Regional Airport (KFLO) (34.19N 79.72W)	15/0153	995.5	14/2001	39 (10 m, 2 min)	52				7.68
Georgetown County Airport (KGGE) (33.31N 79.32W)	15/0635	991.9	15/0415	28 (10 m, 2 min)	41				
Hartsville Regional Airport (KHVS) (34.40N 80.10W)	15/0615	1001.4	15/2215	27 (10 m, 2 min)	41				
Marlboro County Jetport (KBBP) (34.62N 79.73W)	14/1515	1004.4	14/1515	23 (10 m, 2 min)	36				
Fairfield Co. Aprt, WInnsboro(KFDW) (33.19N 80.04W)	16/0655	1002.8	15/1115		38				
Grand Strand/N Myrtle Beach Airport (KCRE) (33.81N 78.72W)	14/2234	978.7	15/0045	35 (10 m, 2 min)	52				11.68
Santee-Cooper Reg. Arpt (Manning) (KMNI) (33.58N 80.21W)	15/1915	997.5	15/0335		38				
McEntire Joint NGB, Columbus (KMMT) (33.93N 80.80W)	15/0756	1002.4	15/0419		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)				
Myrtle Beach IAP (KMYR) (33.68N 78.93W)	14/2223	983.9	14/1856	33 (10 m, 2 min)	53				9.67
Marion County Airport (KMAO) (34.18N 79.33W)	14/2325	990.9	15/0035	33 (10 m, 2 min)	53				
Shaw AFB (Sumter) (KSSC) (33.98N 80.47W)	15/1130	1000.2	15/0228		47				
Sumter Airport (KSMS) (33.99N 80.36W)	15/0955	999.8	15/0135		41				
Williamsburg-Kingstree Regional Airport (KCKI) (33.72N 79.86W)	15/0615	1001.4	15/2215	27 (10 m, 2 min)	41				
Texas Tech Stick Net (TTSN)									
Myrtle Beach Airport-Hwy 17 (TTSN-215) (33.69N 78.88W)		981.4		25 (2 m, 1 min)	43				
Myrtle Beach Travel Park (TTSN-217) (33.77N 78.77W)		979.8		35 (2 m, 1 min)	49				
Grand Strand Airport (TTSN-219) (33.80N 78.73W)		978.1		28 (2 m, 1 min)	46				
SC Hwy 90/22 Intrsctn (TTSN-220) (33.85N 78.82W)		977.5		30 (2 m, 1 min)	50				
Robert Edge Pkwy-Carolina Bays Pkwy Intrsctn (TTSN-222) (33.83N 78.70W)		978.4		41 (2 m, 1 min)	53				
SC Hwy 9/US701 Intrsctn (TTSN-223) (34.08N 78.87W)		975.1		33 (2 m, 1 min)	48				
Weatherflow Sites									
Charleston-Battery Point (XCHA) (32.76N 79.95W)	15/0810	996.0	15/0625		37				
Beaufort (XBUF) (32.34N 80.59W)	15/0832	1000.0	15/1832		34				
Folly Beach Pier (XFOL) (32.65N 79.94W)	15/0749	997.0	15/0154		38				

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)				
Ft. Sumter/Charleston Harbor (XSUL) (32.75N 79.87W)	15/0811	997.0	14/2336	36 (12 m)	48				
Isle of Palms (XIOP) (32.78N 79.79W)	15/0805	997.0	15/0455		34				
Lake Arrowhead (XARW) (33.78N 78.77W)	14/2307	976.0	14/1348	25 (10 m, 1 min)	46				
Murrell's Inlet (XMUR) (33.52N 79.03W)	15/0319	985.0	14/2339	42 (7 m, 1 min)	51				
Pinopolis/Lake Moultrie (XSUM) (32.75N 79.87W)	15/0750	993.9	15/0020		41				
Sullivans Island (XSUL) (32.10N 81.08W)	15/0815	995.0	14/2330		39				
CoCoRaHS Sites									
Cheraw 1.2 ESE (SC-CF-8) (34.69N 79.88W)									23.21
Conway 6.2 E (SC-HR-61) (33.83N 78.95W)									15.23
Dillon 3.8 NW (SC-DL-4) (34.46N 79.41W)									18.68
Georgetown 6.0 S (SC-GT-4) (33.27N 79.29W)									11.55
Hartsville 1.7 NW (SC-DR-7) (34.38N 80.10W)									11.46
Loris 1.4 ENE (SC-HR-19) (34.06N 78.86W)									22.88
Loris 2.9 WSW (SC-HR-33) (34.03N 78.93W)									23.68
Myrtle Beach 5.0 WNW (SC-HR-46) (33.72N 78.97W)									12.77
Myrtle Beach 5.2 SW (SC-HR-73) (33.64N 78.95W)									10.87

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Myrtle Beach 8.4WNW (SC-HR-27) (33.71N 79.03W)									17.00
Myrtle Beach 8.4WNW (SC-HR-67) (33.74N 79.02W)									15.39
Pawley's Island 0.8 WNW (SC-GT-26) (33.42N 79.13W)									12.09
Pawley's Island 2.6 N (SC-GT-24) (33.46N 79.11W)									15.72
Surfside Beach 1.0 NE (SC-HR-39) (33.62N 78.96W)									8.24
Tega Cay 1.6 SE (SC-YR-13) (35.02N 80.99W)									6.02
York 6.3 E (SC-YR-6) (34.98N 81.12W)									5.80
HADS Sites									
Bennettsville 9 W (BENS1) (34.61N 79.79W)									18.07
Cheraw (CEWS1) (34.70N 79.87W)									10.07
Chesterfield 3 SW (CTFS1) (34.73N 80.04W)									17.09
Darlington (DLGS1) (34.30N 79.91W)									11.14
Galivants Ferry (GALS1) (34.06N 79.25W)									17.05
Georgetown 2 E (GEOS1) (33.36N 79.22W)									10.15
Hartsville (HARS1) (34.37N 80.12W)									11.23
Homewood 2 SSE (CSCS1) (33.86N 79.04W)									15.96

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Jefferson 7 E (JEFS1) (34.65N 80.27W)									21.18
McBee 3 NE (MBES1) (34.50N 80.22W)									14.22
Nixonville 1 NNW (ACWS1) (33.85N 78.90W)									12.61
Pageland 3 SE (PAGS1) (34.75N 80.34W)									10.93
Pee Dee River 4 ENE Cheraw (CHES1) (34.70N 79.88W)									22.58
NOS Sites									
Springmaid Pier (MROS1) (33.66N 78.92W)	15/0100	986.5				2.19	4.32	1.9	
Oyster Landing (N Inlet Estuary) (NITS1) (33.35N 79.19W)						2.48	3.80	1.4	
Charleston, Cooper River Entrance (CHTS1) (32.78N 79.92W)	15/0806	998.9	16/1612	20 (9 m)	32	1.49	4.06	1.4	
USGS Storm Tide Sensors									
Murrells Inlet – Waccamaw River (Georgetown Co.) (SCGEO14325) (33.56N 79.09W)							6.03	3.8	
Surfside Beach – Surfside Beach Swash (Horry Co.) (SCHOR14328) (33.60N 78.97W)							5.55	3.1	
Myrtle Beach – Withers Swash (Horry Co.) (SCHOR00003) (33.68N 78.89W)							4.77	2.5	
Myrtle Beach – Midway Swash (Horry Co.) (SCHOR17779) (33.66N 78.92W)							4.90	2.5	

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Myrtle Beach – Singleton Swash (Horry Co.) (SCHOR17780) (33.76N 78.79W)							4.80	2.4	
Garden City - AIW (Horry Co.) (SCHOR14332) (33.76N 78.82W)							4.58	2.4	
Murrells Inlet (Georgetown Co.) (SCGEO14321) (33.53N 79.03W)							4.67	2.4[WS]	
North Myrtle Beach – Whitepoint Swash (Horry Co.) (SCHOR14333) (33.79N 78.74W)							4.72	2.3	
North Myrtle Beach – Williams Creek (Horry Co.) (SCHOR14329) (33.84N 78.62W)							4.57	2.2	
Myrtle Beach – AIW (Horry Co.) (SCHOR14327) (33.58N 79.00W)							3.69	1.9	
Murrells Inlet – Parsonage Creek (Georgetown Co.) (SCGEO14320) (33.58N 79.00W)							4.03	1.9	
Georgetown – Sampit River (Georgetown Co.) (SCGEO14322) (33.36N 79.38W)							3.83	1.6	
Georgetown – Pee Dee River (Georgetown Co.) (SCGEO14315) (33.37N 79.27W)							3.42	1.3	
Gilliard – Chapel Creek (Georgetown Co.) (SCGEO14317) (33.51N 79.18W)							3.44	0.6	
Others									

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)				
Birdstown Crossroads 2 SSE (34.43N 79.97W)									14.43
Chesterfield (34.74N 80.09W)									19.94
Effingham 2 W (34.05N 79.79W)									9.33
Jefferson (34.65N 80.39W)									16.84
Pawley's Island 2 SW (33.41N 79.14W)									14.41
Red Hill (33.79N 79.01W)									11.43
Wedgefield Plantation 5 SE (33.37N 79.18W)									12.49
Wedgefield Plantation 6 SSE (33.34N 79.19W)									10.10
Tennessee									
ICAO Sites									
Tri-Cities/Bristol Arpt (KTRI) (36.47N 82.40W)									1.19
HADS Sites									
Bryson City 13 N (NFGT1) (35.61N 83.43W)									1.44
Cosby (CBYT1) (35.82N 83.25W)									1.87
Elizabethtown 5 SE (WTGT1) (36.33N 82.13W)									1.48
Gatlinburg 2 SW (CBYT1) (35.69N 83.54W)									1.56
Townsend 5 S (TNST1) (35.59N 83.78W)									1.76
Trade (TRAT1) (36.35N 81.73W)									3.48
Cosby (CBYT1) (35.82N 83.25W)									1.87

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
HADS Sites									
Mount Leconte (MTLT1) (35.66N 83.44W)									3.10
Vermont									
ICAO Sites									
William H Morse State Airport-Bennington (KDDH) (42.89N 73.25W)									2.49
Other									
Marlboro (MRLV1) (42.84N 72.69W)									1.80
Virginia									
ICAO Sites									
Hanover Co. Municipal Airport (KOFP) (37.71N 77.43W)									3.38
Norfolk IAP (KORF) (36.90N 76.19W)	14/0251	1014.0	13/1751	28 (10 m, 2 min)	37				0.32
Danville regional Airport (KDAN) (36.57N 79.34W)									5.74
Lynchburg Regional Airport (KLYH) (37.32N 79.21W)									2.52
Richmond IAP (KRIC) (37.51N 77.32W)									1.27
Richmond Exec. Arpt-Chesterfield Co. (KFCI) (37.41N 77.53W)									2.06
Roanoke Regional Airport (KROA) (37.32N 79.97W)									3.20
Washington-Dulles IAP (KIAD) (38.94N 77.47W)									1.08

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
NOS Sites									
Cape Henry (8638999-CHYV2) (36.91N 75.78W)	14/0836	1012.5	14/0836	35 (27.9 m)	39				
Chesapeake Bay Bridge Tunnel (8638901-CHBV2) (37.03N 76.08W)	17/2254	1012.3	14/0200	31 (14 m)	35	2.13		2.0	
Dahlgren (NCDV2) (38.32N 77.04W)	17/2318	1010.6	17/1118	16 (8 m)	19	2.03	2.89	2.0	
Dominion Terminal Associates (DOMV2) (36.96N 76.42W)	17/2242	1013.0	14/1218	24 (9 m)	33				
Kiptopeke (KPTV2) (37.17N 75.99W)			17/2142	22 (7 m)	31	1.65	2.61	1.6	
Lewisetta (LWTV2) (38.00N 76.46W)	17/2342	1011.7	14/1254	23 (6 m)	28	1.92	2.57	1.9	
Money Point (MNPV2) (36.78N 76.30W)	17/2248	1012.8	14/2230	18 (6 m)	26	2.18		2.0	
South Craney Island (CRYV2) (36.89N 76.34W)	17/2254	1012.7	14/0318	28 (9 m)	35				
Sewells Point (SWPV2) (36.95N 76.33W)	17/2248	1012.7				2.27	3.10	2.0	
Wachapreague (WAHV2) (37.61N 75.69W)	17/2254	1013.7	14/0218	26 (7 m)	31	1.95	3.57	1.7	
Willoughby Degaussing Station (8638614-WDSV2) (36.96N 76.33W)	17/2230	1012.2	14/0518	31 (23 m, 1 min)	36				
Windmill Point (WNDV2) (37.62N 76.29W)						1.77	2.14	1.9	
York River East Rear Range Light (YKRV2) (37.25N 76.33W)	17/2054	1013.3	13/2300	30 (15 m)	35				
Yorktown USCG Training Center (YKTV2) (37.23N 76.48W)	17/2100	1012.2	14/0306	29 (10 m)	34	2.17	3.10	2.0	
Weatherflow Sites									
3rd Island-Chesapeake Bay Bridge Tunnel (XBBT) (37.03N 76.08W)	14/0710	1012.0	14/2035	31 (4.6 m, 1 min)	37				

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[A]	Sustained (kt)[B]	Gust (kt)				
Cape Henry (XHEN) (36.92N 76.01W)	14/0727	1011.0	14/0422	30 (23 m, 1 min)	36				
CoCoRaHS Sites									
Alum Ridge 4 ENE (36.96N 80.39W)									4.07
Arlington 2.7 W (VA-AR-11) (38.88N 77.15W)									3.17
Bassett 1.1 E (VA-HN-9) (36.76N 79.96W)									4.42
Blacksburg 2.4 ENE (VA-MN-21) (36.57N 78.40W)									3.0
Boones Mill 5.5 E (VA-FR-15) (37.12N 79.85W)									4.58
Brookneal 2.9 E (VA-CM-10) (37.06N 78.89W)									4.70
Burnt Chimney 2 NW (37.12N 79.85W)									4.35
Callaway 4 WSW (36.99N 80.13W)									8.84
Cave Spring 2.4 WSW (VA-RN-1) (37.19N 80.02W)									4.62
Charity 3 WNW (36.84N 80.26W)									4.33
Copper Hill 6.2 S (VA-FL-2) (36.99N 80.13W)									9.80
Danville 4.9 NNE (VA-PT-7) (36.64N 79.37W)									5.36
Farmville 1.0 SSW (VA-PN-2) (37.28N 78.40W)									5.23
Ferrum 1.9 SSW (VA-FR-19) (36.90N 80.03W)									5.27
Floyd 5.2 NW (VA-FL-9) (36.96N 80.39W)									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)				
Glen Allen 4.6 W (VA-HR-6) (37.65N 77.57W)									4.50
Gordonville 10.4 S (VA-LS-4) (37.99N 78.21W)									6.28
Independence 1.3 S (VA-GR-3) (36.60N 81.15W)									5.27
Jeterville 3.6 W (VA-AM-2) (37.30N 78.16W)									7.98
Lynchburg 6.7 ESE (VA-CM-4) (37.35N 79.08W)									4.16
Meadows of Dan 2.3 E (VA-PR-5) (36.73N 80.35W)									10.85
Meadows of Dan 4.5SW (VA-PR-2) (36.68N 80.45W)									8.24
Midlothian 0.6 NE (VA-CS-19) (37.51N 77.64W)									5.64
Midlothian 4.7 SSW (VA-CS-26) (37.44N 77.67W)									5.91
Mosely 1.9 NNW (VA-CS-43) (37.44N 77.71W)									5.77
Poages Mill 1 ESE (37.19N 80.02W)									4.12
Richmond 3.9 NW (VA-RCC-10) (37.58N 77.51W)									4.37
Roanoke 5.8 SW (VA-RN-13) (37.22N 80.04W)									4.27
Rocky Mount 2.2 NW (VA-FR-4) (37.02N 79.91W)									5.92
Rocky Mount 4.3 NNW (VA-FR-5) (37.05N 79.91W)									5.98
Swoope 1.6 ENE (VA-AG-11) (38.17N 79.18W)									3.27

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)				
Victoria 0.9 N (VA-LB-2) (37.00N 78.22W)									5.89
Vinton 3.0 E (VA-BD-27) (37.27N 79.83W)									3.66
Waynesboro 1.5 WSW (VA-AG-15) (38.06N 78.93W)									4.07
Wirtz 7.1 ENE (VA-FR-34) (37.10N 79.77W)									4.98
Woolwine 3.2 ENE (VA-PR-8) (36.80N 80.22W)									5.21
Woolwine 3.7 NNE (VA-PR-6) (36.84N 80.26W)									4.64
Willis 2.7 SE (VA-FL-6) (36.83N 80.45W)									10.26
HADS Sites									
Laurel Fork (36.71N 80.52W)									5.65
NWS COOP Sites									
Woolwine (36.62N 81.38W)									5.86
NWS IFLOWS Sites									
Bent Mountain 1 NNW (37.17N 80.12W)									4.45
Bent Mountain 2 SSW (37.12N 80.12W)									4.19
Buffalo Ridge 4 WSW (36.71N 80.33W)									4.83
Copper Hill 2 N (37.11N 80.13W)									4.92
Horsepasture 2 E (36.62N 79.91W)									6.05
Meadows of Dan 3 NNE (36.78N 80.39W)									6.26
Meadows of Dan 3 SE (36.69N 80.37W)									5.71

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)				
Shawsville 4 E (37.16N 80.19W)									5.60
Stuart 4 NNW (36.69N 80.31W)									5.43
Terrys Fork 1 NE (37.07N 80.25W)									3.91
Whitetop 2 NNE (36.63N 81.60W)									3.47
Other									
Bent Mountain 1 NNE CWOP (37.17N 80.11W)									5.64
Clarksville (CLAV2) (36.62N 78.57W)									4.76
Copper Hill 1 NNE (COHV2) (37.09N 80.12W)									6.74
Danville 1 NE VADOT (37.43N 79.90W)									4.90
Farmville 2 N (FARV2L) (37.33N 78.38W)									6.60
Ferrum AWS (36.93N 80.02W)									6.60
Galax 1 SE (GAAV2) (36.65N 80.92W)									5.61
Martinsville (MARV2) (36.71N 79.87W)									4.50
Meadows of Dan 1 W CWOP (36.73N 80.44W)									6.65
Meadows of Dan 5 SW (MODV2) (36.67N 80.45W)									8.01
Pedlar Mills 8 N (PDLV2) (37.67N 79.28W)									3.36
Poages Mill 2 W CWOP (37.20N 80.09W)									5.24
Rocky Mount 1 NW (37.01N 79.00W)									5.92

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)				
Salem City 1 E AWS (37.28N 80.04W)									3.56
South Boston (SOBV2) (36.70N 78.88W)									4.68
Sperryville (SPYV2) (38.62N 78.23W)									4.58
Staunton 16 NW (TDLV2) (38.37N 79.21W)									3.57
Stewartsville AWS (37.27N 79.29W)									4.52
Volney GOES (36.62N 81.38W)									2.60
Willis GOES (36.86N 80.48W)									6.36
Willis (WLLV2) (36.87N 80.93W)									7.09
Wytheville 1 S (WYTV2) (36.93N 81.08W)									2.51
West Virginia									
ICAO Sites									
North Central West Virginia Airport-Clarksburg (KCKB) (39.30N 80.23W)									1.58
Tri-State Airport-Huntington (KHTS) (38.37N 82.56W)									1.50
Other									
Ansted 2 SW (HWKW2) (38.12N 81.12W)									1.67
Buckhannon-Buckhannon River (BKNW2) (39.01N 80.22W)									2.11

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)				
Clarksburg-Ten Mile Creek (TCSW2) (39.28N 80.55W)									1.87
Clearco 1 S - Job's Knob (JOBW2) (38.08N 80.57W)									2.40
Falls Mill 1 SSE-Little Kanawha River (WLDW2) (38.75N 80.53W)									1.79
Frost 3 NE (FSTW2) (38.29N 79.82W)									1.75
Keyser 3 E (KEYW2) (39.41N 78.94W)									1.76
Point Pleasant-Ohio River (POPW2) (38.84N 82.14W)									2.15
Rock Camp (RCPW2) (37.48N 80.58W)									1.51
Spencer (SPEW2) (38.80N 81.36W)									1.72
Terra Alta 1 N (RCPW2) (39.45N 79.55W)									1.61

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.
WS Wave Setup

Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Florence, 31 August–17 September 2018. 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	**18.3**	**30.8**	**40.8**	**50.2**	**71.5**	**115.7**	**155.7**
OCD5	33.4	77.8	136.2	203.6	372.9	538.5	707.8
Forecasts	65	63	61	59	55	51	47
OFCL (2013-17)	24.1	37.4	50.5	66.6	98.4	137.4	180.7
OCD5 (2013-17)	44.7	95.8	153.2	211.2	318.7	416.2	490.6

Table 5b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Florence, 31 August–17 September 2018. 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	17.4	29.3	39.2	48.6	69.9	115.0	154.5
OCD5	32.0	77.5	138.2	208.2	384.0	556.2	729.8
GFSI	**17.3**	**29.2**	41.2	52.6	72.6	**104.8**	160.2
EMXI	19.3	35.3	48.4	60.9	94.9	151.7	204.0
EGRI	19.7	33.8	44.6	52.7	76.0	**110.4**	155.1
CMCI	21.9	37.6	54.3	74.5	112.4	152.8	170.9
NVGI	22.7	39.1	56.8	77.3	123.7	175.3	206.5
AEMI	17.4	30.7	44.3	56.6	82.6	118.9	163.5
HWFI	16.8	**28.7**	42.5	56.1	83.7	128.8	172.4
TVCA	15.8	**27.1**	**37.5**	**45.6**	**65.4**	**99.1**	**132.0**
TVCE	16.1	**28.4**	39.6	48.9	**69.1**	**101.3**	**133.0**
TVCX	16.1	**28.1**	**37.8**	**46.3**	**66.7**	**103.6**	**138.4**
TCON	15.7	**26.9**	**37.6**	**46.0**	**61.9**	**89.8**	**121.0**
GFEX	**17.1**	30.1	42.4	51.7	**69.4**	**107.2**	**152.3**
HCCA	**15.9**	**28.2**	**37.7**	**46.8**	72.9	128.8	177.8
FSSE	**17.2**	**29.1**	40.2	50.8	79.4	140.2	190.8
TABD	22.9	46.2	68.5	91.2	140.6	190.2	237.7
TABM	23.3	42.7	57.9	75.5	96.6	**109.0**	166.8
TABS	40.8	79.0	103.7	111.9	129.4	145.1	199.8
Forecasts	60	60	59	57	53	49	45

Table 6a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for for Hurricane Florence, 31 August–17 September 2018. 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	6.3	12.7	16.1	18.1	22.5	17.3	**13.3**
OCD5	8.7	15.0	18.9	22.2	27.2	29.2	27.1
Forecasts	65	63	61	59	55	51	47
OFCL (2013-17)	5.5	8.0	10.1	11.4	12.7	14.5	15.0
OCD5 (2013-17)	7.1	11.1	14.4	17.4	20.6	22.3	23.7

Table 6b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Florence, 31 August – 17 September 2018. 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	6.8	13.0	15.8	17.6	22.7	17.7	12.7
OCD5	9.1	15.4	18.9	22.0	28.0	29.8	26.2
GFSI	7.5	**12.0**	**15.1**	**17.4**	**20.1**	19.9	18.6
EMXI	9.7	15.4	19.9	22.3	27.3	32.7	35.9
EGRI	9.3	16.0	21.4	26.1	32.5	31.9	24.2
CMCI	8.6	14.6	21.0	26.0	33.7	35.2	26.3
NVGI	9.9	17.6	23.4	28.3	36.9	35.6	28.7
AEMI	9.2	14.7	20.3	24.7	32.0	33.3	24.9
HWFI	7.4	**11.0**	**14.1**	**16.5**	**19.9**	**16.2**	16.0
HCCA	7.8	**12.2**	**15.1**	**15.4**	**18.7**	**16.0**	**12.5**
FSSE	7.9	**12.9**	**15.0**	**16.2**	**18.2**	18.4	15.3
DSHP	8.5	13.4	16.3	18.4	**20.6**	**17.0**	13.0
LGEM	8.4	13.3	16.3	17.9	**19.6**	18.2	13.4
ICON	7.6	**11.9**	**14.4**	**15.9**	**18.2**	**17.0**	14.7
IVCN	7.5	**11.5**	**14.0**	**15.6**	**18.3**	**16.3**	14.1
Forecasts	60	60	59	57	53	49	44

Table 7. Wind watch and warning summary for Hurricane Florence, 31 August–17 September 2018.

Date/Time (UTC)	Action	Location
30 / 1500	Tropical Storm Warning issued	Santiago/Fogo/Brava CVI
1 / 1200	Tropical Storm Warning discontinued	All of Cabo Verde Islands (CVI)
11 / 0900	Hurricane Watch issued	Edisto Beach to NC/VA Border
11 / 2100	Tropical Storm Watch issued	NC/VA Border to Cape Charles Light
11 / 2100	Tropical Storm Watch issued	Chesapeake Bay south of New Point Comfort
11 / 2100	Hurricane Watch extended from	Edisto Beach to South Santee River
11 / 2100	Hurricane Warning issued	South Santee River to Duck
12 / 0900	Hurricane Watch changed to Tropical Storm Warning	Duck to NC/VA Border
13 / 0900	Tropical Storm Watch changed to Tropical Storm Warning	Chesapeake Bay south of New Point Comfort
13 / 0900	Tropical Storm Watch changed to Tropical Storm Warning	Duck to Cape Charles Light
13 / 2100	Tropical Storm Warning issued	Edisto Beach to South Santee River
14 / 1500	Tropical Storm Warning discontinued	North of Duck, including Chesapeake Bay south of New Point Comfort

14 / 1500	Hurricane Warning replaced with Tropical Storm Warning from	Bogue Inlet to Duck
14 / 1500	Tropical Storm Warning modified to	South Santee River to Bogue Inlet
14 / 2100	Hurricane Watch discontinued	All
14 / 2100	Hurricane Warning discontinued	All
14 / 2100	Tropical Storm Warning discontinued	north of Cape Hatteras, including Albemarle Sound
14 / 2100	Tropical Storm Warning modified to	Edisto Beach to Cape Hatteras, including Pamlico Sound
15 / 0300	Tropical Storm Warning discontinued	North of Ocracoke Inlet
15 / 0300	Tropical Storm Warning modified to	Edisto Beach to Ocracoke Inlet
15 / 1500	Tropical Storm Warning discontinued	South of South Santee River and north of Cape Lookout
15 / 1500	Tropical Storm Warning modified to	South Santee River to Cape Lookout, including Pamlico Sound, Neuse River, and Pamlico River
15 / 2100	Tropical Storm Warning discontinued	North of Surf City
15 / 2100	Tropical Storm Warning modified to	South Santee River to Surf City
16 / 0900	Tropical Storm Warning discontinued	All

Table 8. Storm surge watch and warning summary for Hurricane Florence, 31 August – 17 September 2018.

Date/Time (UTC)	Action	Location
11/0900	Storm Surge Watch issued	Edisto Beach to the NC/VA border, including Pamlico and Albemarle Sounds
11/2100	Storm Surge Warning issued	South Santee River to Duck, including Pamlico and Albemarle Sounds, including the Neuse and Pamlico Rivers
11/2100	Storm Surge Watch modified to	Edisto Beach to South Santee River
11/2100	Storm Surge Watch modified to	North of Duck to the NC/VA border
14/0300	Storm Surge Watch discontinued	North of Duck to the NC/VA border
14/2100	Storm Surge Warning modified to	Myrtle Beach to Salvo, including Pamlico Sound and the Neuse and Pamlico Rivers
14/2100	Storm Surge Watch discontinued	All
15/0300	Storm Surge Warning modified to	Myrtle Beach to Ocracoke Inlet, including Pamlico Sound and the Neuse and Pamlico Rivers
15/2100	Storm Surge Warning discontinued	All

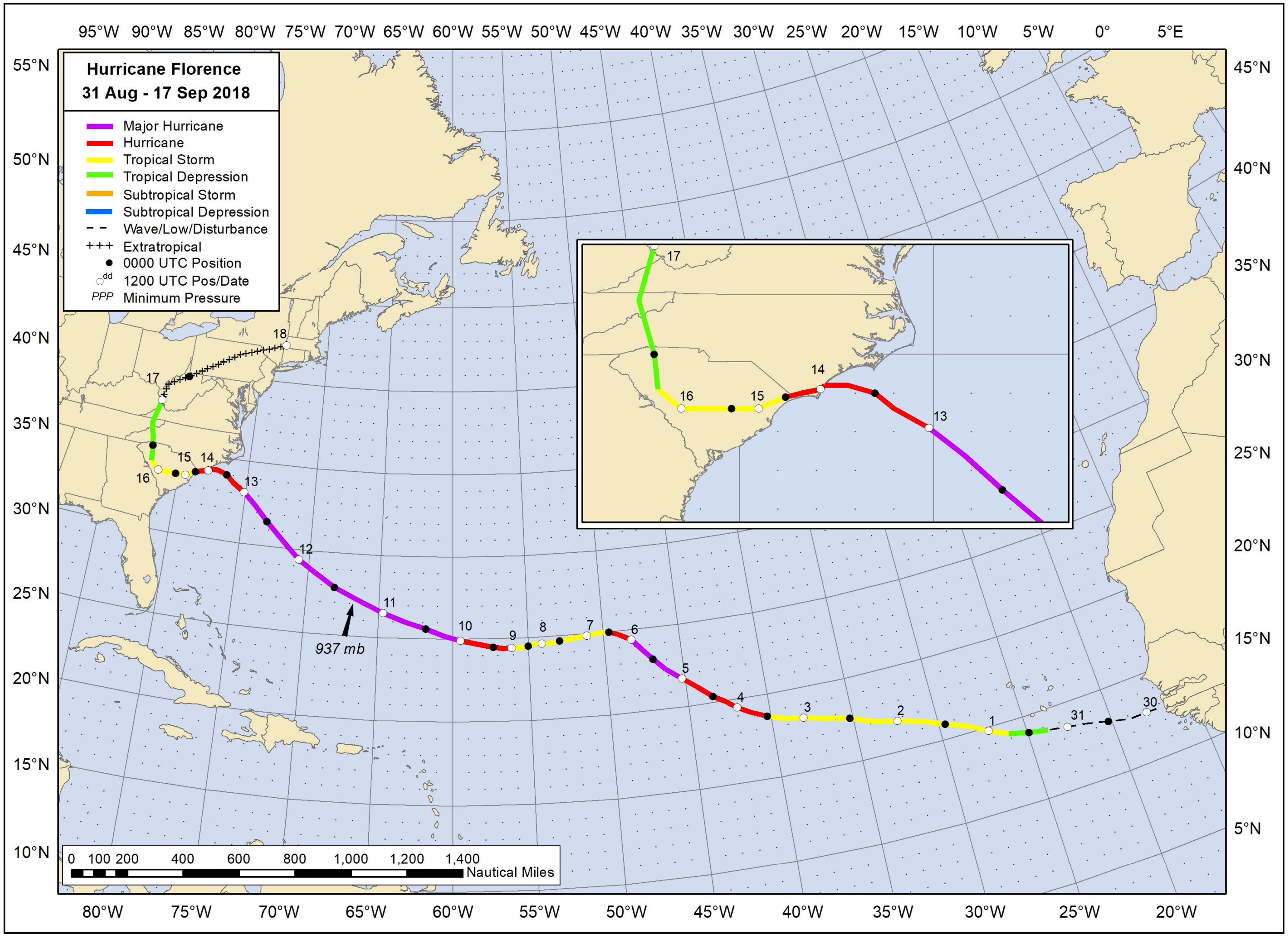

Figure 1. Best track positions for Hurricane Florence, 31 August–17 September 2018. The track over the United States and during the extratropical stage is partially based on analyses from the NOAA Weather Prediction Center.

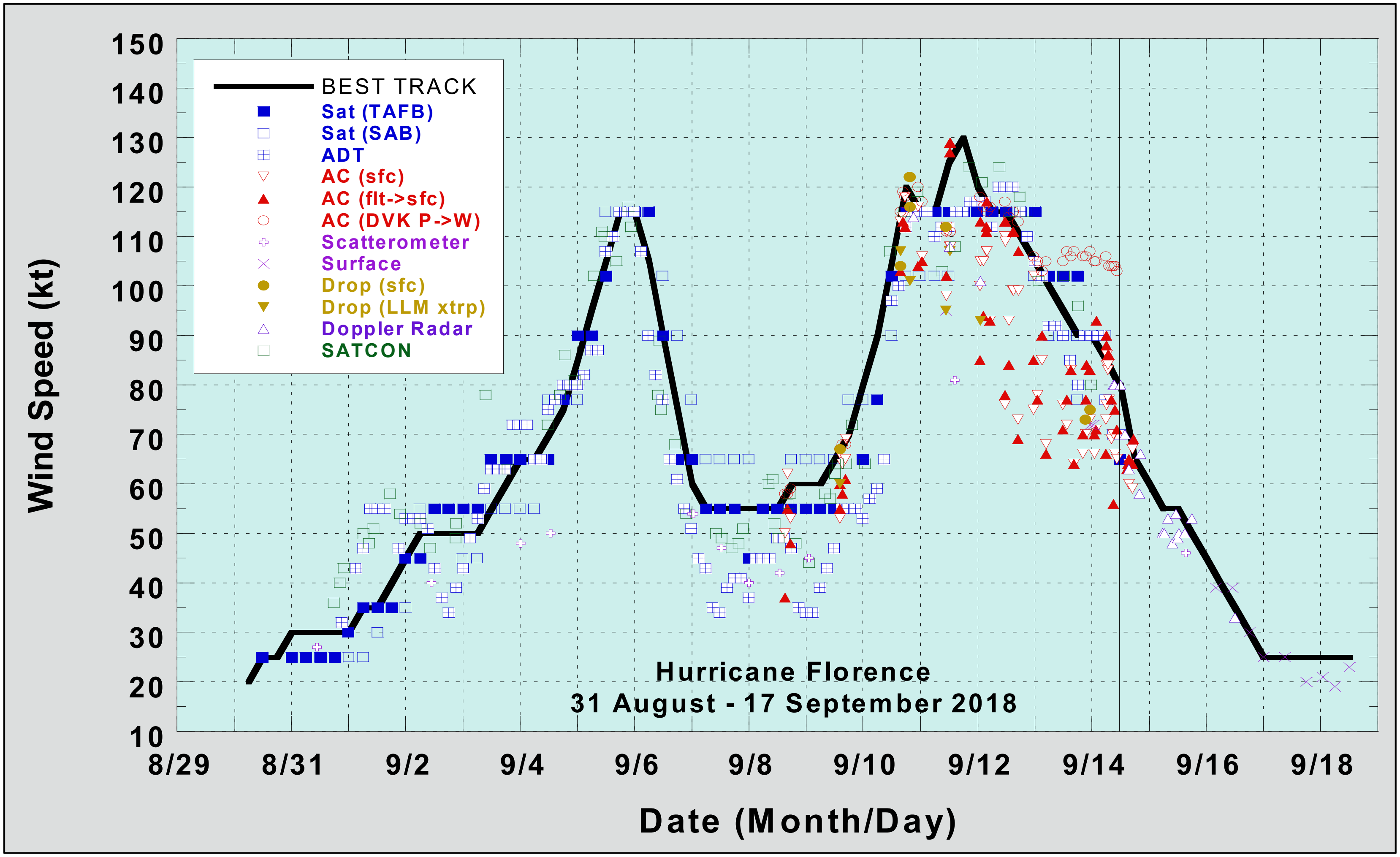

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Florence, 31 August–17 September 2018. Aircraft observations have been adjusted for elevation using 90%, 80%, and 75% adjustment factors for observations from 700 mb, 850 mb, and 925 mb, respectively. 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. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC, and the solid vertical line corresponds to landfall.

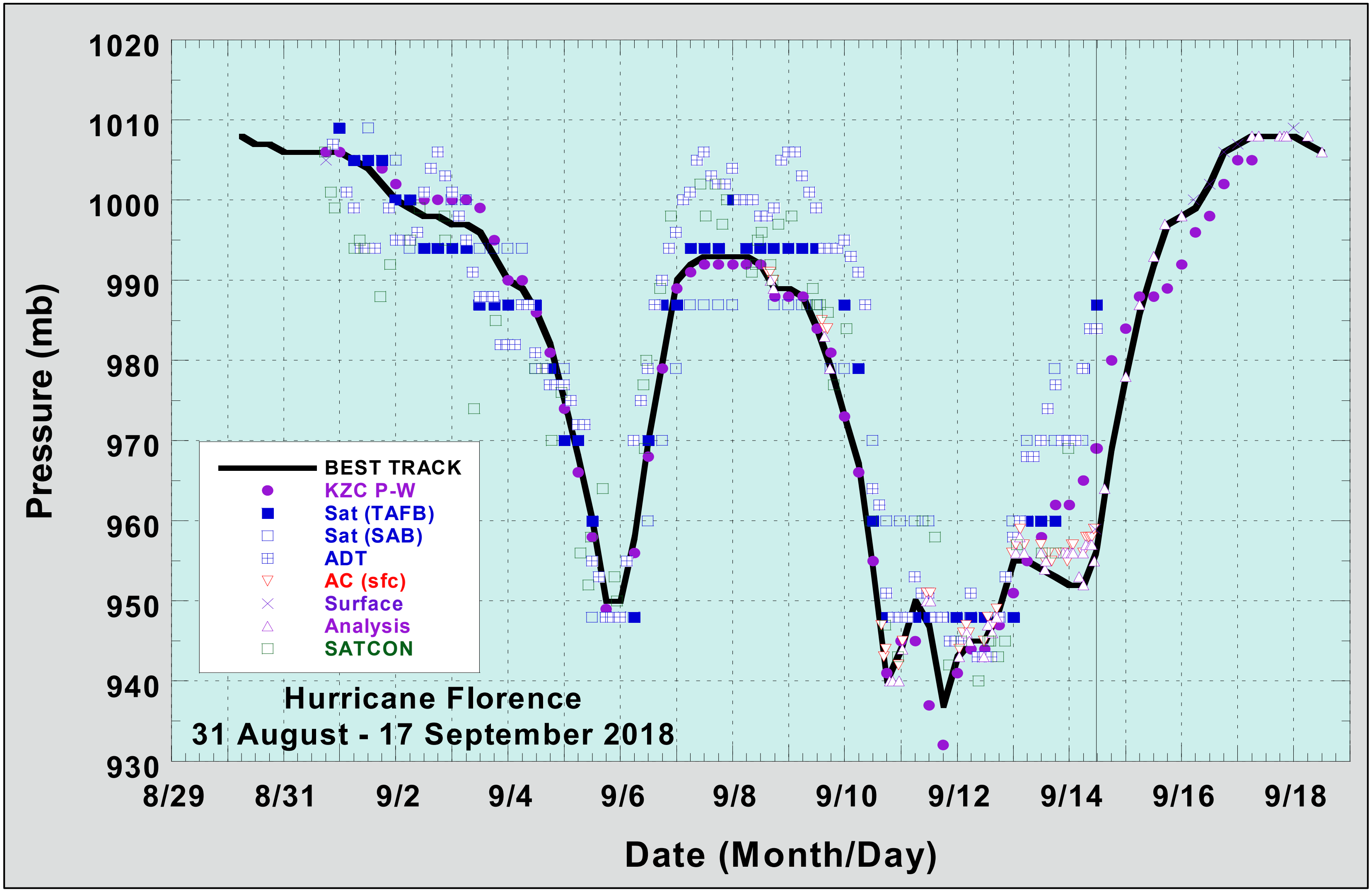

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Florence, 31 August–17 September 2018. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC, and the solid vertical line corresponds to landfall.

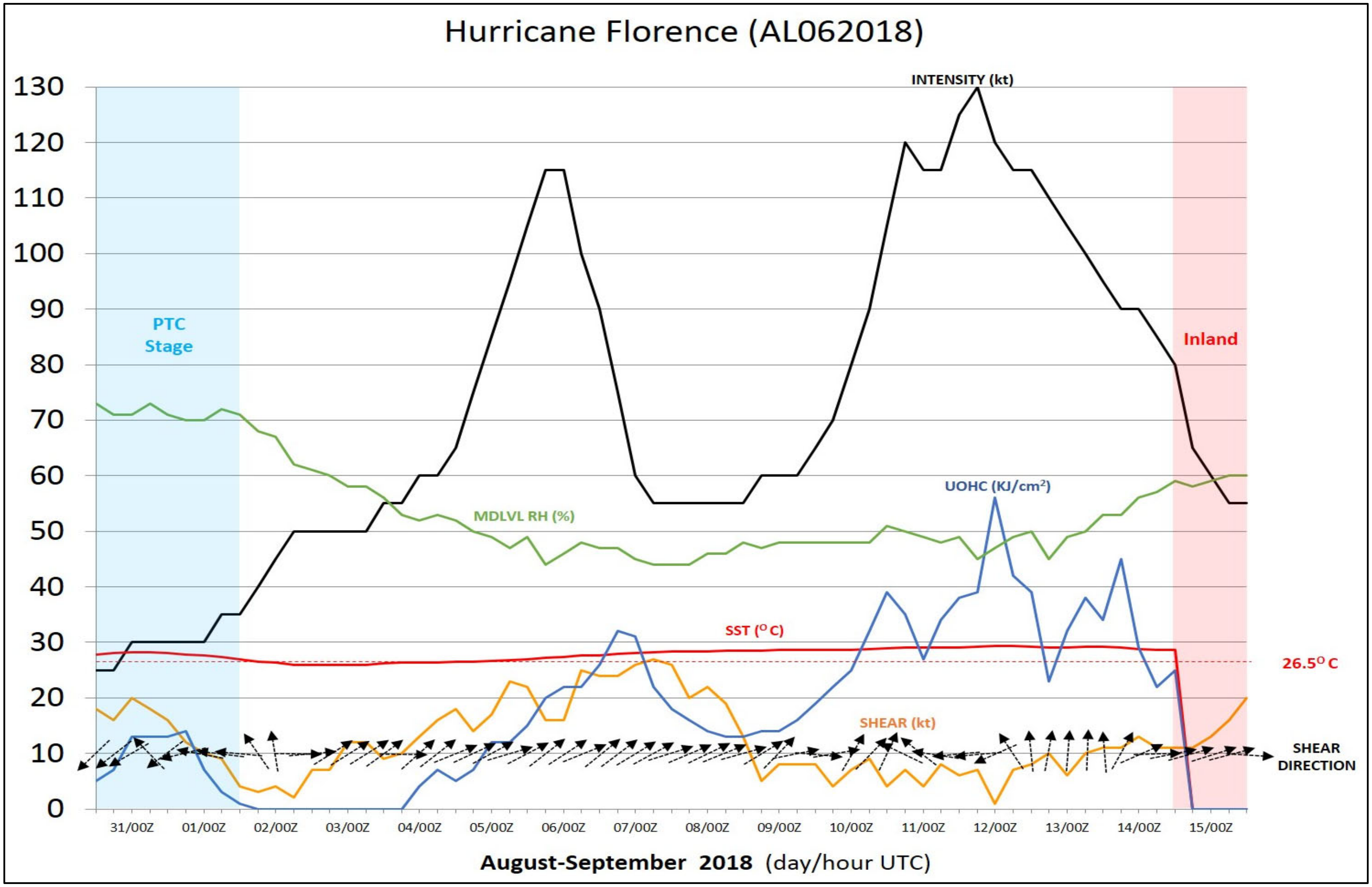

Figure 4. Time series of Hurricane Florence's actual intensity versus GFS-based SHIPS model analyzed environmental parameters: 850−200-mb vertical wind shear (**SHEAR - kt**), sea-surface temperature (**SST - °C**), upper-ocean heat content (**UOHC – kJ cm^{-2}**), and 700−500-mb average relative humidity (**MDLVLRH - %**). Direction of vertical wind shear vectors (black dashed arrows) is relative to true north, with north being at the top of the page. Time period covered is from 1200 UTC 30 August to 1200 UTC 15 September 2018, which includes Florence's Potential Tropical Cyclone stage (blue shading) and when the tropical cyclone was inland (red shading).

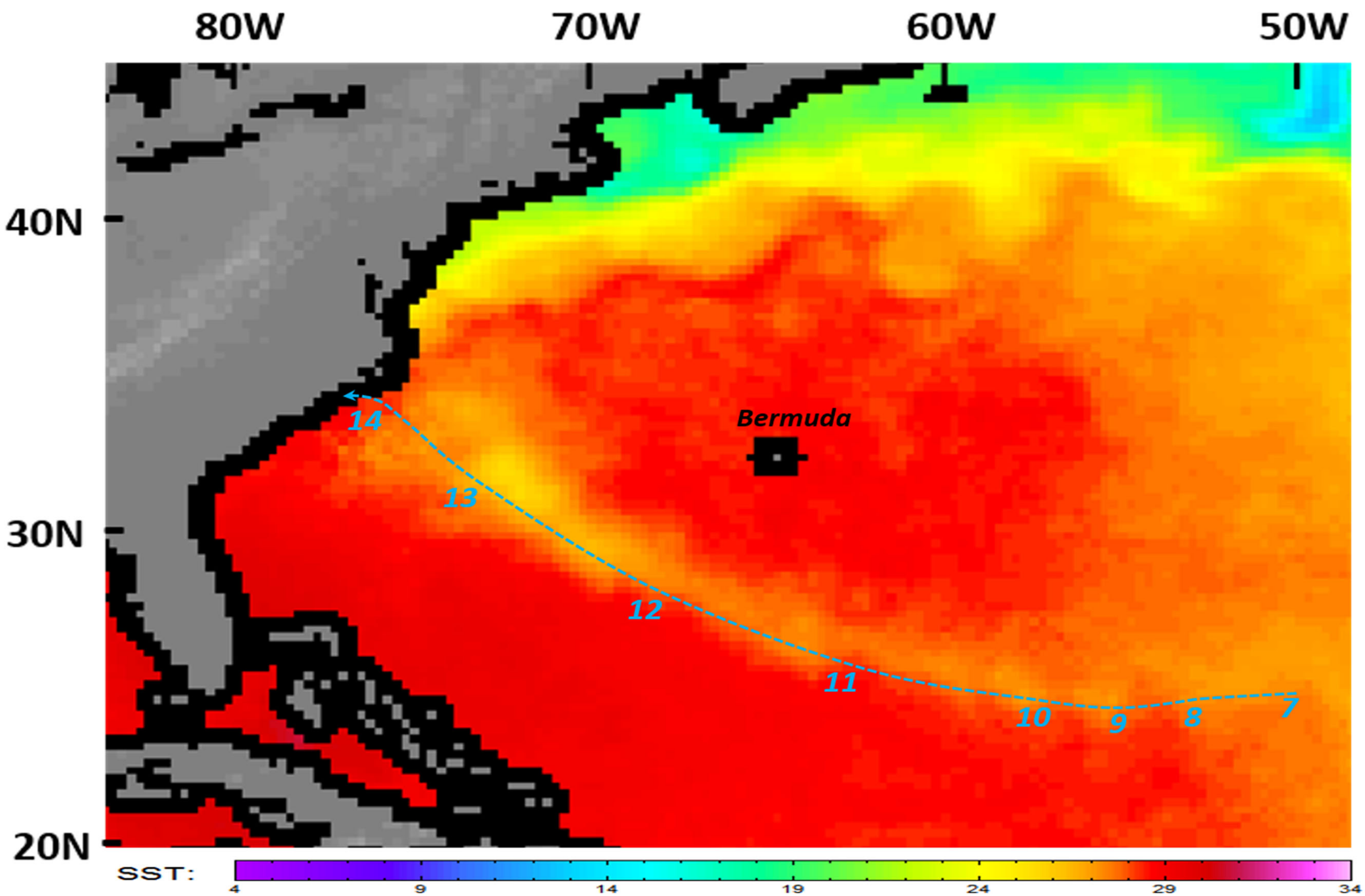

Figure 5. Sea-surface temperature analyses (°C) valid at 1200 UTC 14 September. Florence's track is indicated by the dashed blue line with September dates labeled at 0000 UTC. Cold upwelling beneath the hurricane began on 9 September, with the most significant cooling of about 4°C occurring southwest of Bermuda on 12 September after Florence had reached its peak intensity of 130 kt at 1800 UTC 11 September. Image courtesy of Remote Sensing Systems (RSS), Santa Rosa, CA.

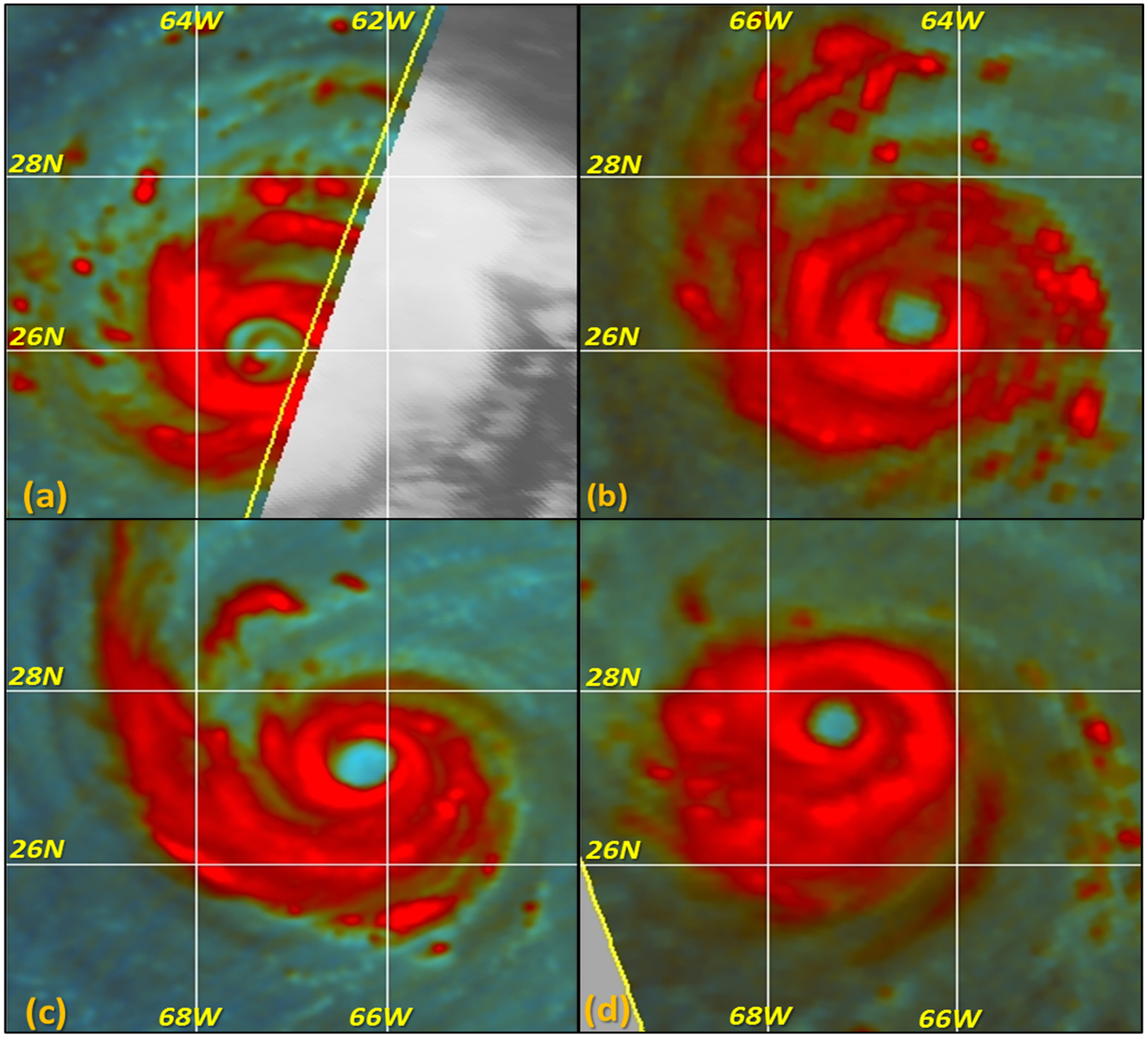

Figure 6. Passive microwave satellite showing Florence completing its first ERC and undergoing a second RI phase on 11 September 2018 — (a) 0706 UTC GCOM showing 32-n mi dimeter eye with along remnant inner eyewall, (b) 1103 UTC SSMI/S, (c) 1728 UTC GCOM indicating a thickening eyewall, and (d) 2135 UTC SSMI/S depicting the 15-n-mi diameter mid-level eye that was contracting. Images courtesy of the Naval Research Laboratory, Monterey, CA.

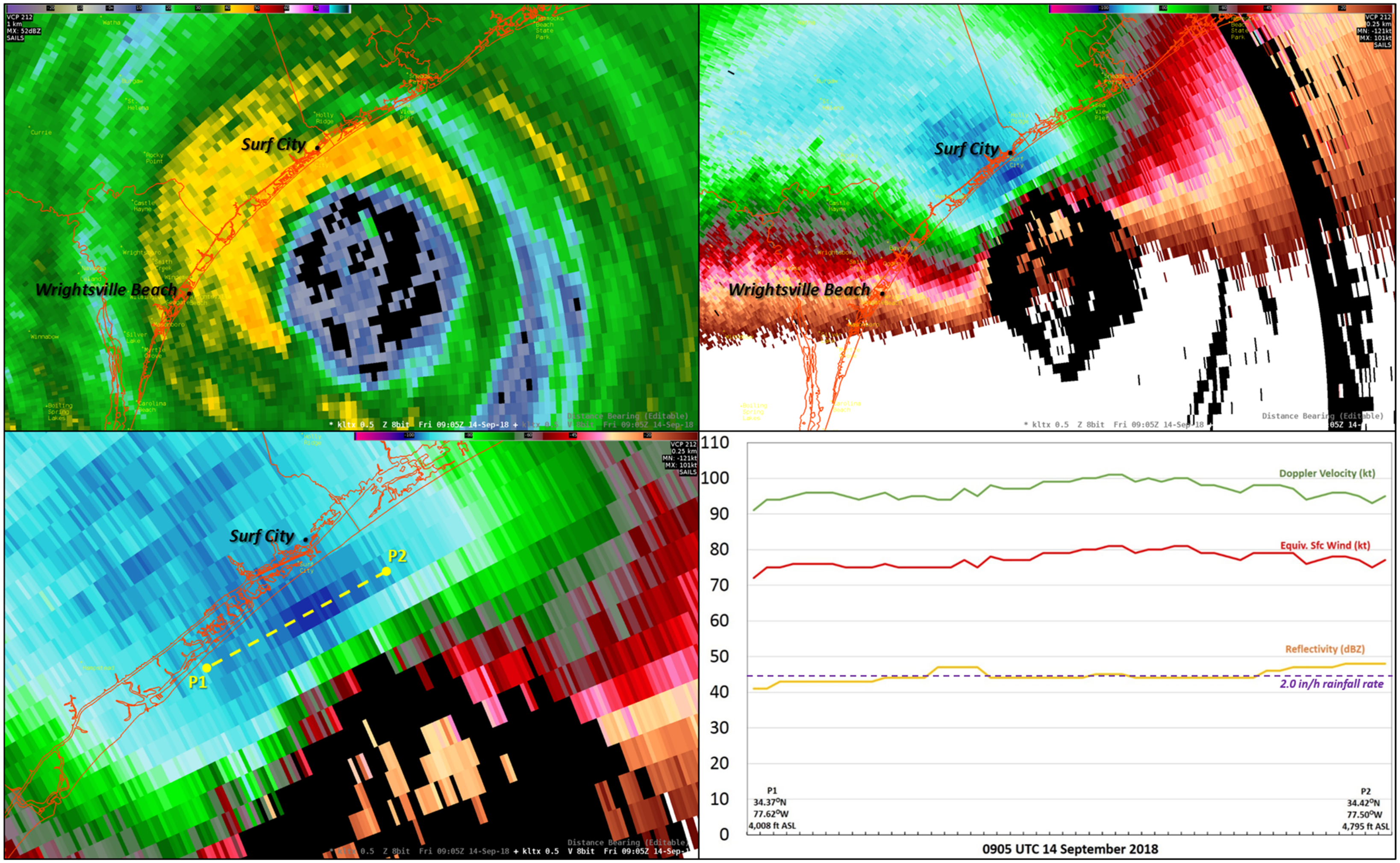

Figure 7. Wilmington, North Carolina (KLTX) WSR-88D Doppler weather radar view of Florence's large eye at 0905 UTC 14 September about 2 h prior to landfall; antenna elevation was 0.5° — (a) Reflectivity (dBZ), (b) Doppler velocity (kt), (c) zoomed-in Doppler velocity (250-meter intervals) along the 060° azimuthal radial (relative to KLTX), and (d) analysis along the radial from endpoints P1 to P2: Doppler Velocity (kt; green line), Equivalent Surface Wind Speed (kt; red line), Reflectivity (dBZ; orange line; 2.0 in/h rainfall rate (dashed purple line).

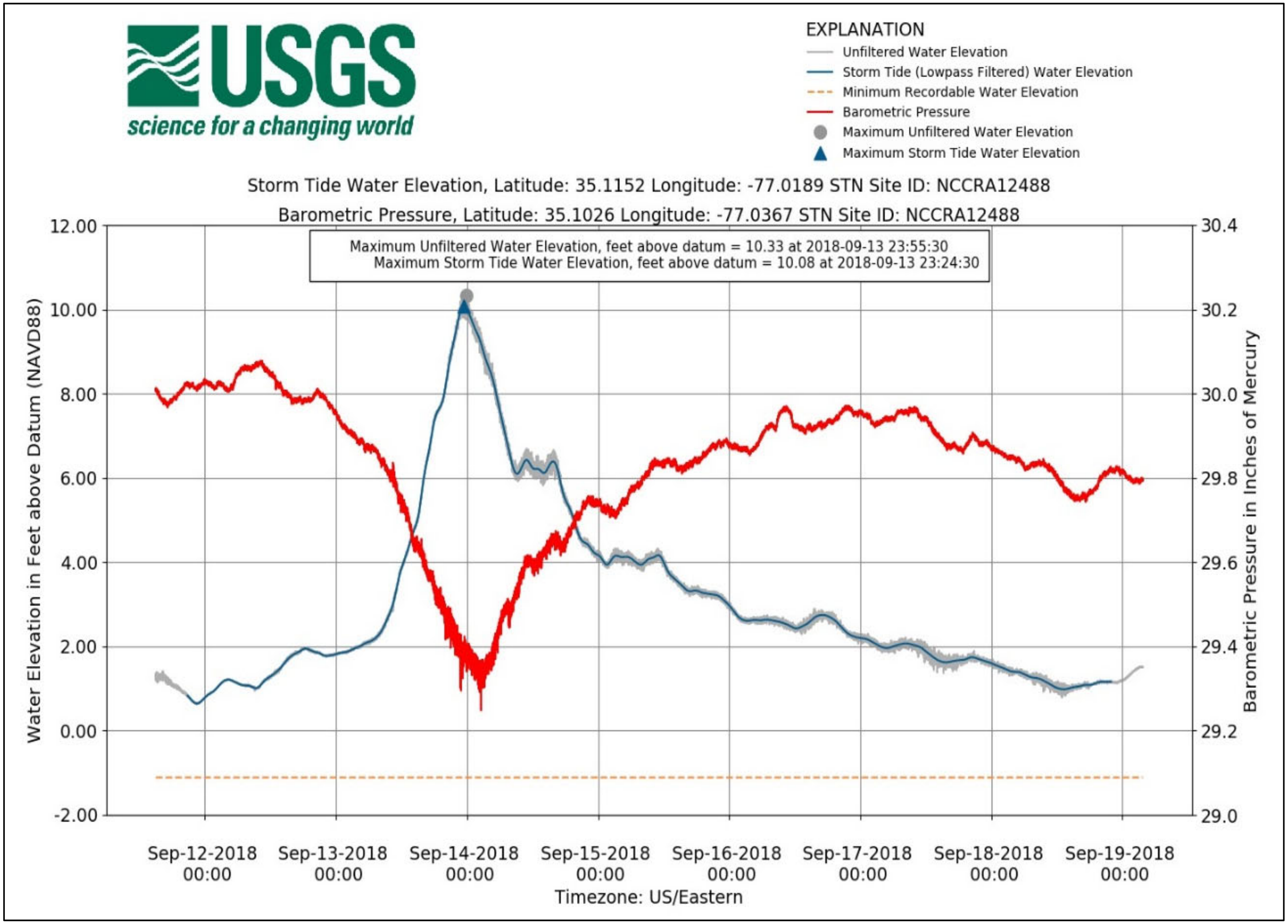

Figure 8. Instantaneous water level (gray, ft above NAVD88), wave-filtered water level (blue, ft above NAVD88) and barometric pressure (red, inches Hg) recorded from a USGS sensor installed across the Neuse River from Downtown New Bern. Data were collected during the period 12-19 September 2018. Image courtesy of the U.S. Geological Survey (USGS).

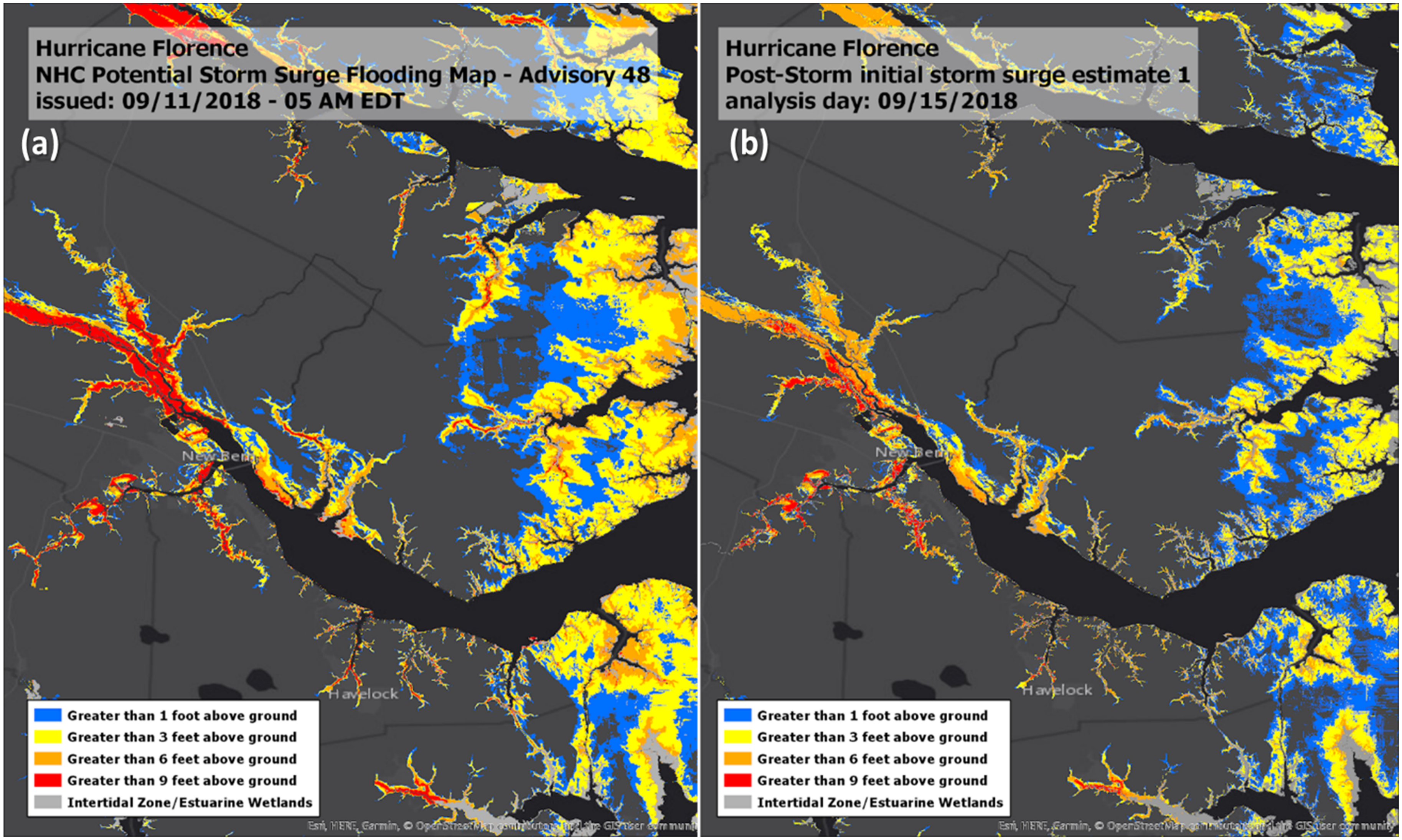

Figure 9. (a) Potential Storm Surge Flooding Map for issued at 0900 UTC 11 September 2018 before Florence reached the coast, showing areas at risk of coastal flooding from storm surge inundation (ft). (b) Post-storm simulation of storm surge inundation (ft) from Florence for the same area along western Pamlico Sound and the Neuse River using the NWS SLOSH storm surge model. Images courtesy of the NHC Storm Surge Unit.

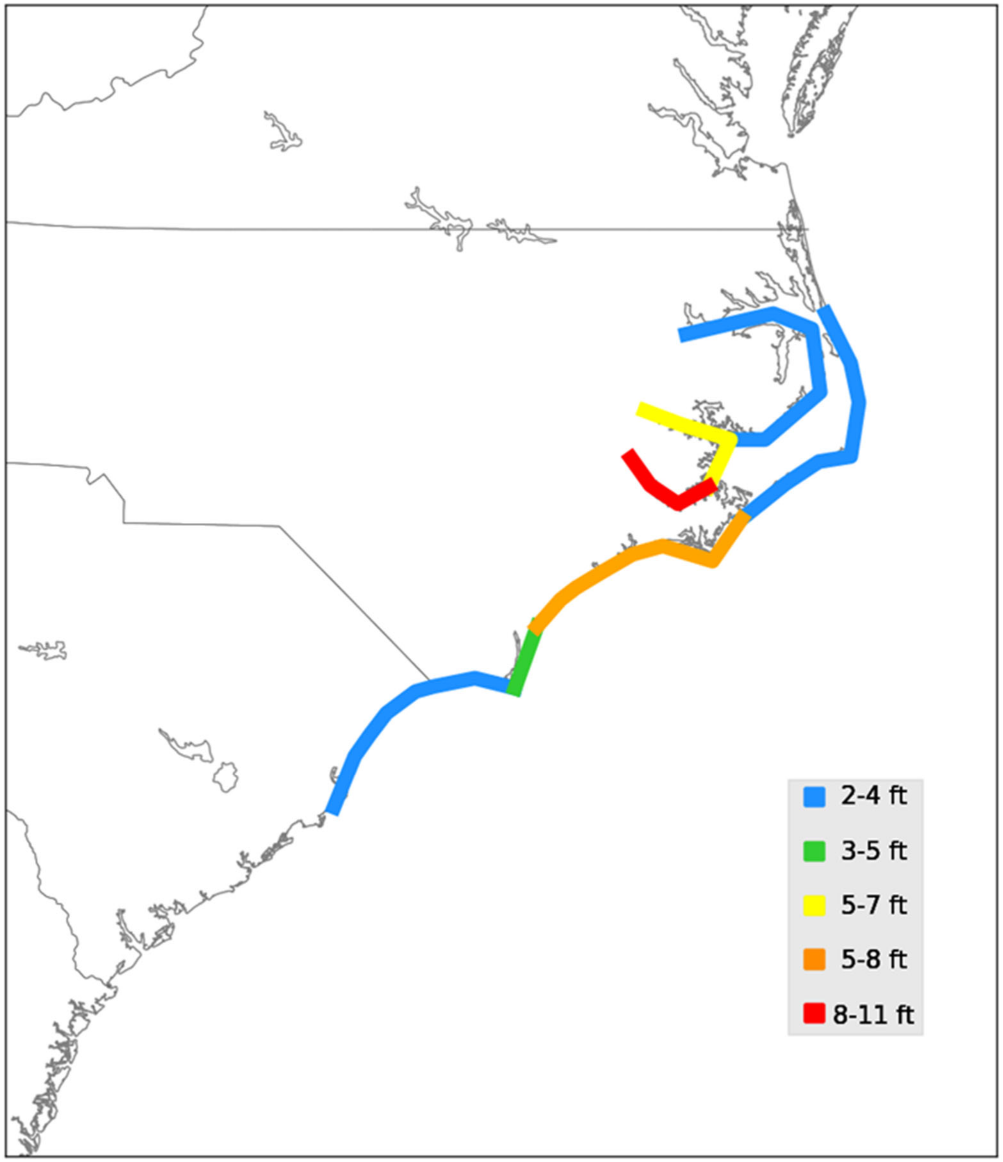

Figure 10. Estimated maximum storm surge inundation levels (ft above ground level) along the coasts of North and South Carolina due to Hurricane Florence. Estimates are based on USGS and NWS high water mark observations, NOS tide station observations above MHHW, USGS storm tide pressure sensors, and a SLOSH hindcast. Image courtesy of the NHC Storm Surge Unit.

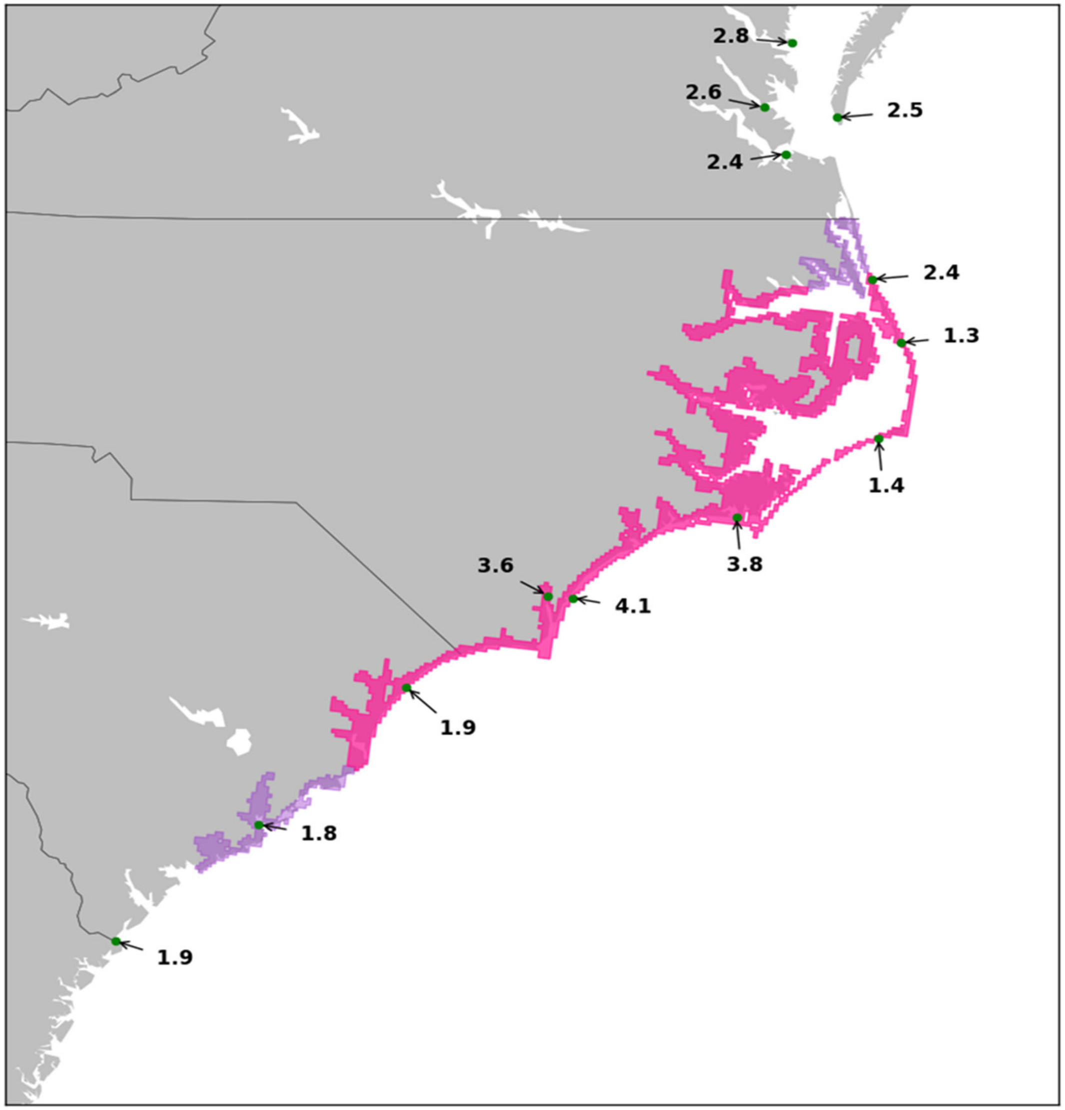

Figure 11. Areas along the coast where a Storm Surge Warning (magenta) or Storm Surge Watch (lavender) was in effect at any time during Hurricane Florence, along with maximum NOS tide station observations in feet above MHHW. Note that this figure does not include water level observations from USGS storm tide pressure sensors or high water mark measurements. Image courtesy of the NHC Storm Surge Unit.

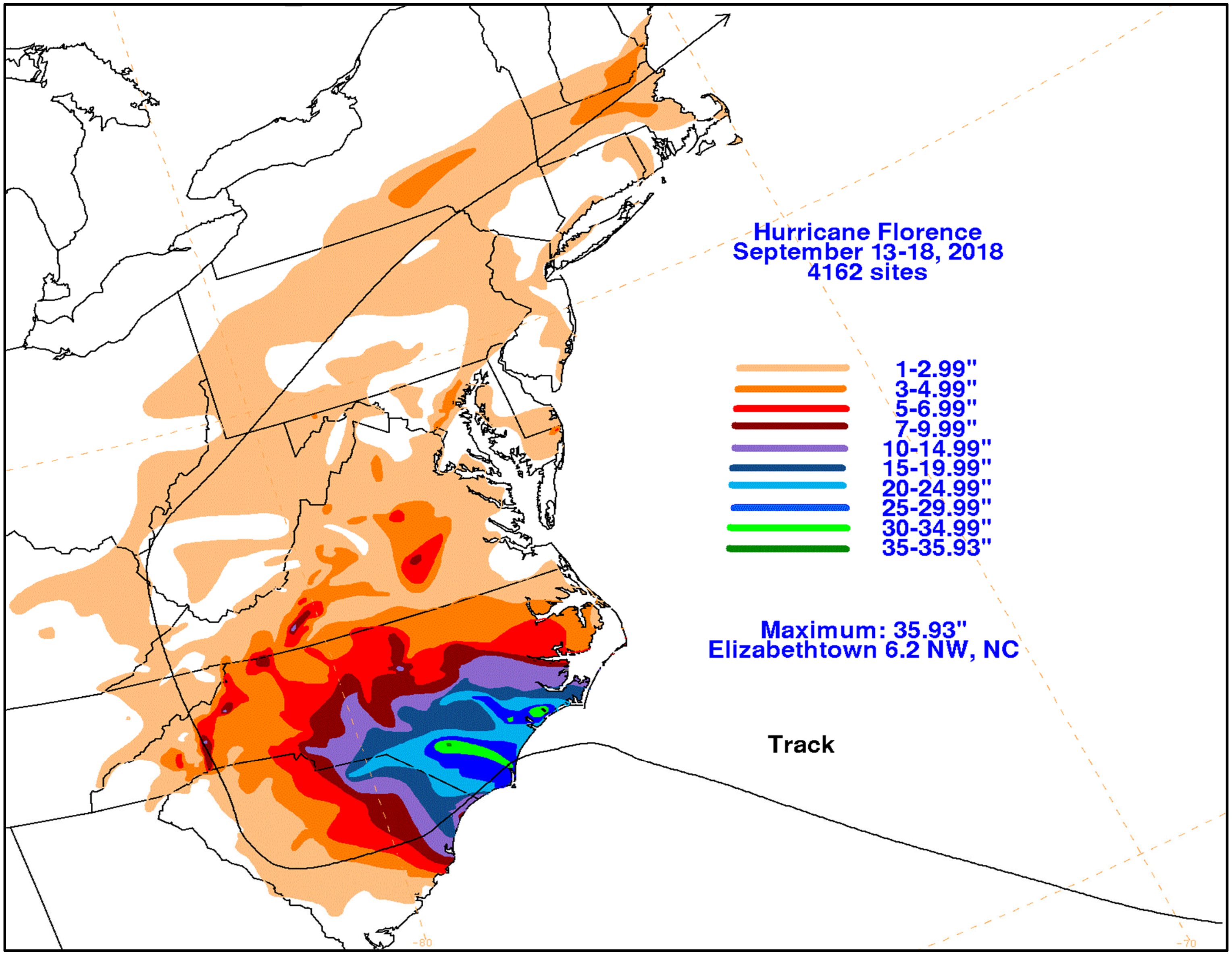

Figure 12. Hurricane Florence U.S. rainfall analysis (inches) during the period 13–18 September 2018, which includes extratropical phase. Graphic courtesy of the NOAA Weather Prediction Center.

Figure 13. Sand deposited by Florence’s storm surge in Surf City, North Carolina.

Figure 14. House severely damaged by storm surge in New Bern, North Carolina.

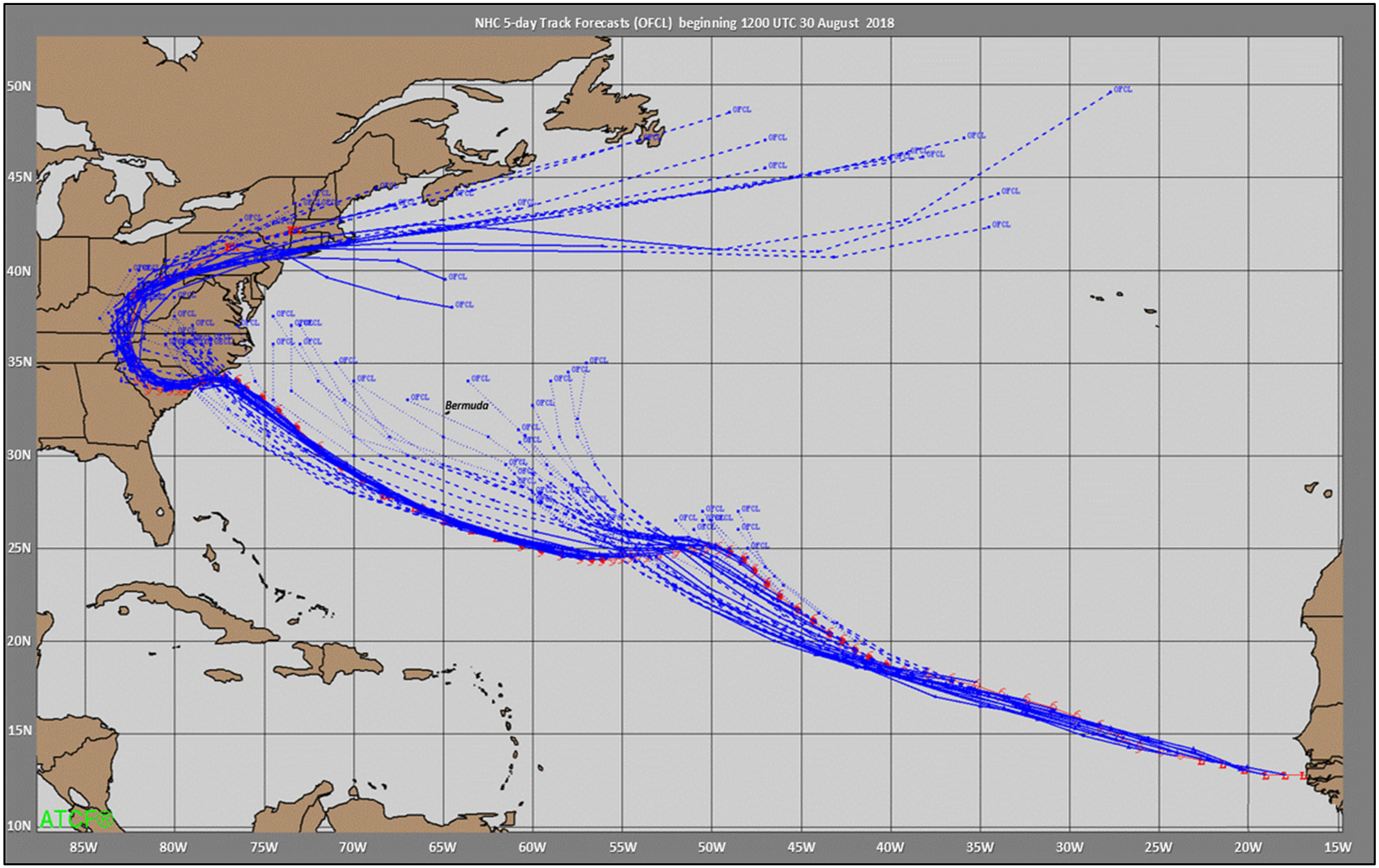

Figure 15. All NHC official track forecasts (blue lines, with 0, 12, 24, 36, 48, 72, 96, and 120 h positions indicated) for Hurricane Florence, 31 August–17 September 2018. The best track is shown by the solid red line with positions shown every 6 h.

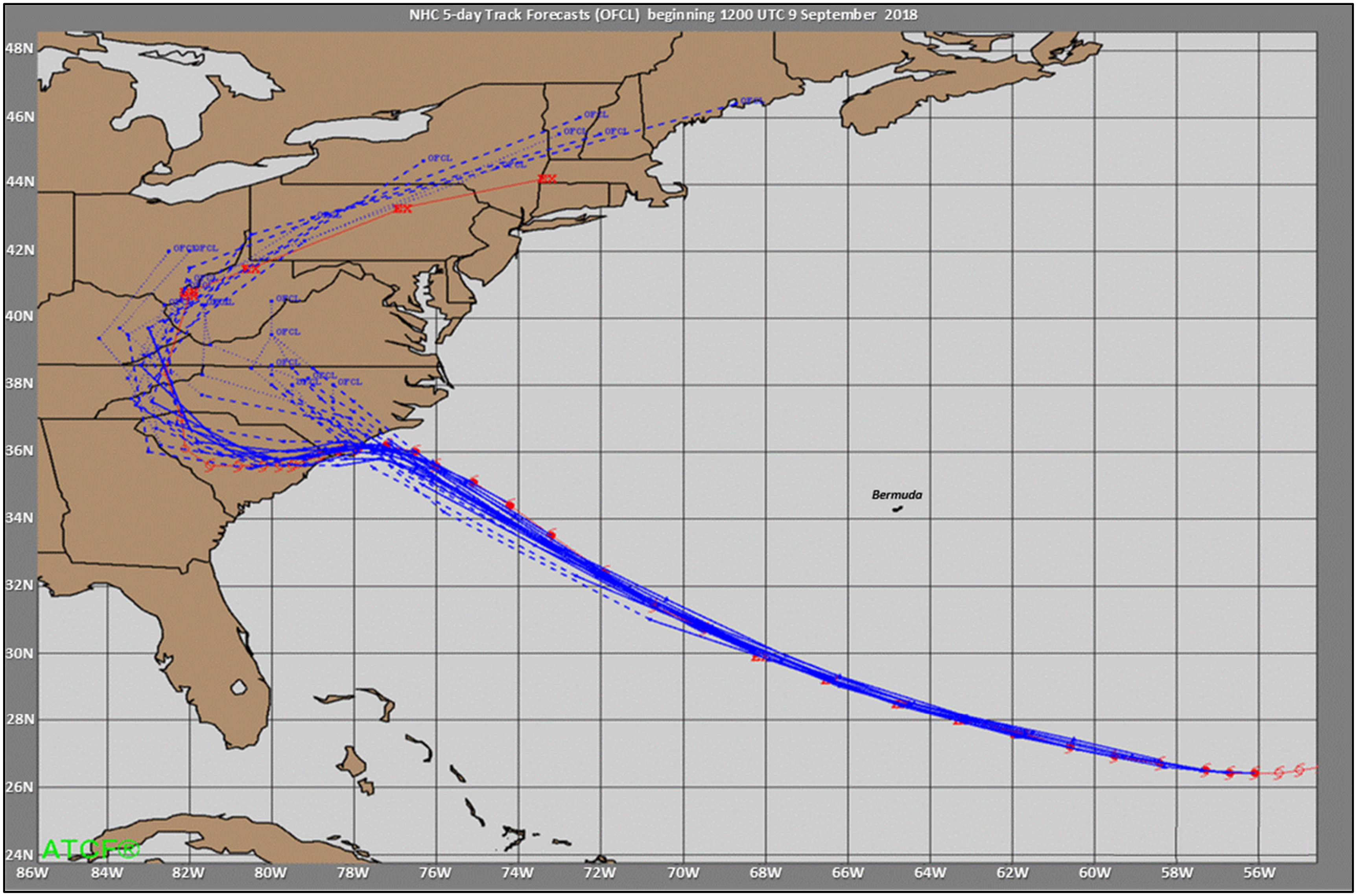

Figure 16. NHC 120-h pre-landfall official track forecasts (blue lines) for Hurricane Florence beginning at 1200 UTC 9 September 2018. The best track is shown by the solid red line with positions shown every 6 h.

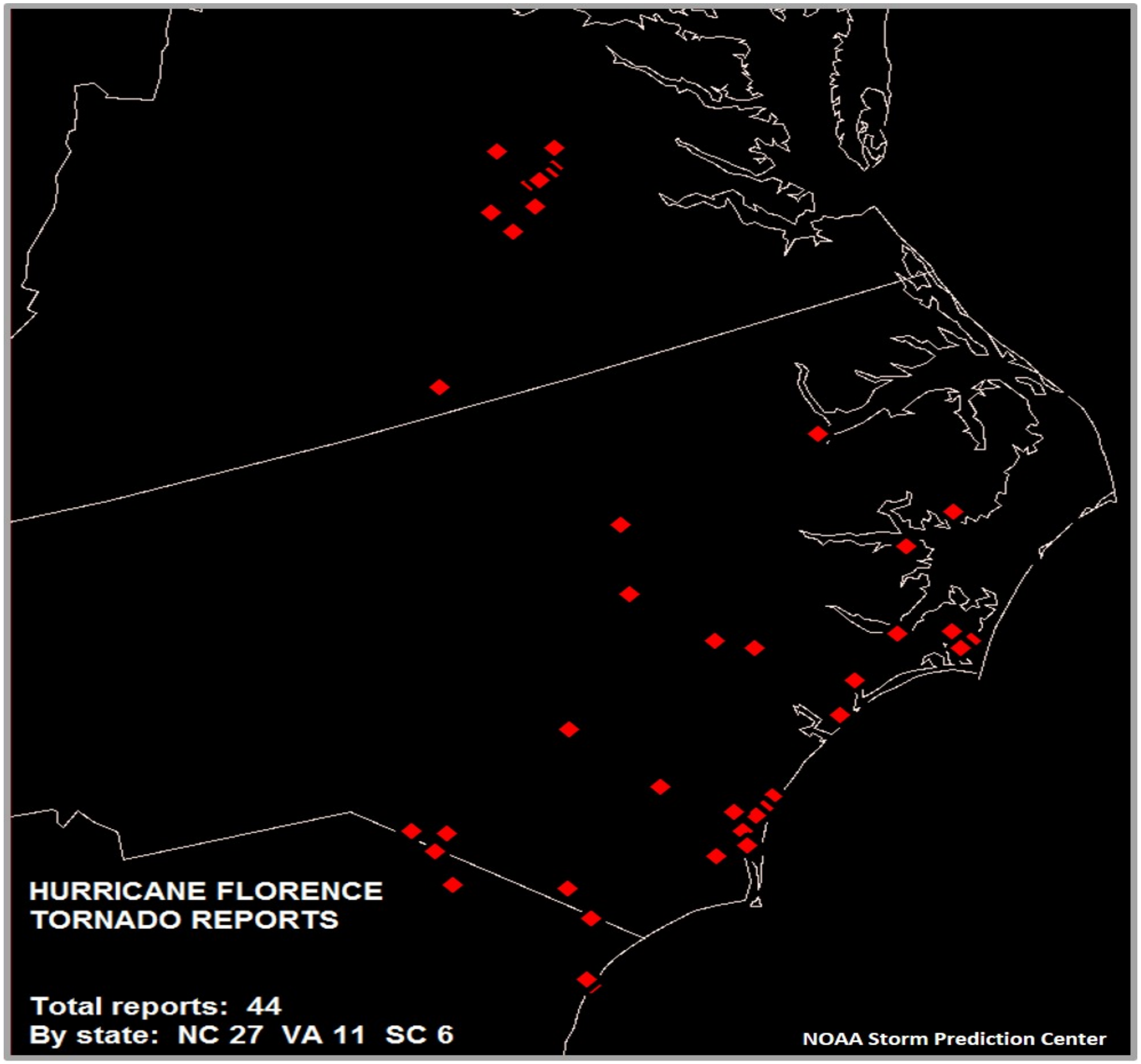

Figure 17. Tornado reports associated with Hurricane Florence during the period 13–17 September 2019. Image courtesy NOAA Storm Prediction Center (SPC), Norman, Oklahoma.

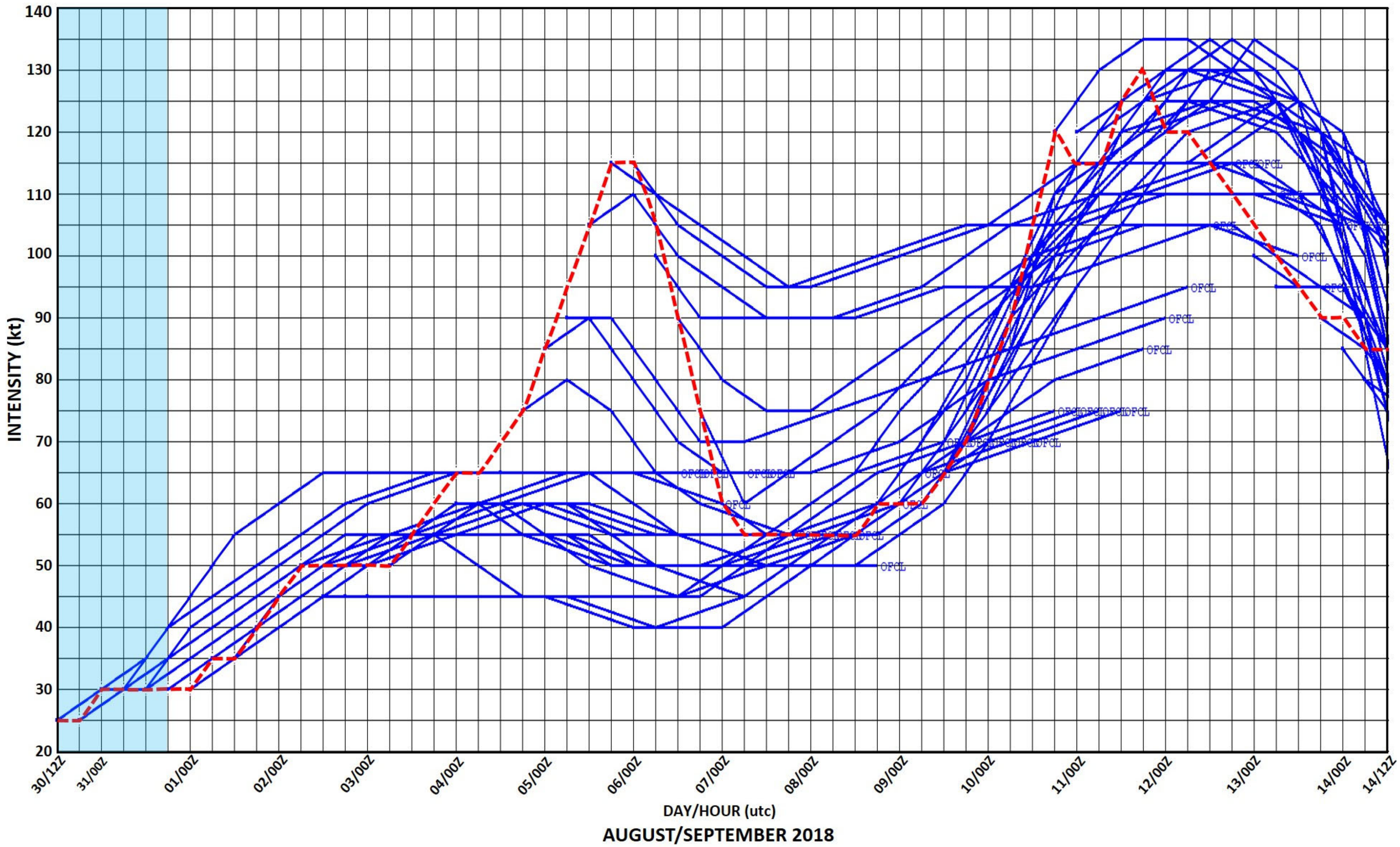

Figure 18. Selected NHC official intensity forecasts (solid blue lines labeled OFCL, kt) for Hurricane Florence during the period 1200 UTC 31 August until 1200 UTC 14 September 2019. Florence's 'best track' intensity (kt) is indicated by the dashed red line. Landfall occurred at 1115 UTC 14 September. Potential Tropical Cyclone (PTC) forecast periods are indicated by blue shading.