NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE SALLY

(AL192020)

11–17 September 2020

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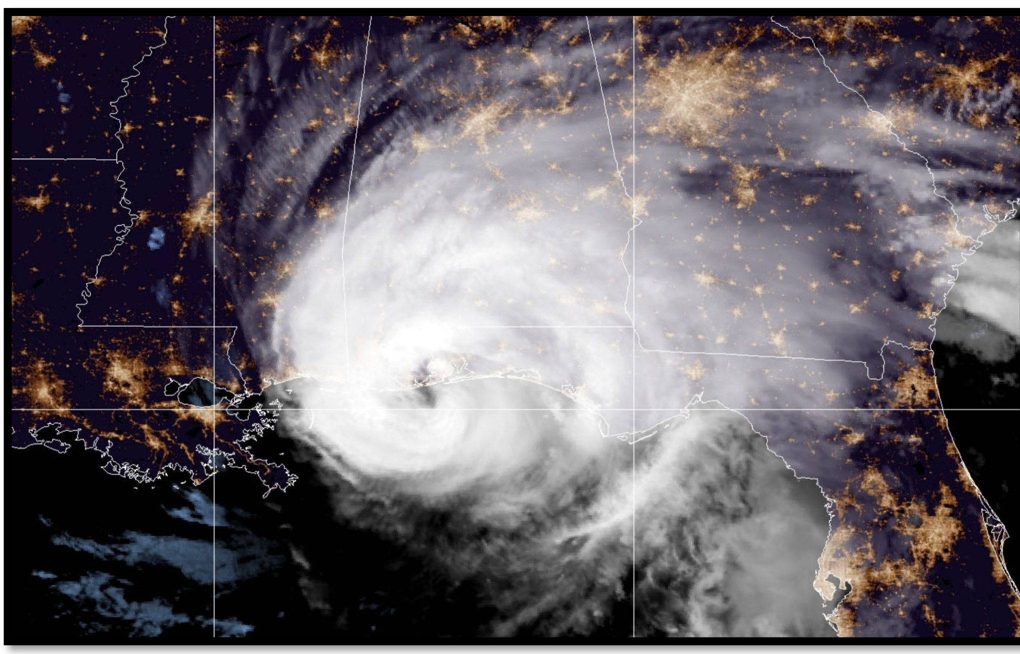

GOES-EAST GEOCOLOR IMAGE OF HURRICANE SALLY AT 0930 UTC 16 SEPTEMBER 2020, JUST BEFORE IT MADE LANDFALL ON THE COAST OF ALABAMA (IMAGE COURTESY OF NOAA/NESDIS/STAR)

Sally was an erratic hurricane, both in its track and intensity, that made landfall along the coast of Alabama at category 2 intensity (on the Saffir-Simpson Hurricane Wind Scale). Sally produced hurricane-force winds along the coasts of Alabama and the western Florida Panhandle, a complex pattern of storm surge flooding along much of the central and northeastern U.S. Gulf coast, and record river flooding resulting from heavy rainfall. Sally is responsible for four direct fatalities in Florida, Alabama, and Georgia and caused 7.3 billion USD in damage in the United States.

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Hurricane Sally

11–17 SEPTEMBER 2020

SYNOPTIC HISTORY

At the beginning of September, Tropical Storm Omar[1] formed off the coast of North Carolina and moved eastward over the subtropical waters of the western Atlantic. Omar became embedded within an amplifying mid-level trough by 4 September, and a pronounced surface trough developed to the south and southwest of the tropical storm, extending just south of Bermuda. Omar dissipated on 5 September, and its remnants moved toward the north Atlantic, leaving the southern portion of the trough to begin moving slowly west-southwestward over the western Atlantic. For several days, the trough continued on this slow west-southwestward trajectory and produced a disorganized cluster of showers and thunderstorms which first reached the Bahamas on 10 September. This area of disturbed weather lacked both convective organization and a well-defined center of circulation during that entire period, but those two criteria for genesis were met by 1800 UTC 11 September, marking the formation of a tropical depression between Andros Island and Bimini in the Bahamas, roughly 100 n mi east-southeast of Miami, Florida. 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].

The depression turned westward, reaching the coast of southeastern Florida near Cutler Bay just after 0600 UTC 12 September. Multiple reporting sites near the coasts of Miami-Dade and Broward Counties began reporting sustained tropical-storm-force winds later that morning, and it is estimated that the depression had become a tropical storm by 1200 UTC while the center was located over the Everglades about 25 n mi west of Homestead. Tropical Storm Sally then continued westward, its center emerging over the southeastern Gulf of Mexico around 1500 UTC.

After moving offshore, Sally turned to the northwest, but moderate northwesterly shear prevented steady strengthening. Sally's winds increased to 50 kt by 1200 UTC 13 September, but its intensity then held steady the rest of the day. A burst of deep convection developed near and to the east of center early the next day, and with the shear relaxing a bit and turning out of the west, Sally went through a relatively short period of rapid intensification (RI) and became a hurricane around 1200 UTC 14 September while centered about 125 n mi south of Pensacola, Florida. During the RI event, Sally's intensity increased by 25 kt over an 18-h period, reaching a relative peak of 75 kt by 1800 UTC that day. A resumption of moderate-to-strong vertical shear likely halted the RI episode, however, with NOAA Tail Doppler Radar (TDR) data showing that

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[1] Stewart, Stacy. "Tropical Cyclone Report: Tropical Storm Omar." National Oceanic and Atmospheric Administration / National Weather Service / National Hurricane Center, 31 Jan. 2021, www.nhc.noaa.gov/data/tcr/AL152020_Omar.pdf.

[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.

Sally had a sheared and asymmetric structure midday on 14 September (Fig. 4). The shear caused Sally to weaken back to an intensity of 70 kt by 0600 UTC 15 September and maintain that intensity for much of the day. At the same time, steering currents had nearly collapsed, and Sally slowed to a crawl while beginning a northward motion toward the northern Gulf coast.

Late on 15 September, Sally began a second short period of RI, with its intensity increasing from 70 kt at 1800 UTC 15 September to 95 kt by 0600 UTC 16 September. While the deep-layer vertical shear near the hurricane did not abate during that period, model diagnostics indicate that upper-level divergence increased by twofold on 15 September, which could have offset the magnitude of the shear and aided in intensification. Sally's northern eyewall began moving onshore Baldwin County, Alabama, between 0500–0600 UTC and affected coastal areas for the next 3 h, with some of the most violent gusts occurring near mesovortices that were observed along the inner edge of the eyewall via radar imagery and storm chaser pressure observations. Sally ultimately made landfall at Gulf Shores around 0945 UTC with maximum sustained winds of 95 kt (Fig. 5).

The hurricane continued northeastward across extreme southern Alabama and the extreme western part of the Florida Panhandle during the morning, and it weakened to a tropical storm by 1800 UTC that day just as the center crossed back into southern Alabama. The storm continued to weaken quickly as it moved farther inland, becoming a tropical depression by 0600 UTC 17 September when centered about 20 n mi south-southeast of Montgomery, Alabama. The depression then merged with a frontal boundary and became extratropical later that morning just before crossing the border into Georgia. The post-tropical cyclone moved faster toward the northeast across Georgia and South Carolina, and it dissipated between Columbia and Florence, South Carolina, soon after 0600 UTC 18 September, when a new, more dominant area of low pressure formed along the front farther north over eastern North Carolina.

METEOROLOGICAL STATISTICS

Observations in Sally (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and 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 dropsonde observations from nine flights of the 53rd Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command and four flights of the NOAA Aircraft Operations Center (AOC) WP-3D aircraft. The NOAA AOC G-IV aircraft also flew three synoptic surveillance flights around Sally. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Global Precipitation Mission (GPM), the European Space Agency's Advanced Scatterometer (ASCAT), and Defense Meteorological Satellite Program (DMSP) satellites, among others, as well as the National Weather Service WSR-88D and the NOAA WP-3D tail Doppler radar, were also useful in constructing the best track of Sally.

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

Winds and Pressure

Sally's estimated peak and Alabama landfall intensities of 95 kt from 0600 UTC to 0945 UTC 16 September are a blend of several pieces of data:

(1) an Air Force Reserve Hurricane Hunter aircraft measured a peak 700-mb flight-level wind of 110 kt at 0845 UTC 16 September, which adjusts to a surface intensity estimate of just below 100 kt;

(2) the same aircraft measured a peak SFMR wind of 88 kt at 0707 UTC. Recent research suggests that for a hurricane of Sally's intensity and structure, SFMR undersampling of the peak winds could have been as much as 8%[3]. Applying that adjustment yields estimated peak surface winds of 95 kt;

(3) a dropsonde from the same flight recorded an average wind of 113 kt in the lowest 150 m of the sounding at 0509 UTC, which equates to an intensity around 95 kt;

(4) an unofficial measurement of 98-kt sustained winds at the top of an 18-m mast was received (unknown time) from Ingram Bayou, Alabama, reducing to 90–95 kt at a standard 10-m elevation; and

(5) A storm chaser measured a pressure gradient of 6.4 mb / n mi within Sally's northern eyewall in Gulf Shores, Alabama. The magnitude of this pressure gradient was similar to gradients measured by the storm chaser in category 4 Hurricanes Harvey and Maria and thus is more than supportive of a 95-kt intensity.

Sally's estimated minimum pressure of 965 mb, occurring at landfall, is based on a pressure reading of 965 mb from a second storm chaser near the coast in Gulf Shores, Alabama, at 0917 UTC 16 September. A near-simultaneous pressure of 966.4 mb was measured by a WeatherFlow instrument located 7–8 n mi farther inland near Foley, Alabama, at 0910 UTC. Surface observations and radar data suggest that Sally's pressure minimum preceded its wind center by more than an hour or two in some locations.

Sally reached an initial peak intensity, estimated to be 75 kt, from 1800 UTC 14 September to 0000 UTC 15 September. Several observing platforms from that day indicated that Sally's circulation was tilted to the north with height, and there were multiple mesovortices with significant updrafts at flight level embedded along the inner edge of the eyewall. Because of this structure, scientists at the NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML) / Hurricane Research Division (HRD) have advised that the highest winds measured by reconnaissance aircraft and dropsondes were likely affected by transient eyewall features and thus would not be representative of the hurricane's circulation. An analysis of NOAA P-3 TDR data (Fig. 4), which tends to smooth out some of these transient features, showed an expansive

[3] Klotz, Bradley W., and David S. Nolan. "SFMR Surface Wind Undersampling over the Tropical Cyclone Life Cycle". *Monthly Weather Review* 147.1 (2019): 247-268. https://doi.org/10.1175/MWR-D-18-0296.1.

area of 90–95 kt winds at an altitude of 0.5 km (about 1600 ft). These winds reduce to maximum surface winds of about 75 kt. Additionally, Sally's minimum central pressure of 986 mb at the time would not generally be supportive of an intensity higher than 75 kt.

Sally was close to becoming a tropical storm before it made landfall near Cutler Bay, Florida, around 0600 UTC 12 September. The C-MAN station at Fowey Rocks, just offshore from Miami, measured a brief increase in winds near Sally's center around the time of landfall, with a peak sustained wind of 37 kt (equating to 32 kt at 10 m) occurring at 0620 UTC. Winds increased to tropical storm force later that morning around 1500 UTC at several sites along the southeastern Florida coast, including Fowey Rocks, near convection to the east of the center. In addition, an ASCAT-C scatterometer pass from 1445 UTC indicated that tropical-storm-force winds were occurring over the Straits of Florida just south of the Florida Keys. These data suggest that Sally had become a tropical storm earlier that morning, by 1200 UTC 12 September, when its center was located over the Everglades of southern Florida.

Sally produced sustained hurricane-force winds across portions of extreme southern Alabama and the extreme western part of the Florida Panhandle near where it made landfall (Fig. 6). The strongest winds measured from a land or marine observation site were sustained winds of 98 kt and a gust to 119 kt at the top of an 18-m meter mast at Ingram Bayou, Alabama. Other hurricane-force measurements in Alabama include sustained winds of 87 kt and a gust to 105 kt at Fort Morgan (at an elevation of 38 m), sustained winds of 81 kt and a gust to 103 kt at Perdido Pass, and sustained winds of 76 kt with a gust to 90 kt at Dauphin Island. In Florida, a sustained wind of 64 kt with a gust to 80 kt was reported at the Pensacola Naval Air Station. NOAA buoy 42012 just south of Orange Beach, Alabama, also reported sustained winds of 70 kt and a gust to 95 kt within Sally's northeastern eyewall.

Sustained tropical-storm-force winds occurred across other areas of the northern Gulf coast from extreme southeastern Louisiana eastward to the Big Bend of Florida on 15 and 16 September. In Louisiana, the National Ocean Service (NOS) station at Pilot's Station East measured an elevated sustained wind of 43 kt and a gust to 52 kt, while the NOS site at Petit Bois Island at the Port of Pascagoula, Mississippi, reported a sustained wind of 50 kt and a gust to 65 kt. Along the coast of the Florida Panhandle, several sites between Pensacola and Panama City reported sustained winds of 50 kt or higher. Tropical-storm-force winds also occurred well east of Panama City, with sustained winds of 34 kt occurring as far east at St. Marks, Florida. Only a few reports of sustained tropical-storm-force winds were received inland from the immediate coast.

Sustained tropical-storm-force winds also occurred in a few areas of southern Florida on 12 September. The C-MAN station at Fowey Rocks reported sustained winds of 40 kt and a gust to 48 kt at an elevation of 44 m. Closer to standard heights, WeatherFlow sites at Biscayne Bay Light and Dania Pier both reported sustained winds of 34 kt and gusts to 42 kt. Near the Florida Keys, the C-MAN station at Sand Key Light measured a sustained wind of 37 kt and a gust to 40 kt.

Storm Surge[4]

Sally's erratic track near the complex shoreline of the northern Gulf coast produced a multifaceted storm surge event, with some areas experiencing flooding followed by a period of abnormally low water due to offshore winds on the backside of the hurricane. The combination of the surge and tides produced maximum inundation levels of 5 to 7 ft above ground level along the coasts of Baldwin County, Alabama, and Escambia and Santa Rosa Counties, Florida. The highest water level measured in the area was from the NOS tide gauge in Pensacola, which recorded a peak water level of 5.6 ft above Mean Higher High Water (MHHW). A team from the NWS Weather Forecast Office in Mobile conducted a post-storm survey of high water marks, and the highest stillwater mark found was 4.2 ft above ground level (AGL) in Orange Beach, Alabama. The team found many exposed debris lines several feet higher which likely included the effects of waves on top of the surge. A post-storm model simulation of storm surge inundation conducted by the NHC Storm Surge Unit (not shown) indicates that a few vulnerable areas where observations did not exist, including in the upper reaches of Escambia and Blackwater Bays, likely experienced storm surge flooding of 6 to 7 ft AGL. Figure 7 shows maximum water levels directly measured or observed from Florida to southeastern Louisiana during or after Sally.

Storm surge flooding of 3 to 5 ft above ground level occurred to the west of Sally's landfall location along the Alabama coast, the Mississippi coast, and in southeastern Louisiana. Easterly and then northerly winds on the back side of Sally pushed water into portions of southeastern Louisiana, where the NOS tide gauge at Shell Beach measured a peak water level of 5.4 ft MHHW. Similarly, a United States Geological Survey (USGS) gauge at Black Bay near Pointe-a-la-Hache recorded a peak water level of 5.2 ft MHHW, and a U.S. Army Corps of Engineers (USACE) gauge at the Bayou Dupre Flood Gate measured a water level of 4.7 ft MHHW. Several stations on the south side of Lake Pontchartrain registered water levels as high as 3.8 ft MHHW. In Mississippi, the highest measured water level was 3.7 ft MHHW by the NOS gauge at the Bay Waveland Yacht Club. In Alabama, the NOS gauge at Dauphin Island measured a peak water level of 3.1 ft MHHW. Other stations around Mobile Bay generally had peak water levels of 1 to 2 ft MHHW.

Probably more noteworthy around Mobile Bay was the reverse surge event that occurred on the backside of Sally's circulation once the winds turned out of the north. As shown in Fig. 8, nearly all NOS tide gauges around the bay recorded minimum water levels below the Mean Lower Low Water (MLLW) line, the tidal datum that is used as the reference for water depths on nautical charts and allows vessel pilots to ascertain if the bottom of their vessel will hit the seafloor during

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

the lowest tides.[5] The NOS gauge at Coast Guard Sector Mobile, for example, measured a minimum water level of 7.0 ft below MLLW. At this site, high water levels produced minor coastal flooding on 15 September and then dropped by about 10.6 ft over roughly 20 h (an average of half a foot per hour), exposing parts of the bay floor on 16 September. Water levels at some of the tide gauges were so low that they exceeded the physical limits of the instruments, and actual minimum water levels could not be recorded.

Storm surge inundation of 2 to 4 ft above ground level occurred along the coast of the Florida Panhandle east of Pensacola to the Big Bend, although some areas near Apalachee Bay experienced even higher water levels. In particular, a USGS gauge on the Aucilla River at Nutall Rise, nearly 200 n mi east of Sally's landfall, recorded a peak water level of 5.8 ft MHHW on 16 September. Data from the gauge indicate that water levels first began rising above normal levels on 13 September when Sally was over the eastern Gulf of Mexico, and the peripheral winds of the meandering hurricane caused these water levels to increase further over the ensuing three days. It is likely, however, that the coastal flooding in this area was isolated in nature, as no other gauge in the region recorded a water level any higher than 3.4 ft MHHW. Farther west, the NOS gauge at Panama City Beach measured a peak water level of 3.8 ft MHHW.

No significant coastal flooding occurred along the western or southeastern coast of Florida, nor in the Florida Keys, when Sally moved across the area as a tropical storm. Some of the highest water levels recorded in the region were 1.8 ft MHHW at Ft. Myers and 1.4 ft MHHW at Virginia Key.

Rainfall and Flooding

Sally's slow motion while approaching and moving across the northern Gulf coast resulted in high rainfall totals (Fig. 9), which caused significant flooding across portions of southern Alabama and the Florida Panhandle. At least two feet of rain was measured at a few locations in Baldwin County, Alabama, and Escambia County, Florida, and a wider swath of at least 1 foot of rain extended around that area across southern Alabama and the Florida Panhandle. The highest reported rainfall total from the entire event was 29.99 inches at Orange Beach, Alabama. A storm-total amount of 29.30 inches was also reported slightly west of that location near Fort Morgan, Alabama. Across the border in Florida, a maximum total of 24.88 inches was measured just west of Naval Air Station Pensacola. A secondary maximum occurred over the Florida Keys, with some areas receiving a foot or more of rain. A total of 12.88 inches of rain was measured in Islamorada on Lower Matecumbe Key. Maximum rainfall totals by state include:

Alabama:	29.99 inches at Orange Beach
Florida:	24.88 inches just west of Naval Air Station Pensacola
Georgia:	10.81 inches at Sterling
Mississippi:	3.27 at Moss Point
Louisiana:	6.94 inches near Pearl River

[5] *Tidal Datums and Their Applications*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Center for Operational Oceanographic Products and Services. NOAA Special Publication NOS CO-OPS 1. https://www.tidesandcurrents.noaa.gov/publications/tidal_datums_and_their_applications.pdf

South Carolina:	8.58 inches west of Landrum
North Carolina:	11.13 inches near Brevard

Freshwater flooding across southern Alabama and the western Florida Panhandle was exacerbated by storm surge, which prevented rainwater from draining into adjacent tidal rivers, bays, or the Gulf of Mexico. Major-to-moderate flooding occurred along many rivers, with several river gauges measuring their highest level on record. In Baldwin County, Alabama, major flooding occurred on the Styx River near Elsanor and on the Fish River near Silverhill. In Walton County, Florida, several rivers and creeks, including the Shoal River near Mossy Head, Alaqua Creek near Pleasant Ridge, and Bruce Creek near Redbay, reached record levels, producing major to moderate flooding. Record flooding also occurred on Holmes Creek at Vernon in Washington County, Florida, and Wrights Creek near Bonifay in Holmes County, Florida.

Tornadoes

There were 16 tornadoes reported while Sally was a tropical cyclone: one in Florida, six in Georgia, and nine in South Carolina (Table 4, Fig. 10). All were rated EF0 or EF1 (on the Enhanced Fujita Scale), were generally short lived, and caused a total of about $41,000 in damage. The most significant tornado, an EF1, occurred just west of Waycross, Georgia, in Ware County, and damaged the roof of a church and the gravestones in a nearby cemetery, accounting for $40,000 of the total tornado damage. The tornado with the longest path was an EF0 in northern Florida that was on the ground for nearly 10 miles, crossing from Calhoun County into Jackson County.

Seven additional tornadoes occurred in South Carolina (3) and North Carolina (4) after Sally had become an extratropical low, causing an estimated total of $86,000 in damage. The costliest was an EF0 just southwest of Florence, South Carolina, that damaged a couple of mobile homes. The strongest was a short-lived EF1 that occurred near Merrimon in Carteret County, North Carolina.

CASUALTY AND DAMAGE STATISTICS

Sally is responsible for four direct fatalities[6] in the United States: two as a result of hazardous marine conditions, one from storm surge, and one from gusty winds toppling a tree onto a home. In Florida, a 27-year-old man drowned after he left his Riola Place neighborhood of Pensacola on Perdido Bay in a 12-ft jon boat, seeking his mother's pontoon boat that had become untethered in the hurricane.[7] His body was found washed ashore near Blue Angel

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

[7] Body of missing boater lost during Hurricane Sally found Wednesday afternoon. *Pensacola News Journal*. 23 September 2020. https://www.pnj.com/story/news/2020/09/23/body-missing-boater-lost-during-hurricane-sally-found-wednesday-afternoon/3510760001/

Recreation Park. Media reports and the medical examiner indicate that a 45-year-old woman drowned near Innerarity Point, Florida, after her vehicle was overtaken by rising storm surge.[8] She abandoned the vehicle and was last seen in a kayak on Innerarity Point Road before she went missing. Her body was found several days later. In Alabama, the Baldwin County coroner reported that a 72-year-old man on a large boat in Wolf Bay drowned during the storm, his body found floating behind an Orange Beach residence. In Georgia, a 30-year-old man was killed on 16 September when gusty winds and heavy rains caused a portion of a large oak tree to fall on a home in southwest Atlanta.[9]

Various reports also indicate there were at least five deaths that were indirectly attributed to Sally, or that occurred when Sally was no longer a tropical cyclone. A person in Pensacola and an 82-year-old man in Baldwin County, Alabama, each died from carbon monoxide poisoning due to improper generator use, and a 33-year-old man died in Foley, Alabama, when a tree fell on him while he was attempting to cut tree limbs. In Georgia, a man at a Cobb County bus stop was killed when a driver lost control of his car on wet roads, and a 71-year-old woman died near Snellville in Gwinnett County when a tree fell on her while she was walking her dog.

The NOAA National Centers for Environmental Information (NCEI) estimates that Sally caused $7.3 billion (USD) in damage in the United States, mainly across Alabama and the Florida Panhandle.

Alabama

Hurricane-force winds associated with Sally's slow-moving eyewall produced widespread damage to trees, power lines, and buildings across Mobile and Baldwin Counties. A few older homes were destroyed, and many structures were damaged by fallen trees or suffered significant roof, siding, and fence damage. In downtown Mobile, numerous oak trees suffered major damage at Bienville Square, and there was minor damage to some businesses. Over 1,000 pecan trees were downed on farms in Baldwin County, and the Alabama Forestry Commission estimates that over $1.5 million (USD) of timber was destroyed. Wind damage extended well inland across southwest and south-central Alabama, with numerous downed trees and power lines across the region. Media reports indicate that at least 275,000 customers lost power in Alabama during the event, including almost all of Baldwin County and 85% of Escambia County.

Widespread storm surge inundation and significant flood damage occurred across coastal Alabama. The greatest damage occurred along the back bays and sounds, especially east of Gulf Shores to the Florida state line and northward into Perdido Bay. The surge moved several large boats onto land. Many docks and piers were destroyed, and a section of the Gulf State Park Pier in Gulf Shores was lost. Several marinas, including the Dauphin Island Marina, were seriously damaged as well.

In addition to the rising storm surge, the extreme rainfall associated with Sally produced widespread flash flooding and river flooding across southern Alabama. Numerous water rescues

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[8] Friend: Woman last seen on kayak during Hurricane Sally was trying to save her life. WEAR-TV. 24 September 2020. https://weartv.com/news/local/friend-woman-last-seen-on-kayak-during-hurricane-sally-was-trying-to-save-her-life

[9] Hurricane Sally's remnants blamed for 3 metro Atlanta deaths. *Atlanta Journal-Constitution*. 18 September 2020. https://www.ajc.com/news/hurricane-sallys-remnants-blamed-for-3-metro-atlanta-deaths/SXLK2GZNTFG75HKI36CDN6R2VM/

were conducted during the event. In Escambia County, ten roads became impassible by floodwaters, and some roads and bridges were washed out. In Coffee County, all roads in the northern half of the county were declared impassible for approximately 16 h until floodwaters receded. A swift water rescue occurred near Dry Creek just north of Brantley in Crenshaw County, where several roads were damaged by flooding.

Florida

Sally's winds, storm surge, and excessive rainfall caused extensive damage across the Florida Panhandle. Thousands of structures were damaged in Escambia and Santa Rosa Counties by strong wind and storm surge, and around 50 structures were destroyed. Many homes suffered roof and siding damage, and media reports indicate that at least 240,000 customers lost power due to widespread downed trees and power lines. A study from the University of Florida estimates that Sally caused $55–100 million (USD) in agricultural losses in the western Florida Panhandle. The largest storm surge impacts occurred in the Perdido Key area and along parts of Pensacola and Escambia Bays, where numerous structures were significantly damaged. The storm surge moved numerous large boats and barges onto land, and a section of the U.S. Highway 98 Three Mile Bridge over Pensacola Bay collapsed when a construction barge struck the bridge. The surge and rough waves covered Johnson Beach Road along the Gulf Islands National Seashore with 4 to 5 ft of sand, and NOAA National Geodetic Survey aerial imagery indicates that three new cuts were created on the east side of Johnson Beach (Fig. 11).

Due to the incoming storm surge, extreme rainfall produced by Sally had nowhere to drain, which resulted in widespread flash and river flooding as well. Significant flooding occurred in many homes and structures across the region, and thousands of water rescues were performed. Numerous roads were made impassable, and some roads and small bridges were washed out. Freshwater and storm surge flooding produced 2 to 4 ft of inundation in parts of Downtown Pensacola. In Walton County, Alaqua Creek rapidly rose above record flood stage and inundated homes along SR-20 west of Freeport with up to 4 ft of water. Record flooding also occurred along other creeks in the Florida Panhandle, which resulted in numerous road closures and some nearby homes being inundated with 2 to 4 ft of water. The Shoal and Blackwater Rivers both reached major flood stage, and the I-10 bridge over the Shoal River in Okaloosa County was closed.

Sally produced heavy rainfall that caused areas of street flooding in Miami-Dade, Broward, and Monroe Counties. Widespread street flooding in Key West inundated some homes and businesses with up to six inches of water, and numerous roads were made impassable by floodwaters and stalled vehicles. In Collier County, widespread street flooding occurred in the Naples-Marco Island area. Minor wind damage to trees and power lines occurred across portions of South Florida, and over 10,000 customers lost power.

Georgia

Sally and its remnants produced gusty winds and heavy rainfall across much of western and central Georgia on 16–17 September. The saturated ground resulted in some downed trees, which led to scattered power outages that affected over 30,000 customers during the event. Significant flash flood damage was reported in Washington County, where SR-24 suffered multiple washouts and collapses of the roadway, and Williamson Swamp Creek inundated SR-231 near Davisboro and surrounded some homes with water. Elsewhere, widespread flooding in Augusta and Waynesboro led to numerous road closures and some flooded vehicles.

Mississippi

Sally's impacts were limited to portions of coastal Mississippi, mainly the result of storm surge as well as some gusty winds. In Jackson County, over 60 roads primarily near the coast were inundated with water. Storm surge and rough waves damaged the fishing pier in Moss Point on the Escatawpa River. Tropical-storm-force wind gusts in the eastern portion of Jackson County downed dozens of trees, which blocked some roadways and damaged a couple of homes. In Hancock County, around 100 low-lying roads were flooded with approximately ten roadways deemed impassible. No fatalities or injuries were reported in the state.

Louisiana

Storm surge impacts in southeastern Louisiana were limited to areas outside the Hurricane and Storm Damage Risk Reduction System (HSDRRS). In Lafourche Parish, 2 to 3 ft of water covered portions of LA Highway 1 south of the Golden Meadow flood gate at peak inundation, which resulted in a road closure that cut off areas to the south including Grand Isle. One to two feet of inundation affected low-lying portions of Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany Parishes, which made some roadways impassible. Some tropical-storm-force wind gusts were measured in the southern portion of Plaquemines Parish, but no significant damage occurred. No fatalities or injuries were reported in the state.

FORECAST AND WARNING CRITIQUE

Genesis

Sally's formation was not well forecast. The precursor disturbance was first mentioned in the NHC Tropical Weather Outlook (TWO) and given a low (<40%) 5-day chance of formation 42 h before Sally became a tropical depression (Table 5). The 5-day genesis probabilities were increased to the medium (40–60%) category 24 h before formation and to the high (>60%) category only about 2.5 h before formation, in a Special TWO issued at 1525 UTC 11 September. The disturbance was first given a low chance of formation during the ensuing two-day period 24 h before it became a tropical depression, and a medium chance 6 h before formation. The 2-day probability only reached the high category at the time that Sally is estimated to have formed.

Track

A verification of NHC official track forecasts for Sally is given in Table 6a. Official forecast track errors were lower than the mean official errors for the previous 5-yr period at all forecast times except for 36 and 120 h. Despite Sally's seemingly erratic track near the northern Gulf coast, the climatology and persistence OCD5 errors were lower than their respective 5-year means at all forecast times, indicating that Sally's overall track was easier to forecast than that of a typical Atlantic tropical cyclone. A homogeneous comparison of the official track errors with selected guidance models is given in Table 6b and Fig. 12.[10] On the whole, two individual deterministic models had lower errors than the NHC official forecasts: the Hurricane Multi-Scale Ocean-Coupled Non-Hydrostatic Model (HMNI) and the Naval Research Laboratory COAMPS-TC Model (CTCI). In addition, the HFIP Corrected Consensus aid (HCCA) and the TVCA, TVCX, and TVDG multi-model consensus aids also had lower errors than the official forecasts. Conversely, some of the typically better-performing models, including the Global Forecast System (GFSI), the European Centre for Medium-Range Weather Forecasts model (EMXI), and the Hurricane Weather and Research Forecast System (HWFI), did not perform particularly well and generally had higher errors than the official forecast.

Sally's track forecasts were more challenging, and possibly less accurate at times, near the northern Gulf coast, despite the overall NHC official forecasts having relatively low errors and superior performance compared to some of the typically best-performing models. There are a few possible explanations:

(1) The official forecasts and many of the models suffered from a noticeable left-of-track (west) bias near the northern Gulf coast. As shown in Fig. 13, many of NHC's track forecasts depicted a potential landfall in southeastern Louisiana or Mississippi, even as late as 36 h before the eventual landfall in Alabama. But this bias was not limited to the official forecasts: several of the typically better-performing global models, GFSI and EMXI, as well as the TVCA model consensus, also depicted tracks over southeastern Louisiana or Mississippi for many model cycles. The GEFS ensemble mean (AEMI) had one of the worst west biases, at one point showing a 5-day forecast off the Texas coast near Galveston.

(2) The bulk track verification statistics wash out nuances in the forecasts that occurred about 3 days before Sally's landfall. A verification of forecasts valid at the synoptic time closest to Sally's landfall in Alabama (1200 UTC 16 September) indicates that the official forecasts made within 2 days of landfall, and 4 days before landfall (Fig. 14a), had lower-than-average errors compared to the previous 5-year period. However, the forecasts made about 3 days before landfall (at 60 and 72 h) (Fig. 14b) had *higher-than-average* errors compared to the previous 5-year period. Since critical decisions and preparations, as well as the issuance of watches and warnings, are often made about 3 days before a hurricane makes landfall, the poorer-than-usual forecasts at this particular time range may have caused a false sense of security to those in the most-impacted areas of Alabama and Florida. Sally's first few forecasts may have also prompted what cognitive psychologists call the "anchoring effect," the human tendency to rely too heavily, or "anchor," on one piece of information (in this case, those first few forecasts) when making decisions, and not adjust those decisions as new information arrives[11].

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[10] The UK Met Office Global Model (EGRI) and the Florida State Superensemble (FSSE) did not have enough forecasts to meet NHC's homogeneity requirement and thus were not included in the track model verification.
[11] Kahneman, Daniel. *Thinking, Fast and Slow*. 1st ed., Farrar, Straus and Giroux, 2011.

(3) It is often difficult to forecast the precise motion of storms that meander or become nearly stationary when embedded in weak steering environments, particularly when the track is dependent on the storm's intensity. While overall track errors are typically low in these situations, small changes in the heading of slow-moving storms near land have significant implications for which part of a coastline will be most impacted by a storm. This makes forecasts in such situations more prone to being seen as erroneous even if overall position errors are low. Sally's expected turn from west-northwest to north-northeast during the two days before landfall ended up being much sharper than originally anticipated, possibly because the hurricane strengthened more than expected, which shifted the area of highest impact from southeastern Louisiana and Mississippi eastward to Alabama and the western Florida Panhandle.

Intensity

A verification of NHC official intensity forecasts for Sally is given in Table 7a. Official forecast intensity errors were higher than the mean official errors for the previous 5-yr period at all forecast times except 36 and 48 h. Climatology and persistence OCD5 errors were much higher than their respective 5-yr means, suggesting that Sally's intensity was more difficult to forecast than for a typical Atlantic tropical cyclone, likely due to land interaction and the two episodes of RI the cyclone experienced. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 7b and Fig. 15. Despite the relatively challenging forecasts and large errors compared to the past five years, NHC's official intensity forecasts overwhelmingly beat the intensity guidance. A few models beat the official forecasts at 12 and 120 h, but otherwise no model had lower errors than the official forecasts between 24 and 96 h.

Sally's intensity forecasts had the complication of a large degree of land interaction. Since most intensity models employ their own forecast track and not the NHC official track forecast (e.g., HWFI, HMNI, HCCA, etc.), Sally's potential amount of time over land and associated weakening varied from model to model and from forecast cycle to forecast cycle. Overall model-to-model comparisons, and comparisons to the official forecasts, are therefore probably not very instructive for this storm. That said, inspection of the two periods of RI showed some patterns. For the first RI episode, the models and the official forecast for the 1800 UTC 13 September forecast cycle correctly indicated that strengthening would occur, but they all showed a peak intensity occurring 12 h too late (Fig. 16a). For the second RI episode, the official forecast and the models for the 0600 UTC 15 September forecast cycle all showed Sally's intensity remaining steady or decreasing slightly over the next 24 h (Fig. 16b), even though they all still had the center offshore during that time. In the end, Sally strengthened by 25 kt during the 12-h period ending at 0600 UTC 16 September.

Storm Surge

For areas that received the highest storm surge inundation from Sally, the initial peak storm surge inundation forecast issued at 2100 UTC 12 September was 2 to 4 ft above normally dry ground for the Alabama coast and 1 to 3 ft for the Florida Panhandle coast. Because of Sally's eastward shift in track from Louisiana to Alabama, these forecasts were gradually raised over time. For Alabama, the inundation forecast settled on 4 to 7 ft above normally dry ground by 1500

UTC 14 September. For the extreme western Florida Panhandle, the inundation forecast increased to 3 to 5 ft above normally dry ground at 1500 UTC 15 September but did not increase fully to 4 to 7 ft until just before landfall, at 0630 UTC 16 September.

For southeastern Louisiana and Mississippi, the initial peak storm surge inundation forecast issued at 2100 UTC 12 September was 6 to 9 ft above normally dry ground, and that forecast was increased to 7 to 11 ft at 0900 UTC 13 September. The forecast for this area began to gradually decrease at 0300 UTC 15 September when it became clearer that Sally would instead more directly threaten areas farther east.

Watches and Warnings

Coastal wind watches and warnings associated with Sally are given in Table 8a. For areas that experienced sustained hurricane-force winds, a Hurricane Watch was first issued for the Alabama coast at 2100 UTC 12 September, and a Tropical Storm Watch was issued at the same time for portions of the Florida Panhandle coast. A Tropical Storm Warning was issued for both Alabama and portions of the Florida Panhandle coast at 0900 UTC 13 September (with the Hurricane Watch still in effect for Alabama). Sustained tropical-storm-force winds began brushing the coast in these areas around 2100 UTC 14 September, indicating that the watches provided a lead time of 48 h and the warnings provided a lead time of 36 h.

The Tropical Storm Warnings were upgraded to Hurricane Warnings for Alabama and the western Florida Panhandle at 1500 UTC and 2100 UTC 14 September, respectively. Sustained hurricane-force winds first reached the coast of Alabama around 0300 UTC 16 September, indicating that the long-duration hurricane watch was issued 78 h before hurricane-force winds began, and the hurricane warning was issued 36 h beforehand. Sustained hurricane-force winds first reached the coast of the western Florida Panhandle around 0900 UTC 16 September, indicating that the hurricane warning there was also issued 36 h before hurricane-force winds began. A Hurricane Watch was never issued for the Florida Panhandle.

Hurricane warnings were issued for portions of the coast of Louisiana and Mississippi at 0900 UTC 13 September. These warnings did not verify, as only sustained tropical-storm-force winds affected a portion of those states' coasts.

A Tropical Storm Watch was issued for the southeastern coast of Florida at 2100 UTC 11 September, and that watch was subsequently discontinued at 0900 UTC 12 September. Sustained tropical-storm-force winds occurred along the coasts of Miami-Dade and Broward Counties on the morning of 12 September, after the tropical storm watch had been discontinued.

Storm surge watches and warnings associated with Sally area given in Table 8b. A Storm Surge Watch was first issued for the northern Gulf coast from the mouth of the Mississippi River to the Alabama/Florida border, including Lake Pontchartrain, Lake Maurepas, Lake Borgne, and Mobile Bay at 2100 UTC 12 September. A Storm Surge Warning was issued at 0900 UTC 13 September from Port Fourchon, Louisiana, to the Mississippi/Alabama border, including the intervening lakes, and was extended eastward to the Alabama/Florida border and Mobile Bay at 0300 UTC 14 September. Storm surge warnings were again extended eastward along the Florida Panhandle coast to the Okaloosa/Walton County line at 2100 UTC 14 September, and then to the Walton/Bay County line at 0300 UTC 16 September. Since sustained tropical-storm-force winds began along the coast around 2100 UTC 14 September, the initial Storm Surge Watch and Warning provided lead times of 48 h and 36 h, respectively.

Ultimately, storm surge warnings extended along the coast from Port Fourchon, Louisiana, to the Walton/Bay County line in Florida. Storm surge inundation of 3 feet or greater above normally dry ground (which NHC uses as a first-cut threshold for the storm surge watch/warning) occurred within most parts of the Storm Surge Warning area, except within Mobile Bay (Fig. 17). Several tide stations and stream gauges east of the warning area along the Florida Panhandle and Apalachee Bay reported slightly above 3 ft MHHW, and the National Weather Service office in Tallahassee had those areas covered under a Coastal Flood Advisory for expected minor coastal flooding as early as the early morning of 13 September. A Coastal Flood Warning was issued for coastal Jefferson and Taylor Counties in Florida on the afternoon of 16 September to warn of significant coastal flooding in the isolated area near the mouth of the Aucilla River (where 5.8 ft MHHW was measured).

IMPACT-BASED DECISION SUPPORT SERVICES (IDSS) AND PUBLIC COMMUNICATION

The NHC began communication with emergency managers on 12 September as Sally emerged over the western Gulf of Mexico. This communication included briefings and Federal video-teleconferences with FEMA Headquarters and FEMA Regions 4 and 6, along with Gulf states. These decision support briefings were coordinated through the FEMA Hurricane Liaison Team, embedded at the NHC. The NHC director maintained direct communications with senior state emergency management officials to discuss the evolving threat to the Gulf coast. In addition, the Tropical Analysis and Forecast Branch of NHC provided 7 live briefings on Sally to U.S. Coast Guard District 7 in support of their life-saving mission. In addition to NHC's IDSS described above, there was a large-scale collaborative IDSS effort across the NWS, including Weather Forecast Offices, River Forecast Offices, and National Centers, in response to the multiple life-threatening hazards produced by Sally.

NHC opened a media pool on 14 September to the network broadcast and cable news/weather outlets and those local TV stations along the northern Gulf coast and inland from Lake Charles, Louisiana, to Tallahassee, Florida. During the four-day pool operation, 108 broadcasts were provided. Audio recordings of the top-of-the-hour generic pool broadcasts were made available on the NHC website.

On social media, the @NHC_Atlantic Twitter account had 36 million Twitter impressions beginning when Sally's precursor disturbance was first highlighted in the Tropical Weather Outlook at 0000 UTC 10 September. NHC provided 12 Facebook Live broadcasts via its Facebook page with 850,000 views during the four-day period. Postings of the latest NHC advisories were made onto the NHC Facebook page at a minimum of once every three hours. The post reach during this event was 4.76 million, and the post engagement was 2.68 million.

ACKNOWLEDGMENTS

Data in Table 3 were compiled in part from Post Tropical Cyclone Reports issued by NWS Forecast Offices (WFOs) in Miami, Key West, and Tallahassee, Florida; Mobile, Alabama; and New Orleans and Lake Charles, Louisiana, as well as Public Information Statements issued by inland WFOs. Data and reports from the Weather Prediction Center (WPC), National Data Buoy Center, NOS Center for Operational Oceanographic Products and Services, U.S. Geological Survey, and U.S. Army Corps of Engineers were also used in the creation of this report. Laura Alaka and William Booth from the NHC Storm Surge Unit provided storm surge data and a storm surge hindcast for the analysis, Hurricane Specialist John Cangialosi created the best track map (Fig. 1), and Zack Taylor from WPC created the rainfall map (Fig. 7). Dr. Paul Reasor and Dr. Sim Aberson from the NOAA Atlantic Oceanographic and Meteorological Laboratory / Hurricane Research Division, as well as James Franklin, are thanked for their assistance in interpreting aircraft flight-level, dropsonde, and P-3 Tail Doppler Radar data. Josh Morgerman of iCyclone and Mike Theiss of Ultimate Chase are thanked for the data they collected in the core of Sally along the Alabama coast.

Table 1. Best track for Hurricane Sally, 11–17 September 2020.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
11 / 1800	25.4	78.6	1007	30	tropical depression
12 / 0000	25.6	79.4	1004	30	"
12 / 0600	25.6	80.2	1003	30	"
12 / 1200	25.5	80.8	1003	35	tropical storm
12 / 1800	25.6	81.6	1003	35	"
13 / 0000	26.0	82.5	1003	35	"
13 / 0600	26.7	83.5	1001	45	"
13 / 1200	27.2	84.5	996	50	"
13 / 1800	27.6	85.4	996	50	"
14 / 0000	27.9	86.0	996	50	"
14 / 0600	28.2	86.5	996	55	"
14 / 1200	28.4	86.9	991	65	hurricane
14 / 1800	28.6	87.3	986	75	"
15 / 0000	28.7	87.7	986	75	"
15 / 0600	28.8	88.0	984	70	"
15 / 1200	29.0	88.1	982	70	"
15 / 1800	29.3	88.1	981	70	"
16 / 0000	29.6	88.0	975	75	"
16 / 0600	29.9	87.9	967	95	"
16 / 0945	30.3	87.7	965	95	"
16 / 1200	30.5	87.6	967	85	"
16 / 1800	31.1	87.2	982	60	tropical storm
17 / 0000	31.6	86.7	994	35	"
17 / 0600	32.1	86.1	1000	30	tropical depression
17 / 1200	32.6	85.2	1003	30	extratropical
17 / 1800	33.2	83.8	1004	30	"
18 / 0000	33.7	82.3	1004	30	"
18 / 0600	34.1	80.8	1005	30	"
18 / 1200					dissipated
16 / 0600	29.9	87.9	967	95	maximum winds
16 / 0945	30.3	87.7	965	95	minimum pressure
12 / 0600	25.6	80.2	1003	30	landfall near Cutler Bay, Florida
16 / 0945	30.3	87.7	965	95	landfall near Gulf Shores, Alabama

Table 2. Selected ship reports with winds of at least 34 kt for Hurricane Sally, 11–17 September 2020.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
11 / 2200	9HA366	25.7	78.3	160 / 35	1018.4
12 / 0900	9HA366	25.7	78.3	160 / 35	1019.4
12 / 1600	C6XS7	25.9	78.4	170 / 36	1011.7
12 / 1700	C6SA3	25.8	78.0	170 / 38	1013.0
14 / 1200	LAHR7	26.6	85.5	180 / 35	1015.1
14 / 2100	WLIY	27.0	87.2	230 / 35	1005.4
14 / 2200	C6ED5	27.1	86.7	230 / 35	1010.0
15 / 2000	WLOZ	27.6	88.3	270 / 35	1005.0

Table 3. Selected surface observations for Hurricane Sally, 11–17 September 2020.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Florida									
International Civil Aviation Organization (ICAO) Sites									
Pensacola Naval Air Station (KNPA) (30.35N 87.32W)	16/1056	984.4	16/1119	64	80				
Hurlburt Field (KHRT) (30.43N 86.68W)	16/1556	999.1	16/1456	39	57				15.88
Milton – NAS Whiting Field North (KNSE) (30.72N 87.02W)	16/1656	990.4	16/1656	39	57				
Valparaiso – Eglin Air Force Base (KVPS) (30.48N 86.53W)	16/1952	999.9	16/1809	28	49				16.32
Tyndall Air Force Base (KPAM) (30.07N 85.59W)	16/2140	1004.0	16/1609	33	47				13.55
Apalachicola Regional Airport (KAAF) (29.73N 85.02W)	16/2153	1006.1	16/1620	27	47				9.28[I]
Panama City – NW Florida Beaches Intl. Airport (KECP) (30.36N 85.79W)	16/2253	1003.8	16/1420	29	44				12.52
Ft. Lauderdale – Hollywood Intl. Airport (KFLL) (26.07N 80.15W)	12/1053	1006.8	12/1453	26	41				3.00
Destin – Ft. Walton Beach Airport (KDTS) (30.40N 86.47W)	16/1953	1000.4	16/0353	23	40				8.61[I]
Homestead Air Reserve Base (KHST) (25.48N 80.38W)	12/0648	1003.3	12/0702	26	38				4.32
Pompano Beach Air Park (KPMP) (26.25N 80.12W)	12/1053	1007.3	12/1625	25	38				2.08
Ft. Lauderdale Executive Airport (KFXE) (26.20N 80.17W)	12/1053	1007.3	12/1555	25	37				2.55
West Palm Beach Intl. Airport (KPBI) (26.68N 80.09W)	12/1053	1008.3	12/1705	29	37				1.81

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)				
Miami Intl. Airport (KMIA) (25.80N 80.29W)	12/1045	1006.4	12/1535	26	36				3.35
Naples Municipal Airport (KAPF) (26.15N 81.77W)	12/2145	1002.9	13/0240	24	36				5.24
Crestview – Bob Sikes Airport (KCEW) (30.79N 86.52W)	16/1453	1002.1	16/0746	21	36				11.52
Hollywood North Perry Airport (KHWO) (26.00N 80.24W)	12/1044	1007.1	12/1540	24	35				
Opa Locka Airport (KOPF) (25.91N 80.28W)	12/0853	1006.9	12/1700	28	35				
Marco Island Airport (KMKY) (26.00N 81.67W)	12/2020	1002.9	12/2256	27	35				10.23
Key West Naval Air Station (KNQX) (24.58N 81.68W)	12/1953	1006.4	13/0229	29	35				7.10
Tallahassee Intl. Airport (KTLH) (30.40N 84.35W)	16/2153	1006.9	16/1926	23	35				5.98
Key West Intl. Airport (KEYW) (24.56N 81.76W)	12/1953	1006.5	13/0211	27	34				9.71
Duke Field/Eglin Air Force Base (KEGI) (30.65N 86.52W)	16/0010	1007.7	16/0101	19	34				5.25[i]
DeFuniak Springs Airport (K54J) (30.73N 86.15W)			16/0135	21	31				10.63
Florida Keys/Marathon Intl. Airport (KMTH) (24.73N 81.05W)	12/1153	1005.7	12/1330	17	26				8.39
Coastal-Marine Automated Network (C-MAN) Sites									
Tyndall AFB Tower C (SGOF1) (29.41N 84.86W)	16/2100	1006.6	16/1600	42 (35.1 m, 10 min)	53				
Fowey Rocks (FWYF1) (25.59N 80.10W)	12/0600	1005.5	12/1520	40 (44 m, 10 min)	48				
Sand Key Light (SANF1) (24.56N 81.88W)	12/2020	1006.3	13/0157	37 (15.6 m, 1 min)	40				
Keaton Beach (KTNF1) (29.82N 83.59W)	17/1000	1007.6	17/0700	26 (10 m)	40				
Venice (VENF1) (27.07N 82.45W)	12/2200	1006.5	13/1650	25 (12 m, 10 min)	33				

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)				
National Ocean Service (NOS) Sites									
Pensacola (PCLF1) (30.40N 87.21W)	16/1224	986.1	16/1354	50 (10 m)	66	5.54	6.53	5.6	
Panama City Beach (PCBF1) (30.21N 85.88W)	16/2142	1003.4	16/1130	46 (17 m)	52	3.41	4.66	3.8	
Panama City (PACF1) (30.15N 85.67W)			16/1524	28 (10 m)	47	3.02	4.13	3.4	
Apalachicola (APCF1) (29.73N 84.98W)	16/2106	1006.6	16/1224	33 (9 m)	40	3.26	3.96	3.1	
Lake Worth Pier (LKWF1) (26.61N 80.03W)	12/0806	1007.2	13/0148	32 (12 m)	39	1.18	1.81	1.3	
Virginia Key (VAKF1) (25.73N 80.16W)	13/2036	1011.9	12/1642	26 (12 m)	36	1.19	1.63	1.4	
Cedar Key (CKYF1) (29.13N 83.03W)	12/2000	1009.2	12/1848	25 (12 m)	32	2.32	3.51	2.0	
Key West (KYWF1) (24.55N 81.81W)	12/2006	1006.2	12/2036	22 (17 m)	32	0.78	1.31	1.3	
Naples (NPSF1) (26.13N 81.81W)	12/2148	1003.8	14/1018	24 (10 m)	32	1.45	2.22	1.6	
Old Port Tampa (OPTF1) (27.86N 82.55W)	13/0000	1008.4	16/1754	18 (18 m)	29	1.25	2.39	1.6	
Clearwater Beach (CWBF1) (27.98N 82.83W)	13/0912	1008.0	16/2012	22 (8 m)	29	1.81	2.52	1.6	
St. Petersburg (SAPF1) (27.76N 82.63W)	12/2124	1008.4	12/2206	21 (9 m)	27	1.39	2.25	1.5	
Vaca Key (VCAF1) (24.71N 81.11W)	12/1224	1005.7	12/1424	21 (10 m)	26	0.70	0.64	1.0	
Fort Myers (FMRF1) (26.65N 81.87W)	12/2136	1005.9	13/0748	15 (8 m)	24	1.48	2.07	1.8	
South Port Everglades (PEGF1) (26.08N 80.12W)	12/0806	1007.2				0.85	1.86	1.3	
Port Manatee (PMAF1) (27.64N 82.56W)	12/2112	1007.7				1.22	2.06	1.5	
Tampa - East Bay (EBEF1) (27.92N 82.42W)	12/2148	1008.4				1.36	2.56	1.7	
WeatherFlow Sites									
Fair Point Light 2 (XFPL) (30.37N 87.21W)	16/1221	987.5	16/1131	53 (4.6 m, 5 min)	71				
Gulf Breeze (XGBZ) (30.36N 87.16W)	16/1239	988.1	16/1354	46 (15 m, 1 min)	66				

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)				
Santa Rosa Sound DB127 (XSRS) (30.38N 87.00W)	16/1218	992.0	16/1220	52 (7.0 m, 1 min)	62				
Okaloosa Island Fishing Pier (XOFP) (30.39N 86.59W)			16/0815	50 (13.7 m, 5 min)	61				
Ft. Walton Beach (XFWB) (30.40N 86.56W)	16/0920	999.4	16/0813	46 (7.3 m, 1 min)	56				
St. Andrew Bay (XSTA) (30.13N 85.72W)	16/2131	1001.9	16/1257	41 (9.4 m, 1 min)	49				
St. George Island (XSTG) (29.67N 84.86W)	16/2059	1003.6	16/1611	39 (15.2 m, 1 min)	47				
Government Cut (XGVT) (25.74N 80.10W)	12/0807	1003.2	12/1432	38 (23 m, 1 min)	46				
Biscayne Bay Harbor Pilots (XBBH) (25.76N 80.14W)	12/0600	1004.3	12/1435	30 (13 m)	44				
Crystal Beach (XCBS) (30.39N 87.41W)	16/2031	998.0	16/1704	32 (13.7 m, 1 min)	44				
Port Everglades (XPEG) (26.08N 80.11W)	12/0857	1001.2	12/1524	33 (41 m)	43				
Morningside Park (XMSP) (25.82N 80.18W)	12/1015	1005.2	12/1630	29 (10 m)	43				
Smith Shoal Light (XSMS) (24.72N 81.92W)	12/2020	1003.4	13/0255	29 (19.2 m)	43				
Panama City Beach (XPAN) (30.23N 85.88W)	16/2208	998.5	16/1154	31 (15.2 m, 1 min)	43				
Apalachee Bay – Panacea Channel L8 (XAPA) (30.01N 84.34W)	17/0859	1005.5	16/1704	39 (8.5 m, 1 min)	43				
Biscayne Bay Light 20 (XKBS) (25.65N 80.19W)	12/0530	1006.0	12/1520	34 (6 m, 1 min)	42				
Dania Pier (XDAN) (26.05N 80.11W)	12/0912	1005.7	12/1527	34 (9 m, 5 min)	42				
Dinner Key Light 1 (XDIN) (25.71N 80.21W)	12/0556	1006.4	12/1531	30 (6 m)	39				
Turkey Point (XTKY) (25.43N 80.34W)	12/0625	1002.5	12/1425	30 (20 m)	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)				
Juno Beach Pier (XJUP) (26.89N 80.06W)	12/0818	1007.1	12/1718	31 (6 m, 1 min)	39				
Key West CG (XKYW) (24.57N 81.80W)	12/1927	1003.8	13/0138	22 (10 m)	39				
Doral (XURB) (25.85N 80.37W)	12/0833	1004.0	12/1653	19 (15 m)	37				
Boynton Beach (XBOY) (26.54N 80.05W)	12/0802	1006.4	12/1632	23 (10 m)	37				
Hillsboro Inlet (XHBI) (26.25N 80.08W)	12/0940	1005.8	12/1545	31 (5 m)	37				
South Miami (XSOM) (25.63N 80.30W)	12/0629	1004.4	12/1444	23 (10 m)	35				
North Miami (XNMI) (25.90N 80.16W)	12/1035	1004.2	12/1630	20 (17 m)	34				
Remote Automated Weather Stations (RAWS)									
Cache/Everglades NP (LPIF1) (25.39N 80.68W)			12/1523		41 (6.1 m)				
Ochopee (OCOF1) (25.89N 81.32W)			12/2003	27 (6.1 m, 10 min)	38				
St. Marks (PRWF1) (30.01N 84.42W)			16/1646	15 (6.1 m, 10 min)	34				
WeatherSTEM Sites									
Island View Park (29.85N 84.64W)			16/1606	43	54				9.41
Saint George Island Bridge (29.66N 84.88W)			16/1505	47	50				
Ed Wallen Beach Access (30.35N 86.23W)			16/1710	45	50				14.44
Florida A&M University (30.43N 84.29W)			16/1712	39	49				5.65
Gulf Coast State College (30.19N 85.73W)			16/1542	43	48				11.33
UM Health System (25.78N 80.22W)			12/1440		47 (57 m)				
Shell Point Beach (30.06N 84.29W)			16/1530	42	47				6.37
FSU – Panama City Campus (30.19N 85.72W)			16/1604	43	47				
FAU Stadium (26.37N 80.10W)			12/1950	30	46				
Franklin County EOC (29.72N 85.03W)			16/1643	38	44				
Miramar Beach (30.38N 86.36W)			16/2052	36	43				16.62

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)				
FSU Coastal & Marine Lab (29.92N 84.51W)			16/1644	40	43				
St. Marks Lighthouse (30.07N 84.18W)			16/1707	34	43				
Choctaw Beach (30.48N 86.33W)			16/1041	39	43				10.35
Inlet Beach (30.28N 86.01W)			16/1139	32	38				17.55
Sunrise (26.16N 80.29W)			12/1700	29	37				
Mexico Beach (29.95N 85.43W)			16/1547	32	37				11.85
Miami – Frost Museum (25.78N 80.18W)			12/1510	27 (21 m)	36				
Panama City Beach Sports Complex (30.20N 85.77W)			16/1139	30	36				12.05
Lafayette High School (30.05N 83.17W)			16/1611	30	36				
Bay County Water Treatment Plant (30.21N 85.61W)			16/2154	29	35				15.49
Gulf County EOC (29.81N 85.29W)			16/0625	31	35				14.21
Walton High School (30.74N 86.12W)			16/1251	29	34				12.80
Northeast Tallahassee (30.49N 84.25W)			16/1717	29	34				3.77
Challenger Learning Center (30.44N 84.28W)			16/2103	21	34				4.85
Bay County Sheriff's Office (30.21N 85.65W)			16/1657		34				
Mossy Head (30.74N 86.33W)									17.84
Panama City Beach W End (30.25N 85.94W)									17.36
Walton County EM (30.72N 86.09W)									15.62
Washington County EOC (30.63N 85.60W)									14.48
South Walton H.S. (30.38N 86.18W)									13.96
Freeport H.S. (30.54N 86.12W)									13.78
Florida Panhandle Technical College (30.77N 85.55W)									13.46

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)				
Youngstown (30.36N 85.44W)									12.49
Ochlockonee Boat Ramp (29.96N 84.39W)									11.38
W.R. Tolar K-8 School (30.40N 84.98W)									11.02
Holmes County H.S. (30.79N 85.69W)									10.77
Paxton School (30.97N 86.31W)									10.07
South Alabama Mesonet									
Jay (30.95N 87.17W)				31 (10 m, 1 min)	45				14.16
Public/Other									
Century - Northview High School (30.97N 87.41W)			16/1910	42[l]	65[l]				
Shell Point (SHPF1) (30.06N 84.29W)	17/0930	1005.7	16/1712	33 (5 m)	49				
Rock Harbor (25.06N 80.48W)			12/1416	31	43				
Marco Island (MRCSC) (25.91N 81.73W)			13/0041		43				
Islamorada – Upper Matecumbe Key (24.93N 80.63W)			12/1322		39				
WFO Key West (KKEY) (24.55N 81.79W)			13/0210		38				11.36
Keys Energy Services – Stock Island (24.56N 81.73W)			13/0207		37				
Panacea (FW6414) (29.97N 84.36W)			16/1646		37				
Keys Energy Services – James Street (24.56N 81.80W)			13/0146		36				
NAS Pensacola 4 W (30.33N 87.39W)									24.88
Navarre (30.41N 86.91W)									19.95
Gulf Breeze (30.36N 87.16W)									18.97
Pace (30.60N 87.16W)									15.07
Panama City (PCYF1) (30.20N 85.63W)									14.32
Bonifay 2 W (BFYF1) (30.80N 85.72W)									10.38

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)				
United States Geological Survey (USGS) Sites									
Aucilla River at Nutall Rise (NUTF1) (30.11N 83.98W)							7.70	5.8	
Spring Creek (SBIF1) (30.07N 84.33W)							5.04	3.4	
Suwannee River (SUWF1) (29.34N 83.09W)							3.44	2.0	
Northwest Florida Water Management District Gauges									
White City (SEWF1) (29.88N 85.22W)								3.4	
St. Marks (MRKF1) (30.15N 84.21W)								2.0	
Suwannee River Water Management District Gauges									
Steinhatchee (STIF1) (29.67N 83.38W)								2.2	
National Weather Service (NWS) High Water Marks									
Gulf Breeze (30.35N 87.17W)								2.5	
NWS Cooperative Observer Program (COOP) Sites									
Pensacola 7 NNE (PSAF1) (30.53N 87.20W)									18.04
Niceville (NCVF1) (30.53N 86.49W)									14.71
Woodruff Dam (WDRF1) (30.72N 84.87W)									10.88
Wewahitchka (WEWF1) (30.12N 85.20W)									10.55
Community Collaborative Rain, Hail, & Snow Network (CoCoRaHS) Sites									
Pensacola 1.9 NE (FL-ES-26) (30.47N 87.17W)									22.25
Navarre 6.2 E (FL-SR-21) (30.41N 86.81W)									20.97
Pensacola 18.9 WSW (FL-ES-24) (30.31N 87.47W)									19.97
Pensacola 4.7 N (FL-ES-53) (30.51N 87.18W)									19.61

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Freeport 3.4 S (FL-WT-2) (30.45N 86.14W)									18.67
Gonzalez 2.1 E (FL-ES-15) (30.57N 87.25W)									18.57
Pensacola 6.4 N (FL-ES-54) (30.54N 87.21W)									17.74
Miramar Beach 9.5 ESE (FL-WT-3) (30.35N 86.20W)									17.65
Panama City Beach 0.3 SW (FL-BY-7) (30.21N 85.86W)									17.49
Pensacola 13.5 WNW (FL-ES-35) (30.53N 87.39W)									17.38
Mary Esther 0.6 E (FL-OK-29) (30.41N 86.65W)									17.33
Vernon 10.6 WSW (FL-WS-1) (30.57N 85.87W)									16.79
DeFuniak Springs 4.1 NNW (FL-WT-22) (30.78N 86.14W)									16.26
Pensacola 2.4 SW (FL-ES-48) (30.42N 87.22W)									16.21
DeFuniak Springs 2.9 N (FL-WT-12) (30.76N 86.12W)									15.93
Niceville 3.6 SE (FL-OK-1) (30.49N 86.44W)									15.47
Navarre 2.1 WNW (FL-SR-12) (30.41N 86.90W)									15.43
Eglin AFB 5.6 NE (FL-OK-2) (30.52N 86.49W)									14.97
Valparaiso 1.4 N (FL-OK-42) (30.51N 86.50W)									14.92
Panama City Beach 5.9 WNW (FL-BY-10) (30.25N 85.94W)									14.83

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
DeFuniak Springs 12.5 NW (FL-WT-5) (30.84N 86.28W)									14.43
Destin 1.2 NW (FL-OK-33) (30.40N 86.49W)									14.23
Ft. Walton Beach 1.7 SE (FL-OK-43) (30.42N 86.59W)									14.22
Panama City 1.9 SE (FL-BY-24) (30.15N 85.65W)									14.21
Sunny Hills 3.3 N (FL-WS-3) (30.59N 85.58W)									13.98
Shalimar 1.2 NNW (FL-OK-41) (30.46N 86.59W)									13.76
Niceville 2.1 SE (FL-OK-37) (30.51N 86.46W)									13.71
Panama City Beach 4.4 ESE (FL-BY-22) (30.18N 85.79W)									13.39
Fountain 3.4 SSE (FL-BY-15) (30.43N 85.40W)									13.24
Milton 2.9 NW (FL-SR-26) (30.66N 87.08W)									13.05
Pensacola 12.4 WNW (FL-ES-55) (30.51N 87.38W)									13.00
Islamorada 7.8 SW (FL-MN-39) (24.85N 80.74W)									12.88
Panama City Beach 5.4 SE (FL-BY-21) (30.16N 85.78W)									12.78
Century 12.1 W (FL-ES-39) (30.96N 87.47W)									12.74
Inlet Beach 0.7 E (FL-WT-14) (30.28N 86.00W)									12.40
Alford 0.6 SSE (FL-JK-2) (30.69N 85.39W)									12.21

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)				
Islamorada 7.8 SW (FL-MN-8) (24.85N 80.74W)									12.01
Key West 0.5 SW (FL-MN-24) (24.56N 81.78W)									11.70
Panama City 6.9 ESE (FL-BY-16) (30.14N 85.57W)									11.68
Saint James City 0.4 SSE (FL-LE-22) (26.49N 82.08W)									11.52
Key West 1.0 SW (FL-MN-7) (24.55N 81.79W)									11.36
Hosford 2.7 SW (FL-LB-3) (30.35N 84.82W)									11.08
Marianna 3.9 E (FL-JK-3) (30.77N 85.17W)									10.98
Key West 1.3 ENE (FL-MN-16) (24.57N 81.76W)									10.82
Quincy 6.0 SW (FL-GD-3) (30.53N 84.66W)									10.71
Eastpoint 1.4 NW (FL-FR-3) (29.76N 84.89W)									10.41
Niceville 3.4 ESE (FL-OK-20) (30.51N 86.43W)									10.13
Georgia									
ICAO Sites									
Columbus Airport (KCSG) (32.52N 84.94W)	17/0850	1003.3	17/0533	26	37				6.57
Atlanta Hartsfield – Jackson Intl. Airport (KATL) (33.64N 84.43W)	17/1052	1006.2	17/0625	23	34				4.18
Albany – SW Georgia Regional Airport (KABY) (31.54N 84.19W)	17/0953	1004.8	16/1925	22	32				5.65

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Donalsonville Airport (K17J) (31.01N 84.88W)			16/1635	24	32				5.28
RAWS									
Sterling (STRG1) (31.21N 81.61W)									10.81
NWS COOP Sites									
Warner Robins (MMMG1) (32.61N 83.62W)									10.52
Brunswick (BRUG1) (31.17N 81.50W)									9.98
Sandersville (SDRG1) (32.97N 82.80W)									7.48
Americus (AMRG1) (32.03N 84.25W)									6.66
Donalsonville (DNVG1) (31.03N 84.89W)									6.17
Hydrometeorological Automated Data System (HADS) Sites									
Newton 8 W (IWYG1) (31.31N 84.47W)									10.33
Washington 8 S (WTNG1) (33.59N 82.73W)									9.33
Flint River near Montezuma (MNTG1) (32.30N 84.04W)									8.50
Flint River at Albany (ABNG1) (31.59N 85.02W)									6.82
Upatoi Creek near Columbus (UPAG1) (32.41N 84.82W)									6.68
Echeconnee Creek near Byron (BYNG1) (32.67N 83.73W)									6.64
Muckalee Creek near Leesburg (MCKG1) (31.78N 84.14W)									6.62
Kinchafoonee Creek near Dawson (DSNG1) (31.76N 84.25W)									6.39
CoCoRaHS Sites									
Bishop 2.6 WSW (GA-OC-14) (33.80N 83.48W)									9.07

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)				
Warner Robins 0.3 W (GA-HS-3) (32.61N 83.64W)									8.29
Kathleen 2.5 NW (GA-HS-16) (32.53N 83.63W)									7.67
Columbus 5.6 NNE (GA-MS-4) (32.53N 84.94W)									7.05
Perry 4.0 ESE (GA-HS-17) (32.45N 83.67W)									7.00
Waverly Hall 6.9 S (GA-HR-7) (32.58N 84.74W)									6.98
Ellaville 4.5 ENE (GA-SY-3) (32.25N 84.23W)									6.82
Macon 2.8 NNE (GA-BB-21) (32.87N 83.63W)									6.80
Bonaire 3.0W (GA-HS-5) (32.54N 83.65W)									6.75
Harrison 2.1 ESE (GA-WG-1) (32.81N 82.69W)									6.75
Waverly Hall 8.2 S (GA-MS-7) (32.57N 84.75W)									6.74
Macon 2.2 NE (GA-BB-22) (32.86N 83.63W)									6.73
Byron 3.0 S (GA-PE-3) (32.61N 83.76W)									6.72
Perry 0.8 NE (GA-HS-12) (32.47N 83.73W)									6.67
Macon 6.8 ENE (GA-JN-6) (32.88N 83.55W)									6.62
Forsyth 8.3 S (GA-MN-10) (32.91N 83.94W)									6.60
Hawkinsville 9.1 NW (GA-HS-11) (32.36N 83.60W)									6.56

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Macon 2.5 NNE (GA-BB-19) (32.87N 83.63W)									6.42
Macon 6.3 E (GA-BB-16) (32.84N 83.55W)									6.39
The Rock 1.0 N (GA-UP-1) (32.98N 84.24W)									6.34
Americus 3.1 SSW (GA-SR-3) (32.03N 84.25W)									6.23
Albany 4.6 NW (GA-LE-2) (31.63N 84.23W)									6.17
Butler 8.3 NNW (GA-TY-1) (32.66N 84.31W)									6.09
Byron 2.0 E (GA-HS-24) (32.65N 83.72W)									6.07
Grovetown 2.0 SSW (GA-CU-11) (33.42N 82.21W)									6.04
Alabama									
ICAO Sites									
Mobile Regional Airport (KMOB) (30.68N 88.25W)	16/1156	994.8	16/1026	40	71				3.56
Mobile Downtown Airport (KBFM) (30.64N 88.07W)	16/1053	990.6	16/0935	41	65				4.23
Mac Crenshaw Memorial Airport (KPRN) (31.85N 86.61W)	16/2157	994.5	16/2013	24	49				5.67
Andalusia-Opp Airport (K79J) (31.32N 86.41W)	16/2156	996.5	16/1456	30	46				11.31
Florala Municipal Airport (K0J4) (31.04N 86.31W)	16/2158	997.6	16/1211	21	40				10.34
Cairns Army Airfield – Ft. Rucker (KOZR) (31.29N 85.72W)	16/2231	1000.6	16/1344	22	39				9.74

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Evergreen Airport – Middleton Field (KGZH) (31.42N 87.04W)	16/1353	1003.2	16/1412	22	39				4.95
Hanchey Army Heliport – Ft. Rucker (KHEY) (31.35N 85.65W)	16/2227	1000.6	16/1742	25	38				7.34
Enterprise Municipal Airport (KEDN) (31.30N 85.90W)			16/1615	21	37				8.97
Montgomery Regional Airport (KMGM) (32.30N 86.41W)	17/0053	1003.1	16/2127	27	37				4.64
Shell Army Heliport – Ft. Rucker (KSXS) (31.36N 85.85W)	16/2255	999.8	16/1423	26	35				9.75
Troy Municipal Airport (KTOI) (31.86N 86.01W)	16/2353	1001.2	16/2157	22	35				9.74
Dothan Regional Airport (KDHN) (31.32N 85.45W)	16/2353	1002.3	16/1645	25	34				6.58
Lowe Army Heliport – Ft. Rucker (KLOR) (31.36N 85.75W)	16/2233	998.8	16/1603	16	28				7.32
Coastal-Marine Automated Network (C-MAN) Sites									
Dauphin Island (DPIA1) (30.25N 88.07W)	16/1000	981.3	16/0810	70 (14 m, 10 min)	86				
NOS Sites									
Fort Morgan (FMOA1) (30.23N 88.03W)	16/0806	974.9	16/0818	87 (38 m)	105				
Dauphin Island (DILA1) (30.25N 88.08W)	16/0942	980.5	16/0812	76 (11 m)	90	3.20	3.79	3.1	
					Low Water:	-0.34	0.59	1.1 MLLW	
USCG Sector Mobile (MCGA1) (30.65N 88.06W)	16/1036	991.3	16/1224	40 (9 m)	58	2.26	3.14	2.0	
					Low Water:	-8.14	-7.53	-7.0 MLLW	
East Fowl River Bridge (EFRA1) (30.44N 88.11W)						2.48	3.45	2.6	
					Low Water:	-2.73	-1.87	-1.2 MLLW	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Bayou La Batre Bridge (BLBA1) (30.41N 88.25W)						2.29	3.32	2.4	
Low Water:						-2.69	-2.33	-1.6 MLLW	
Weeks Bay, Mobile Bay (WBYA1) (30.42N 87.83W)						2.45		2.2	
Low Water:						-1.54*		-0.6 MLLW*	
West Fowl River Bridge (WFRA1) (30.38N 88.16W)						1.95	2.93	2.0	
Low Water:						-1.79	-1.13	-0.4 MLLW	
Dog River Bridge (BYSA1) (30.57N 88.09W)						1.85		2.0	
Low Water:						-5.69		-3.9 MLLW	
Mobile State Docks (OBLA1) (30.71N 88.04W)	16/1012	991.5				1.73	2.89	1.7	
Low Water:						-6.32*	-5.24*	-4.8 MLLW*	
Chickasaw Creek (CIKA1) (30.78N 88.07W)						1.87	2.77	1.5	
Low Water:						-4.72*	-3.97*	-3.5 MLLW*	
WeatherFlow Sites									
Gulf Shores – Foley (XGLF) (30.36N 87.65W)	16/0910	966.4	16/0844	65 (10.4 m, 1 min)	81				
Florida Coastal Monitoring Program Tower 5 (XUF5t) (30.29N 87.68W)	16/0903	969.0	16/0752	66 (10 m)	80				
Florida Coastal Monitoring Program Tower 1 (XUF1t) (30.28N 87.70W)	16/0856	968.6	16/0736	27 (10 m)	55				
Buccaneer Yacht Club (XBUC) (30.58N 88.07W)	16/0956	986.8	16/0234	45 (10.4 m, 1 min)	54				
South Alabama Mesonet									
Elberta (30.41N 87.59W)				55 (10 m, 1 min)	86				20.99
Fairhope (30.54N 87.88W)				47 (10 m, 1 min)	62				

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)				
Foley (30.37N 87.65W)				39 (10 m, 1 min)	66				21.04
Atmore (31.02N 87.45W)				39 (10 m, 1 min)	51				
Gasque (30.24N 87.85W)				36 (10 m, 1 min)	57				
Dog River (30.56N 88.10W)				36 (10 m, 1 min)	53				
Andalusia (31.29N 86.50W)				34 (10 m, 1 min)	43				10.08
Grand Bay (30.51N 88.37W)				32 (10 m, 1 min)	52				
Mobile (USA Campus West) (30.69N 88.19W)				32 (10 m, 1 min)	48				
Mobile (USA Campus) (30.70N 88.18W)				30 (10 m, 1 min)	51				
Mt. Vernon (31.09N 88.00W)				29 (10 m, 1 min)	45				
Castleberry (31.30N 87.03W)				27 (10 m, 1 min)	40				
Ashford (31.20N 85.26W)				19 (10 m, 1 min)	35				
Saraland (30.83N 88.07W)				12 (10 m, 1 min)	43				
Robertsdale (30.58N 87.73W)									16.81
Public/Other									
Ingram Bayou (30.31N 87.55W)				98 (18 m)	119				
Perdido Pass (DOW8) (30.28N 87.55W)			16/0750	81 (11 m)	103				
City of Orange Beach (30.27N 87.59W)				73 [I]	90 [I]				29.99
Middle Bay Lighthouse (MBLA1) (30.44N 88.01W)	16/1026	979.0	16/0930	73 (14.2 m)	81				
Gulf Shores (Ultimate Chase)	16/0917	965							
Gulf Shores (iCyclone) (30.26N 87.69W)	16/0903 16/0922 16/0934	968.2							
Fort Morgan 2 E (30.23N 87.99W)									29.30
Dixon RAWS (31.16N 86.70W)									12.06

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 Water Level Sensors									
Fairhope (ALBAL00004) (30.53N 87.91W)							2.78	1.6	
NWS High Water Marks									
Orange Beach (30.30N 87.55W)								4.2	
Gulf Shores (30.25N 87.69W)								3.5	
Orange Beach (30.28N 87.56W)								3.0	
Orange Beach (30.31N 87.52W)								2.9	
Gulf Shores (30.25N 87.69W)								2.8	
Gulf Shores (30.26N 87.69W)								2.5	
Orange Beach (30.28N 87.57W)								2.5	
Orange Beach (30.28N 87.56W)								1.7	
Orange Beach (30.28N 87.57W)								1.6	
Gulf Shores (30.26N 87.69W)								1.1	
NWS COOP Sites									
Brewton 3 ENE (BRWA1) (31.14N 87.05W)									17.44
Geneva (GVAA1) (31.04N 85.87W)									13.45
Fairhope 2 NE (FHPA1) (30.55N 87.88W)									12.41
Enterprise 4 W (ENTA1) (31.30N 85.90W)									9.98
Dauphin Island (DAUA1) (30.25N 88.07W)									9.66
HADS Sites									
Brewton (BWMA1) (31.10N 87.07W)									14.27
Fish River near Silverhill (FSHA1) (30.55N 87.80W)									13.80
Pea River near Ariton (ARTA1) (31.59N 85.78W)									10.96

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)				
Tiawasee Creek (TAWA1) (30.64N 87.89W)									10.50
CoCoRaHS Sites									
Elberta 3.1 SSW (AL-BW-53) (30.37N 87.62W)									23.32
Pollard 2.4 N (AL-ES-1) (31.06N 87.17W)									18.83
Summerdale 2.7 WNW (AL-BW-85) (30.50N 87.74W)									15.92
Foley 7.4 SW (AL-BW-8) (30.34N 87.78W)									15.34
Gulf Shores 1.6 S (AL-BW-93) (30.25N 87.71W)									14.00
Red Level 0.3 SW (AL-CV-13) (31.40N 86.61W)									13.55
Fairhope 3.1 NNW (AL-BW-32) (30.56N 87.90W)									13.45
Loxley 3.5 SSE (AL-BW-87) (30.58N 87.74W)									13.44
Daphne 4.9 SE (AL-BW-79) (30.57N 87.84W)									12.58
Foley 2.0 SSW (AL-BW-31) (30.38N 87.70W)									12.56
Point Clear 0.6 SW (AL-BW-86) (30.48N 87.91W)									12.55
Fairhope 1.5 WSW (AL-BW-40) (30.51N 87.91W)									12.44
Loxley 2.4 WNW (AL-BW-98) (30.63N 87.80W)									11.93
Fairhope 2.2 E (AL-BW-71) (30.52N 87.85W)									11.71
Rehobeth 2.1 SSW (AL-HS-13) (31.10N 85.46W)									10.86

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
Fairhope 1.6 W (AL-BW-82) (30.51N 87.91W)									10.80
Clayton 7.8 W (AL-BR-6) (31.88N 85.58W)									10.80
Daphne 1.5 SSW (AL-BW-60) (30.61N 87.91W)									10.49
Enterprise 3.8 ESE (AL-DL-11) (31.30N 85.79W)									10.42
Daphne 4.2 NE (AL-BW-36) (30.68N 87.86W)									10.21
Elberta 3.9 S (AL-BW-96) (30.36N 87.61W)									10.07
Seale 2.4 NNE (AL-RS-7) (32.33N 85.16W)									10.00
Mississippi									
ICAO Sites									
Pascagoula – Trent Lott Airport (KPQL) (30.46N 88.53W)	16/0943	995.6	16/0943	35	48				3.13
Gulfport – Biloxi Intl. Airport (KGPT) (30.40N 89.07W)	16/0858	1001.4	16/0252	26	40				0.05
Biloxi – Keesler Air Force Base (KBIX) (30.43N 88.92W)	16/0834	1000.9	15/0336	27	38				0.27
NOS Sites									
Petit Bois Island – Port of Pascagoula (PTBM6) (30.21N 88.50W)	16/0818	994.1	16/0118	50 (5 m, 10 min)	65				
Bay Waveland Yacht Club (WYCM6) (30.33N 89.33W)	16/0900	1003.6	15/2112	32 (10 m, 2 min)	40	3.29	4.73	3.7	
Pascagoula NOAA Lab (PNLM6) (30.37N 88.56W)						3.23	4.33	3.5	
WeatherFlow Sites									
Ship Island (XSHI) (30.23N 88.98W)	16/0456	1000.7	15/2339	43 (11.8 m, 1 min)	52				

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)				
Biloxi (XBIL) (30.44N 88.98W)	16/0924	998.0	16/0013	26 (15.2 m, 1 min)	38				
Gulfport (XGPT) (30.36N 89.11W)	16/0854	1000.1	15/2131	26 (10.3 m, 1 min)	35				
USGS Water Level Sensors									
Mississippi Sound at Gulfport Harbor (MSHAR25057) (30.36N 89.09W)							4.94	3.6	
Pearlington - East Pearl River (MSHAN06615) (30.24N 89.61W)							4.67		
Bayou Cumbest (MSJAC25056) (30.40N 88.45W)							3.66		
CoCoRaHS Sites									
Moss Point 1.2 NNW (MS-JC-27) (30.44N 88.53W)									3.27
Gautier 4.9 N (MS-JC-22) (30.46N 88.65W)									1.66
Other Sites									
Crooked Bayou – Grand Bay (GDXM6) (30.36N 88.42W)	16/0700	996.0	16/0730	35 (4.5 m, 2 min)					
South Alabama Mesonet									
Agricola (30.82N 88.52W)				23 (10 m, 1 min)	36				
Pascagoula (30.36N 88.52W)				20 (10 m, 1 min)	34				
Louisiana									
ICAO Sites									
New Orleans Lakefront Airport (KNEW) (30.04N 90.03W)	16/1008	1005.4	16/0247	28	34				0.02
Slidell Airport (KASD) (30.35N 89.82W)	16/1033	1005.1	16/0449	22	30				0.02

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)				
C-MAN Sites									
Southwest Pass (BURL1) (28.90N 89.43W)			15/1000	40 (38 m, 2 min)	45				
NOS Sites									
Pilot's Station East (PSTL1) (28.93N 89.41W)	15/0936	1002.4	15/1500	43 (24 m, 2 min)	52	3.08		3.5	
Pilottown (PILL1) (29.18N 89.26W)	15/2018	1002.9	15/2000	38 (12 m, 2 min)	44	3.57		3.7	
Shell Beach (SHBL1) (29.87N 89.67W)	16/0930	1004.9	16/0000	32 (16 m, 2 min)	38	4.86	6.10	5.4	
New Canal (NWCL1) (30.03N 90.11W)	16/0912	1005.5	15/0918	26 (10 m)	31	3.38	4.08	3.8	
Grand Isle (GISL1) (29.26N 89.96W)			15/1318	23 (9 m)	30	1.72		2.1	
Port Fourchon (PTFL1) (29.11N 90.20W)						2.33		2.8	
Eugene Island (EINL1) (29.37N 91.38W)						2.47		2.0	
LAWMA, Amerada Pass (AMRL1) (29.45N 91.34W)						2.18	2.48	1.8	
WeatherFlow Sites									
East Bay Tower (XEBT) (29.06N 89.30W)	15/0419	1003.0[I]	15/0500	34[I] (15.2 m, 5 min)	43[I]				
New Orleans Lakefront AP (XLKF) (30.04N 90.02W)	16/0933	1003.6	15/2002	30 (10.3 m, 1 min)	36				
Bayou Bienvenue (XBYU) (30.00N 89.90W)	16/0925	1001.8	15/2200	24 (27.4 m, 5 min)	35				
Pontchartrain Causeway – Midlake (XPTN) (30.20N 90.12W)	15/1038	1005.5	15/2026	31 (12.5 m, 1 min)	35				
USGS Water Level Sensors									
Kenner – Lake Pontchartrain (LAJEF06563) (30.04N 90.24W)							4.17	3.6	
Pointe-a-la-Hache (LAPLA27142) (29.57N 89.76W)							6.28		
Slidell - Rigolets (LASTT23298) (30.18N 89.73W)							4.03		

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Estimated Inundation (ft)[e]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)				
USGS Stream Gauges									
Black Bay near Pointe-a-la-Hache (PSIL1) (29.63N 89.56W)							6.55	5.2	
Crooked Bayou near Delacroix (GRPL1) (29.71N 89.72W)							5.85	4.5	
Mississippi Sound near Grand Pass (GRPL1) (30.12N 89.25W)							5.26	4.0	
Barataria Pass at Grand Isle (EGIL1) (29.27N 89.95W)							4.55	3.7	
Caillou Bay SW of Cocodrie (CCOL1) (29.08N 90.87W)							3.87	3.0	
Caminada Pass NW of Grand Isle (CPGL1) (29.23N 90.05W)							3.62	2.8	
Barataria Bay N of Grand Isle (NGIL1) (29.42N 89.95W)							3.04	2.2	
Caillou Lake SW of Dulac (DCLL1) (29.25N 90.92W)							2.98	2.0	
Hackberry Bay NW of Grand Isle (HACL1) (29.40N 90.04W)							2.63	1.9	
Lower Atchafalaya River at Morgan City (MRGL1) (29.69N 91.21W)							3.76	1.8	
Little Lake near Cutoff (CTFL1) (29.52N 90.18W)							2.27	1.6	
United States Army Corps of Engineers (USACE) Gauges									
Bayou Dupre Flood Gate (BDML1) (29.94N 89.84W)							5.92	4.7	
Chef Manteur Pass near Lake Borgne (CMPL1) (30.07N 89.80W)							4.96	3.8	

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)				
Lake Pontchartrain at Lakefront Airport (LPML1) (30.04N 90.02W)							4.36	3.8	
Lake Pontchartrain – West End (WEGL1) (30.02N 90.12W)							4.21	3.7	
Rigolets near Lake Pontchartrain (RIGL1) (30.16N 89.74W)							4.34	3.3	
Lake Pontchartrain at Mandeville (LPML1) (30.37N 90.09W)							3.54	2.9	
Mississippi River SW Pass at East Jetty (SWBL1) (28.93N 89.41W)							4.35	2.7	
Pass Manchac Pontchatoula (LPML1) (30.28N 90.40W)							3.39	2.4	
Bayou Bienvenue Flood Gate (30.00N 89.92W)							3.11	1.9	
Gulf Intracoastal Waterway near Paris Bridge Road (PRSL1) (30.01N 89.94W)							2.71	1.5	
Offshore									
NOAA Buoys									
Orange Beach (42012) (30.07N 87.56W)	16/0830	970.5	16/0449	70 (4 m, 1 min)	95				
Luke Offshore Test Platform (42040) (29.21N 88.23W)	15/0020	998.5 [I]	15/0005	52 [I] (4 m, 1 min)	64 [I]				
Pensacola (42039) (28.79N 86.03W)	14/0050	1003.7	14/0857	43 (4 m, 1 min)	51				
West Tampa (42036) (28.51N 84.51W)	13/2210	1005.9	13/1542	35 (4 m, 1 min)	41				
University of South Florida COMPS Buoys									
C10 – WFS Central Buoy, 25 m Isobath (42013) (27.17N 82.94W)	13/0700	1005.2	13/0900	39 (3 m)	51				

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)				
C12 – WFS Central Buoy, 50 m Isobath (42022) (27.51N 83.74W)	13/1000	1003.6	13/1400	35 (3 m)	46				
Oil Platforms									
Main Pass 140B AWOS (Apache Corp) (KMIS) (29.30N 88.84W)			15/1435	65 (85 m, 2 min)	80				
Main Pass 289C AWOS (Apache Corp) (KVKY) (29.26N 88.44W)			15/1155	60 (115 m, 2 min)	69				
West Delta 27A (AngloSuisse Offshore) (KDLP) (29.12N 89.55W)			16/1935	43 (34.7 m, 2 min)	50				
Louisiana Offshore Oil Port (LOPL1) (28.89N 90.02W)			14/2054	28 (57.9 m, 2 min)	36				

[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.
[I] Incomplete
[*] Denotes that the physical limit of the sensor was reached, and the actual minimum water level was not recorded

Table 4. Tornadoes documented during Hurricane Sally. Rows highlighted in beige denote tornadoes that occurred during Sally's extratropical phase.

County	Begin Location	End Location	EF Scale	Begin Date/Time	Length (miles)	Width (yards)	Deaths	Injuries	Damage
Florida									
Calhoun/ Jackson	2 SSE Macedonia	1 E Union City	0	16/0653	9.92	50	0	0	1K
Georgia									
Cook	2 SE Greggs	0 NNW Greggs	0	16/1530	2.22	50	0	0	0
Brooks	2 NNW Grooverville	2 WNW Pidcock	0	16/1540	2.97	50	0	0	0
Brooks	3 ESE Morven	4 E Barney	0	16/1546	5.26	50	0	0	0
Thomas	1 W Hollis	3 NW Hollis	0	16/1606	2.3	50	0	0	0
Ware	1 ESE Hebardville	1 ESE Hebardville	1	16/1833	0.16	200	0	0	40K
Effingham	2 W Blandford	2 W Rahn	1	17/0154	2.66	150	0	0	0
South Carolina									
Sumter/ Richland	8 W Pinewood	1 SE Kingville	Unknown	17/0658	7.00	150	0	0	0
Sumter	6 W Pinewood	7 WNW Pinewood	Unknown	17/0659	2.5	100	0	0	0
Dorchester	2 N Reevesville	2 N Reevesville	1	17/0813	0.6	150	0	0	0
Orangeburg	1 NNW Wells	1 N Wells	0	17/0849	0.23	100	0	0	0
Clarendon	4 SSW St. Paul	3 SW St. Paul	0	17/0917	0.93	100	0	0	0
Clarendon	3 E Paxville	3 E Paxville	0	17/1014	0.6	25	0	0	0

County	Begin Location	End Location	EF Scale	Begin Date/Time	Length (miles)	Width (yards)	Deaths	Injuries	Damage
Sumter	2 NE Britton	3 WSW Mayesville	0	17/1043	5.88	50	0	0	0
Calhoun	2 NNE Lone Star	3 NNE Lone Star	0	17/1106	1.01	25	0	0	0
Calhoun	2 SSE Singleton	2 SSE Singleton	0	17/1145	0.32	25	0	0	0
Sumter	2 NW Pinewood	2 W Privateer	0	17/1219	6.26	25	0	0	0
Florence	1 N Sardis	1 SSE Timmonsville Airport	0	17/1345	4.99	25	0	0	50K
Florence	2 NE Willow Creek Siding	2 ESE Claussen	0	17/1421	2.24	20	0	0	1K
North Carolina									
Pender	2 SSW Vista	2 SSW Vista	0	17/1917	0.09	20	0	0	30K
Carteret	1 S Merrimon	1 S Merrimon	1	17/2016	0.15	25	0	0	0
New Hanover	1 NNE East Wilmington	1 NNE East Wilmington	0	17/2028	0.15	20	0	0	5K
Pamlico	2 WNW Hobucken	2 WNW Hobucken	0	18/0033	0.1	20	0	0	0

Table 5. 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%)	24	42
Medium (40%-60%)	6	24
High (>60%)	0	2.5

Table 6a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Sally, 11–17 September 2020. 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	60	72	96	120
OFCL	**20.9**	**36.3**	51.1	**64.8**	**73.2**	**87.8**	**105.9**	212.8
OCD5	30.8	60.7	97.2	134.5	167.8	211.2	262.1	395.8
Forecasts	21	19	17	15	13	11	7	3
OFCL (2015-19)	24.1	36.9	49.6	65.1	80.7	96.3	133.2	171.6
OCD5 (2015-19)	44.7	96.1	156.3	217.4	273.9	330.3	431.5	511.9

Table 6b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Sally, 11–17 September 2020. 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	60	72	96	120
OFCL	22.4	34.7	47.6	59.5	65.0	79.1	109.0	221.5
OCD5	31.9	62.7	95.9	126.0	154.7	199.7	247.8	372.7
GFSI	**21.8**	36.0	**46.1**	65.4	73.2	88.0	**101.6**	246.1
EMXI	22.4	42.7	65.9	85.9	91.3	97.5	121.0	**218.5**
CMCI	28.8	47.7	63.2	75.3	76.6	**75.0**	**68.3**	**78.6**
NVGI	32.4	50.5	65.7	82.5	88.0	83.2	**102.8**	**109.7**
HWFI	23.8	35.2	51.1	70.0	86.7	119.1	138.4	247.3
HMNI	22.7	**30.2**	**38.0**	**43.1**	**43.3**	**42.0**	**68.6**	**94.9**
CTCI	**19.4**	**26.4**	**38.1**	**54.8**	68.4	**70.4**	**81.3**	**48.3**
HCCA	**19.4**	**29.6**	**41.6**	**55.8**	**61.9**	**78.7**	110.2	**195.5**
AEMI	27.7	48.0	69.0	95.2	116.4	148.0	206.2	357.6
GFEX	**21.3**	**34.3**	49.6	66.3	72.7	85.2	**105.2**	231.8
TVCA	**18.9**	**27.0**	**38.6**	**53.4**	**58.4**	**76.1**	**97.5**	**182.2**
TVCX	**19.5**	**27.9**	**39.2**	**54.9**	**61.2**	**77.0**	**94.1**	**188.0**
TVDG	**20.0**	**27.5**	**37.8**	**50.5**	**58.5**	**74.9**	**95.1**	**196.6**
TABS	55.1	115.6	176.0	222.5	263.1	300.8	363.5	531.1
TABM	31.0	52.0	65.7	80.5	91.1	105.6	116.4	**70.0**
TABD	25.7	41.6	67.7	104.6	146.5	174.5	249.8	309.7
Forecasts	17	15	14	12	10	8	5	2

Table 7a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Sally, 11–17 September. 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	60	72	96	120
OFCL	8.1	**7.6**	**7.4**	**9.7**	15.0	16.4	16.4	16.7
OCD5	10.9	11.2	16.6	25.5	28.6	32.6	35.6	14.3
Forecasts	21	19	17	15	13	11	7	3
OFCL (2015-19)	5.2	7.7	9.4	10.7	11.9	13.0	14.4	15.5
OCD5 (2015-19)	6.8	10.8	14.1	17.0	18.8	20.6	22.5	24.6

Table 7b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Sally, 11–17 September 2020. 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 7a due to the homogeneity requirement.

Model ID	Forecast Period (h)							
	12	24	36	48	60	72	96	120
OFCL	9.4	8.7	7.5	10.0	17.0	8.8	21.0	7.5
OCD5	11.8	12.1	17.1	25.8	26.5	23.6	41.2	**5.5**
HWFI	9.8	12.3	14.6	19.3	21.3	14.5	41.8	13.5
HMNI	**9.2**	13.9	13.4	18.0	18.5	12.0	29.6	9.0
CTCI	**8.9**	11.6	14.2	16.3	19.9	23.1	48.2	21.5
DSHP	10.4	10.1	8.6	16.3	17.9	9.2	21.6	**2.5**
LGEM	11.6	11.6	9.2	18.9	22.1	13.2	25.4	**3.5**
ICON	10.0	9.9	8.7	14.9	17.9	10.4	29.6	**7.0**
IVCN	9.6	10.1	9.4	14.2	18.2	11.8	32.8	10.0
IVDR	9.5	10.0	10.1	14.8	18.9	13.9	36.6	12.5
HCCA	**9.1**	8.7	8.3	13.7	18.3	10.4	33.6	**5.0**
GFSI	12.1	12.6	13.2	24.2	31.2	27.9	47.0	19.0
EMXI	13.4	14.3	17.3	26.6	30.5	25.5	39.6	12.0
Forecasts	17	15	14	12	10	8	5	2

Table 8a. Tropical cyclone wind watch and warning summary for Hurricane Sally, 11–17 September 2020.

Date/Time (UTC)	Action	Location
11 / 2100	Tropical Storm Watch issued	Ocean Reef to Jupiter Inlet FL
12 / 0300	Tropical Storm Watch issued	Okaloosa/Walton County Line to Ochlockonee River FL
12 / 0900	Tropical Storm Watch discontinued	Ocean Reef to Jupiter Inlet FL
12 / 2100	Tropical Storm Watch modified to	AL/FL Border to Ochlockonee River FL
12 / 2100	Hurricane Watch issued	Grand Isle LA to AL/FL Border
12 / 2100	Hurricane Watch issued	Lake Pontchartrain and Lake Maurepas
13 / 0900	Hurricane Watch changed to Hurricane Warning	Lake Pontchartrain and Lake Maurepas
13 / 0900	Tropical Storm Watch modified to	Indian Pass to Ochlockonee River FL
13 / 0900	Tropical Storm Warning issued	Ocean Springs MS to Indian Pass FL
13 / 0900	Hurricane Watch modified to	Ocean Springs MS to AL/FL Border
13 / 0900	Hurricane Warning issued	Grand Isle LA to Ocean Springs MS
13 / 1500	Tropical Storm Warning issued	Morgan City to Intracoastal City LA
13 / 1500	Hurricane Watch discontinued	Morgan City to Grand Isle LA
13 / 1500	Hurricane Warning modified to	Morgan City LA to Ocean Springs MS
14 / 0300	Tropical Storm Warning modified to	AL/MS Border to Indian Pass FL
14 / 0300	Hurricane Watch modified to	AL/MS Border to AL/FL Border
14 / 0300	Hurricane Warning modified to	Morgan City LA to AL/MS Border
14 / 1500	Tropical Storm Warning modified to	AL/FL Border to Indian Pass FL
14 / 1500	Hurricane Watch discontinued	All
14 / 1500	Hurricane Warning modified to	Morgan City LA to AL/FL Border
14 / 2100	Tropical Storm Watch discontinued	All

Date/Time (UTC)	Action	Location
14 / 2100	Tropical Storm Warning modified to	Navarre to Indian Pass FL
14 / 2100	Tropical Storm Warning discontinued	Morgan City to Intracoastal City LA
14 / 2100	Hurricane Warning modified to	Morgan City LA to Navarre FL
15 / 0300	Tropical Storm Warning issued	Morgan City to Grand Isle LA
15 / 0300	Hurricane Warning modified to	Grand Isle LA to Navarre FL
15 / 0900	Hurricane Warning changed to Tropical Storm Warning	Lake Pontchartrain and Lake Maurepas
15 / 0900	Tropical Storm Warning modified to	Mouth of the Pearl River to Grand Isle LA
15 / 0900	Hurricane Warning modified to	Mouth of the Pearl River to Navarre FL
15 / 1500	Tropical Storm Warning discontinued	Lake Pontchartrain and Lake Maurepas
15 / 1500	Tropical Storm Warning modified to	Bay Saint Louis MS to Grand Isle LA
15 / 1500	Hurricane Warning modified to	Bay Saint Louis MS to Navarre FL
16 / 0300	Tropical Storm Warning modified to	Okaloosa/Walton County Line to Indian Pass FL
16 / 0300	Hurricane Warning modified to	Bay Saint Louis MS to Okaloosa/Walton County Line FL
16 / 0900	Tropical Storm Warning discontinued	Bay Saint Louis MS to Grand Isle LA
16 / 0900	Tropical Storm Warning issued	Mouth of the Pearl River to AL/MS Border
16 / 0900	Hurricane Warning modified to	AL/MS Border to Okaloosa/Walton County Line FL
16 / 1500	Tropical Storm Warning discontinued	Mouth of the Pearl River to AL/MS Border
16 / 1800	Tropical Storm Warning modified to	AL/MS Border to Indian Pass FL
16 / 1800	Hurricane Warning discontinued	All
16 / 2100	Tropical Storm Warning modified to	AL/FL Border to Indian Pass FL
17 / 0000	Tropical Storm Warning modified to	Okaloosa/Walton County Line to Indian Pass FL
17 / 0300	Tropical Storm Warning discontinued	All

Table 8b. Storm surge watch and warning summary for Hurricane Sally, 11–17 September 2020.

Date/Time (UTC)	Action	Location
12 / 2100	Storm Surge Watch issued	Mouth of the Mississippi River to the Alabama/Florida border
12 / 2100	Storm Surge Watch issued	Lake Pontchartrain, Lake Maurepas, Lake Borgne, and Mobile Bay
13 / 0900	Storm Surge Warning issued	Port Fourchon LA to the Mississippi/Alabama border
13 / 0900	Storm Surge Warning issued	Lake Pontchartrain, Lake Maurepas, and Lake Borgne
14 / 0300	Storm Surge Warning modified	Port Fourchon LA to the Alabama/Florida border
14 / 0300	Storm Surge Warning issued	Mobile Bay
14 / 2100	Storm Surge Warning modified	Port Fourchon LA to the Okaloosa/Walton County Line FL
15 / 0900	Storm Surge Warning discontinued	Port Fourchon to the Mouth of the Mississippi River LA
16 / 0300	Storm Surge Warning discontinued	Mouth of the Pearl River to the Mississippi/Alabama border
16 / 0300	Storm Surge Warning modified	Mississippi/Alabama border to the Walton/Bay County Line FL
16 / 0630	Storm Surge Warning discontinued	Mouth of the Mississippi River LA to the Mouth of the Pearl River
16 / 0630	Storm Surge Warning discontinued	Lake Pontchartrain, Lake Maurepas, and Lake Borgne
16 / 0900	Storm Surge Warning discontinued	Mississippi/Alabama border to Dauphin Island AL
16 / 1800	Storm Surge Warning discontinued	Dauphin Island AL to the Alabama/Florida border
16 / 1800	Storm Surge Warning discontinued	Mobile Bay
17 / 0000	Storm Surge Warning discontinued	All

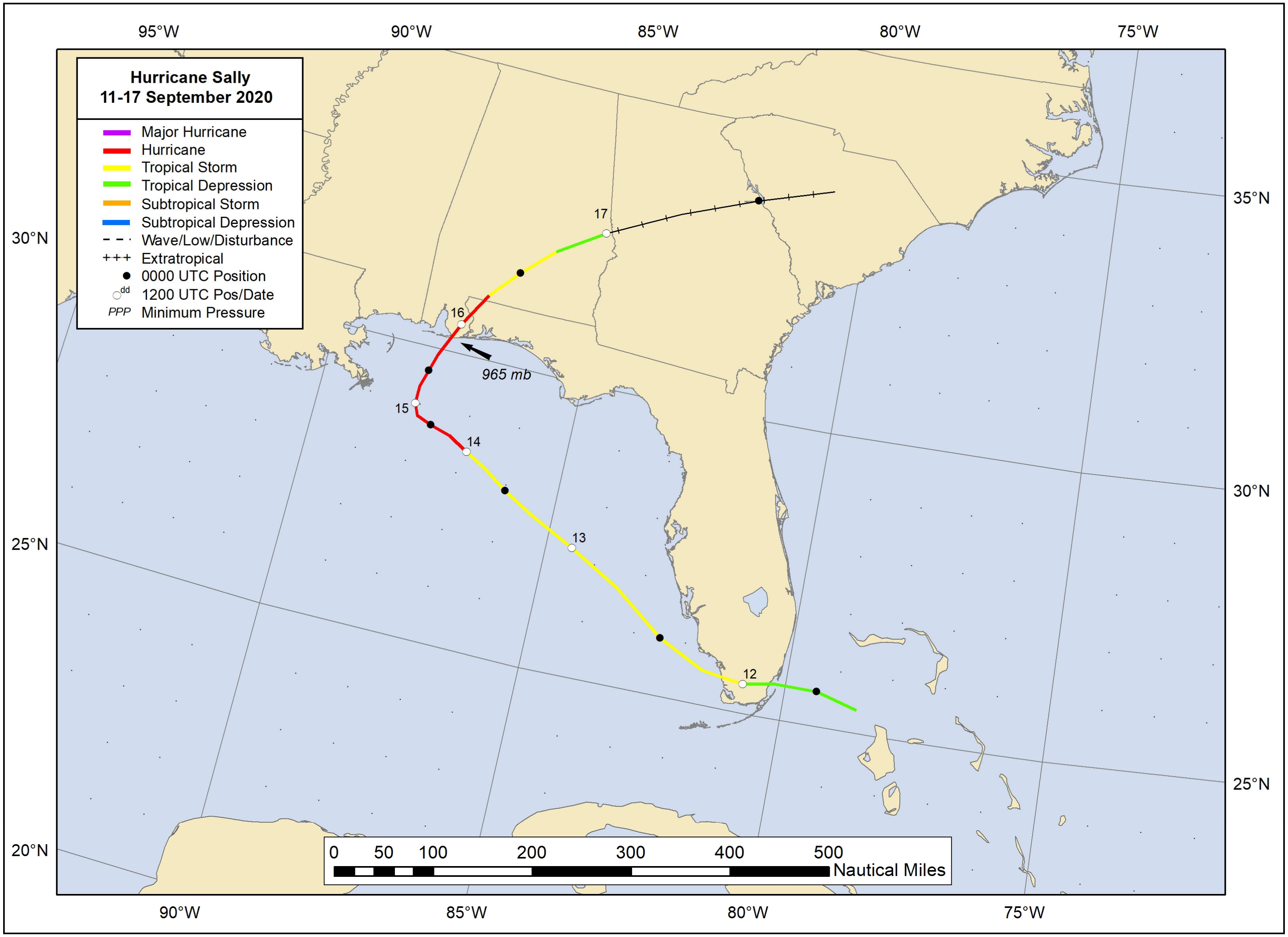

Figure 1. Best track positions for Hurricane Sally, 11–17 September 2020. The extratropical track over the United States is partially based on analyses from the NOAA Weather Prediction Center.

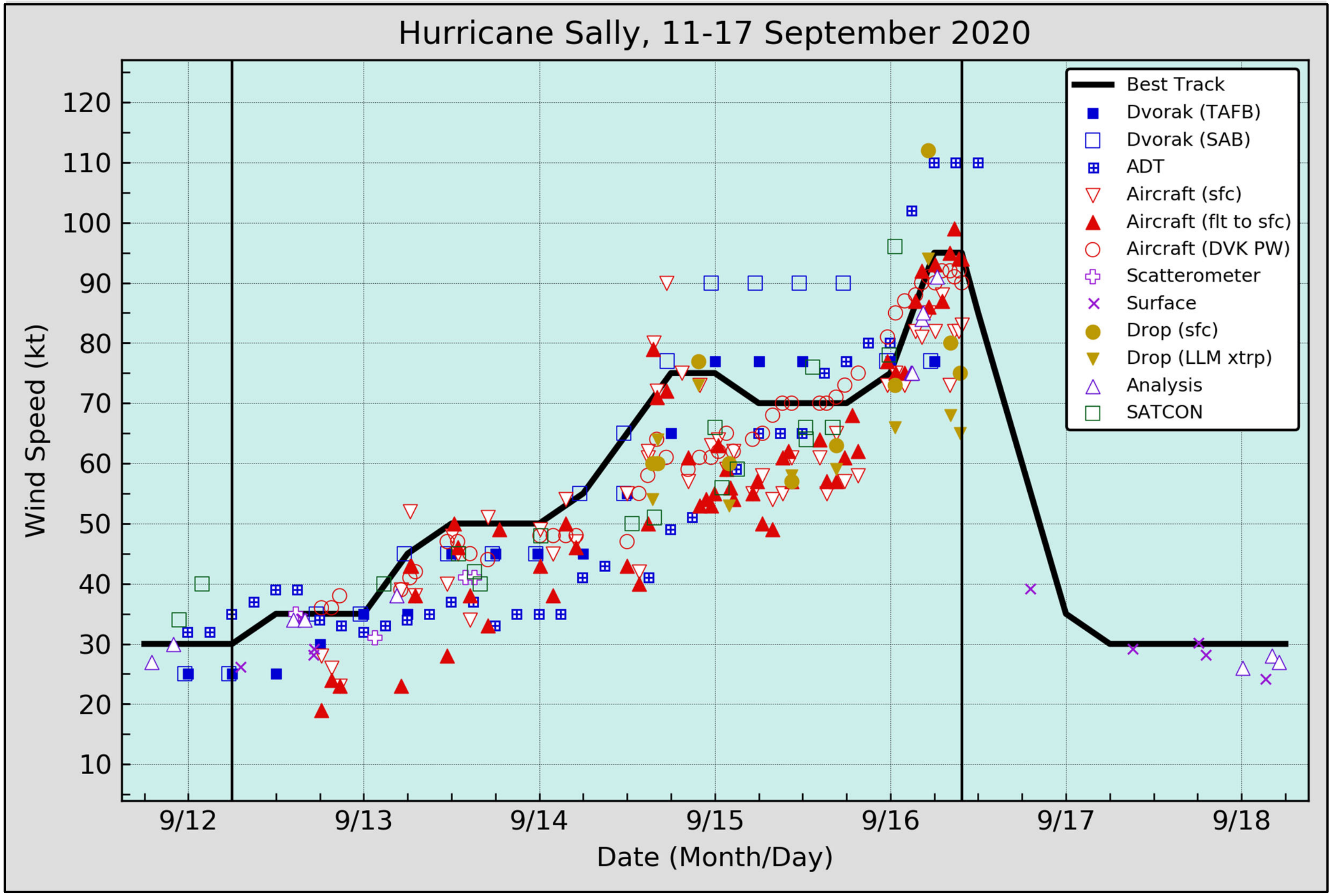

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Sally, 11–17 September 2020. Aircraft observations have been adjusted for elevation using 90%, 80%, and 75% adjustment factors for observations from 700 mb, 850 mb, and 925 mb, respectively. Advanced 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 solid vertical lines correspond to landfalls.

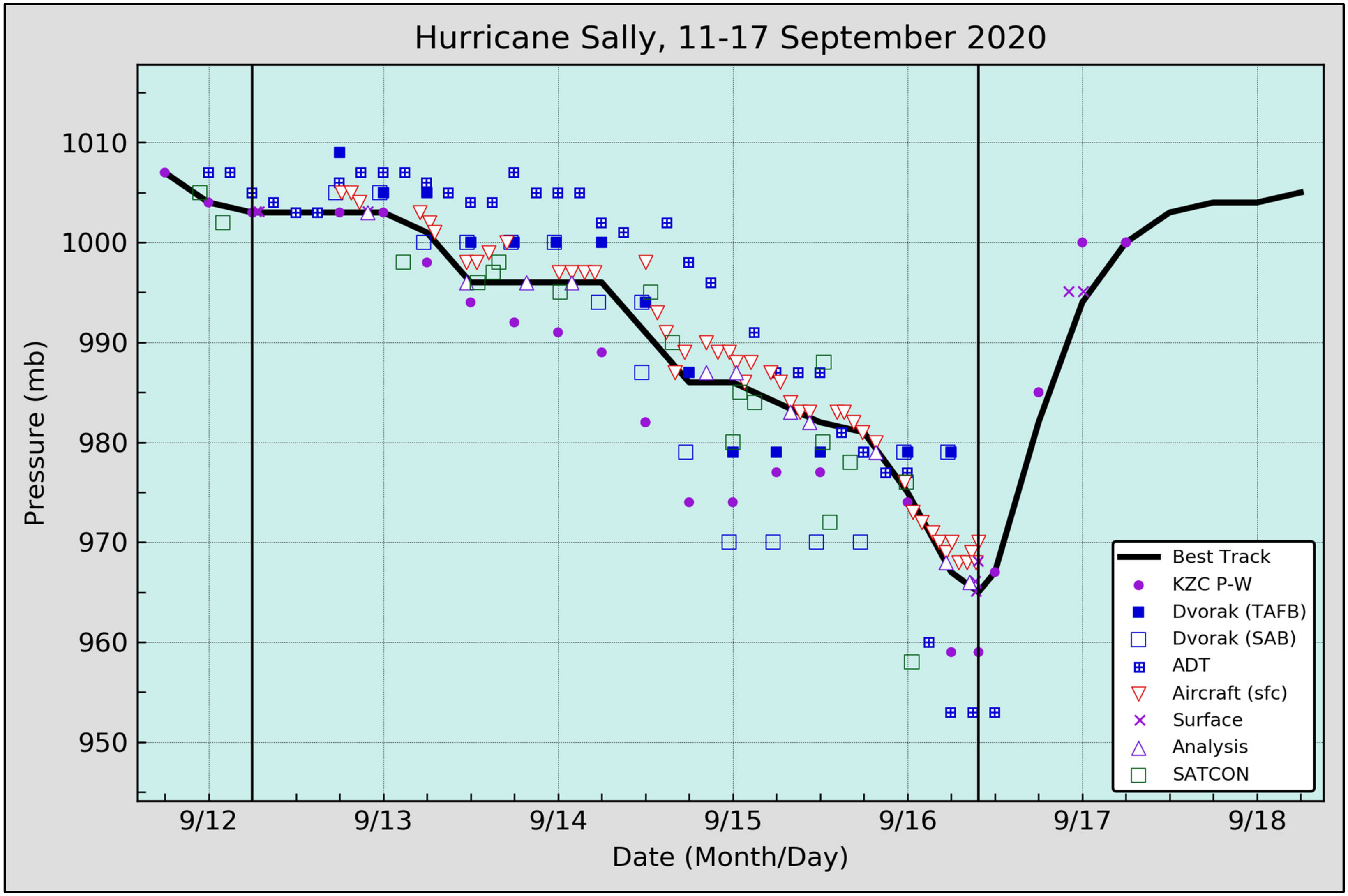

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Sally, 11–17 September 2020. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological 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 solid vertical lines correspond to landfalls.

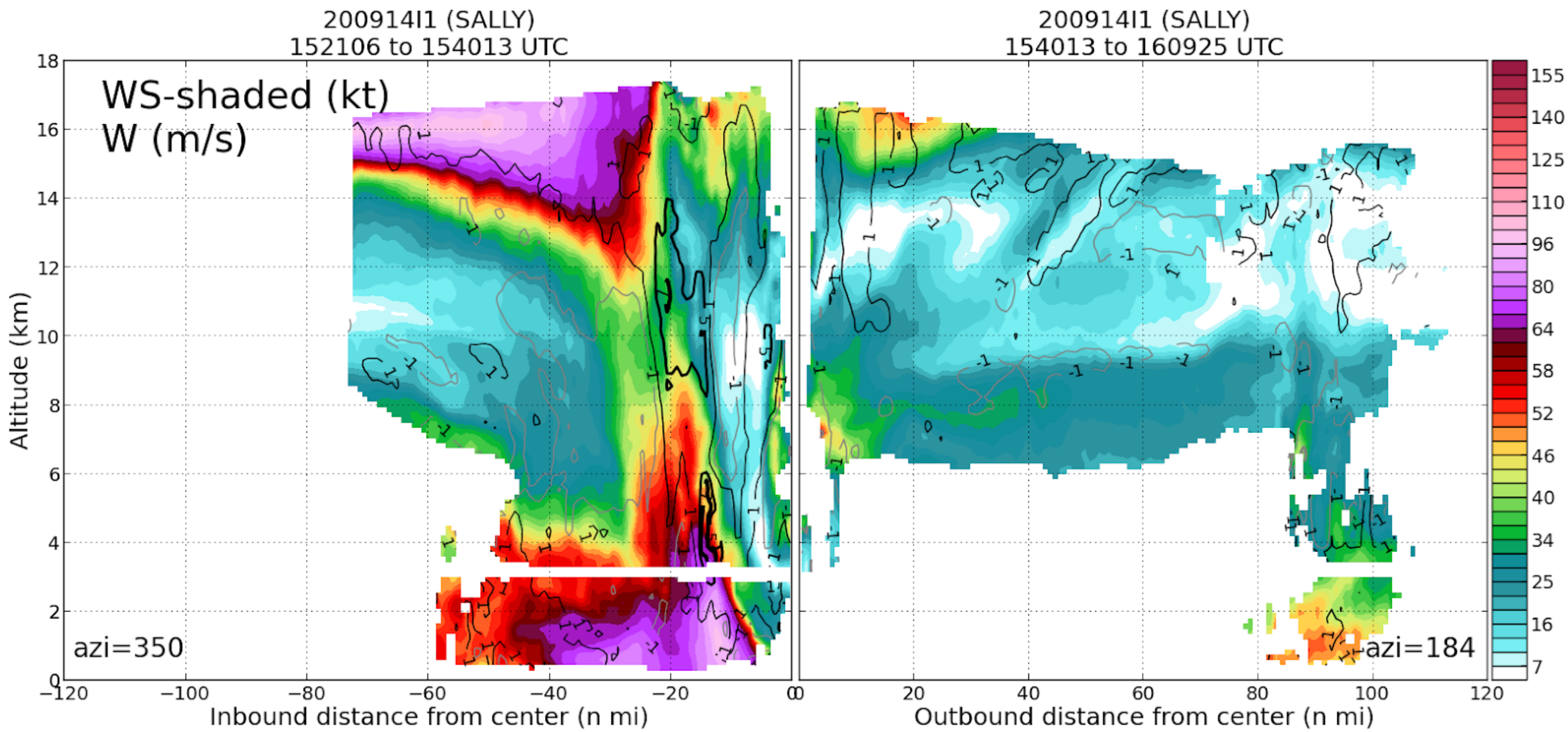

Figure 4. Cross section analysis of winds measured by the NOAA P-3 Tail Doppler Radar within Hurricane Sally from 1521 UTC to 1609 UTC 14 September. Colored shading indicates wind speed (kt), and solid black lines denote vertical velocity (m/s). The left side of the diagram is north, and the right side is south. The analysis shows a northward tilt of the northern eyewall with height, strong updrafts along the inner edge of the eyewall between 3 and 6 km altitude, and maximum winds of 90 to 95 kt within the northern eyewall at an altitude of 0.5 km. Image courtesy of the NOAA Atlantic Oceanographic and Meteorological Laboratory / Hurricane Research Division.

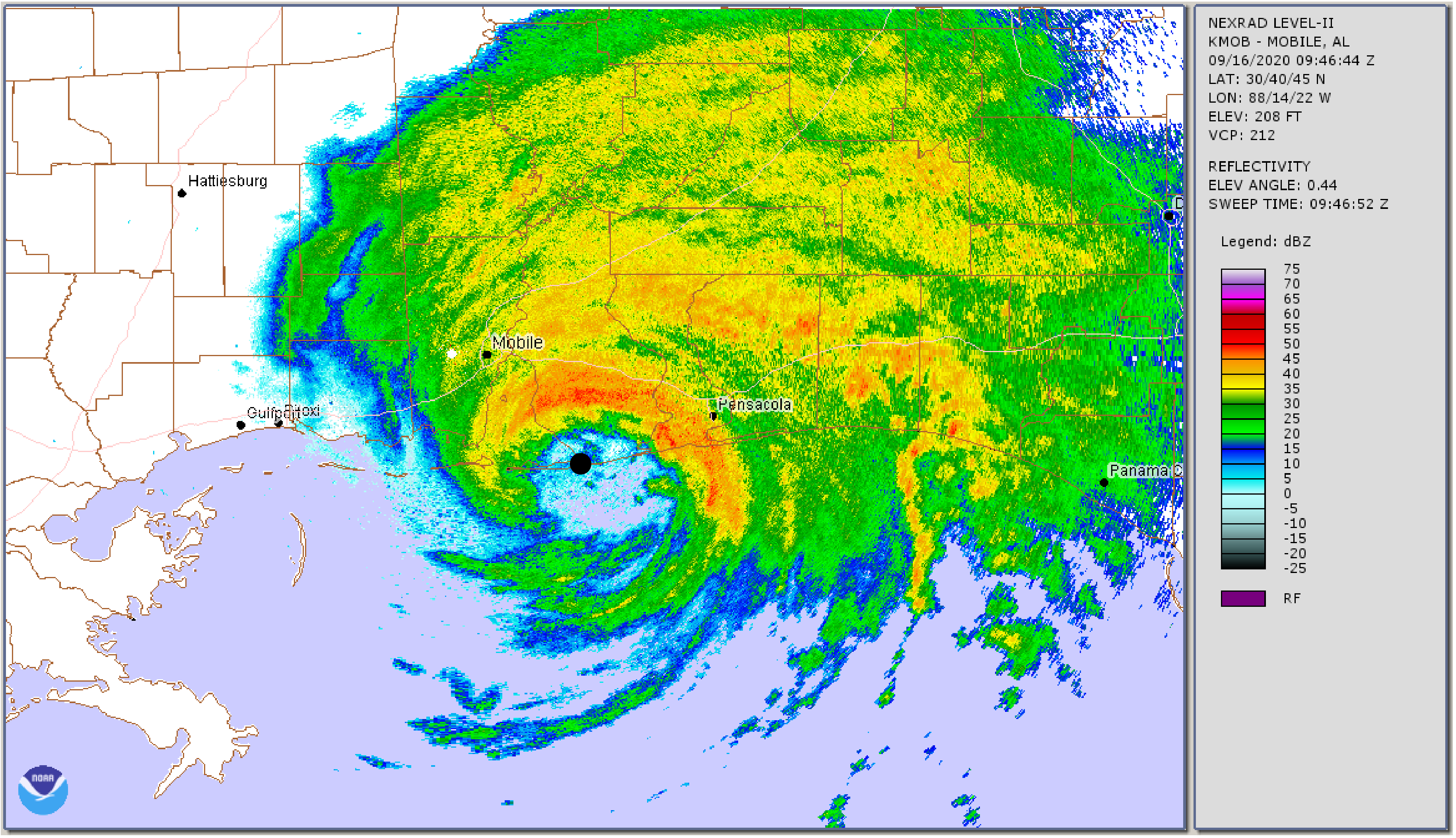

Figure 5. Radar reflectivity from the National Weather Service WSR-88D radar in Mobile, Alabama, at 0946 UTC 16 September, around the time of Sally's landfall at Gulf Shores, Alabama. At the time, Sally's center (denoted by the black dot) was located on the northwestern side of the eye.

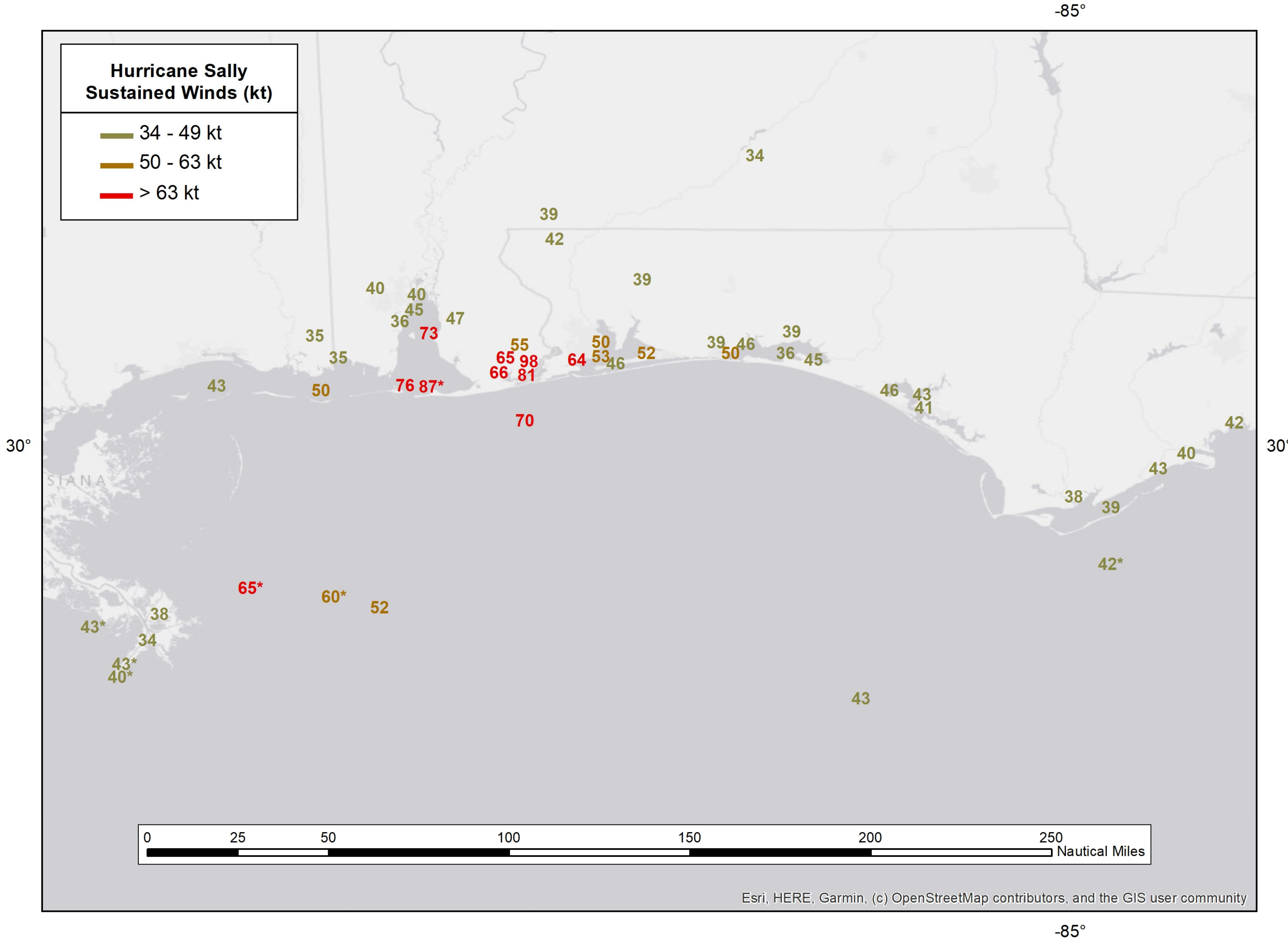

Figure 6. Selected peak sustained winds (kt) reported during Hurricane Sally. An asterisk denotes observations that were elevated more than 20 m above the surface.

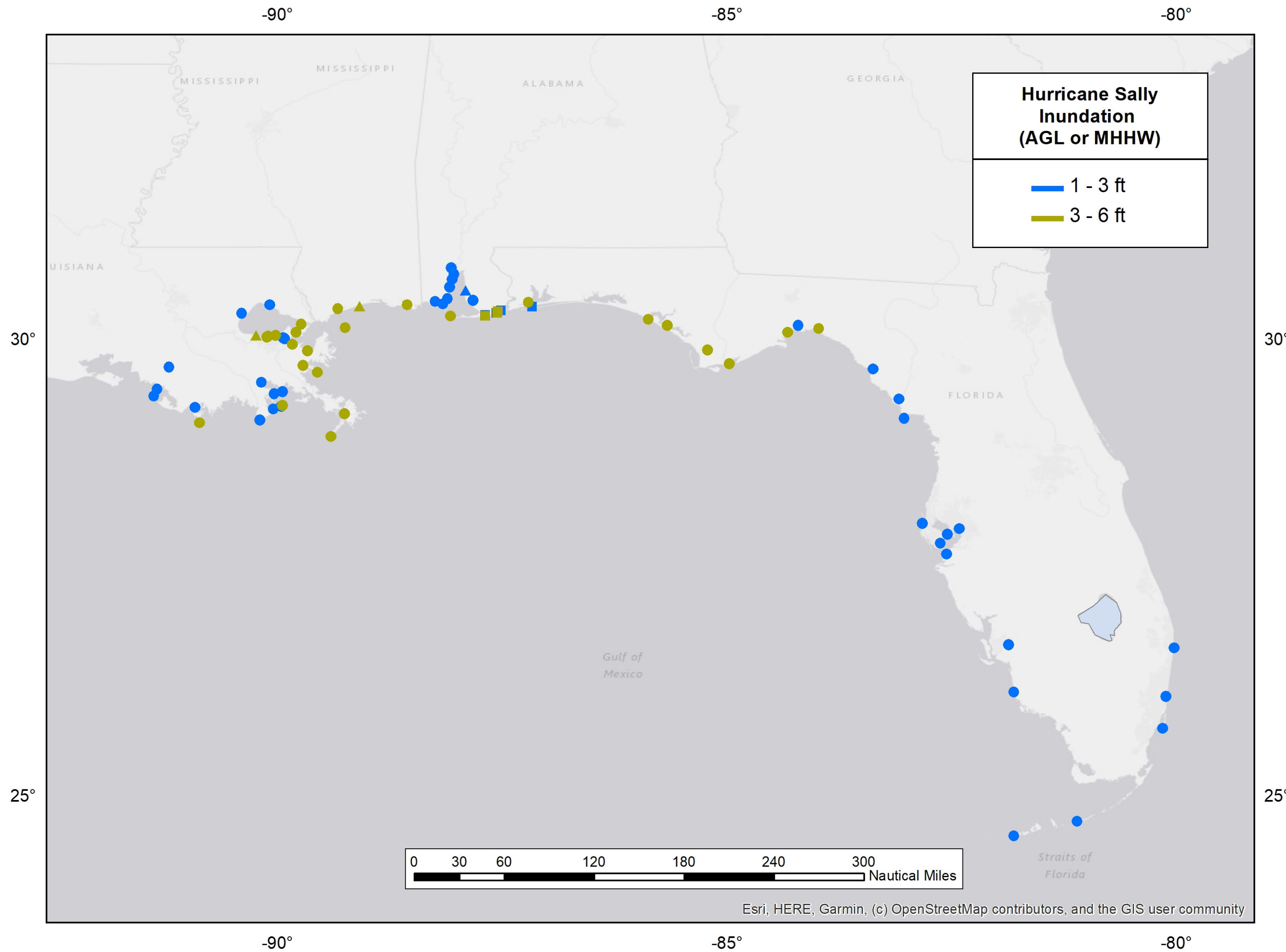

Figure 7. Maximum water levels measured from tide gauges (circles), water level sensors (triangles), and surveyed high water marks (squares) from Hurricane Sally. Water levels are referenced as feet above ground level (AGL) or above Mean Higher High Water (MHHW), which is used as a proxy for inundation (above ground level) on normally dry ground along the immediate coastline.

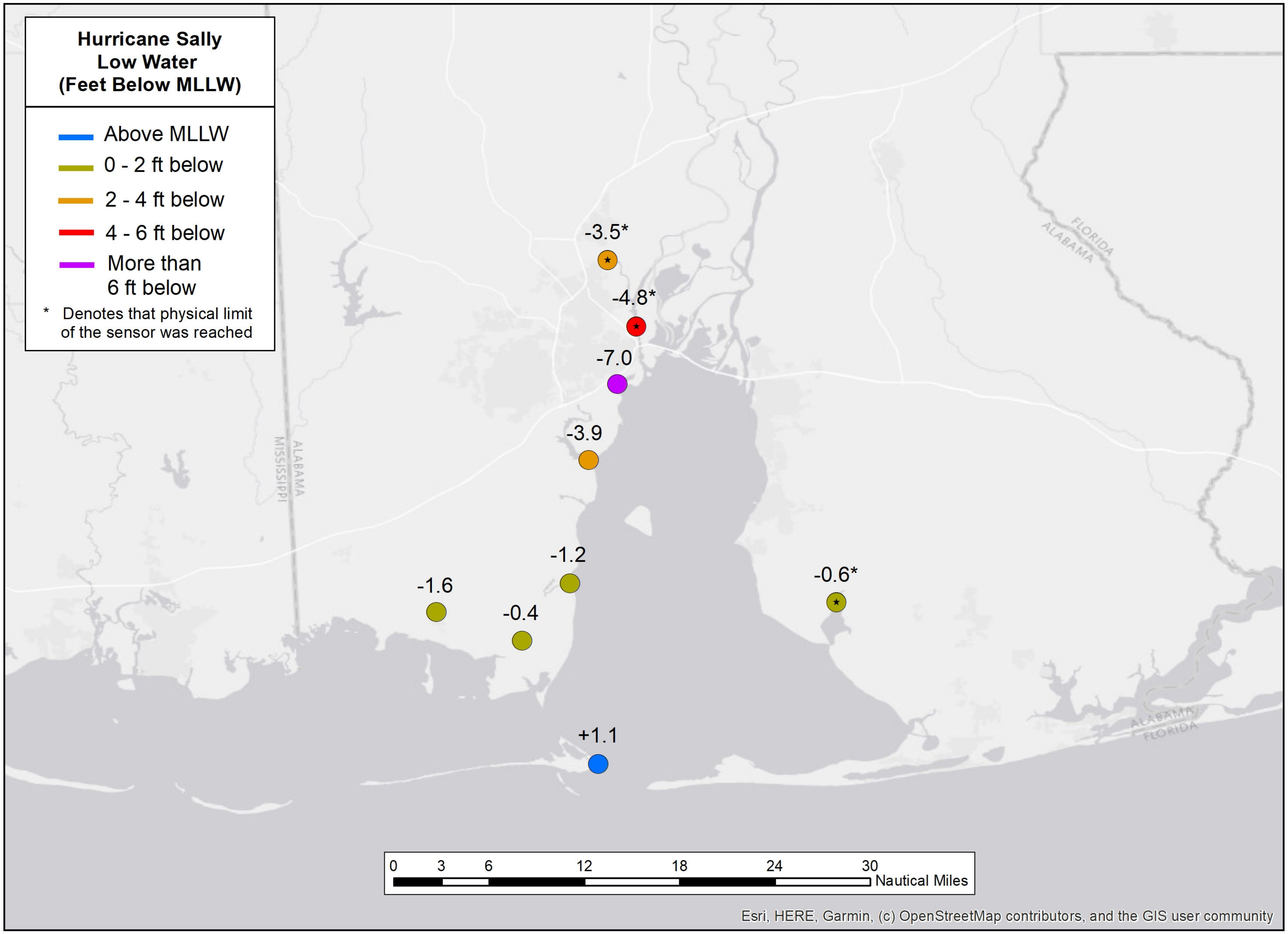

Figure 8. Low water levels measured from tide gauges around Mobile Bay during Hurricane Sally. Water levels are referenced as feet relative to Mean Lower Low Water (MLLW). Markers with a star indicate that the physical limit of the senor was reached, and the actual water level at the station may have been lower than recorded.

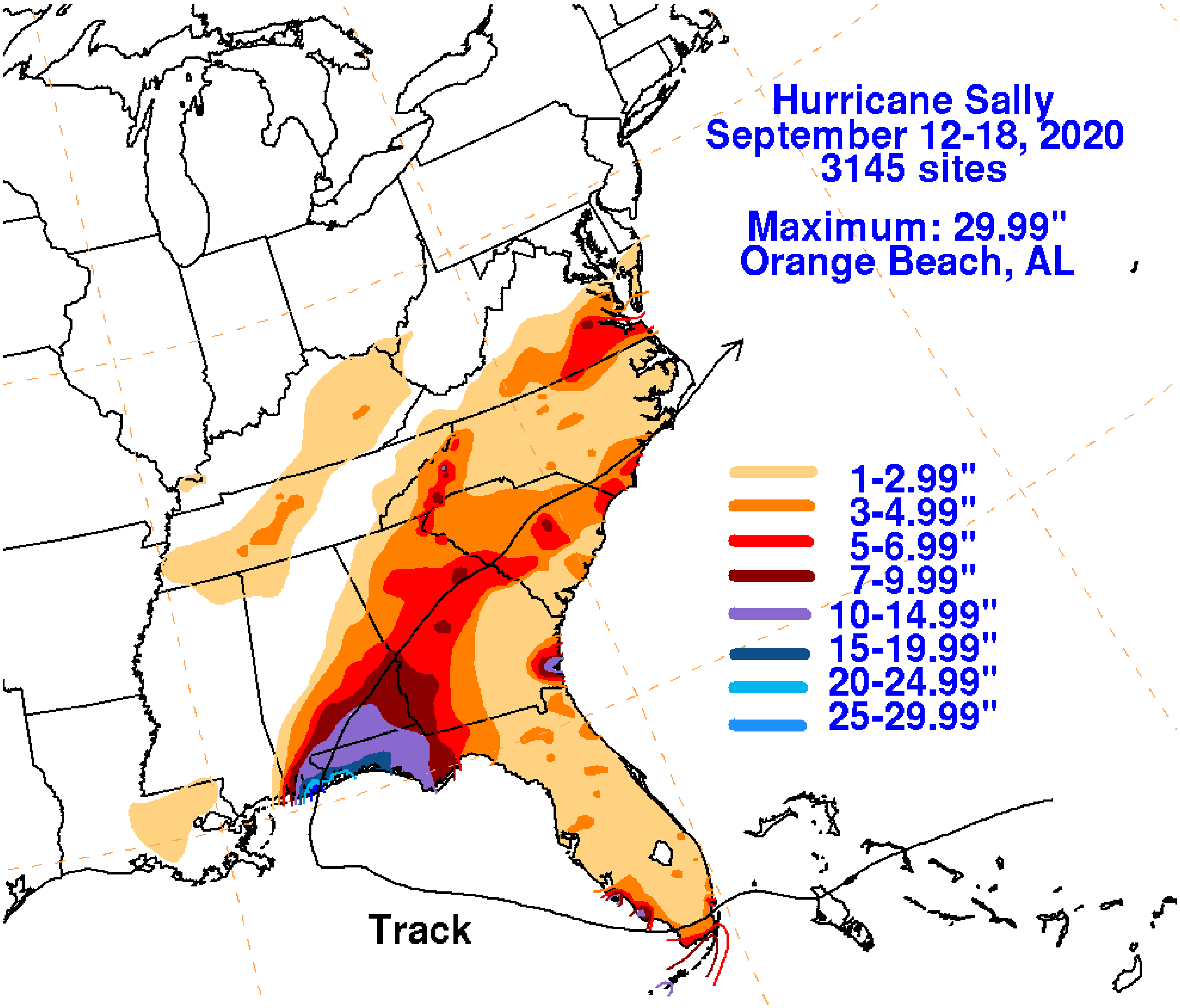

Figure 9. Rainfall accumulations (inches) from Hurricane Sally. Image courtesy of the NOAA Weather Prediction Center.

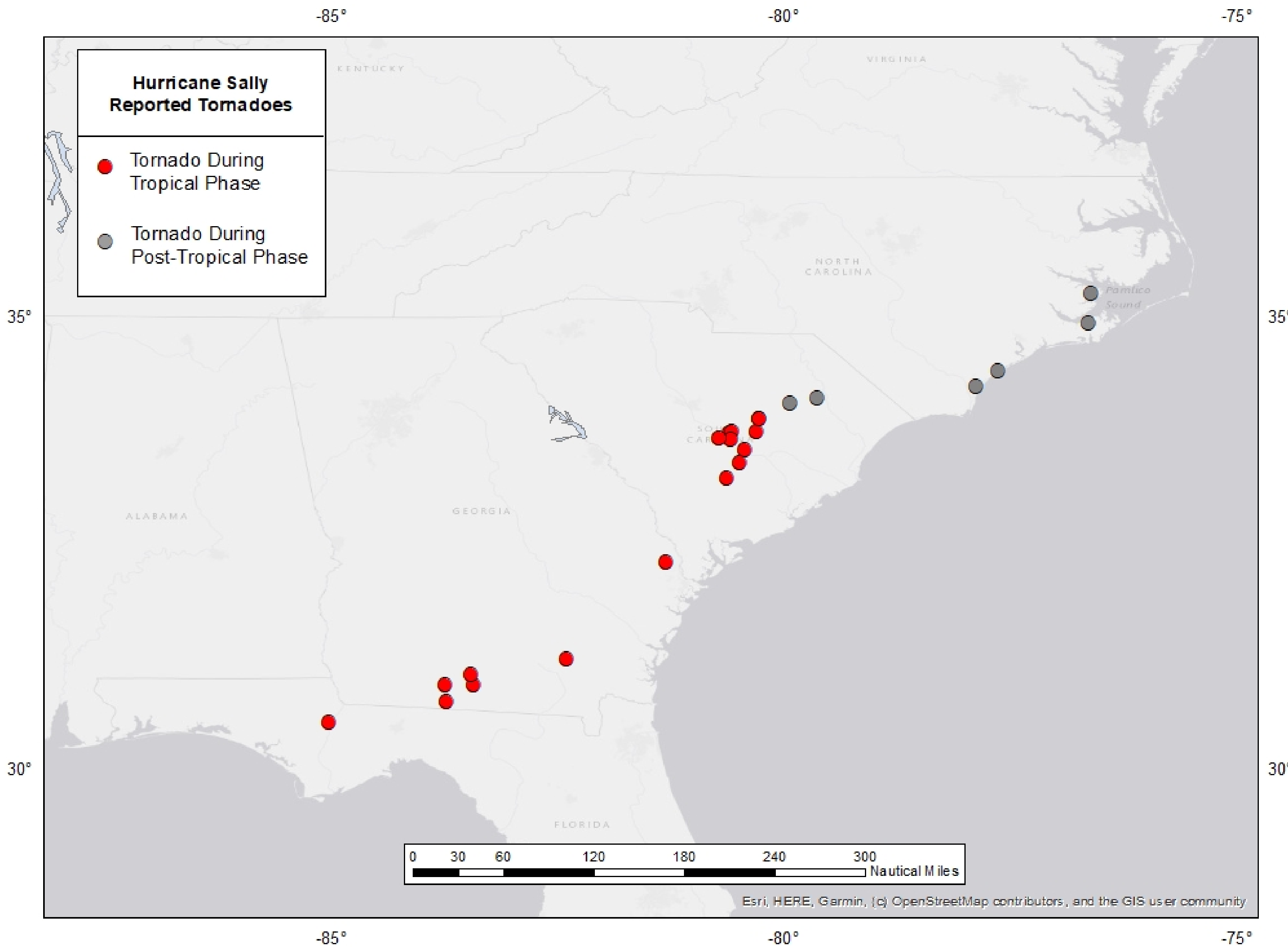

Figure 10. Location of tornadoes documented in association with Hurricane Sally, during its tropical and post-tropical phases, between 16–18 September 2020.

Figure 11. NOAA National Geodetic Survey aerial damage assessment image after Hurricane Sally showing three new cuts through Johnson Beach, Florida, on the eastern end of Perdido Key.

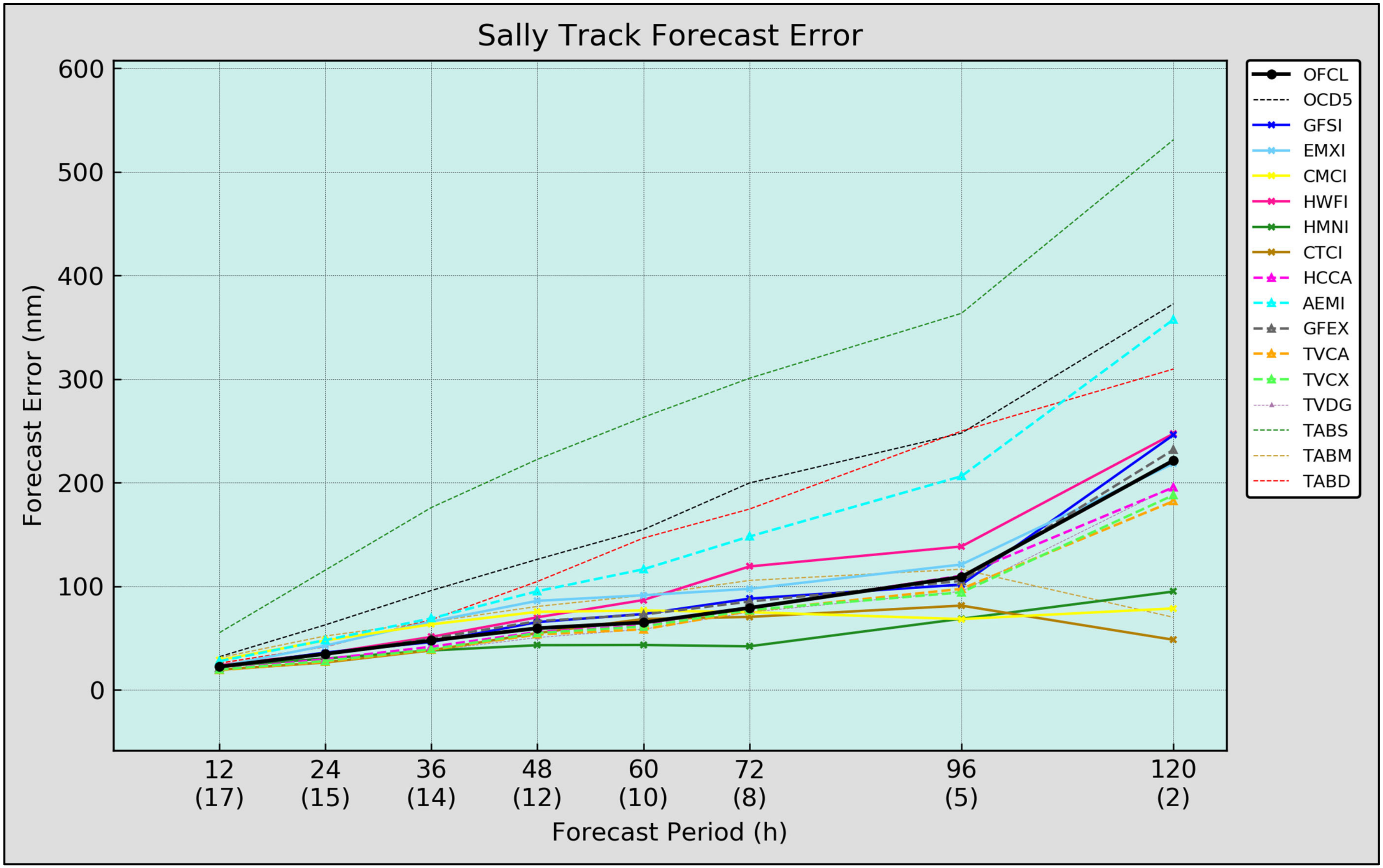

Figure 12. Homogeneous comparison of NHC official track forecast errors (black) with the errors from selected track forecast guidance models (in n mi) for Hurricane Sally, 11–17 September 2020.

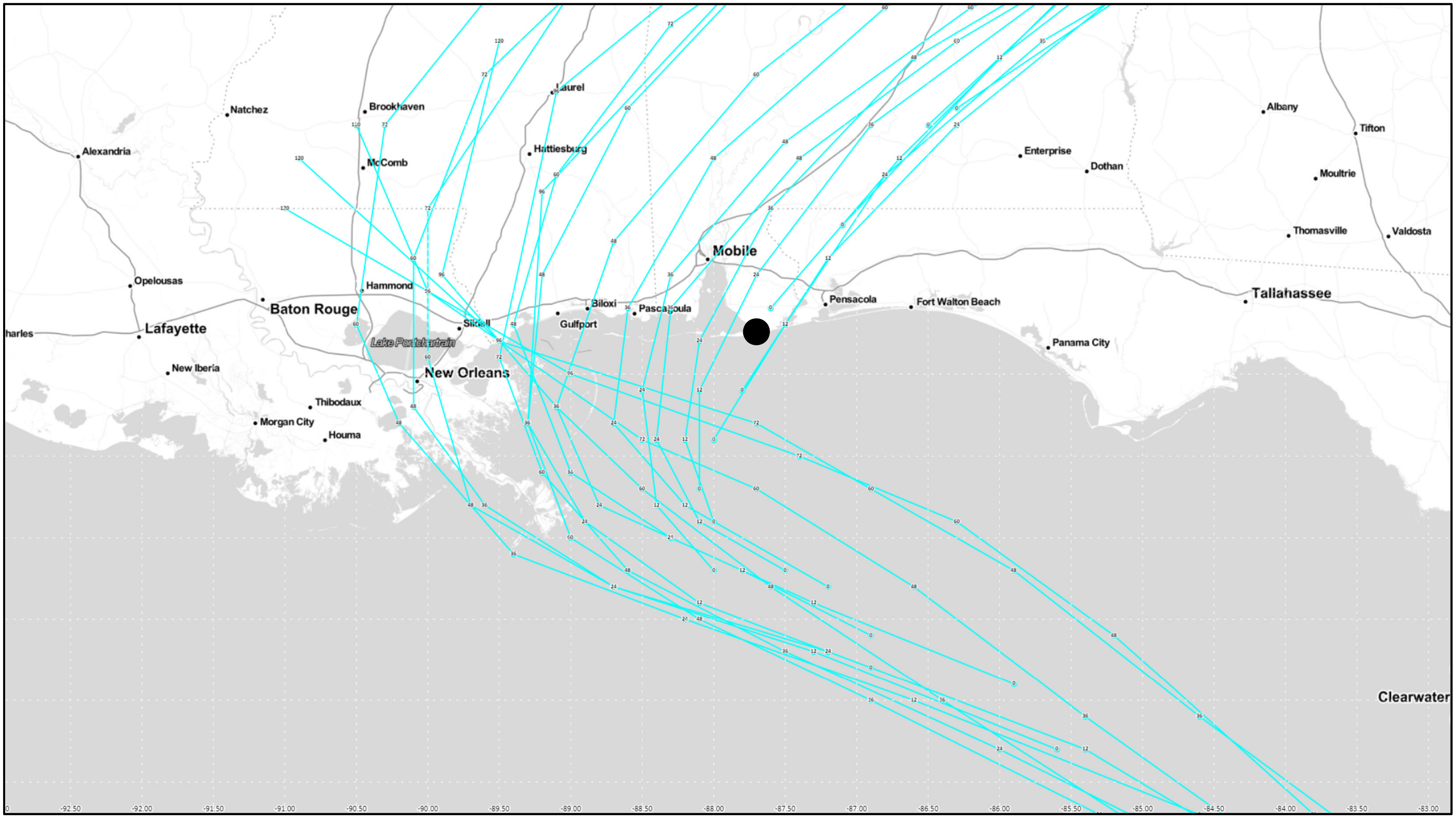

Figure 13. NHC official 5-day track forecasts issued every 6 h for Hurricane Sally, 11–17 September 2020. The black dot indicates Sally's landfall at Gulf Shores, Alabama, on 16 September.

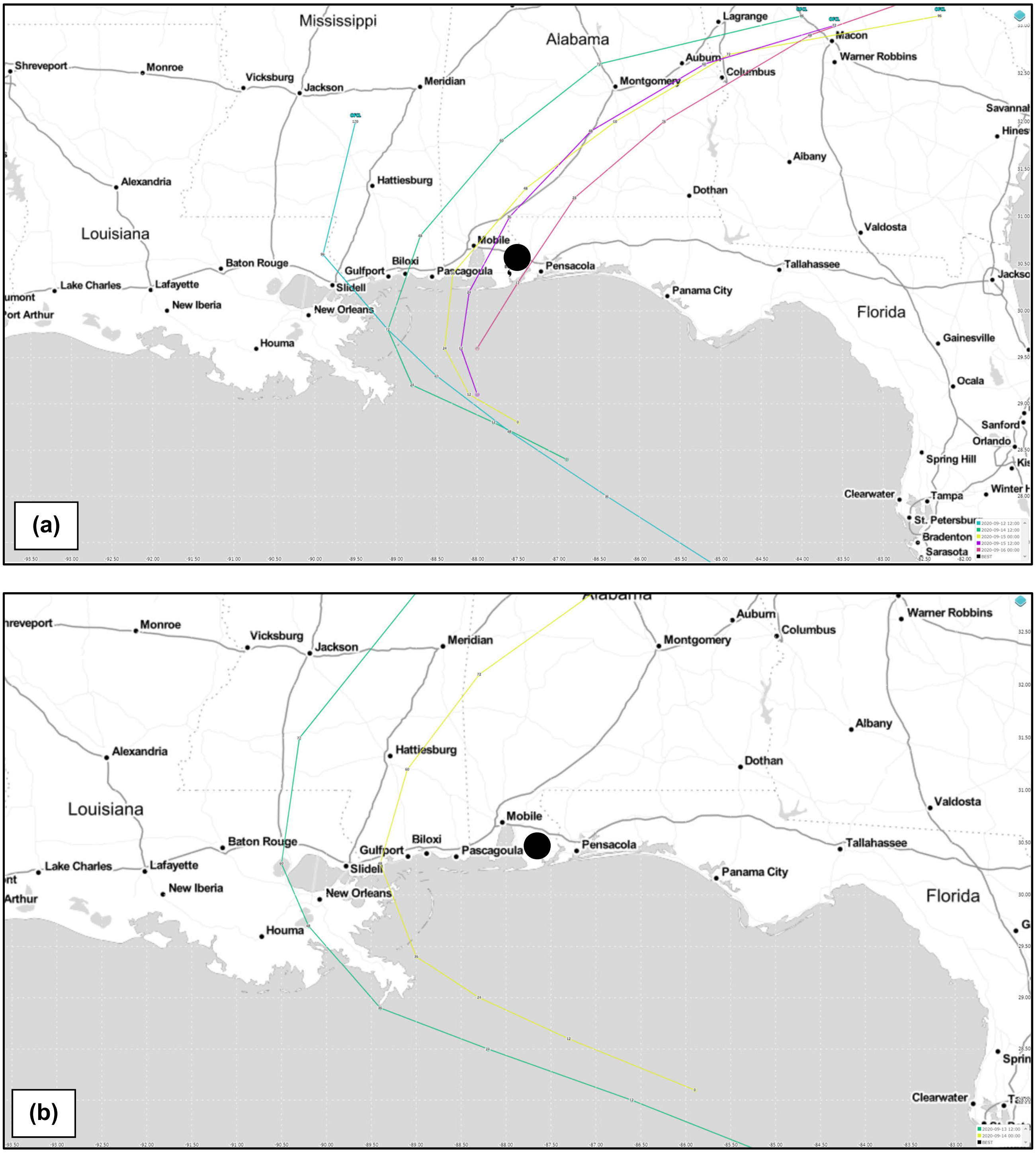

Figure 14. (a) NHC official track forecasts issued 12, 24, 36, 48, and 96 h before 1200 UTC 16 September (the synoptic time closest to landfall), which all had lower errors than their respective 5-yr means. (b) NHC official track forecasts issued 60 and 72 h before 1200 UTC 16 September, which had higher errors than their respective 5-yr means. The black dots indicate Sally's position at 1200 UTC 16 September 2020.

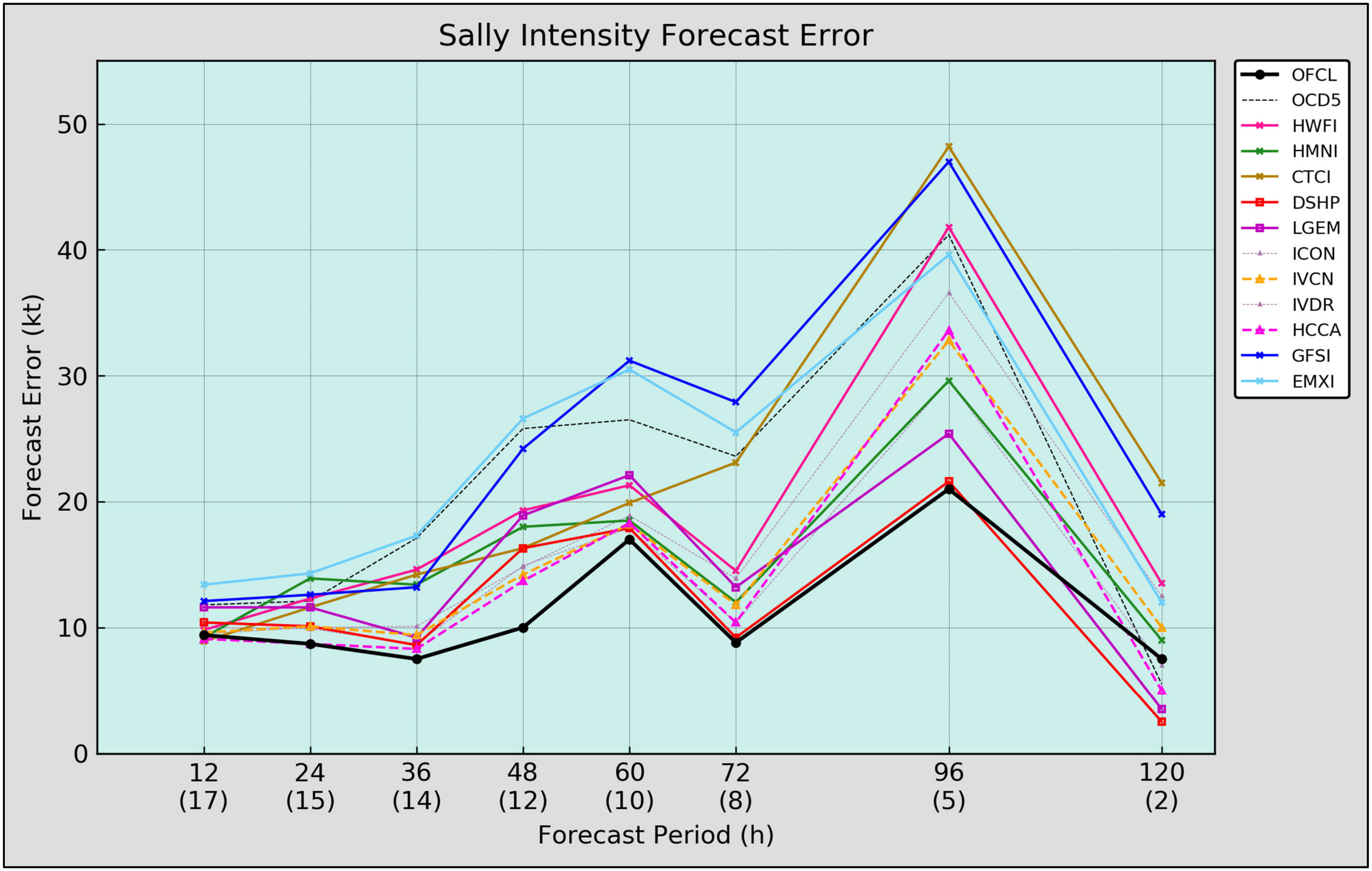

Figure 15. Homogeneous comparison of NHC official intensity forecast errors (black) with the errors from selected intensity forecast guidance models (in kt) for Hurricane Sally, 11–17 September 2020.

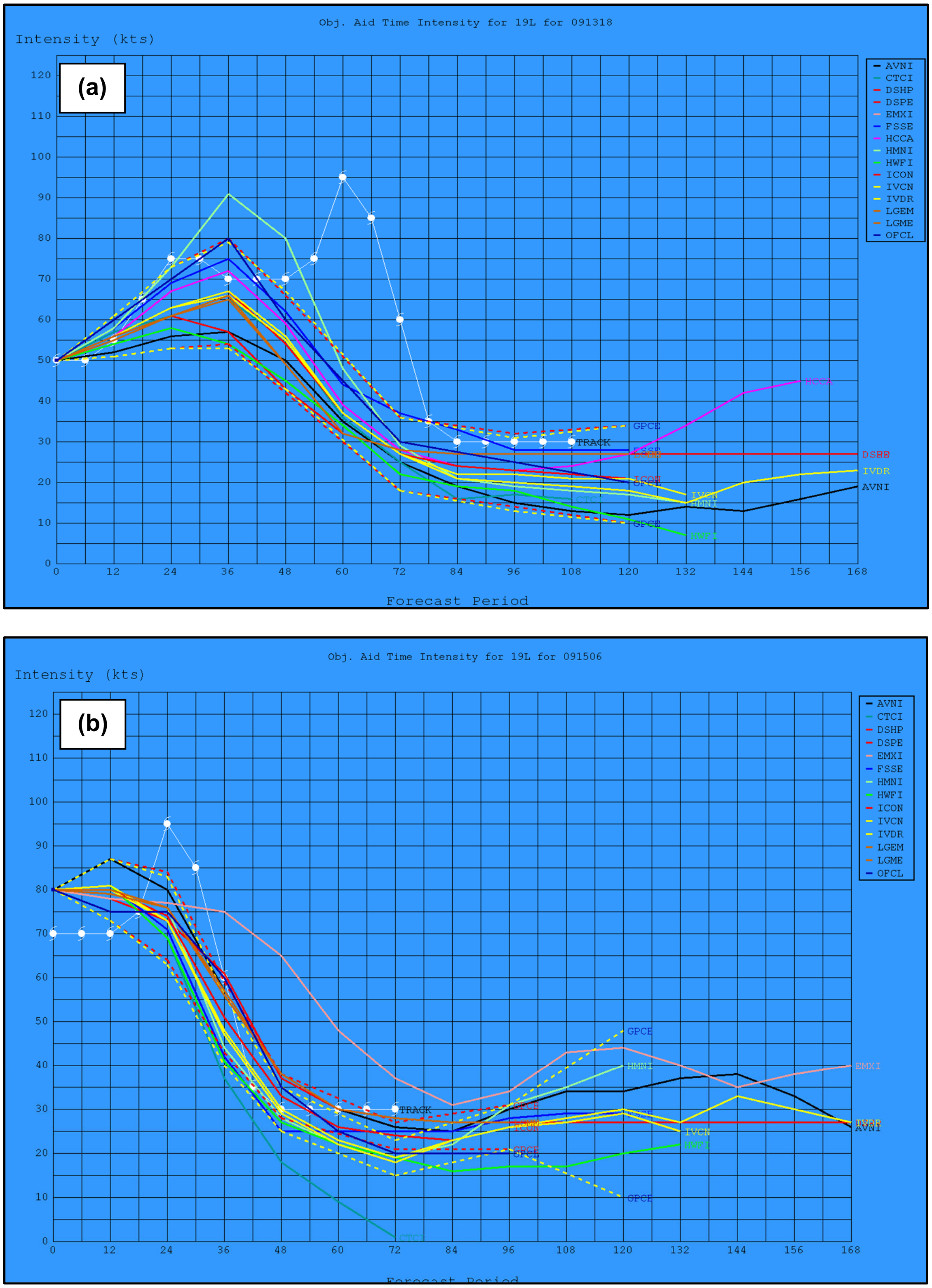

Figure 16. (a) NHC official forecast and intensity model solutions (kt) from 1800 UTC 13 September, 24 h before Sally reached its first peak intensity of 75 kt. (b) NHC official forecast and intensity model solutions (kt) from 0600 UTC 15 September, 24 h before Sally reached its second peak intensity. The best track intensity (kt) is indicated by the white line and symbols.

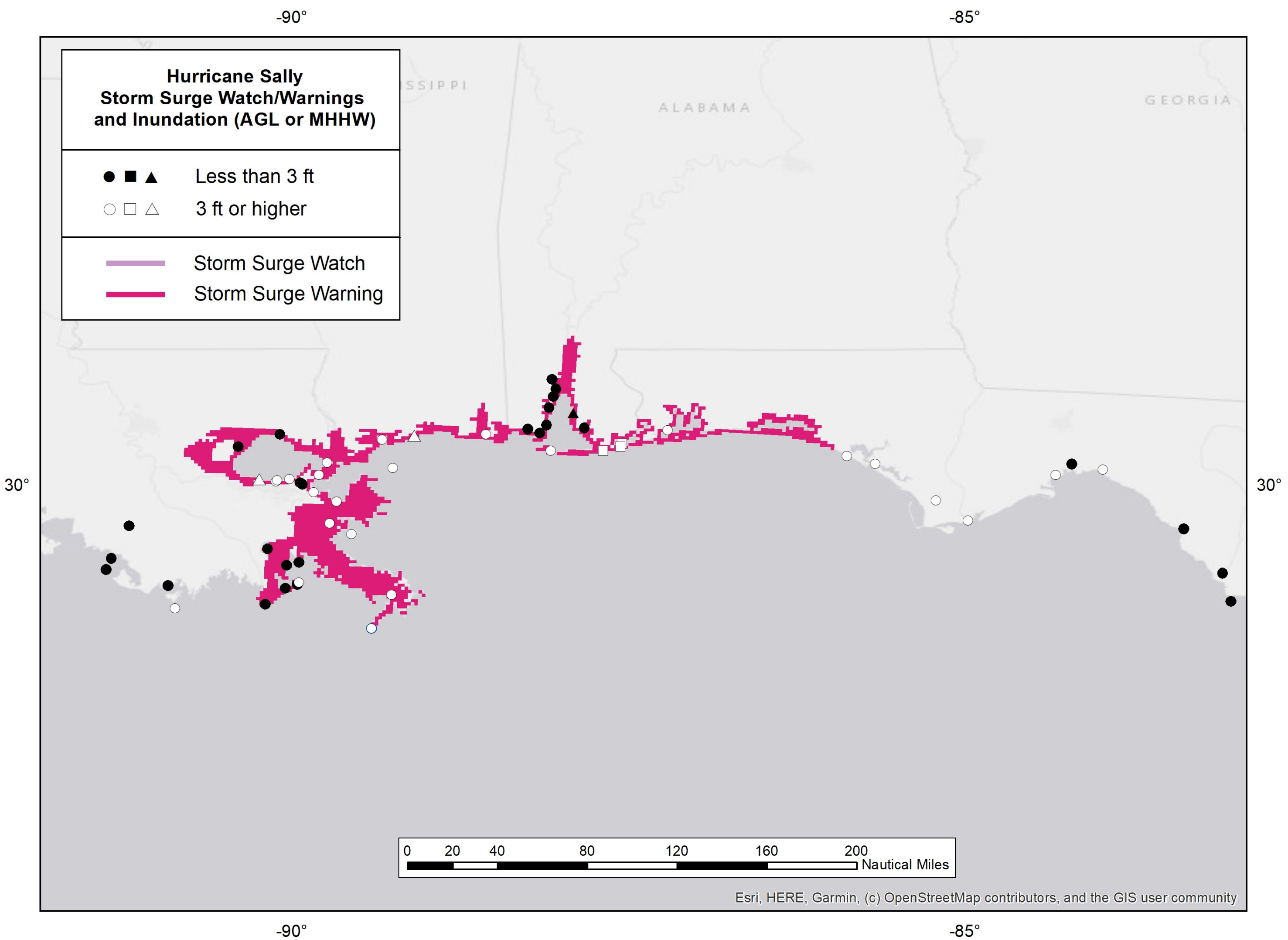

Figure 17. Maximum water levels measured from tide and stream gauges (circles), water level sensors (triangles), and high water marks (squares) during Hurricane Sally and areas covered by storm surge watches (lavender) and warnings (magenta). Water levels are referenced as feet above ground level (AGL) or Mean Higher High Water (MHHW), which is used as a proxy for inundation (above ground level) on normally dry ground along the immediate coastline. Black markers denote water levels less than 3 ft above ground level, and white markers denote water levels 3 ft or higher above ground level.