Tropical Cyclone Report
Hurricane Gustav
(AL072008)
25 August – 4 September 2008

John L. Beven II and Todd B. Kimberlain
National Hurricane Center
22 January 2009

Gustav moved erratically through the Greater Antilles into the Gulf of Mexico, eventually making landfall on the coast of Louisiana. It briefly a category 4 hurricane on the Saffir-Simpson Hurricane Scale and caused many deaths and considerable damage in Haiti, Cuba, and Louisiana.

a. Synoptic History

Gustav formed from a tropical wave that moved westward from the coast of Africa on 13 August. The wave continued westward across the tropical Atlantic, with the associated shower activity first showing signs of organization on 18 August. Westerly vertical wind shear, however, prevented significant development for the next several days. The wave moved through the Windward Islands on 23 August with a broad area of low pressure accompanied by disorganized shower activity. Organization increased late on 24 August as the system moved northwestward across the southeastern Caribbean Sea, and it is estimated that a tropical depression formed near 0000 UTC 25 August about 95 n mi northeast of Bonaire in the Netherland Antilles. 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[1].

The depression formed a small inner wind core during genesis with a radius of maximum winds of less than 10 n mi. Subsequently, it rapidly intensified. It became a tropical storm near 1200 UTC 25 August and a hurricane just after 0000 UTC 26 August. Gustav reached an intensity of 80 kt later on 26 August, then weakened slightly before making landfall on the southwestern peninsula of Haiti near 1800 UTC that day. The center of Gustav crossed the peninsula into the Canal du Sud, and the cyclone weakened to a tropical storm by early 27 August.

A low- and mid-level ridge built over the western Atlantic and Florida on 27 August, and Gustav turned westward in response. Although the center was over water on 27 August, enough of the circulation was interacting with Hispañiola to prevent re-intensification. Indeed, Gustav weakened further to an intensity of 40 kt by late that day. Early on 28 August the storm moved southward, possibly due to a reformation of the center. During this change of course, the

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

maximum winds increased to 60 kt. Little change in strength occurred before the center moved westward over Jamaica around 1800 UTC that day. The storm then turned west-northwestward early on 29 August and emerged from the western end of Jamaica about 1200 UTC that day. Later that day, Gustav entered an area of stronger southeasterly low and mid-level flow on the southwestern side of the ridge. As a result, the cyclone began a northwestward motion at about 15 kt that would continue until its final landfall.

The cyclone intensified over the warm water of the northwestern Caribbean Sea. Gustav regained hurricane status late on 29 August, then became a Category 2 hurricane as it moved through the Cayman Islands early on 30 August. It rapidly intensified to a Category 4 hurricane before it made landfall on the eastern coast of the Isle of Youth, Cuba, near 1800 UTC that day. Gustav reached a peak intensity of 130 kt as it made landfall in the Pinar del Rio province of western Cuba near 2200 UTC 30 August. The eye of Gustav emerged into the southeastern Gulf of Mexico early on 31 August.

Gustav weakened over Cuba, and it continued to weaken over the Gulf of Mexico on 31 August. An upper-level trough west of Gustav caused some southerly vertical wind shear, and satellite imagery suggested that mid- to upper-level dry air became entrained into the cyclone. This combination appears to have prevented strengthening over the warm Gulf waters. However, the hurricane grew in size as it crossed the Gulf. By 1 September, tropical-storm-force winds extended roughly 200 n mi from the center in the northeastern quadrant and hurricane-force winds extended roughly 70 n mi from the center in the same quadrant. Gustav made its final landfall near Cocodrie, Louisiana, around 1500 UTC 1 September with maximum winds near 90 kt (Category 2).

The hurricane weakened to a tropical storm and its forward motion slowed as it crossed southern and western Louisiana later on 1 September. It became a tropical depression on 2 September over northwestern Louisiana. Gustav then meandered over southwestern Arkansas, extreme northeastern Texas, and extreme southeastern Oklahoma on 3 September as it encountered weak steering currents at the western end of the Atlantic ridge. An approaching mid- to upper-level trough and accompanying cold front caused Gustav to accelerate northeastward on 4 September, with the cyclone becoming extratropical due to merging with the front. The extratropical remnants of Gustav were absorbed by another extratropical low on 5 September as it moved through the Great Lakes.

b. Meteorological Statistics

Observations in Gustav (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), as well as flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from flights of the 53rd Weather Reconnaissance Squadron (53rd WRS) of the U. S. Air Force Reserve Command. Data and imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA QuikSCAT, and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in tracking Gustav.

The 53rd WRS and NOAA Hurricane Hunter aircraft flew 29 missions in association with Gustav. These included 15 53rd WRS operational flights, 5 NOAA research missions, and 6 synoptic surveillance missions of the NOAA G-IV jet. There was also one NOAA mission to deploy aircraft expendable bathythermographs, one 53rd WRS mission to deploy drifting buoys, and one NOAA mission to study oceanic changes caused by the hurricane. During the flights, the maximum observed 700-mb flight-level winds were 143 kt at 2014 UTC 30 August, with a 141-kt wind reported at 1654 UTC that day. The maximum surface wind estimated in Stepped Frequency Microwave Radiometer (SFMR) data was 108 kt at 1658 UTC 30 August, and an eyewall dropsonde reported a surface wind of 108 kt nine minutes earlier. It should be noted that SFMR winds near the time of Gustav's landfall in Cuba were unreliable due to shoaling issues. The lowest central pressure reported by aircraft was 941 mb at 2154 UTC 30 August.

Ship reports of winds of tropical storm force associated with Gustav are given in Table 2. The only observation of hurricane-force winds was from the **Bona Foam** (call sign C6CL6), which reported 68 kt at 2100 UTC 31 August. However, this report appears a little high compared to aircraft data and other nearby reports.

Selected surface observations from land stations and data buoys are given in Table 3. Gustav brought hurricane conditions to portions of western Cuba, with the strongest winds reported at Paso Real de San Diego in Pinar del Rio province. This station (elevation 10 m) reported a 1-minute wind of 135 kt at 2235 UTC 30 August with a peak gust of 184 kt. The World Meteorological Organization has been investigating the validity of the report as a possible world record wind gust in a tropical cyclone. As of this writing, the data appear valid. However, these winds are possibly associated with a transient eyewall mesovortex and enhanced by terrain affects. Due to this and the SFMR issues mentioned above, the peak intensity estimate of 130 kt is based mainly on aircraft flight-level winds. Hurricane conditions also occurred over portions of southern Louisiana. The National Ocean Service station at the Southwest Pass of the Mississippi River (elevation 24 m) reported 6-minute winds of 79 kt at 0918 UTC 1 September with a gust to 102 kt. An offshore oil rig (elevation 122 m) reported sustained winds of 90 kt at 0505 UTC 1 September with a gust to 108 kt. Strong winds accompanied Gustav well inland, with wind gusts of tropical-storm force occurring as far north as central Arkansas. Gustav also brought hurricane conditions to the southwestern Peninsula of Haiti. However, no observations are available from this area.

The lowest pressure reported in western Cuba was 939.9 mb at La Fe on the Isle of Youth at 1845 UTC 30 August. This pressure appears to be a little low compared to other nearby observations, and the 943 mb Isle of Youth landfall pressure is based on aircraft data. In Louisiana, the lowest observed pressures were 951.6 mb at the United States Geological Survey station at Caillou Lake, and 954.5 mb at the Louisiana Marine Consortium (LUMCOM) laboratory in Cocodrie. The Caillou Lake reading also appears somewhat low compared to other nearby measurements, and the Louisiana landfall pressure of 954 mb is based on the LUMCOM pressure and aircraft data. In Jamaica, the lowest observed pressure was 988.7 mb at an amateur radio station in Stoney Hill.

Gustav likely caused a significant storm surge in western Cuba. No surge observations, however, are available from this area. The hurricane caused a widespread storm surge along the northern Gulf coast, with above normal tides reported from the Florida Panhandle to the upper Texas coast, including Lake Ponchartrain (Table 3). Surges of 12-13 feet occurred along the Louisiana coast in the Mississippi Delta southeast of New Orleans, with surges of 9-10 ft in other portions of southeastern Louisiana. The storm surge overtopped the levees and floodwalls in a few parts of the New Orleans metropolitan area. However, it did not cause widespread inundation of the city and its surburbs.

Heavy rainfall and widespread freshwater flooding occurred along the path of Gustav. Camp Perrin, Haiti reported a storm total rainfall of 10.75 in, while Baharona, Dominican Republic reported a storm total rainfall of 9.71 in. In Cuba, Central René Fraga and Perico in Matanzas province reported 24 h totals of 10.70 and 10.69 in respectively. In Louisiana, Larto Lake reported a storm total of 21.00 in. The rainfall distribution elsewhere in the United States is shown in Fig. 4. The rains over Louisiana and Arkansas caused moderate flooding along many rivers.

Gustav is known to have produced 41 tornadoes – 21 in Mississippi, 11 in Louisiana, 6 in Florida, 2 in Arkansas, and 1 in Alabama. The strongest tornado was an EF2 in Evangeline Parish, Louisiana.

c. Casualty and Damage Statistics

As of this writing, reports from relief agencies and the media indicate that Gustav was directly responsible for 112 deaths – 77 in Haiti, 15 in Jamaica, 8 in the Dominican Republic, 7 in Louisiana, 4 in Florida, and 1 at sea. The deaths in the Dominican Republic were due to a landslide or mudslide. Five deaths in Louisiana were due to falling trees, while the other two were caused by the EF2 tornado in Evangeline Parish. The deaths in Florida were drownings in rip currents that were caused by high surf produced by the hurricane. In addition, there are 41 deaths indirectly associated with Gustav in Louisiana.

Gustav was the second of four tropical cyclones (along with Fay, Hanna, and Ike) to affect the Greater Antilles in quick succession. Because of the timing of these events, it is very difficult to separate the impacts of the individual storms in the region using the reports from relief agencies and the media. Therefore, the true death toll from Gustav will probably never be known.

Gustav caused considerable casualties and damages along its track. Significant property damages occurred in Haiti and the Dominican Republic, although monetary damage figures are not available. The storm caused $210 million (U. S.) in damages in Jamaica. Gustav's winds and tides caused major damages in western Cuba, particularly in the provinces of Pinar del Río and the Isle of Youth. However, monetary damage figures are not available. In the United States, the Insurances Services Office reports that the hurricane caused an estimated $2.15 billion in damages to insured property, of which $2.045 billion occurred in Louisiana. Doubling this figure to account for uninsured losses results in estimated U. S. damages of $4.3 billion.

d. Forecast and Warning Critique

Forecasting the genesis of Gustav was somewhat problematic. The pre-Gustav disturbance was first mentioned in the Tropical Weather Outlook (TWO) on 18 August, when it first showed signs of organization. Over the next two days, it was correctly forecast that vertical wind shear would slow development, and the probabilities associated with an experimental genesis forecast were in the "medium" (20-50% chance of tropical cyclone formation within 48 h) and "low" (less than 20% chance of tropical cyclone formation within 48 h) categories. On 22 August, the TWOs noted that the upper-level wind would become more favorable for development. However, it was not until early on 24 August (about 18 h before genesis) that the TWO mentioned the possibility of a depression forming, and the experimental genesis forecast did not reach the "high" (greater than 50% chance of tropical cyclone formation within 48 h) category until the time of genesis.

A verification of official and guidance model track forecasts is given in Table 4. Average official track errors for Gustav were 23, 42, 65, 85, 124, 137, and 149 n mi for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. The number of forecasts ranged from 32 at 12 h to 20 at 120 h. These errors are significantly lower than the average long-term official track errors (Table 4) and were almost 50% lower at 120 h. While the average errors are very good, examination of the individual forecasts (Figure 5) suggests two areas where they could have been better. First, the southward motion that resulted in Gustav hitting Jamaica was not anticipated. Second, the forecasts of Gustav's track across the Gulf of Mexico had a westward and slow bias, with the actual track along the eastern edge of the forecasts and moving faster than forecast.

Average official intensity errors were 14, 18, 19, 21, 22, 21, and 37 kt for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively (Table 5). These errors are significantly higher than the average long-term official intensity errors of 7, 10, 12, 14, 18, 20, and 22 kt, respectively. Examination of the individual forecasts (Figure 6) shows several factors that contributed to the large errors. First, the forecasts early in Gustav's life anticipated that the storm would not interact with land as much as it did, resulting in the forecast intensities being too high. Second, as is often the case, Gustav's rapid intensification on 30 August was underforecast. Third, Gustav's weakening over the Gulf of Mexico was not well anticipated. Finally, several forecasts had Gustav making landfall in Louisiana 24 hr after it actually did, which caused the forecast intensities to be well above the observed intensities.

Watches and warnings associated with Gustav are given in Table 6. A tropical storm warning was issued for Haiti on the first advisory 27 h before landfall, with a hurricane warning issued in a special advisory 3 h later. A tropical storm watch was issued for Jamaica 63 h before the center of Gustav reached the island, with that watch being replaced by a hurricane watch 6 h later. A tropical storm warning was issued for Jamaica 33 h before Gustav made landfall, with a hurricane warning issued for the island about 6 h before landfall. In western Cuba, a hurricane watch was issued 45 h before the center reached the Isle of Youth, while a hurricane warning was issued 30 h before the center arrived. A hurricane watch was issued for the northern Gulf coast 42 h prior to Gustav's Louisiana landfall, and a hurricane warning was issued 30 h before

that final landfall. One warning issue was a westward extension of the hurricane warning to the upper Texas coast on 31 August. This was due to a leftward shift in the forecast guidance and forecast track on that date, which did not verify.

Acknowledgements

Data from the Cayman Islands, Cuba, the Dominican Republic, and Jamaica was provided by their respective national meteorological services. In the U. S., data were provided by the National Weather Service forecast offices in Key West, FL, Miami, FL, Tallahassee, FL, Mobile, AL, Slidell, LA, Lake Charles, LA, Shreveport, LA, Jackson, MS, and Little Rock, AR. Rex Hervey of the National Data Buoy Center provided much of the marine data. David Roth of the Hydrometeorological Prediction Center in Camp Springs, MD provided the rainfall graphic and much of the U. S. rainfall data. Rainfall data in Haiti was provided by Mousson Pierre of the Organization for the Rehabilitation of the Environment.

Table 1. Best track for Hurricane Gustav, 25 August – 4 September 2008.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
25 / 0000	13.5	67.4	1008	25	tropical depression
25 / 0600	14.4	68.5	1005	30	"
25 / 1200	15.1	69.6	1002	35	tropical storm
25 / 1800	15.8	70.5	996	50	"
26 / 0000	16.4	71.2	991	60	"
26 / 0600	16.9	71.7	986	75	hurricane
26 / 1200	17.5	72.1	981	80	"
26 / 1800	18.1	72.8	992	70	"
27 / 0000	18.4	73.1	995	50	tropical storm
27 / 0600	18.6	73.4	999	45	"
27 / 1200	18.7	73.7	998	45	"
27 / 1800	18.9	74.0	999	45	"
28 / 0000	18.8	75.1	999	40	"
28 / 0600	18.1	75.4	995	45	"
28 / 1200	17.9	75.7	984	60	"
28 / 1800	18.0	76.2	984	60	"
29 / 0000	17.8	77.0	987	60	"
29 / 0600	18.0	77.7	990	55	"
29 / 1200	18.3	78.4	989	50	"
29 / 1800	18.8	79.2	984	65	hurricane
30 / 0000	19.2	80.0	975	75	"
30 / 0600	19.7	80.8	968	85	"
30 / 1200	20.7	81.6	955	110	"
30 / 1800	21.6	82.6	943	125	"
31 / 0000	22.7	83.4	950	125	"
31 / 0600	23.6	84.4	960	105	"
31 / 1200	24.8	85.5	961	100	"
31 / 1800	25.9	86.7	960	95	"
01 / 0000	26.9	87.7	953	95	"
01 / 0600	27.9	89.0	954	95	"
01 / 1200	28.8	90.3	955	95	"
01 / 1800	29.8	91.4	961	85	"
02 / 0000	30.7	92.3	971	60	tropical storm
02 / 0600	31.4	93.1	981	40	"
02 / 1200	32.1	93.5	989	30	tropical depression
02 / 1800	32.7	93.9	993	20	"
03 / 0000	33.2	93.9	995	20	"
03 / 0600	33.7	94.3	997	20	"
03 / 1200	33.8	94.4	997	20	"
03 / 1800	34.0	94.4	998	20	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 0000	34.3	94.1	998	15	"
04 / 0600	34.8	93.4	999	15	"
04 / 1200	36.2	92.3	1000	15	extratropical
04 / 1800	38.5	90.7	1000	20	"
05 / 0000	40.2	88.7	1002	20	"
05 / 0600	42.2	86.5	1002	20	"
05 / 1200	43.7	83.8	1004	20	"
05 / 1800					absorbed by extratropical low
30 / 2200	22.4	83.1	941	130	minimum pressure
26 / 1800	18.1	72.8	992	70	landfall on the southwestern peninsula of Haiti
28 / 1800	18.0	76.2	984	60	landfall near Manchioneal, Jamaica
29 / 0200	17.9	77.2	987	60	landfall just east of Lionel Town, Jamaica
30 / 1800	21.6	82.6	943	125	landfall on the southeastern coast of the Isle of Youth, Cuba
30 / 2200	22.4	83.1	941	130	landfall just east of Los Palacios, Cuba
01 / 1500	29.2	90.7	954	90	landfall near Cocodrie, Louisiana

Table 2. Selected ship and fixed buoy reports with winds of at least 34 kt for Hurricane Gustav, 25 August - 4 September 2008.

Date/Time (UTC)	Ship/Buoy ID	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
25/1800	**Hansa Stockholm**	15.9	71.2	030/43	1008.5
28/0600	**Maersk Gateshead**	16.1	71.6	210/37	1008.7
30/1500	WDB325	23.8	82.0	090/44	1007.5
30/2100	WDB325	23.5	80.7	100/42	1003.4
31/0000	A8MH8	23.4	83.2	060/60	992.0
31/0300	A8MH8	23.4	83.0	050/56	991.0
31/1800	C6FM5	27.7	83.4	100/46	1007.0
31/2100	**Bona Foam**	27.8	85.8	050/68	998.0
31/2300	H3VR	25.2	79.9	100/51	1010.0
01/0000	**Bona Foam**	27.9	85.7	090/55	996.0
01/0100	**Deepwater Horizon**	26.1	90.4	000/45	1008.1
01/0800	**Deepwater Horizon**	26.1	90.4	270/35	1000.4

Table 3. Selected surface observations for Hurricane Gustav, 25 August – 4 September 2008.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Dominican Republic								
Barahona								9.71
Bonao								6.23
Duverge								5.78
Juma Bonao								6.85
Monte Plata								5.45
Pedernales								7.70
Polo								9.12
Santo Domingo								4.13
Yamasa								5.89
Haiti								
Camp Perrin								10.75
Jamaica								
78388 – Montego Bay	29/0858	992.0	29/0916	41				6.02
78397 – Kingston	28/2005	990.4	28/2317	46	63			13.31
Mavis Bank								21.05
Stoney Hill (amateur radio)	28/2019	988.7	29/1941	46				
Cayman Islands								
Cayman Brac	N/A	986.8	N/A	55	71			9.42
Grand Cayman East End	N/A	976.0	N/A	51				2.71
Little Cayman						2-4 [e]		
Sister Islands								6.25
Cuba								
Isle of Youth								
78221 – Nueva Gerona	30/1915	944.0						
78309 – Cuba-Francia	30/1900	959.3[i]	30.1945	100	135			8.87

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
78321 – La Fe	30/1845	939.9	30/1825	97	135			7.53
78324 – Punta Del Este	30/1735	945.0						7.58
Pinar Del Río								
78310 – Cabo San Antonio	31/0200	1001.2	31/0259	41	56			1.09
78312 – Santa Lucía	31/0150	974.6	31/0128	63	85			5.77
78313 – Isabel Rubio	30/2000	991.5	30/2345	35	51			1.38
78314 – San Juan y Martínez	31/0010	985.8	30/2315	41	58			2.28
78315 – Pinar del Río	30/2345	974.5	30/2158	65	89			3.13
78316 – La Palma	31/0000	953.0	30/2240	86	123			3.98
78317 – Paso Real de San Diego	31/0000	953.0[i]	30/2235	135	184			3.10
78318 – Bahía Honda	31/0000	976.0	31/0030	76	106			3.11
La Habana								
78322 - Batabanó								5.43
Matanzas								
78327 – Varadero								5.43
78329 – Indio Hatuey								7.59
78330 – Jovellanos								8.99
78331 – Jagüey Grande								11.36
78333 – Playa Girón								10.24
Central René Fraga								11.70
Perico								11.69
Cienfuegos								
78335 – A. de Pasajeros								5.03
Sancti Spíritus								
78337 - Trinidad								4.48
78342 – Topes de Collantes								6.89
7 de Noviembre								4.00
13 de Marzo								4.12
Alabama								4.39
Banao								4.07

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Casilda								4.15
El Pedrero								5.12
Presa Higuanojo								4.78
Santa Lucía								5.12
Louisiana								
International Civil Aviation Organization (ICAO) Sites								
KACP – Oakdale 30.75N 92.69W	02/0103	978.9	02/0103	29	47			
KAEX – Alexandria International Airport 31.33N 92.56W	02/0129	984.0	02/0027	37	53			8.73
KARA – Acadiana Regional Airport 30.02N 91.53W	01/2004	968.8	01/1906	47	66			1.62
KASD – Slidell Airport[i] 30.35N 89.82W	01/1232	997.0	01/1453	25	49			6.97
KBAD – Barksdale Air Force Base 32.50N 93.67W	02/1028	993.4	02/0629	23	35			2.18
KBTR – Baton Rouge Metropolitan Airport 30.54N 91.15W	01/1953	982.1	01/1940	53	79			7.28
KBVE – Boothville[i] 29.33N 89.40W	01/0851	990.2	01/0638	39	61			
KDNK – Fort Polk Self Landing Strip 31.06N 93.09W	02/0022	987.1	01/2259	28	39			
KDTN – Shreveport Downtown Airport 32.53N 93.75W	02/1120	993.4	02/1118	22	35			2.18
KDRI – DeRidder 30.83N 93.34W	02/0240	989.0	01/2347	23	37			
KESF – Alexandria Esler Regional 31.24N 96.24W	01/2306	989.5	01/2153	16	37			1.57
KGAO – Galliano[i] 29.44N 90.26W	01/1020	988.1	01/1020	43	49			
KHDC – Hammond[i] 30.48N 90.47W	01/1315	998.3	01/0959	19	37			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
KLFT – Lafayette Regional Airport 30.12N 92.00W	01/2105	968.5	01/1929	45	67			6.62
KLCH – Lake Charles Regional Airport 30.12N 93.23W	01/2353	992.2	01/2357	29	40			1.45
KMLU - Monroe Regional Airport 32.52N 92.03W	02/1008	998.9	02/0228	27	37			10.24
KMSY – New Orleans Armstrong Airport[i] 29.98N 90.25W	01/1553	989.2	01/1014	39	55			5.89
KNBG – Belle Chasse Naval Air Station 29.82N 90.03W	01/1352	989.5	01/1304	43	63			
KNEW – New Orleans Lakefront Airport[i] 30.04N 90.03W	01/1053	1000.7	01/1439	26	47			
KP92 – Salt Point 29.34N 91.32W	01/1353	989.5	01/1353	25	42			
KPOE – Fort Polk 31.02N 93.11W	02/0441	985.8	02/0238	29	43			
KPTN – Patterson 29.71N 91.34W	01/1235	994.6	01/1253	24	36			
KSHV – Shreveport Regional Airport 32.45N 93.83W	02/1214	993.1	02/0506	28	37			2.28
KTVR – Tallulah / Vicksburg 32.21N 91.01W	02/0845	1003.4	02/0747	35	44			8.22
National Ocean Service (NOS) Sites								
AMRL1 – Amerada Pass 29.67N 91.24W 10.0m	01/1700	965.2	01/1642	53	71	3.39	4.77	
BYGL1 – Bayou Gauche 29.78N 90.42W 9.1m	01/1606	980.8	01/1642	46	66	1.20	1.36	
CAPL1 – Calcasieu Pass 29.77N 93.34W 6.4m	01/2342	994.3	01/2118	30	39	1.17	3.19	
GISL1 – Grand Isle 29.26N 89.96W 9.5m	01/1200	976.7	01/1048	58	75	4.49	5.37	
LABL1 – Bayou LeBranche 30.05N 90.37W 9.1m	01/1642	988.8	01/1724	52	65			
NWCL1 – New Canal 30.03N 90.11W 11.9m	01/1418	989.8	01/1230	52	68	4.68	4.92	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
PSTL1 – SW Pass 28.93N 89.41W 24.0m	01/1000	976.1	01/0918	79	102	4.48	5.59	
SHBL1 – Shell Beach 29.87N 89.67W 10.0m	01/1312	990.1	01/1036	52	68	9.53	10.51	
8762075 – Port Fourchon 29.12N 90.20W						4.48	4.59	
8764404 – Tesoro Terminal 29.67N 91.23W						1.70	2.17	
8765251 – Cypremort Point 29.70N 91.88W						2.63	3.20	
8766072 – Freshwater Canal Locks 29.55N 92.30W						2.69	4.01	
8767816 – Lake Charles 30.23N 93.23W						1.91	2.82	
Remote Automated Weather Stations (RAWS)								
BENL1 - Catahoula 31.50N 92.46W			02/0320	33				12.17
CLCL1 - Cameron 30.13N 93.12W			02/0024	26	39			
CANL1 - Caney 32.80N 93.07W			02/0558	31				4.45
GARL1 – Evangeline/Gardner 31.19N 92.63			02/0104	19	39			13.54
GUML1 - Gum Springs 31.90N 92.77W			02/0109	41				7.22
HAKL1 – Sabine 29.89N 93.40W			02/0049	19	34			
LACL1 – Lacassine 32.00 92.89			01/2346	27	41			3.22
NATL1 - Natchitoches 31.49N 93.19W			02/0220	28				6.01
Hydrometeorological Automated Data System (HADS) Sites (NWS)								
MDLL1 – Lake Ponchatrain NWS at Mid Lake on Causeway 30.15N 90.13W 20.0m			01/1659	50	70	4.50[e]	5.20	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
MDVL1 – 1 SW Mandeville 30.36N 90.09W	01/1550	994.9	01/1659	35	48			8.11
RIGL1 – Rigolets[i] 30.16N 89.74W	01/1400	995.2	01/0400	39				
WSLL1 – West Lake Ponchartrain[i] 30.11N 90.42W			01/1730	49	58			
Other Government Agencies								
DCLL1 - Caillou Lake USGS[i] 29.25N 90.92W	01/1515	951.6	01/1445		63			
DULL1 – Houma Nav. Canal USGS[i] 29.39N 90.73W			01/1200		102			
EGIL1 – Barataria Pass USGS[i] 29.28N 89.94W	01/1215	962.1	01/1215		91			
BGNL1 – NE Bay Gardene USGS[i] 29.59N 89.61W 3.0m	01/1215	982.6	01/1200	61		12.50[e]	13.63	
NGIL1 – Barataria Bay USGS 29.42N 89.95W 3.0m			01/1200	68				
PCDL1 – Bayou Petite Callou USGS[i] 29.39N 90.62W			01/1000		87			
PSIL1 – Black Bay USGS 29.63N 89.67W						12.00[e]	12.83	
SJCL1 – St. James Canal USGS[i] 29.99N 90.89W			01/1500	43				
Bayou Dupre COE 29.93N 89.84W						9.50[e]	10.90	
Bayou Terrebonne USGS 29.40N 90.59W						7.50[e]	8.26	
Caillou Lake USGS 29.25N 90.92W						4.50[e]	5.10	
Golden Meadow COE 29.34N 90.25W						6.00[e]	7.32	
Little Lake USGS 29.52N 90.18W						4.00[e]	4.59	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
New Orleans Lakeshore Orleans Ave. 30.02N 90.10W							4.75	
Rigolets COE 30.17N 89.74W						5.00[e]	5.76	
University Networks								
0101A – Gross Tete TTUHRT 30.41N 91.43W 2.25m			01/1928	37	54			
0102B – 2 SW Plaquemine TTUHRT 30.26N 91.28W 2.25m			N/A	43	59			
0103A – Reserve TTUHRT 30.08N 90.58W 2.25m			01/1833	42	58			
0104B – Thibodaux TTUHRT 29.82N 90.88W 2.25m			01/1641	54	69			
0105A – near Cypremort TTUHRT 29.80N 91.81W 2.25m			N/A	54	66			
0106B – 2 NW Patterson TTUHRT 29.71N 91.34W 2.25m			01/1922	44	56			
0107A – 4 W Jeanerette TTUHRT 29.93N 91.74W 2.25m			01/1913	42	61			
0109A – 5 NW New Iberia TTUHRT 30.05N 91.88W 2.25m			01/1903	44	62			
0111A – Vacherie TTUHRT 29.96N 90.78W 2.25m			01/1651	46	61			
0213A – 1 WSW Youngsville TTUHRT 30.09N 92.02W 2.25m			01/2056	34	48			
0214B – 2 NE Abbeville TTUHRT 30.00N 92.10W 2.25m			01/1942	31	46			
0215A – 4 N Abbeville TTUHRT 30.03N 92.13W 2.25m			01/2008	51	74			
0216B TTUHRT 30.16N 92.20W 2.25m			N/A	43	58			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
0217A – 2 S Crowley TTUHRT 30.18N 92.37W 2.25m			01/2034	32	51			
0218B – 4 NE Kaplan TTUHRT 30.05N 92.24W 2.25m			01/1947	36	49			
0220B – 4 SSE Milton TTUHRT 30.05N 92.05W 2.25m			N/A	37	54			
0221A – 1 ESE Avery Island TTUHRT 29.90N 91.89W 2.25m			01/1847	38	59			
0222B – 3 SW Maurice TTUHRT 30.07N 92.15W 2.25m			01/1957	42	60			
0223A – 3 W Kaplan TTUHRT 30.01N 92.34W 2.25m			01/2021	35	52			
CRSL1 – Pt. Sulphur LAIS 29.58N 89.82W 10.0m	01/1155	985.0	01/1221	55	65			
HMDL1 – Hammond LAIS 30.50N 90.37W 10.0m	01/1405	992.2	01/1735	31	45			
HUML1 – Houma LAIS 29.63N 90.84W 10.0m	01/1627	959.9	01/1604	67	81			
LUML1 – LUMCON Lab Cocodrie 29.25N 90.66W	01/1502	954.5						
PMPL1 – Pass Manchac LAIS 30.29N 90.34W 10.0m	01/1754	988.2	01/1747	58	74			
SGRL1 – St. Gabriel LAIS 30.26N 91.09W 10.0m	01/1744	972.5	01/1710	55	74			
SHEL1 – Ben Hur LAIS 30.36N 91.17W 10.0m	01/1921	974.7	01/1814	45	68			
Alexandria LAIS 31.08N 92.41W 10.0m			01/2242	41	55			
Bossier City LAIS 32.42N 93.64W 10.0m			02/0350	26	34			
Burden LAIS 30.41N 91.05W 10.0m			01/1736	44	61			
Calhoun LAIS 32.52N 92.35W 10.0m			02/0119	24	37			
Chase LAIS 32.10N 91.70W 10.0m			02/0143	31	42			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Crowley LAIS 30.24N 92.35W 10.0m			01/2055	45	63			
Homer LAIS 32.75N 93.07W 10.0m			02/0359	29	38			
Lake Charles LAIS 30.13N 93.22W 10.0m			01/2237	34	42			
LIGO North LAIS 30.57N 90.77W 10.0m			01/1852	32	47			
Monroe LAIS 32.53N 92.04W 10.0m			02/0329	23	34			
Public/Other								
Larto Lake								21.00
Morgan City – Mike Laca	01/1726	957.3						
Near Morgan City – Chris Collura	01/1630	959.0						
Mississippi								
International Civil Aviation Organization (ICAO) Sites								
KBIX – Biloxi Air Force Base 30.43N 88.92W	01/1114	1001.4	01/1519	39	53			
KCBM – Columbus 32.27N 88.35W	01/2205	1011.5		21				
KGLH – Greenville 33.28N 90.98W	03/2323	1003.7	02/1940	25	37			
KGPT – Gulfport Airport 30.40N 89.07W	01/1053	1000.7	01/1439	45	64			
KGWO – Greenwood 33.29N 90.05W	04/0045	1005.6	02/1452	26	32			
KHBG – Hattiesburg 31.16N 89.15W	01/1145	1004.4	02/1310	29	41			6.42
KHEZ – Natchez[i] 31.36N 91.17W	01/2145	997.3	01/1900	24	38			
KJAN – Jackson International 32.19N 90.04W	02/0056	1005.8	02/0227	25	39			
KMCB – McComb Airport 31.18N 90.47W	01/2023	998.3	01/2339	28	47			7.59
KMEI – Meridian 32.20N 88.44W	01/2145	1009.1	01/1800	21	30			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
KPIB – Pinebelt 31.28N 89.20W	01/1845	1006.1	01/2100	20	29			4.08
KPQL – Pascagoula Airport 30.46N 88.53W	01/1053	1003.0	01/1802	27	40			4.61
National Ocean Service (NOS) Sites								
PMLN6 – Pascagoula NOAA Lab 30.36N 88.57W						4.55	5.38	
ULAM6 – Pascagoula Port Dock E 30.35N 88.51W						5.69	6.59	
WYCM6 – Bay Waveland Yacht Club 30.33N 89.33W 10.0m	01/1312	997.7	01/1442	47	58	9.89	10.93	
8741003 - Petit Bois 30.22N 88.50W	01/1036	1000.6	01/1418	39	54			
8741094 – Pascagoula Port Rear Range 30.34N 88.51W	01/1006	1002.1	01/1018	41	52			
8741501 – Pascagoula Port Dock C 30.35N 88.57W	01/1100	1002.1	01/1730	38	51			
8744707 – Gulfport Outer Range 30.23N 88.98W	01/1100	998.2	01/1424	47	60			
8745651 – Gulfport West Pier 30.33N 89.08W	01/1100	999.2	01/1430	47	62			
Remote Automated Weather Stations (RAWS)								
BDEM6 – Bude 31.41N 90.85W			01/2105	20	44			
BLCM6 – Black Creek 30.85N 89.03W			01/1400	17	42			
CYSM6 – Copiah 31.95N 90.38W			02/0009	20	34			6.27
MPAM6 – Pike County 31.18N 90.48W 10.0m			02/0109	27	45			8.92
SNCM6 – Sandhill Crane NWR 30.45N 88.66W 10.0m			01/1551	16	37			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Other Government Agencies								
BBM6 – Back Bay of Biloxi USGS 30.42N 88.89W 3.0m			01/1445	30	44	7.30[e]	8.17	
GDXM6 – Grand Bay NERRS 30.36N 88.42W 10.0m	01/0745	1004.0	01/1430	33	41			
GRPL1 – Grand Pass USGS 30.12N 89.25W	01/1145	991.6	01/1145	56				
OFBM6 – Old Fort Bayou USGS 30.42N 89.83W 3.0m			01/1515		54			
Biloxi Bay Pt. Cadet USGS 30.38N 88.97W						5.70[e]	6.69	
Public/Other								
PRKNS – Gautier GCCC 30.39N 88.65W 10.0m	01/1015	1002.0	01/1414	36				
WLOXT – Biloxi WLOX-TV 30.39N 89.00W 10.0m	01/1045	1001.0	01/1415	33				
Alabama								
International Civil Aviation Organization (ICAO) Sites								
KBFM – Mobile Brookley 30.64N 88.07W	01/0852	1004.7	01/1900	32	44			3.01
KJKA – Gulf Shores 30.29N 87.67W			01/1900	26	40			
KMOB – Mobile Regional 30.67N 88.24W	01/0902	1004.4	01/2056	23	38			2.10
Coastal-Marine Automated Network (C-MAN) Sites								
DPIA1 – Dauphin Island 30.24N 88.07W 13.5m	01/1100	1003.3	01/1400	36	52	3.50	4.20	
National Ocean Service (NOS) Sites								
MCGA1 – Mobile Coast Guard 30.65N 88.06W 16.6m	01/0848	1004.9	01/1816	28	39	6.00	6.70	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
OBLA1 – Mobile State Docks 30.71N 88.04W						4.20	4.90	
8732828 – Weeks Island 30.42N 87.83W						3.17	4.07	
8734673 – Fort Morgan 30.23N 88.03W	01/0824	1000.9	01/0930	43	53			
University Networks								
DPHA1 – Dauphin Island DISL 30.25N 88.08W 14.0m	01/0722	1002.7	01/0722	39				
MBLA1 - Middle Mobile Bay DISL 30.44N 88.01W 10.0m	01/0646	1001.0	01/1244	46				
Texas								
International Civil Aviation Organization (ICAO) Sites								
KBPT – Beaumont, Southeast Texas Regional Airport 29.95N 94.08W	02/0202	997.3	01/2105	26	34			0.24
Coastal-Marine Automated Network (C-MAN) Sites								
SRST2 – Sea Rim State Park 29.67N 94.05W 12.5m	02/0200	998.6	01/2130	22	34			
National Ocean Service (NOS) Sites								
GNJT2 – Galveston North Jetty 29.36N 94.73W 9.0m	02/0154	1001.0	02/0000	30	39	0.87	2.42	
SBPT2- Sabine Pass North 29.73N 93.87W 10.0m	02/0130	998.6	01/2124	32	40	1.90	2.82	
Remote Automated Weather Stations (RAWS)								
Texarkana 33.37N 94.05W			02/0504	18				5.26
University Networks								

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
PORT2 – Port Arthur TCOON 29.87N 93.93W 10.7m			01/2200	18	26	1.32	2.25	
Rainbow Bridge TCOON 29.97N 93.88W						1.34	2.09	
Texas Point TCOON 29.68N 93.84W	02/0130	997.7	01/2136	33	45			
Florida								
International Civil Aviation Organization (ICAO) Sites								
KDTS – Destin 30.40N 86.47W	01/0726	1006.8	01/1653	24	34			1.55
KEYW – Key West International 24.55N 81.75W	31/0733	1004.1	31/0336	40	48			
KMAI – Mariana 30.80N 85.21W	01/0753	1010.2	31/1753	19	35			0.36
KMTH – Marathon Airport 24.73N 81.06W	31/0027	1005.1	31/0049	28	45			2.61
KNDZ – Milton North 30.72N 87.02W	01/1956	1008.9	01/1756	24	37			
KNPA – Pensacola NAS 30.36N 87.32W	01/2056	1009.4	01/2054	25	45			3.62
KNQX – Boca Chica Naval Air Station 24.57N 81.69W			31/0113	35	46			
KNSE – Milton South 30.70N 87.02W	02/1256	1000.0	02/1456	14	18			
KPNS – Pensacola Regional 30.47N 87.20W	01/0849	1005.8	01/1311	28	42			2.09
KVPS – Valpariso 30.48N 86.53W	01/2055	1011.1	01/1707	23	34			1.26
Coastal-Marine Automated Network (C-MAN) Sites								
FWYF1 – Fowey Rocks 25.59N 80.10W 43.9m	31/0800	1007.8	31/1020	33	37			
LONF1 – Long Key 24.84N 80.86W 7.0m	30/2300	1007.7	31/0200	27	42			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
MLRF1 – Molasses Reef Light 25.01N 80.38W 15.8m	31/0800	1007.2	30/1940	29	38			
PLSF1 – Pulaski Shoal Light 24.69N 82.77W 17.7m	31/0900	1001.2	31/0620	50	60			
SANF1 – Sand Key Light 24.46N 81.88W 45.4m	31/0700	1004.7	31/0330	49	64			
SGOF1 – Tyndall AFB Tower 29.41N 84.86W 35.1m	01/0100	1007.8	01/0040	38 (10-min)	45			
SMKF1 – Sombrero Key Light 24.63N 81.11W 48.5m	31/0800	1005.9	31/0100	41	49			
National Ocean Service (NOS) Sites								
PACF1 – Panama City 30.15N 85.67W						2.58	3.54	
PCLF1 – Pensacola 30.40N 87.21W						3.40	4.10	
VCAF1- Vaca Key 24.71N 81.11W 6.4m	31/0030	1006.0	31/0054	23	36	1.00	1.50	
Arkansas								
International Civil Aviation Organization (ICAO) Sites								
KDEQ – Dequeen Helms Sevier County Field 34.05N 94.40W	03/1105	996.8	02/1705	16	27			1.27
KELD - South Arkansas Regional Airport 33.22N 92.82W	02/1118	998.2	02/0443	24	33			4.23
KHOT – Hot Springs Memorial Field	N/A	1000.0	N/A		39			8.76
KLIT – Little Rock Adams Field 34.73N 92.23W	N/A	1001.7	N/A		42			6.37
KLLQ – Monticello Airport 33.63N 91.75W	N/A	1003.0	N/A		39			7.07
KLZK – Little Rock WFO 34.87N 92.25W	N/A	1001.7	N/A		40			7.42

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
KPBF – Pine Bluff Grider Field 34.18N 91.93W	N/A	1002.1	N/A		41			5.34
KRUE – Russellville Municipal Airport 35.25N 93.10W	N/A	1000.0	N/A		36			
KSGT – Stuttgart Municipal Airport 34.60N 91.57W	N/A	1002.1	N/A		34			
KTXK – Texarkana Regional Airport 33.45N 93.98W	03/0139	995.1	02/0415	20	30			5.09
Remote Automated Weather Stations (RAWS)								
Bluff City 33.69N 93.16W			02/1510	20				5.96
Felsenthal 33.16N 92.19W			02/0823	20				11.07
Buoys								
42001 – C. Gulf of Mexico 25.90N 89.67W 10.0m	01/0550	998.8	31/2310	33	45			
42003 E. Gulf of Mexico[i] 26.03N 85.99W 10.0m	31/1450	993.4	31/1440	53	69			
42007 – Mississippi Sound 30.09N 88.77W 5.0m	01/1050	996.8	01/1500	42	54			
42035 – 22 NM E of Galveston TX 29.25N 94.44W	01/2250	999.6	02/0030	27	35			
42036 - NE. Gulf of Mexico 28.50N 84.52W 5.0m	31/2050	1005.6	31/2340	36	46			
42039 – NE. Gulf of Mexico 28.79N 86.01W 5.0m	31/2350	1002.0	01/0150	39	53			
42040 – 64 nm S of Dauphin Island 29.18N 88.29W 5.0m	01/0850	993.7	01/0600	44	56			
Public/Other								

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
KCYD – 114 SE Houma LA 28.17N 89.22W 122.0m	01/0253	993.9	01/0525	90	108			

[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 ASOS reports are 2 min; buoy averaging periods are 8 min.
[c] Storm surge is water height above normal astronomical tide level.
[d] Storm tide is water height above National Geodetic Vertical Datum (1929 mean sea level).
[e] Estimated.
[i] Incomplete record

Table 4. Track forecast evaluation (heterogeneous sample) for Hurricane Gustav, 25 August – 4 September 2008. Forecast errors (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in boldface type.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	37 (34)	84 (34)	151 (34)	225 (34)	363 (30)	456 (26)	509 (22)
GFNI	29 (28)	51 (28)	79 (28)	112 (28)	154 (23)	169 (18)	210 (14)
GFDI	28 (33)	51 (33)	75 (33)	95 (33)	125 (29)	164 (25)	218 (21)
HWFI	31 (34)	49 (34)	72 (34)	98 (34)	140 (30)	166 (26)	183 (22)
NAMI	43 (32)	76 (31)	112 (31)	146 (31)	225 (26)		
COAI	36 (28)	62 (28)	84 (28)	105 (26)	181 (4)		
FM8I	**25** (12)	**34** (7)	**45** (7)	**49** (7)	**72** (6)	**113** (5)	**89** (3)
GFSI	27 (33)	50 (32)	70 (32)	87 (30)	**122** (23)	**129** (18)	209 (12)
AEMI	33 (34)	62 (33)	93 (33)	127 (33)	213 (25)	303 (12)	323 (6)
NGPI	25 (33)	46 (33)	71 (33)	94 (33)	134 (29)	180 (25)	256 (21)
UKMI	29 (31)	49 (31)	75 (31)	115 (31)	146 (25)	232 (21)	305 (17)
EGRI	30 (31)	52 (31)	82 (31)	124 (31)	152 (25)	239 (20)	309 (17)
EMXI	**22** (28)	**31** (28)	**47** (28)	**61** (28)	**103** (26)	163 (23)	228 (19)
JGSI	30 (30)	43 (28)	69 (28)	88 (27)	155 (23)		
BAMD	27 (34)	46 (34)	71 (34)	93 (34)	**118** (30)	153 (26)	263 (22)
BAMM	35 (34)	64 (34)	93 (34)	117 (34)	128 (30)	149 (26)	227 (22)
BAMS	41 (34)	76 (34)	111 (34)	141 (34)	158 (30)	186 (26)	227 (22)
LBAR	26 (34)	**41** (34)	**60** (34)	**80** (34)	**116** (30)	189 (26)	299 (22)
TCON	**22** (30)	**37** (29)	**59** (29)	**80** (29)	**108** (23)	**125** (17)	173 (12)
TCCN	23 (30)	**39** (29)	**63** (29)	88 (29)	127 (23)	169 (17)	245 (12)
TVCN	**21** (34)	**34** (34)	**55** (34)	**77** (34)	**110** (30)	**136** (26)	176 (22)
TVCC	**21** (34)	**35** (34)	**58** (34)	**81** (34)	**11**9 (30)	156 (26)	197 (22)
GUNA	**22** (30)	**38** (29)	**59** (29)	**80** (29)	**103** (23)	**117** (17)	167 (12)
CGUN	**22** (30)	**40** (29)	**63** (29)	86 (29)	**121** (23)	163 (17)	244 (12)
FSSE	25 (29)	**41** (29)	65 (29)	**82** (28)	125 (25)	175 (23)	213 (19)
OFCL	23 (32)	42 (32)	65 (32)	85 (32)	124 (28)	137 (24)	149 (20)
NHC Official (2003-2007 mean)	34.0 (1742)	58.2 (1574)	82.2 (1407)	106.2 (1254)	154.2 (996)	207.5 (787)	272.5 (627)

Table 5. Intensity forecast evaluation (heterogeneous sample) for Hurricane Gustav, 25 August – 4 September 2008. Forecast errors (kt) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in boldface type.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
OCD5	**13.3** (34)	19.7 (34)	21.6 (34)	20.7 (34)	27.7 (30)	33.8 (26)	39.9 (22)
GHMI	13.8 (33)	19.2 (33)	23.0 (33)	25.9 (33)	24.9 (29)	**13.8** (25)	**19.7** (21)
GFNI	**13.5** (28)	20.0 (28)	23.1 (28)	25.3 (28)	28.3 (23)	31.9 (18)	21.6 (14)
HWFI	**12.0** (34)	**17.4** (34)	**15.8** (34)	**13.5** (34)	24.8 (30)	29.4 (26)	37.7 (22)
LGEM	14.0 (34)	21.6 (34)	21.0 (34)	**19.2** (34)	**20.2** (30)	**20.7** (26)	**23.0** (22)
DSHP	13.9 (34)	20.2 (33)	19.5 (33)	**18.8** (33)	**20.3** (30)	24.0 (26)	**28.0** (22)
FSSE	14.1 (29)	**17.4** (29)	22.1 (29)	24.0 (28)	24.1 (25)	**19.4** (23)	**36.4** (19)
ICON	**12.7** (33)	18.6 (32)	**18.3** (32)	**17.7** (32)	**19.6** (29)	**14.3** (25)	**20.3** (21)
IVCN	**12.7** (34)	19.1 (34)	**18.8** (34)	**17.8** (34)	**20.0** (30)	**15.7** (26)	**20.5** (22)
OFCL	13.8 (32)	18.3 (32)	19.2 (32)	20.5 (32)	22.0 (28)	21.3 (24)	36.5 (20)
NHC Official (2003-2007 mean)	6.7 (1742)	10.0 (1574)	12.3 (1407)	14.3 (1254)	18.2 (996)	19.7 (787)	21.8 (627)

Table 6. Watch and warning summary for Hurricane Gustav, 25 August – 4 September 2008.

Date/Time (UTC)	Action	Location
25/1500	Tropical Storm Warning issued	Santo Domingo, Dominican Republic to Port Au Prince, Haiti
25/1500	Tropical Storm Watch issued	Haiti north of Port Au Prince
25/1800	Tropical Storm Warning changed to Hurricane Warning	Santo Domingo, Dominican Republic to Port Au Prince, Haiti
25/1800	Tropical Storm Watch changed to Hurricane Watch	Haiti north of Port Au Prince
25/2100	Hurricane Warning changed to Tropical Storm Warning	Dominican Republic from Santo Domingo to the Barahona Peninsula
26/0300	Hurricane warning extended northward	Haiti from Port Au Prince to Le Mole St. Nicholas
26/0300	Tropical Storm Watch issued	Jamaica
26/0600	Tropical Storm Warning discontinued	Dominican Republic from Santo Domingo to the Barahona Peninsula
26/0900	Tropical Storm Watch changed to Hurricane Watch	Jamaica
26/0900	Hurricane Watch issued	Cuban provinces of Las Tunas, Granma, Holguin, Santiago de Cuba, and Guantanamo
26/1500	Hurricane Watch changed to Hurricane Warning	Cuban provinces of Granma, Santiago de Cuba, and Guantanamo
27/0000	Hurricane Warning discontinued	Dominican Republic
27/0000	Hurricane Watch issued	Cayman Islands
27/0900	Hurricane Warning changed to Tropical Storm Warning	Haiti from the southern border of Haiti/Dominican Republic to Le Mole St. Nicholas
27/0900	Hurricane Watch changed to Tropical Storm Watch	Haiti from Le Mole St. Nicholas eastward
27/0900	Tropical Storm Warning issued	Jamaica
27/1500	Tropical Storm Watch discontinued	Haiti from Le Mole St. Nicholas eastward
28/0300	Tropical Storm Warning discontinued	Haiti north of Port Au Prince
28/0600	Hurricane Warning changed to Tropical Storm Warning	Cuban province of Granma
28/0600	All other warnings and watches discontinued	Cuba

Date/Time (UTC)	Action	Location
28/0900	All warnings discontinued	Haiti
28/1200	Hurricane Warning issued	Jamaica
28/2100	Hurricane Watch issued	Cuban provinces of Isle of Youth, Pinar del Río, Ciudad la Habana, and La Habana
28/2100	Tropical Storm Watch issued	Cuban province of Matanzas
29/0000	Hurricane Watch changed to Hurricane Warning	Cayman Islands
29/1500	Hurricane Watch changed to Hurricane Warning	Cuban provinces of Isle of Youth, Pinar del Río, Ciudad la Habana, and La Habana
29/1500	Tropical Storm Warning issued	Cuban provinces of Matanzas, Cienfuegos, Villa Clara, Sancti Spíritus, Ciego de Avila, and Camaguey
29/1500	Hurricane Warning changed to Tropical Storm Warning	Jamaica
29/2100	Tropical Storm Watch issued	Florida Keys from the Seven Mile Bridge to the Dry Tortugas
30/0300	Hurricane Watch issued	Cuban provinces of Matanzas, Cienfuegos, and Villa Clara
30/0300	Tropical Storm Watch changed to Tropical Storm Warning	Florida Keys west of Key West to the Dry Tortugas
30/0300	Tropical Storm Warning discontinued	Cuban province of Granma
30/0900	All warnings discontinued	Jamaica
30/1200	Hurricane Warning issued	Cuban provinces of Matanzas and Cienfuegos
30/1500	Tropical Storm Watch changed to Tropical Storm Warning	Florida Keys from the Seven Mile Bridge to Key West
30/1500	All warnings discontinued	Cayman Islands
30/2100	Hurricane Watch issued	High Island, Texas to the Alabama/Florida border including New Orleans and Lake Ponchartrain
30/2100	Tropical Storm Watch issued	East of the Alabama/Florida border to Ochlockonee River, Florida
31/0300	Tropical Storm Warning discontinued	Cuban provinces of Sancti Spíritus, Ciego de Avila, and Camaguey
31/0900	Hurricane Watch Changed to Hurricane Warning	Cameron, Louisiana to the Alabama/Florida border including New Orleans and Lake Ponchartrain

Date/Time (UTC)	Action	Location
31/0900	Tropical Storm Watch changed to Tropical Storm Warning	Alabama/Florida border to Ochlockonee River, Florida
31/0900	Tropical Storm Warning issued	High Island, Texas to Cameron, Louisiana
31/0900	All warnings and watches discontinued	Cuba
31/1800	Tropical Storm Warning discontinued	Florida Keys east of the Dry Tortugas
31/2100	Hurricane Warning extended westward	High Island, Texas to Cameron, Louisiana
31/2100	Tropical Storm Warning discontinued	Dry Tortugas, Florida
01/0900	Hurricane Warning changed to Tropical Storm Warning	Mississippi/Alabama border to the Alabama/Florida border
01/1500	Tropical Storm Warning discontinued	East of the Alabama/Florida border
01/2100	Hurricane Warning changed to Tropical Storm Warning	Cameron, Louisiana to High Island, Texas
02/0300	All coastal warning discontinued	

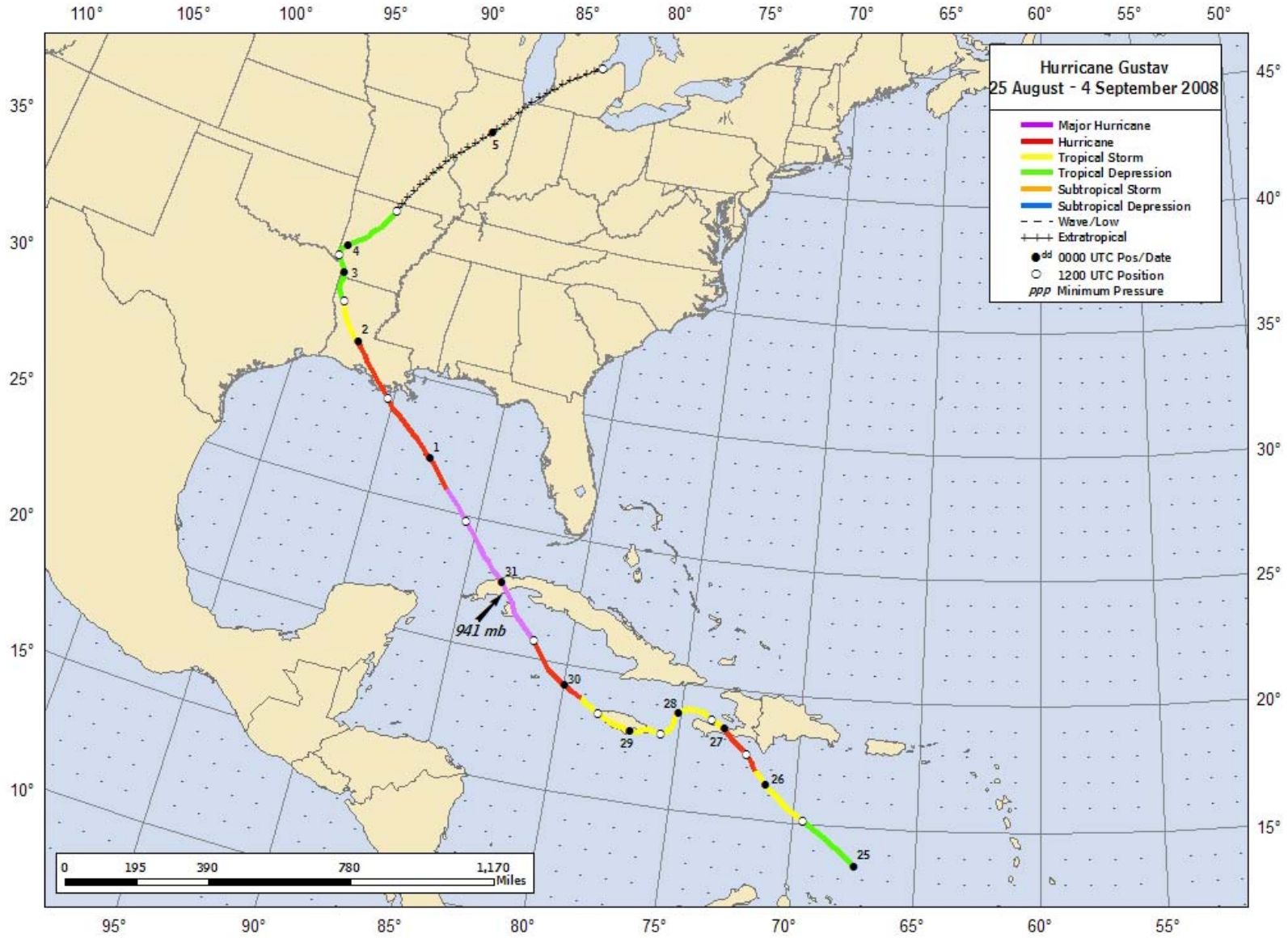

Figure 1. Best track positions for Hurricane Gustav, 25 August – 4 September 2008. Track during the extratropical stage is based on analyses from the NOAA Hydrometeorological Prediction Center.

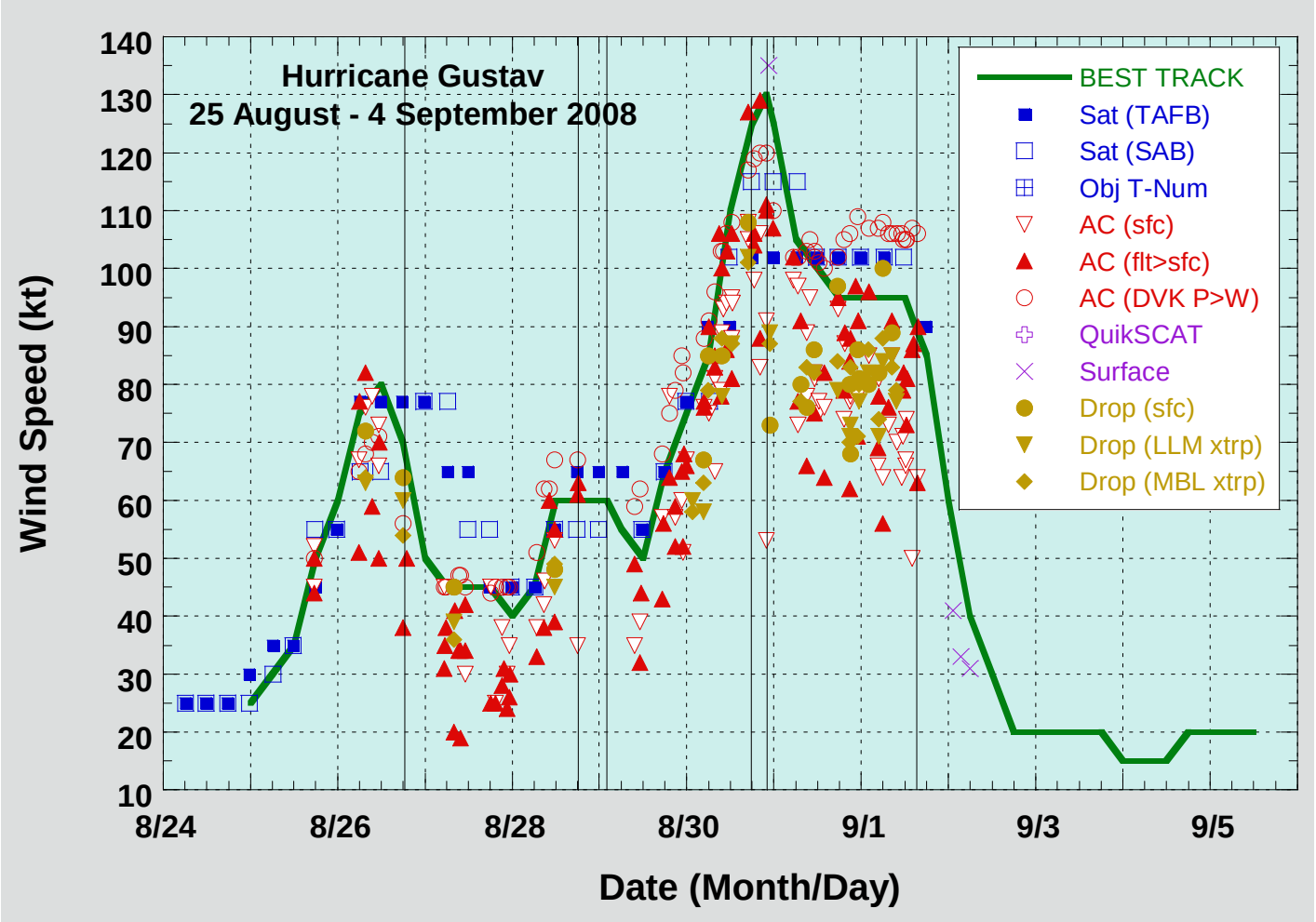

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Gustav, 25 August – 4 September 2008. Aircraft observations have been adjusted for elevation using 90%, 80%, and 75% adjustment factors for observations from 700 mb, 850 mb, and 925 mb, respectively. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM), and from the sounding boundary layer mean (MBL). Estimates during the extratropical stage are based on analyses from the NOAA Hydrometeorological Prediction Center. Dashed vertical lines correspond to 0000 UTC. Solid vertical lines denote landfalls.

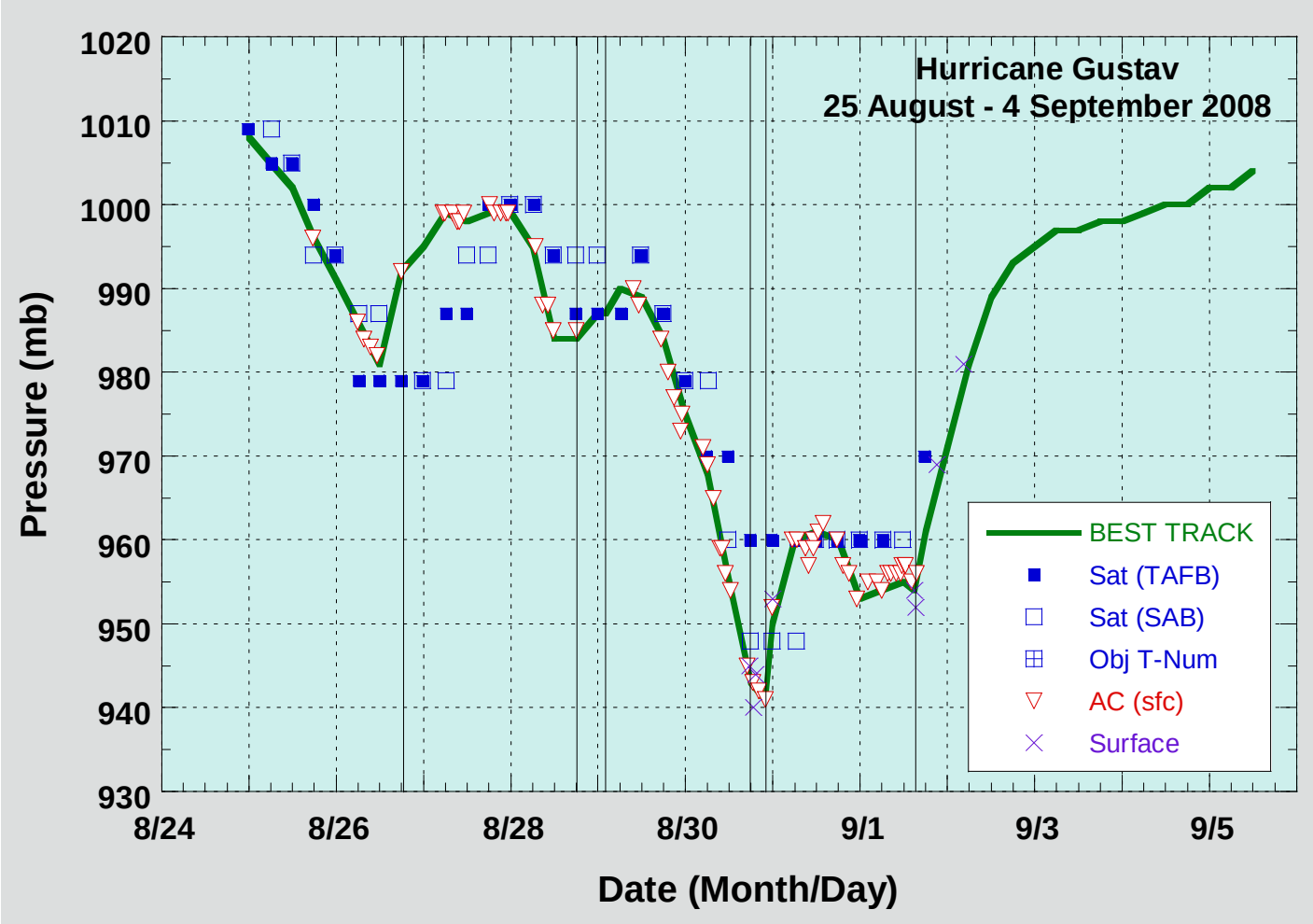

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Gustav, 25 August – 4 September 2008. Estimates during the extratropical stage are based on analyses from the NOAA Hydrometeorological Prediction Center. Dashed vertical lines correspond to 0000 UTC. Solid vertical lines denote landfalls.

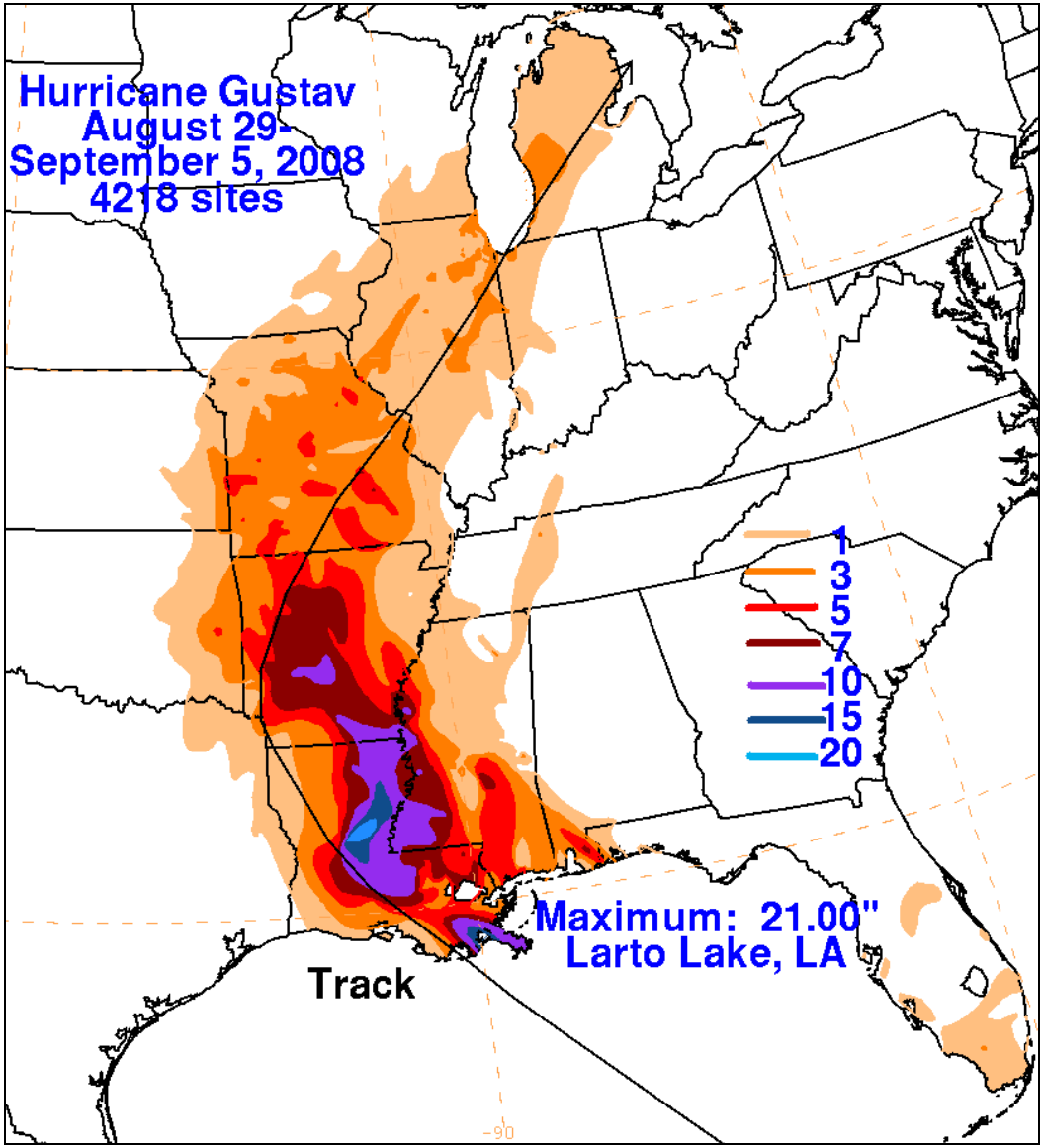

Figure 4. Storm total rainfall map for Hurricane Gustav, 25 August – 4 September 2008. The best track position is given by the black line.

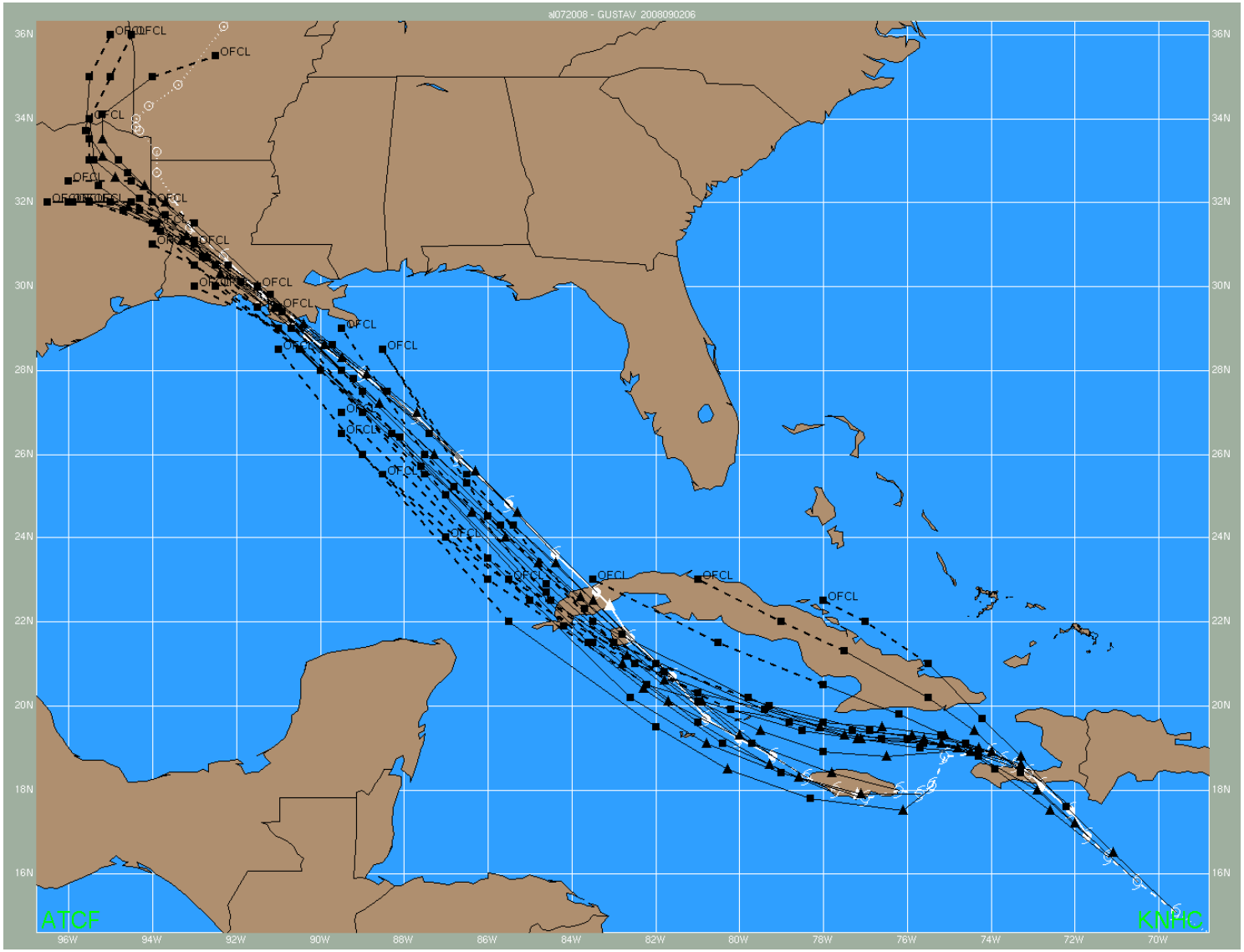

Figure 5. Selected official track forecasts (black lines, with 24, 48, 72, 96, and 120 h positions indicated by the squares and 12 and 36 hr positions indicated by the triangles) for Hurricane Gustav, 25 August – 4 September 2008. The best track is given by the white line with positions at 6 h intervals indicated by the cyclone symbols.

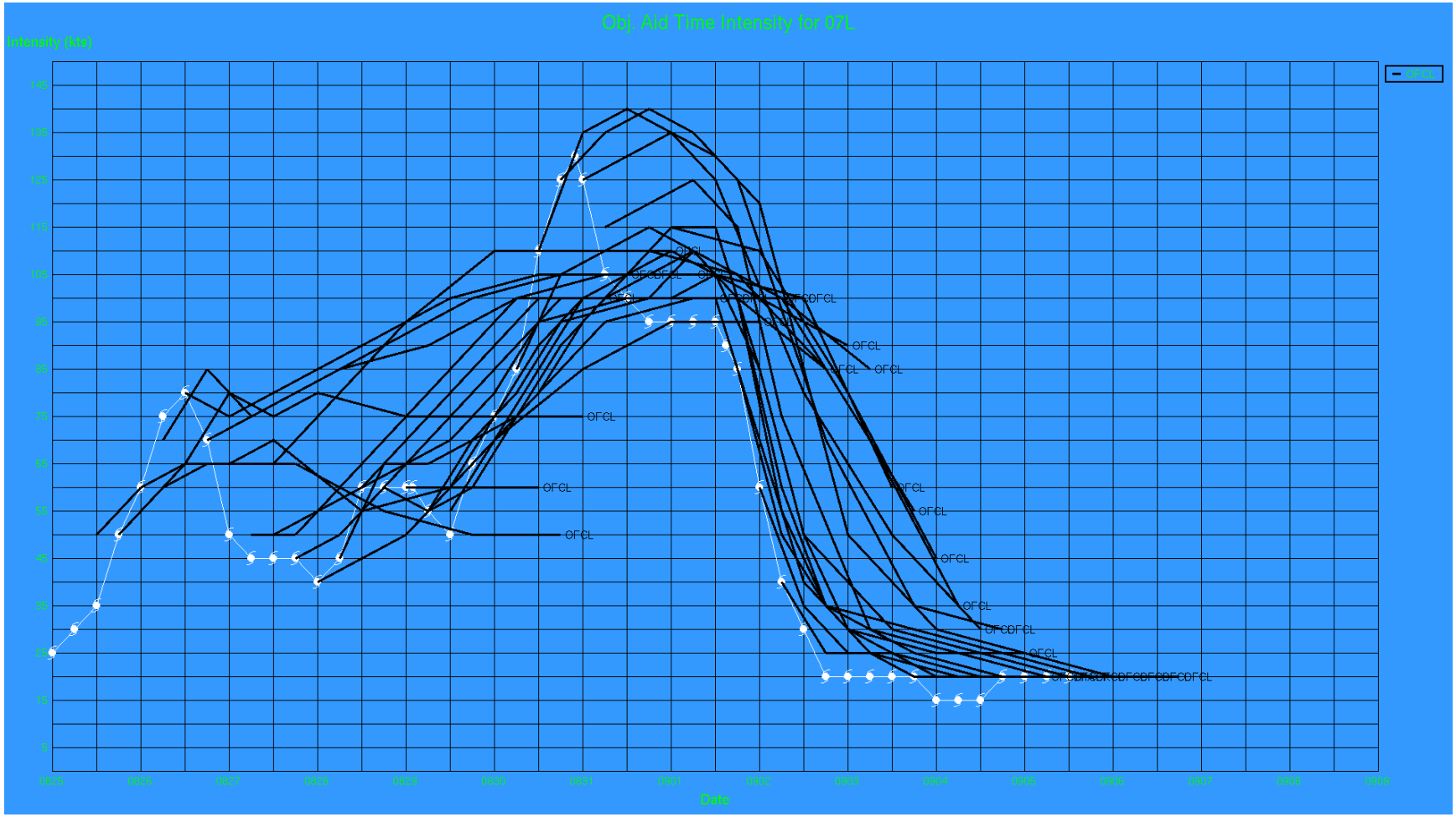

Figure 6. Selected official intensity forecasts (cyan lines) for Hurricane Gustav, 25 August – 4 September 2008. The best track intensity is given by the white line with the cyclone symbols.