NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

HURRICANE JERRY

(AL102019)

17–24 September 2019

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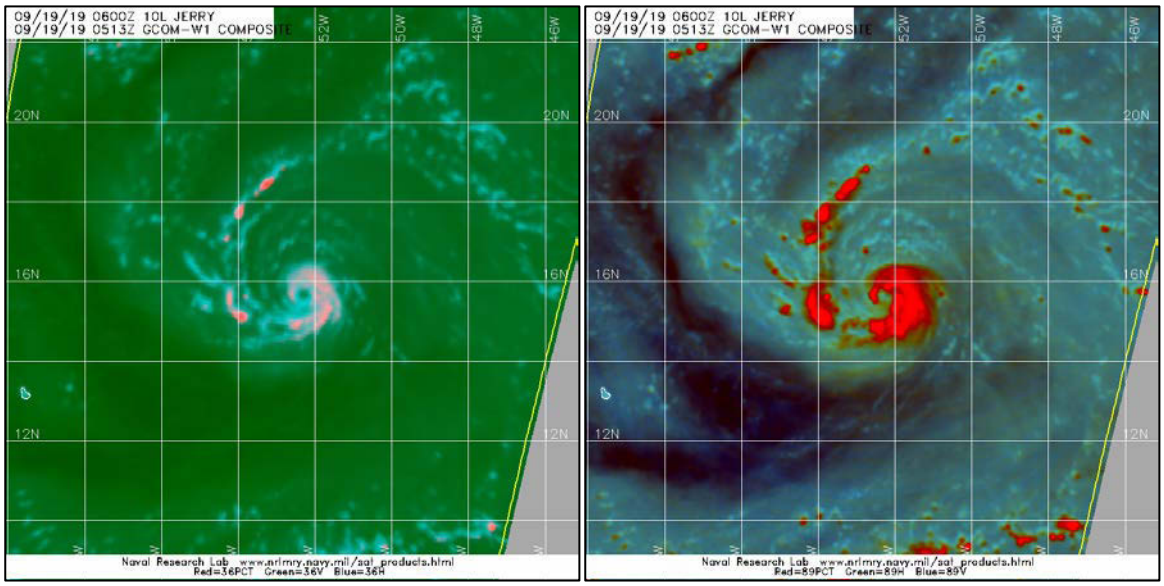
11 December 2019



37-GHZ (LEFT) AND 89-GHZ (RIGHT) MICROWAVE IMAGES OF JERRY WHILE IT WAS RAPIDLY STRENGTHENING EAST OF THE LEEWARD ISLANDS ON 19 SEPTEMBER. IMAGES COURTESY OF THE U.S. NAVAL RESEARCH LABORATORY.

Jerry was a category 2 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that developed over the tropical Atlantic Ocean east of the Lesser Antilles. Jerry passed northeast of the Leeward Islands while weakening to a tropical storm, and eventually passed very close to Bermuda after becoming a post-tropical cyclone. Jerry did not directly affect any land areas while it was a tropical cyclone.

Hurricane Jerry

17–24 SEPTEMBER 2019

SYNOPTIC HISTORY

A tropical wave that moved off the west coast of Africa late on 11 September appears to be the incipient disturbance from which Jerry formed. The wave was accompanied by an area of disorganized showers and thunderstorms while it moved westward over the eastern tropical Atlantic during the next few days. By 15 September, the wave spawned an elongated area of low pressure within the Intertropical Convergence Zone over the central tropical Atlantic. While the wave continued westward, the area of low pressure moved slowly west-northwestward and gradually became better defined during the next 24 to 36 h. The low acquired a well-defined center by 0000 UTC 17 September, and the associated convective activity increased and became sufficiently organized by 0600 UTC that day, marking the formation of a tropical depression about 950 n mi east of the Windward Islands. 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 moved west-northwestward to the south of a strong deep-layer ridge that was centered over the central Atlantic. The cyclone was initially slow to strengthen due to moderate northeasterly vertical wind shear that caused the center to be located near the northeastern edge of the deep convection. Early on 18 September, the convection became better organized and the system strengthened into a tropical storm by 0600 UTC that day. After becoming a tropical storm, Jerry steadily strengthened while over warm waters and within an area of very low vertical wind shear. Twelve hours later Jerry began a period of rapid intensification that lasted until it reached its peak intensity at 0000 UTC 20 September. During that time, microwave imagery revealed that a low-level eye feature had developed (cover photo), and Jerry became a 70-kt hurricane by 1200 UTC 19 September when it was located about 450 n mi east of the Leeward Islands. Jerry continued to rapidly strengthen that day, and although the hurricane's conventional satellite presentation (Fig. 4) did not significantly improve, data from an Air Force Reserve Hurricane Hunter aircraft indicated that Jerry reached a peak intensity of 90 kt by 0000 UTC 20 September. Upon reaching peak intensity, strong northwesterly upper-level winds (around the 250-mb level) and dry mid-level air caused the hurricane to quickly lose organization. Within these unfavorable conditions, Jerry rapidly weakened over the next 24 h while it moved quickly west-northwestward to the south of the strong ridge. Jerry weakened to a tropical storm by 0000 UTC 21 September while it passed about 120 n mi north of the Leeward Islands. About this time, Jerry turned northwestward around the western periphery of the ridge.

[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.

Over the next couple of days, northwesterly shear persisted across the cyclone and deep convection pulsated over the southeastern portion of Jerry's circulation, with the center being exposed at times. The storm maintained an intensity of 55 kt during that period. A mid-level trough associated with recurving Hurricane Humberto to the north produced a pronounced weakness in the ridge between 65°W and 75°W longitude. Jerry responded to this weakness by turning north-northwestward and slowing its forward motion by early on 22 September. After briefly jogging northwestward on 23 September, Jerry resumed its north-northwestward to northward motion. During this time, the shear direction changed to westerly, and the center became more separated from the deep convection. Jerry finally began to gradually weaken early on 24 September as its convection waned and became less organized. Deep convection dissipated by 1800 UTC 24 September, and Jerry degenerated into a post-tropical cyclone with 45-kt winds when it was located about 245 n mi west-southwest of Bermuda. The post-tropical cyclone turned northeastward as a broad mid-latitude trough moved off the northeastern United States coast. The low continued to gradually spin down and its winds weakened below gale force while it approached Bermuda late on 25 September. The remnant low passed near Bermuda around 0000 UTC 26 September, and then moved northeastward to east-northeastward during the next couple of days. The low degenerated into a trough of low pressure about 360 n mi east-northeast of Bermuda shortly after 0000 UTC 28 September.

METEOROLOGICAL STATISTICS

Observations in Jerry (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), and objective Advanced Dvorak Technique (ADT) estimates and Satellite Consensus (SATCON) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Global Precipitation Mission (GPM), the European Space Agency's Advanced Scatterometer (ASCAT), and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Jerry.

Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from 12 flights of the 53rd Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command. The NOAA Aircraft Operations Center (AOC) also conducted two G-IV operational synoptic surveillance missions around Jerry and two G-IV research missions. The NOAA WD-P3 aircraft conducted two low-level research missions into the tropical cyclone.

At the time of Jerry's estimated peak intensity, objective and subjective Dvorak satellite intensity estimates ranged from 61 to 77 kt; however, in-situ observations from Air Force Reserve reconnaissance aircraft indicate that Jerry was stronger. The hurricane's estimated peak intensity of 90 kt at 0000 UTC 20 September is based on a blend of peak SFMR winds of 95 kt and a 700-mb flight-level wind of 97 kt (equivalent surface wind of 89 kt) measured by the hurricane hunter aircraft. In addition, a couple of dropwindsondes released in the northeast eyewall of the hurricane measured surface winds of 87–88 kt. However, mean boundary layer winds (500 m)

and mean winds from the lowest 150 m of the dropsonde support 10-m wind estimates of 82–85 kt. These in-situ observations underscore the value of aerial reconnaissance aircraft data.

Two ships reported winds of tropical storm force in association with Jerry. The ship *Star Java* (call sign LAJS6) reported 60-kt winds at 1800 UTC 23 September, but the reported wind direction is not consistent with the location of the ship within the storm's circulation, making it suspect. A day later, the ship *National Geographic Explorer* (call sign C6WR2) observed 39-kt winds to the west of the cyclone's center at 1800 UTC 24 September.

NOAA buoy 41043 located about 170 n mi north-northeast of the northeastern tip of Puerto Rico measured sustained winds of 33 kt with a gust to 41 kt at 1522 UTC 21 September. NOAA buoy 41048 located about 245 n mi west of Bermuda reported sustained winds of 39 kt with a gust to 47 kt at 1212 UTC 24 September. That buoy also measured a minimum pressure of 999.5 mb at 1910 UTC that day.

There were no reports of tropical-storm-force winds or greater at any land stations.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Jerry.

FORECAST AND WARNING CRITIQUE

The genesis of Jerry was fairly well anticipated. The wave from which Jerry developed was introduced in the Tropical Weather Outlook 96 h prior to genesis (Table 2). The disturbance was given a low (<40%) chance of formation during the next 5 days. The 5-day probability of genesis was raised to the medium (40–60%) category 84 h before development, and to the high (>60%) category a little less than two days before genesis occurred. The short-range (48-h) probabilities did not provide as much lead time, with the system not reaching the medium and high categories until 24 and 12 h before formation, respectively.

A verification of NHC official track forecasts for Jerry is given in Table 3a. Official forecast track errors were generally close to the mean official errors for the previous 5-yr period through 96 h, and lower than the long-term mean at 120 h. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The best performing dynamical model was the GFSI, which had mean errors lower than the official forecast from 24 to 96 h. The GFS ensemble mean (AEMI) also performed well through 96 h. The consensus aids GFEX and TVDG (double weighted global models [GFSI, EXMI, and EGRI] and CTCI and HWFI) also outperformed the NHC forecasts through 96 h, with the TVDG consensus model being the only track aid to best the official forecast at all verifying periods.

A verification of NHC official intensity forecasts for Jerry is given in Table 4a. Official forecast intensity errors were comparable to the mean official errors for the previous 5-yr period.

A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The official forecast had lower mean errors than all of the guidance models at 12 h, and also beat the statistical guidance (DSHP and LGEM) at all time periods. The HMNI and HWFI hurricane models had slightly lower mean errors at various time periods. The Hurricane Forecast Improvement Project (HFIP) corrected consensus model (HCCA) consistently outperformed the NHC forecasts from 24 to 120 h and exhibited mean errors of only 3.7 and 3.1 kt at 96 and 120 h, respectively. The simple consensus aids IVCN and IVDR also performed quite well. The first few NHC forecasts for Jerry did not anticipate the period of rapid strengthening that occurred on 18–19 September. Although these forecasts indicated a peak intensity of 80 kt within 5 days, they did not capture the rate at which Jerry intensified and attained its peak intensity within 72 h of its formation. Intensity forecasts issued after Jerry weakened presumed that the storm would enter a more favorable upper-level environment over the western Atlantic, which would have likely resulted in re-strengthening. The shear, however, remained high, and Jerry ultimately weakened and became a remnant low before reaching Bermuda.

Watches and warnings associated with Jerry are provided in Table 5. Given the possibility of tropical-storm-force winds during Jerry's closest approach to the northeastern Leeward Islands, several countries in that area issued tropical storm watches, but they were never upgraded to tropical storm warnings. The government of Bermuda issued a Tropical Storm Warning for Bermuda about 60 h before the cyclone made its closest approach to the island. At that time, Jerry was forecast to pass near the island as a 50-kt tropical storm. Jerry became a post-tropical cyclone much sooner than expected, however the tropical storm warning was maintained, and NHC continued issuing forecasts on the post-tropical cyclone since it was thought it would still bring tropical-storm conditions to island. Jerry gradually weakened on its approach to Bermuda, however, and the post-tropical cyclone was not producing gale-force winds by the time it made its closest approach to the island.

Table 1. Best track for Hurricane Jerry, 17–24 September 2019.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
17 / 0000	12.6	42.6	1009	25	low
17 / 0600	12.8	43.5	1007	30	tropical depression
17 / 1200	13.0	44.4	1007	30	"
17 / 1800	13.3	45.4	1007	30	"
18 / 0000	13.6	46.3	1006	30	"
18 / 0600	14.0	47.4	1005	35	tropical storm
18 / 1200	14.4	48.6	1002	45	"
18 / 1800	14.8	49.9	1000	50	"
19 / 0000	15.2	51.2	998	55	"
19 / 0600	15.8	52.5	996	60	"
19 / 1200	16.5	53.8	990	70	hurricane
19 / 1800	17.2	55.2	981	80	"
20 / 0000	17.7	56.6	976	90	"
20 / 0600	18.1	58.1	983	85	"
20 / 1200	18.5	59.7	990	75	"
20 / 1800	19.2	61.2	991	65	"
21 / 0000	20.1	62.4	993	60	tropical storm
21 / 0600	21.0	63.5	995	55	"
21 / 1200	21.7	64.5	998	55	"
21 / 1800	22.5	65.5	998	55	"
22 / 0000	23.6	66.1	998	55	"
22 / 0600	24.5	66.5	998	55	"
22 / 1200	25.4	66.6	997	55	"
22 / 1800	26.3	66.8	994	55	"
23 / 0000	27.0	67.2	993	55	"
23 / 0600	27.4	67.7	992	55	"
23 / 1200	27.7	68.0	991	55	"
23 / 1800	28.2	68.3	991	55	"
24 / 0000	28.9	68.6	991	55	"
24 / 0600	29.7	68.9	991	50	"

24 / 1200	30.5	69.1	991	45	"
24 / 1800	30.9	69.1	993	45	low
25 / 0000	31.3	68.9	996	40	"
25 / 0600	31.6	68.4	997	40	"
25 / 1200	31.8	67.4	999	35	"
25 / 1800	32.0	66.1	1000	30	"
26 / 0000	32.3	64.9	1001	25	"
26 / 0600	32.9	63.8	1003	25	"
26 / 1200	33.6	62.9	1005	25	"
26 / 1800	34.1	62.2	1005	25	"
27 / 0000	34.6	61.4	1006	25	"
27 / 0600	35.0	60.5	1006	25	"
27 / 1200	35.3	59.4	1006	25	"
27 / 1800	35.3	58.7	1006	25	"
28 / 0000	35.1	58.3	1007	20	"
28 / 0600					dissipated
20 / 0000	17.7	56.6	976	90	maximum winds and minimum pressure

Table 2. Number of hours in advance of formation associated with the first NHC Tropical Weather Outlook forecast in the indicated likelihood category. Note that the timings for the “Low” category do not include forecasts of a 0% chance of genesis.

	Hours Before Genesis	
	48-Hour Outlook	**120-Hour Outlook**
Low (<40%)	84	96
Medium (40%-60%)	24	84
High (>60%)	12	42

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Jerry, 17–24 September 2019. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	23.9	36.5	**44.1**	**56.9**	**91.2**	**124.8**	**139.8**
OCD5	36.6	66.1	106.8	137.5	201.7	247.0	276.5
Forecasts	27	25	23	21	17	13	9
OFCL (2014-18)	23.6	35.5	47.0	61.8	96.0	136.0	179.6
OCD5 (2014-18)	44.8	97.6	157.4	220.1	340.7	446.6	536.6

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Jerry, 17–24 September 2019. 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 3a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	24.3	33.8	41.5	57.4	101.4	129.6	90.7
OCD5	37.4	66.0	105.9	134.7	177.8	202.6	231.3
GFSI	25.5	**32.6**	**40.7**	**54.5**	**75.5**	**91.2**	113.3
HMNI	26.4	44.0	62.0	89.2	169.8	248.1	196.8
HWFI	30.9	51.4	70.1	96.6	174.0	228.3	223.8
EGRI	25.3	37.7	52.2	69.5	125.9	148.1	98.5
EMXI	26.5	34.4	45.6	62.1	105.6	175.5	171.8
NVGI	28.3	37.4	46.2	57.8	**80.7**	**98.5**	164.2
AEMI	**23.6**	**28.0**	**40.1**	**46.3**	**58.1**	**96.6**	220.2
HCCA	25.1	**32.5**	**40.0**	57.6	110.4	134.2	98.7
FSSE	24.3	**31.9**	41.5	59.2	102.9	140.3	110.7
TVCX	**23.9**	**31.4**	41.7	59.3	102.7	**122.4**	96.9
GFEX	**24.2**	**29.9**	**38.5**	**52.4**	**83.2**	**129.2**	94.6
TVCA	24.5	**31.3**	41.8	59.7	103.8	**117.5**	98.5
TVDG	**23.5**	**30.8**	**40.1**	**56.8**	**99.7**	**116.1**	**85.9**
TABD	42.4	90.2	138.6	186.0	265.8	324.6	401.0
TABM	29.2	42.9	63.6	81.0	112.6	175.9	291.7
TABS	33.9	63.1	100.3	132.3	195.8	232.1	211.8
Forecasts	22	21	19	18	14	10	6

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Jerry, 17–24 September 2019. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	**4.6**	8.0	**9.8**	11.4	**9.1**	**12.7**	15.0
OCD5	7.6	12.4	16.2	20.4	22.1	19.3	19.3
Forecasts	27	25	23	21	17	13	9
OFCL (2014-18)	5.3	7.9	9.9	11.2	13.3	14.4	14.2
OCD5 (2014-18)	6.9	10.9	14.3	17.4	20.9	22.0	22.8

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Jerry, 17–24 September 2019. 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 4a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	5.0	8.4	9.8	10.5	9.7	11.4	12.1
OCD5	8.2	13.2	16.7	19.7	22.5	22.5	21.6
GFSI	7.1	10.0	10.2	10.5	14.2	15.7	18.3
HMNI	6.3	**6.8**	**8.7**	**10.2**	9.7	14.1	**8.6**
HWFI	7.3	10.5	12.5	13.1	**9.5**	**8.4**	**11.6**
EMXI	9.5	11.4	11.0	**8.5**	**6.2**	14.9	12.3
HCCA	6.0	**6.9**	**7.8**	**9.8**	**6.8**	**3.7**	**3.1**
FSSE	6.3	**8.3**	10.3	12.6	12.7	13.7	18.3
LGEM	7.3	9.8	12.4	15.3	16.1	18.0	16.3
DSHP	7.2	9.8	12.8	15.1	15.1	16.2	15.4
ICON	6.7	8.4	**9.6**	**10.3**	**6.6**	**4.2**	**5.1**
IVCN	6.5	**8.0**	**9.0**	**10.2**	**7.3**	**5.6**	**6.3**
IVDR	6.4	**7.6**	**8.3**	**8.5**	**5.0**	**3.2**	**3.0**
Forecasts	23	22	20	19	15	11	7

Table 5. Watch and warning summary for Hurricane Jerry, 17–24 September 2019.

Date/Time (UTC)	Action	Location
18 / 2100	Tropical Storm Watch issued	St. Maarten, St. Martin, St. Barthelemy, Saba, and St. Eustatius
19 / 0000	Tropical Storm Watch issued	Barbuda and Anguilla
20 / 0000	Tropical Storm Watch discontinued	Barbuda and Anguilla
20 / 2100	Tropical Storm Watch discontinued	Saba and St. Eustatius
21 / 0600	Tropical Storm Watch discontinued	All
23 / 0300	Tropical Storm Watch issued	Bermuda
23 / 1200	Tropical Storm Watch changed to Tropical Storm Warning	Bermuda
25 / 2100	Tropical Storm Warning discontinued	All

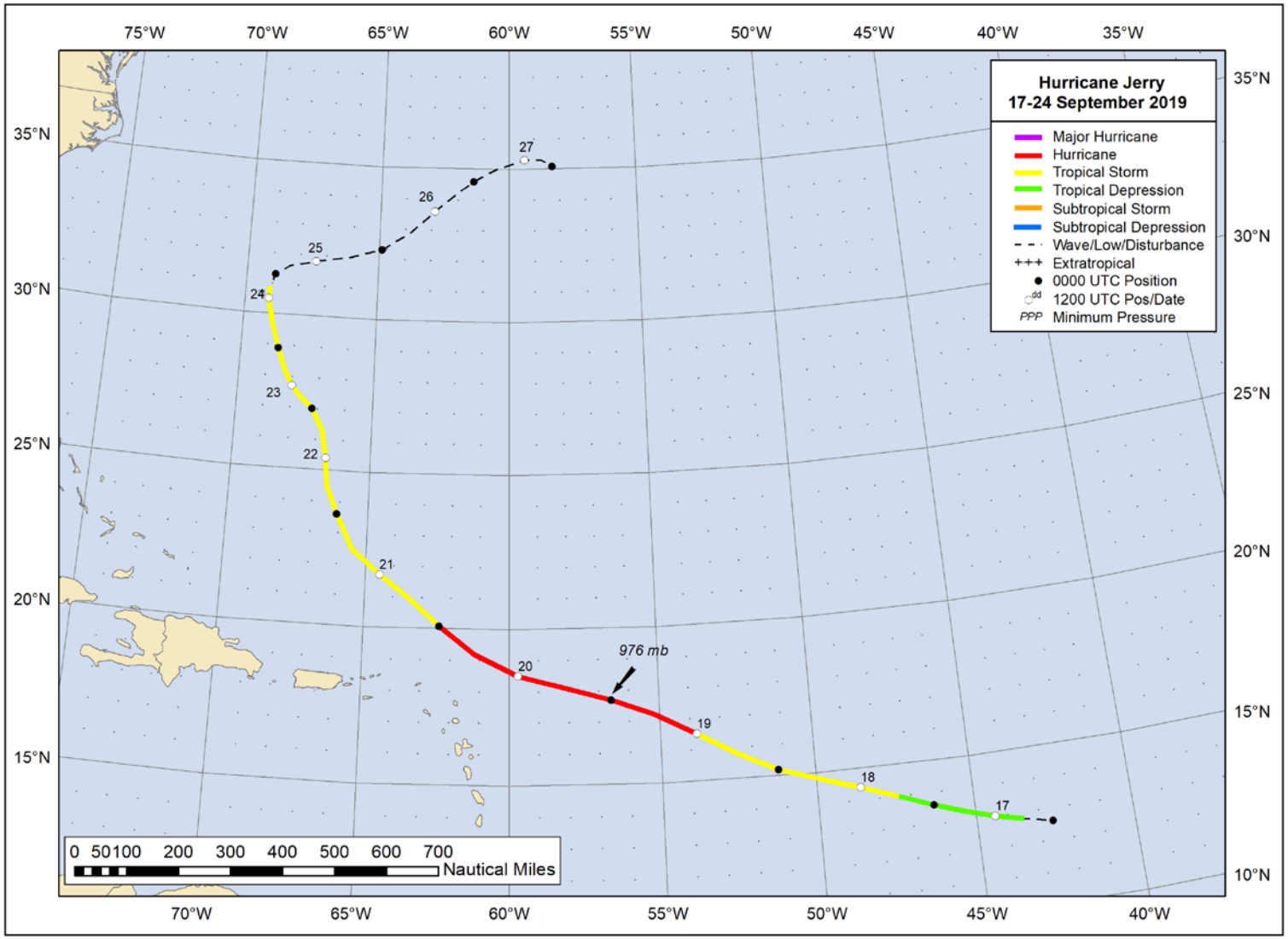


Figure 1. Best track positions for Hurricane Jerry, 17–24 September 2019. The track during the post-tropical stage is partially based on analyses from the NOAA Ocean Prediction Center.

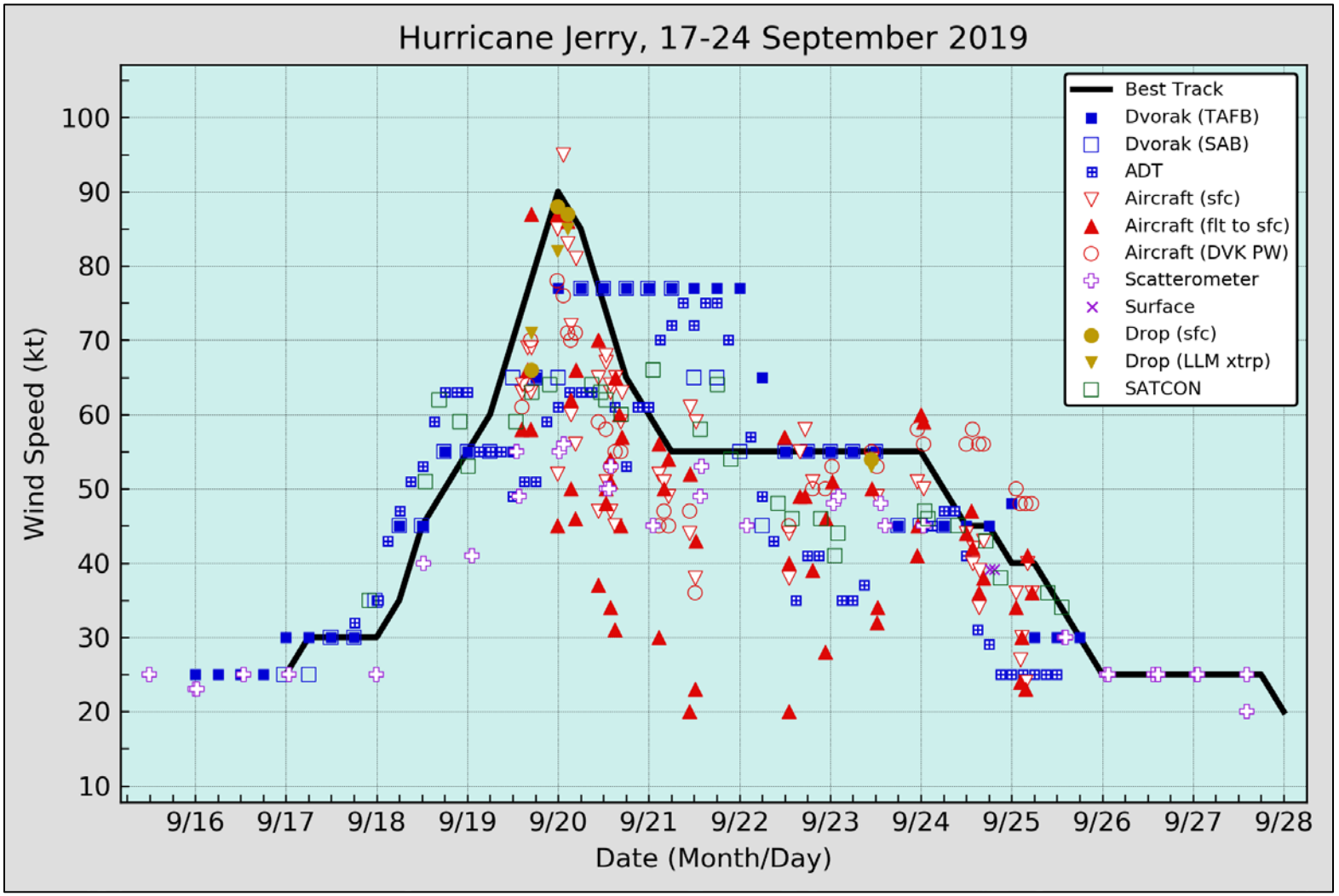


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Jerry, 17–24 September 2019. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM). Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

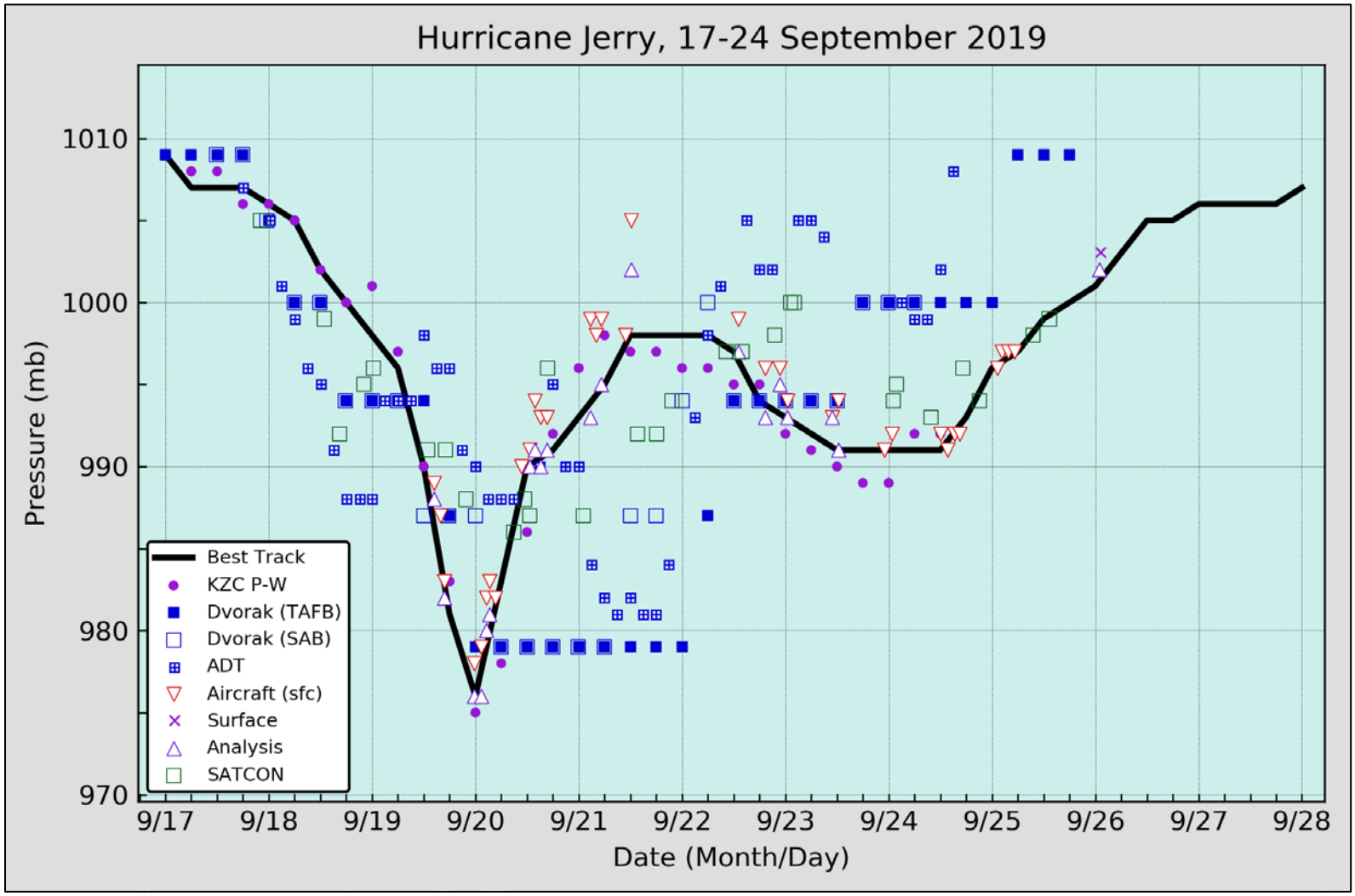


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Jerry, 17–24 September 2019. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.

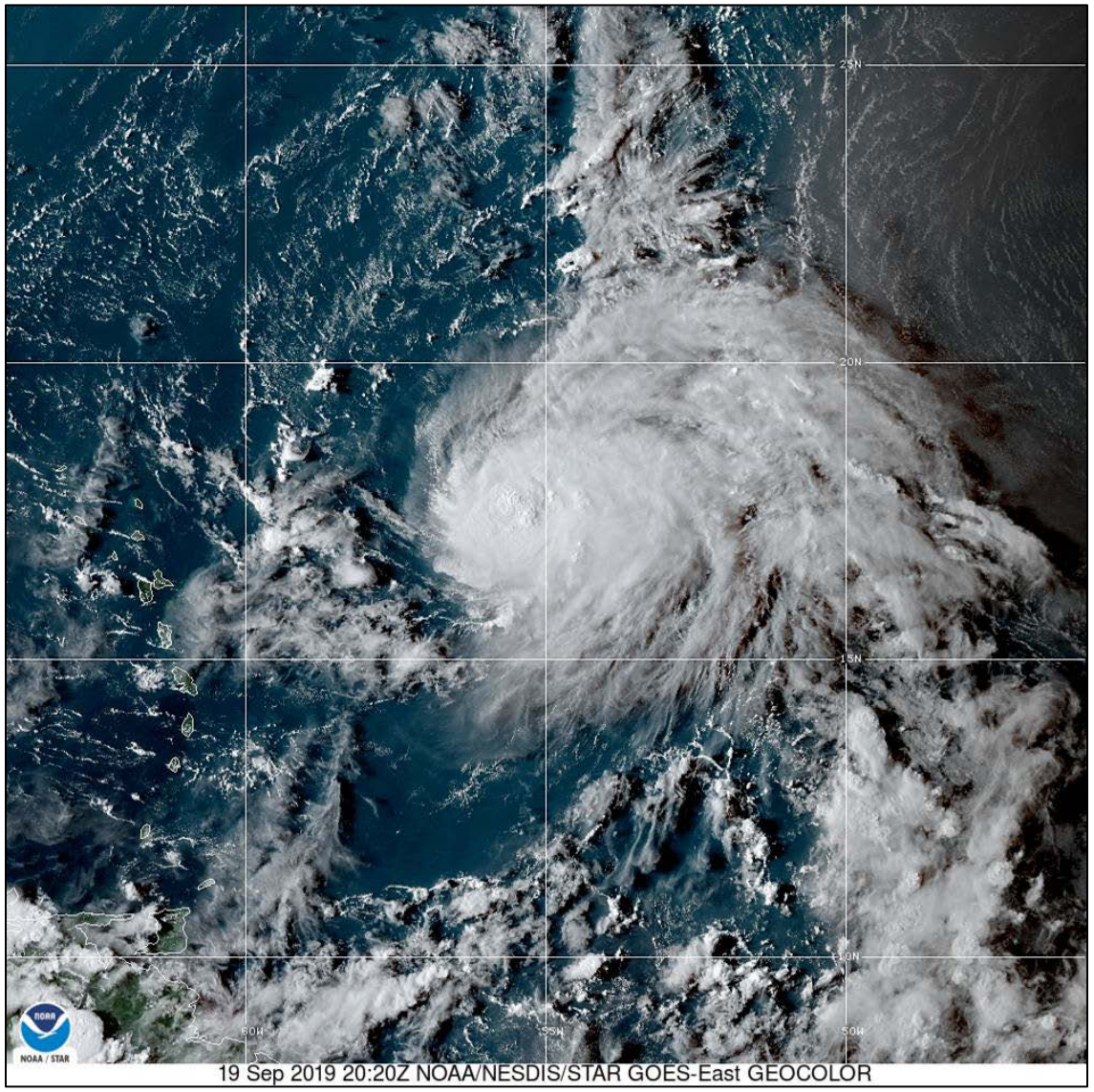


Figure 4. GOES-16 GeoColor image of Hurricane Jerry at 2020 UTC 19 September, a few hours before its estimated peak intensity of 90 kt. Note that the satellite presentation and corresponding Dvorak intensity estimates suggested Jerry was not as strong as indicated by *in-situ* observations from reconnaissance aircraft.