NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE FRANK

(EP072022)

26 July – 2 August 2022

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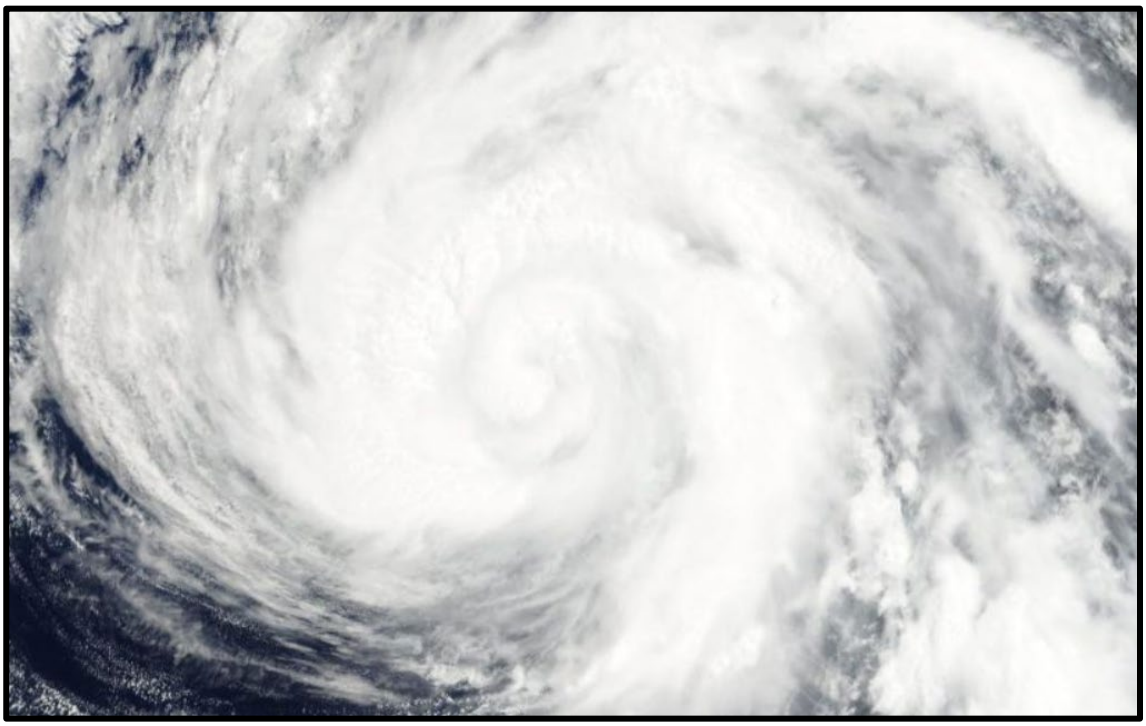
National Hurricane Center
26 October 2022



GOES-17 GEOCOLOR SATELLITE IMAGE OF CATEGORY 1 HURRICANE FRANK AT 1800 UTC 30 JULY 2022. IMAGE COURTESY OF NOAA/NESDIS/STAR.

Frank was a category 1 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that passed well offshore of the coast of southwestern Mexico before dissipating over cool waters well west of the Baja California peninsula.

Hurricane Frank

26 JULY – 2 AUGUST 2022

SYNOPTIC HISTORY

The origins of Frank can be traced back to a tropical wave that departed the west coast of Africa on 14 July (Fig. 1). The wave moved through a very dry environment while it tracked across the tropical Atlantic during the next several days, and the associated deep convection was generally limited due to the unfavorable atmospheric conditions while it moved across that region. The wave first emerged over the far eastern Pacific waters on 22 July, and during the next few days, showers and thunderstorms gradually increased near the wave axis while it moved westward a couple of hundred n mi south of the coasts of El Salvador, Guatemala, and southeastern Mexico. By 1200 UTC 25 July, when the wave was located a few hundred n mi south-southeast of Acapulco, Mexico, satellite data indicated that a well-defined circulation had developed, but the associated shower and thunderstorm activity was still disorganized. Deep convection increased and became better organized around the center later that day, and it is estimated that a tropical depression formed at 0000 UTC 26 July about 350 n mi south of Acapulco. The depression strengthened into Tropical Storm Frank 6 h later. The "best track" chart of Frank's path is given in Fig. 2, with the wind and pressure histories shown in Figs. 3 and 4, respectively. The best track positions and intensities are listed in Table 1[1].

During the early stages of its lifetime, Frank moved westward to west-northwestward at about 10 kt steered by a subtropical ridge centered over northern Mexico. Frank struggled after becoming a tropical storm for the first 30 h with 15-20 kt of northeasterly vertical wind shear confining thunderstorm activity to the west of the center. The shear began to abate late on 27 July, and the more favorable upper-level wind pattern and continued warm waters beneath the system allowed Frank to begin strengthening. Deep convection became more symmetric around the center the next day, and Frank slowly strengthened to a hurricane by 0000 UTC 30 July when it was located about 550 n mi south-southwest of the southern tip of the Baja California peninsula. Around that time, Frank turned northwestward toward a weakness in the subtropical ridge well west of California. The hurricane reached a peak intensity of 80 kt just 6 h later (cover image).

Although the vertical wind shear remained low and water temperatures were still relatively warm around 28°C, Frank's intensification paused. In fact, the strength and broad structure held steady for about an 18-h period through 0000 UTC 31 July. During that time, a ragged eye was occasionally apparent, but dry air intrusions disrupted the inner-core convection preventing additional intensification (Fig. 5). Frank's continued northwestward motion brought the hurricane over progressively cooler waters, and the hurricane crossed the 26°C isotherm by early 31 July. Steady weakening began around then, and Frank's convective pattern gradually degraded. 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.

system weakened back to a tropical storm by 0600 UTC 1 August, and the continued influences of stable air and cool waters caused a gradual spin down of the circulation. Frank degenerated into a 35-kt post-tropical cyclone by 1800 UTC 2 August when it was located about 600 n mi west of the central Baja California coast. The low continued to weaken and opened into a trough shortly after 0000 UTC 4 August well west of the northern portion of the Baja California peninsula.

METEOROLOGICAL STATISTICS

Observations in Frank (Figs. 3 and 4) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), 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 Frank.

Winds and Pressure

Frank maintained an estimated 80-kt peak intensity over an 18-h period from 0600 UTC 30 July to 0000 UTC 31 July. This intensity estimate is based on a blend of objective and subjective satellite estimates during that time period. SAB had the highest Dvorak estimates, 5.0/90 kt, while TAFB was a little lower at 4.5/77 kt, and the ADT estimates were notably lower and ranged from 61-65 kt during that time period. The estimated minimum pressure of 976 mb from 0600 UTC 30 July to 0000 UTC 31 July is based on the Knaff-Zehr-Courtney (KZC) pressure-wind relationship.

There were no reports of tropical-storm-force winds associated with Frank from ships or surface observations.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Frank was adequately forecast, but the cyclone formed a little sooner than anticipated (Table 2). The potential for development of Frank was first noted into the Tropical Weather Outlook (TWO) with a low (<40%) chance of formation 90 h prior to genesis. The 5-day formation chances were increased to the medium (40–60%) and high (>60%) categories 72 h and 54 h before Frank formed, respectively. For the 2-day outlook, a low formation chance was added into the TWO 54 h before formation. The 2-day probabilities were raised to the medium and high categories 30 h and 12 h before Frank developed, respectively. NHC accurately forecast the location of Frank's formation, which was contained within all tropical cyclone genesis areas depicted in the Graphical Tropical Weather Outlook (Fig. 6).

A verification of NHC official track forecasts for Frank is given in Table 3a. Official track forecast (OFCL) errors were lower than the mean official errors for the previous 5-yr period at all forecast times. In fact, the OFCL mean errors for Frank were roughly 30-45% lower than the 5-yr means from 12 to 120 h. It should be noted, however, that the climatology and persistency (OCD5) errors for Frank were also well below their 5-yr means, which suggests that its track was easier to forecast than an average east Pacific tropical cyclone. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The best-performing track models were the consensus aids, especially the corrected consensus approach (HCCA) and the Florida State Superensemble (FSSE), which had lower errors than OFCL at several forecast times. The GFS (GFSI) and ECMWF (EMXI) were good performers for the long-range forecast periods and beat OFCL at 96 and 120 h. Conversely, the UKMET model (EGRI) performed very poorly, with much larger track errors than OFCL at all forecast times and errors even larger than the simple Trajectory and Beta (TAB) models at 120 h.

A verification of NHC official intensity forecasts for Frank is given in Table 4a. Like the track predictions, the OFCL intensity forecast errors were quite low, and roughly 35-70% below the 5-yr means. The OCD5 errors for Frank were also lower than their 5-yr means at all forecast times, indicating the intensity was easier to forecast than average. Although the mean OFCL errors were very low, there were some challenging forecast periods for Frank. Figure 7 shows the individual OFCL intensity forecasts from 0000 UTC 26 July to 0000 UTC 31 July. It can be seen that NHC forecasters predicted a higher and slightly later peak in the intensity of Frank than what occurred. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b and illustrated in Figure 8. Several of the models had similar or slightly lower errors than NHC. The best-performing intensity models were the consensus aids IVCN and IVDR, which beat OFCL at all forecast times. The worst intensity model for Frank was SHIPS (DSHP). DSHP had a significant high bias that led to a nearly 28-kt mean error at 120 h. DSHP also provided poor Rapid Intensification (RI) guidance, as several model runs showed more than a 60% chance of RI occurring during the following 24 h period, which did not materialize.

There were no land-based watches or warnings associated with Frank.

Table 1. Best track for Hurricane Frank, 26 July – 2 August 2022.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
25 / 1200	11.0	98.0	1009	25	low
25 / 1800	11.0	99.1	1008	30	"
26 / 0000	11.1	100.2	1007	30	tropical depression
26 / 0600	11.3	101.2	1006	35	tropical storm
26 / 1200	11.5	102.0	1004	35	"
26 / 1800	11.6	102.9	1004	35	"
27 / 0000	11.8	103.8	1004	35	"
27 / 0600	12.1	104.6	1004	35	"
27 / 1200	12.3	105.5	1004	35	"
27 / 1800	12.4	106.4	1002	40	"
28 / 0000	12.6	107.4	1000	45	"
28 / 0600	12.8	108.5	1000	45	"
28 / 1200	12.9	109.6	1000	45	"
28 / 1800	13.0	110.5	997	50	"
29 / 0000	13.2	111.3	993	55	"
29 / 0600	13.5	112.0	993	55	"
29 / 1200	14.0	112.6	993	55	"
29 / 1800	14.4	113.4	989	60	"
30 / 0000	14.9	114.2	983	70	hurricane
30 / 0600	15.5	115.0	976	80	"
30 / 1200	16.2	115.8	976	80	"
30 / 1800	16.9	116.5	976	80	"
31 / 0000	17.6	117.3	976	80	"
31 / 0600	18.3	118.2	979	75	"
31 / 1200	18.9	119.0	981	70	"
31 / 1800	19.7	119.8	983	70	"
01 / 0000	20.4	120.5	984	65	"
01 / 0600	21.2	121.3	988	60	tropical storm
01 / 1200	21.9	122.1	992	55	"
01 / 1800	22.5	122.9	997	45	"

02 / 0000	23.1	123.7	999	40	"
02 / 0600	23.7	124.5	1001	40	"
02 / 1200	24.4	125.2	1004	35	"
02 / 1800	25.2	125.8	1005	35	low
03 / 0000	26.0	126.4	1006	30	"
03 / 0600	26.9	126.9	1007	30	"
03 / 1200	27.9	127.3	1007	30	"
03 / 1800	28.9	127.5	1008	25	"
04 / 0000	29.9	127.4	1008	25	"
04 / 0600					dissipated
30 / 0600	15.5	115.0	976	80	maximum wind and minimum pressure

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

	Hours Before Genesis	
	48-Hour Outlook	**120-Hour Outlook**
Low (<40%)	54	90
Medium (40%-60%)	30	72
High (>60%)	12	54

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Frank, 26 July – 2 August 2022. 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	**15.8**	**23.2**	**29.7**	**34.7**	**40.0**	**50.1**	**69.4**	**88.4**
OCD5	22.8	45.7	76.4	106.5	133.9	161.7	208.0	235.3
Forecasts	28	26	24	22	20	18	14	10
OFCL (2017-21)	21.9	33.8	45.6	56.9	74.8	79.9	99.5	121.3
OCD5 (2017-21)	35.8	72.3	112.7	155.0	198.7	239.0	309.2	372.2

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Frank, 26 July – 2 August 2022. 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	60	72	96	120
OFCL	14.9	22.8	29.7	36.0	41.6	50.5	67.7	86.0
OCD5	22.3	46.8	78.3	111.2	142.4	174.1	226.2	254.4
GFSI	18.7	30.1	39.0	48.0	54.6	60.9	**61.2**	**67.0**
HMNI	20.5	32.7	43.5	53.5	66.3	83.6	119.4	157.6
HWFI	19.2	31.4	41.2	47.5	53.3	58.7	71.9	107.2
EGRI	19.3	35.4	52.2	66.3	80.5	100.1	151.4	200.2
EMXI	16.0	25.4	32.6	38.7	44.4	55.0	**65.7**	**83.4**
CMCI	24.1	44.2	63.1	77.0	77.0	71.8	69.0	**78.6**
NVGI	26.1	47.3	54.1	55.9	52.8	61.2	106.5	126.3
CTCI	20.1	33.4	44.0	55.1	69.8	85.2	104.4	128.3
AEMI	19.1	31.9	39.4	42.8	47.4	53.3	**66.0**	87.5
HCCA	**14.4**	23.5	30.4	**33.0**	**33.3**	**37.3**	**45.6**	**71.9**
FSSE	15.7	27.2	34.4	**35.0**	**36.9**	**41.5**	**44.4**	87.3
TVCX	15.4	25.4	32.0	38.7	44.1	54.0	69.5	89.3
TVCE	15.9	24.8	33.3	40.8	48.1	60.6	83.3	104.2
TVDG	16.0	25.3	33.2	40.7	47.5	58.3	78.2	98.4
TABS	24.6	62.2	101.6	129.8	142.8	145.1	176.4	175.2
TABM	21.3	47.3	73.3	93.8	106.1	111.5	152.8	156.8
TABD	20.1	41.8	61.1	73.4	85.9	97.3	153.2	182.8
Forecasts	25	23	21	19	17	16	12	8

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Frank, 26 July – 2 August 2022. 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	**4.1**	**5.4**	**7.3**	**7.7**	**8.5**	**8.6**	**5.0**	**7.5**
OCD5	5.5	8.4	11.7	13.0	12.4	13.1	13.4	11.0
Forecasts	28	26	24	22	20	18	14	10
OFCL (2017-21)	5.5	9.1	11.1	12.9	15.3	15.6	16.4	17.0
OCD5 (2017-21)	7.0	12.2	15.8	18.6	20.4	21.2	22.3	21.8

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Frank, 26 July – 2 August 2022. 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	60	72	96	120
OFCL	4.4	5.4	7.9	7.9	9.1	8.4	5.4	8.1
OCD5	5.8	8.7	11.8	12.5	12.1	13.9	13.6	12.0
DSHP	6.1	7.7	10.0	12.9	14.6	17.8	21.8	27.9
LGEM	5.5	5.4	**6.2**	**7.7**	**8.2**	8.9	**4.8**	**4.4**
HWFI	6.1	6.9	**5.4**	**5.2**	**8.5**	9.9	**4.7**	**6.4**
HMNI	4.4	**5.2**	**4.9**	**5.6**	**6.1**	**8.1**	6.8	**2.2**
CTCI	**4.2**	6.1	**7.7**	**7.5**	**8.4**	8.9	7.1	**5.6**
GFSI	4.8	7.1	7.9	**6.0**	**8.0**	**8.2**	6.8	**6.4**
EMXI	4.9	8.9	13.1	15.4	18.9	20.2	19.3	15.2
IVCN	**4.1**	**4.7**	**4.4**	**5.5**	**5.8**	**6.1**	**4.7**	**7.8**
IVDR	**3.9**	**4.5**	**4.0**	**4.1**	**4.5**	**4.6**	**3.6**	**5.6**
HCCA	4.6	6.3	8.1	9.9	9.3	**7.6**	**2.9**	**3.9**
FSSE	**4.1**	**5.0**	**4.8**	**4.4**	**5.1**	**7.1**	**4.9**	12.9
Forecasts	25	23	21	19	17	16	12	8

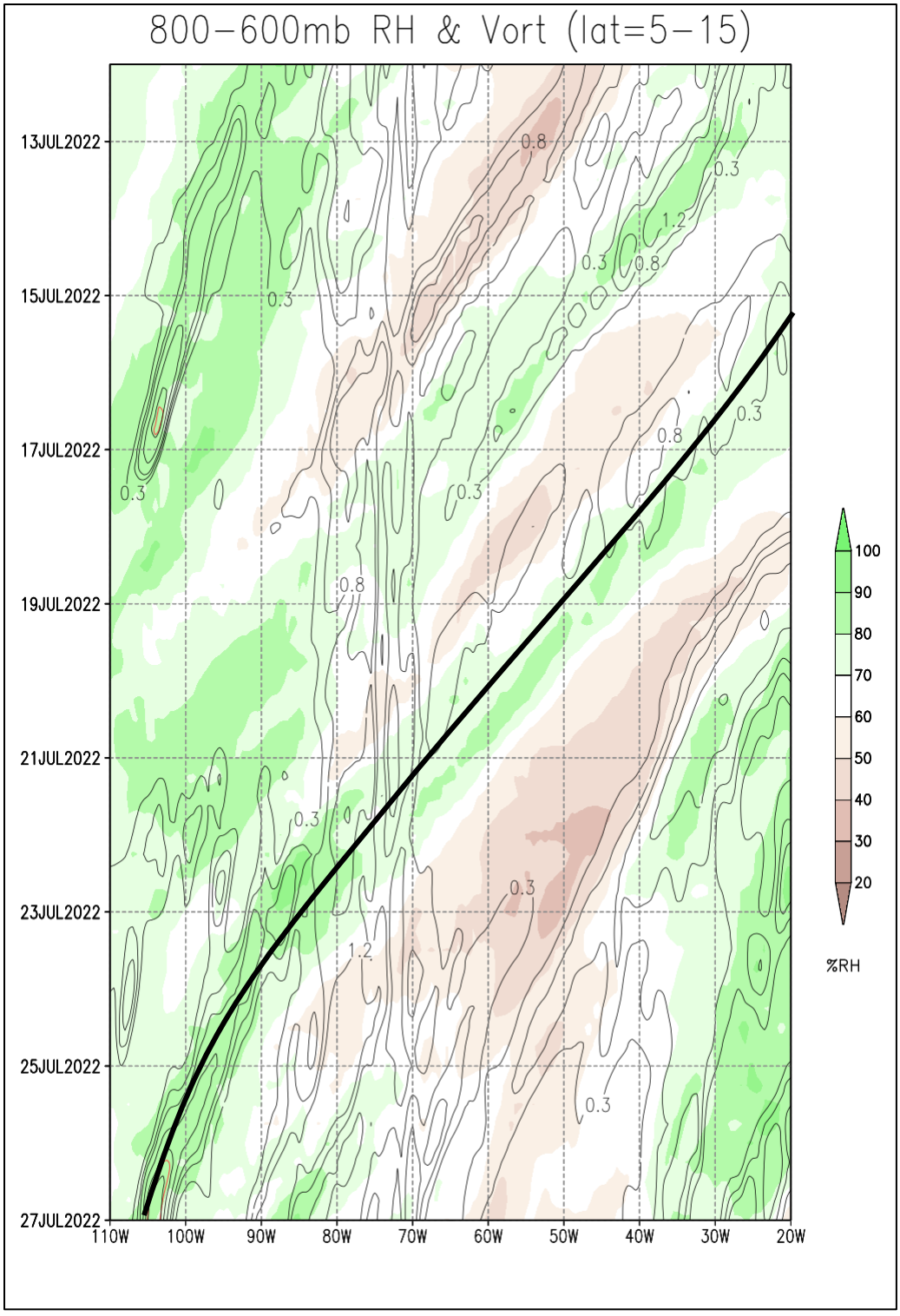


Figure 1. Hovmoller diagram of the GFS model analyses of the deep tropics from 12-27 July displaying 800-600 mb relative humidity (color shaded) and 800-600 mb relative vorticity (contours). The solid black line highlights the tropical wave that led to the development of Hurricane Frank.

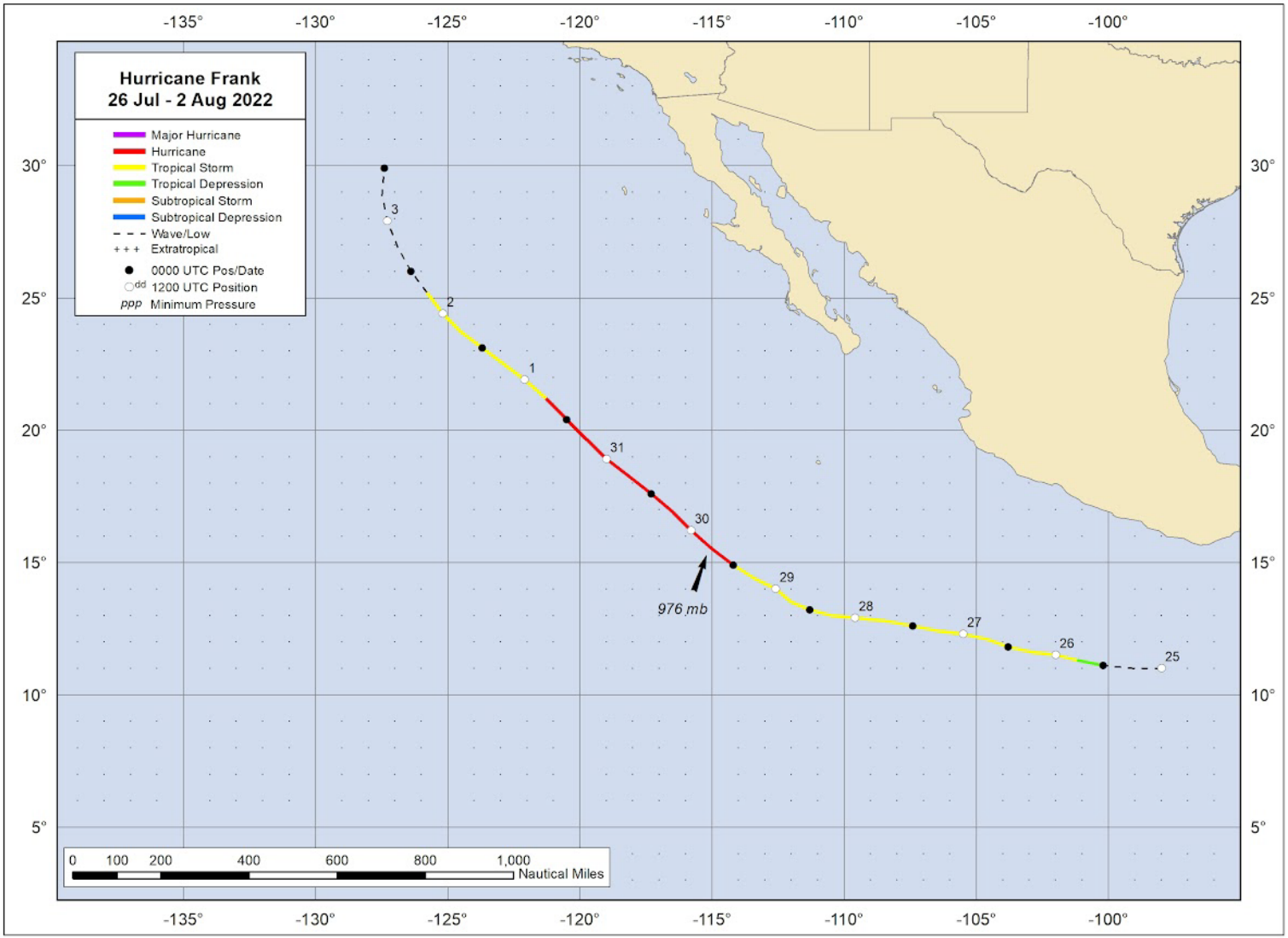


Figure 2. Best track positions for Hurricane Frank, 26 July – 2 August 2022.

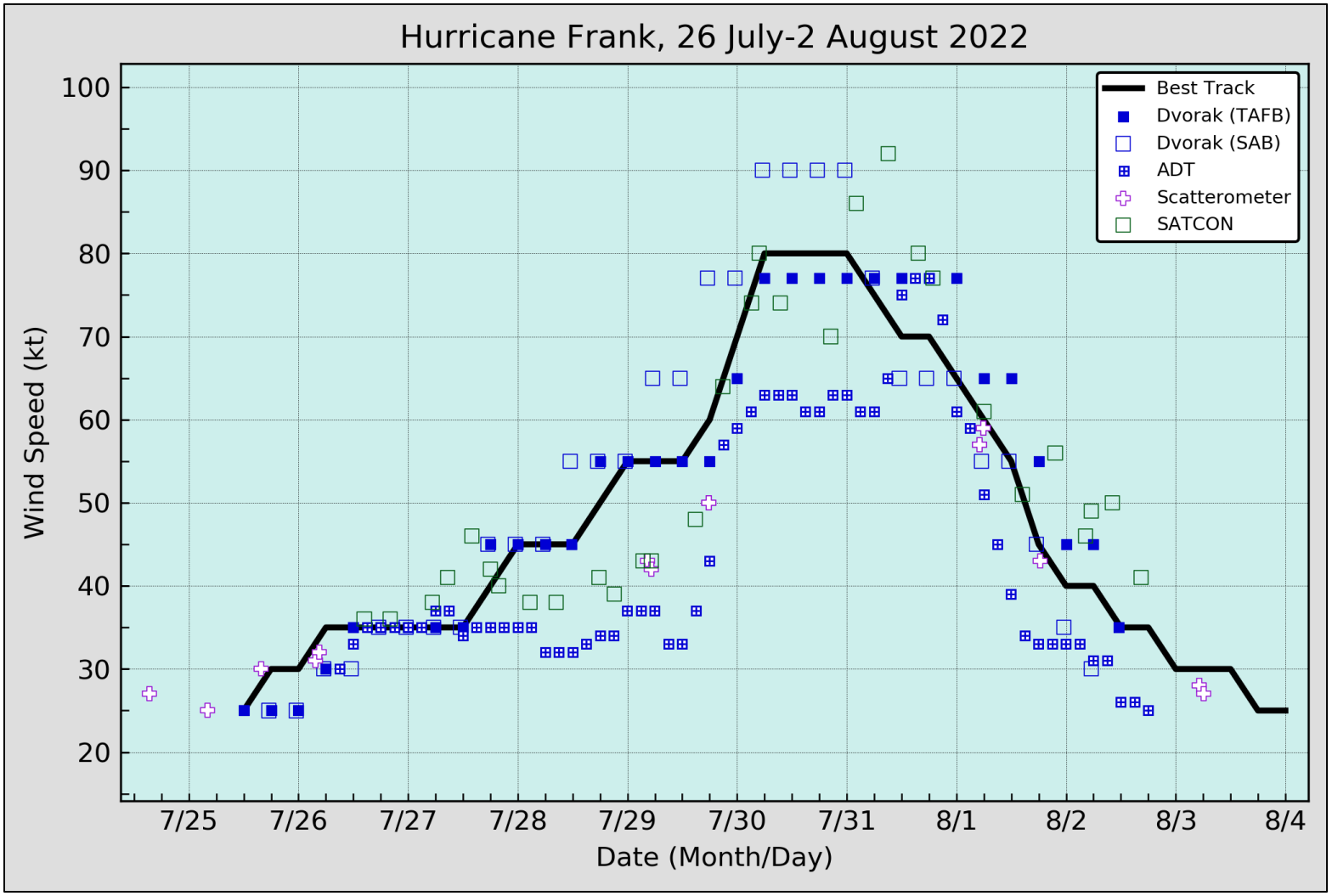


Figure 3. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Frank, 26 July – 2 August 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

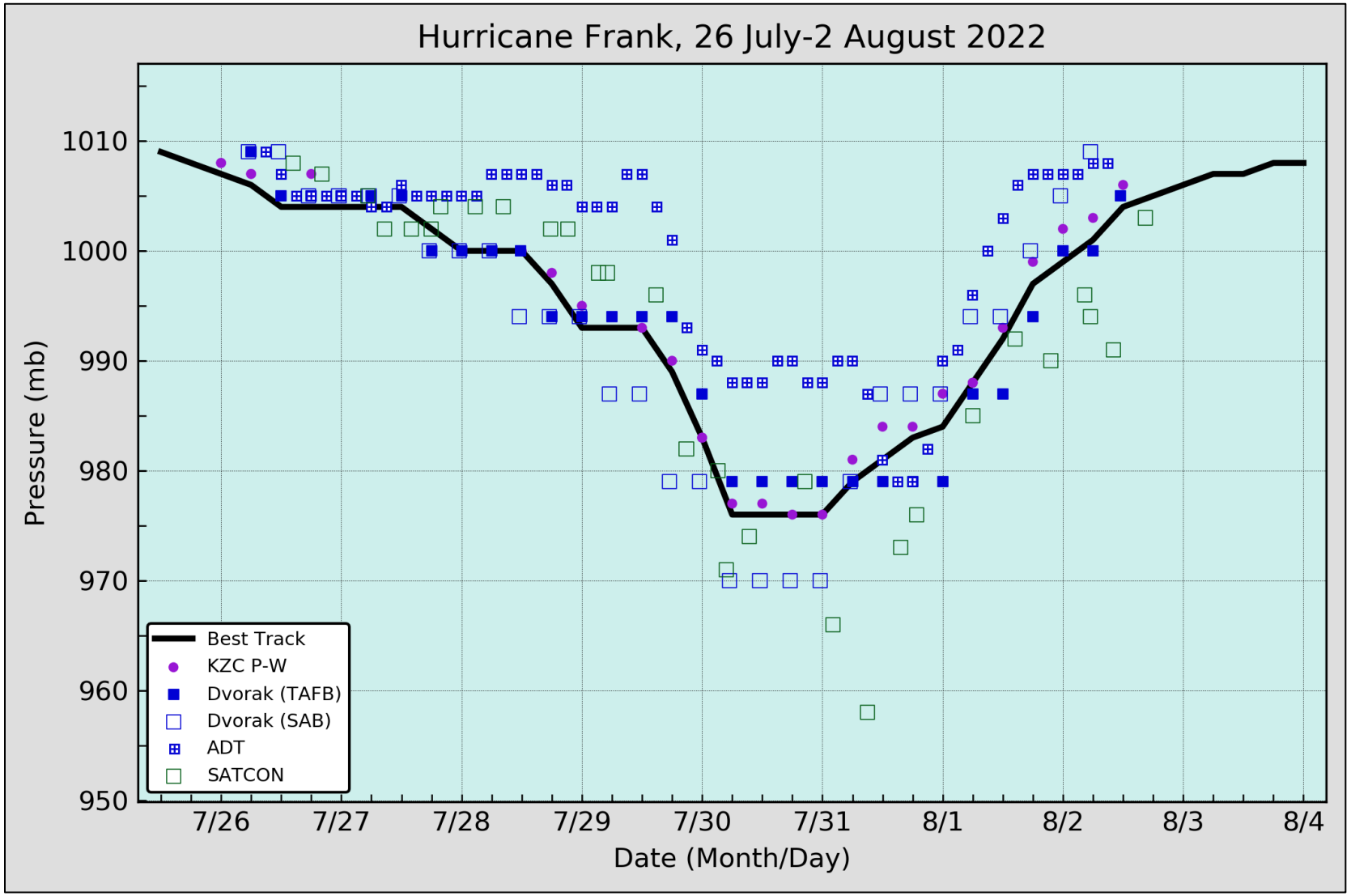


Figure 4. Selected pressure observations and best track minimum central pressure curve for Hurricane Frank, 26 July– 2 August 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological 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.

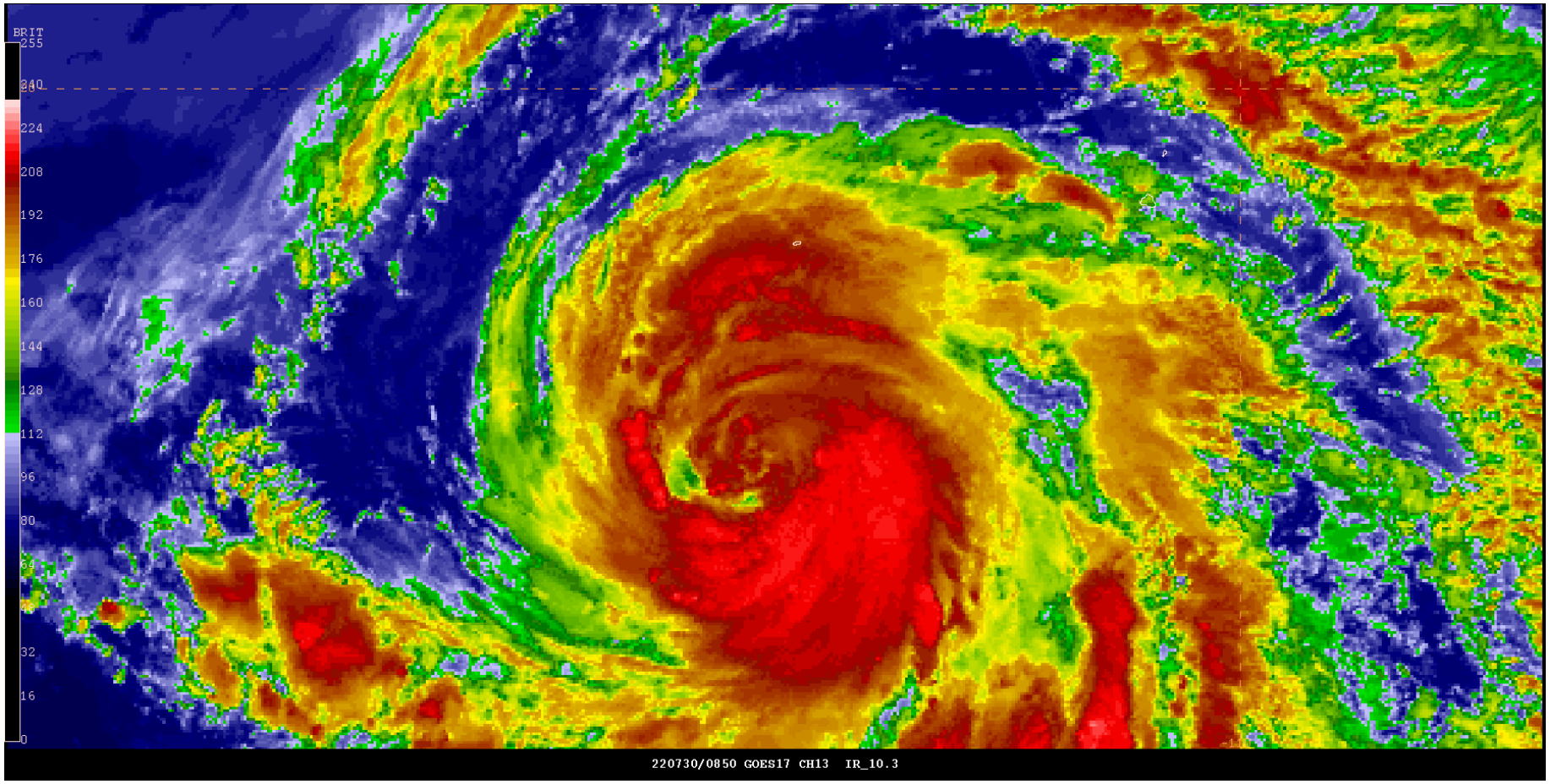


Figure 5. GOES-17 infrared satellite image of Hurricane Frank around its peak intensity at 0859 UTC 30 July.

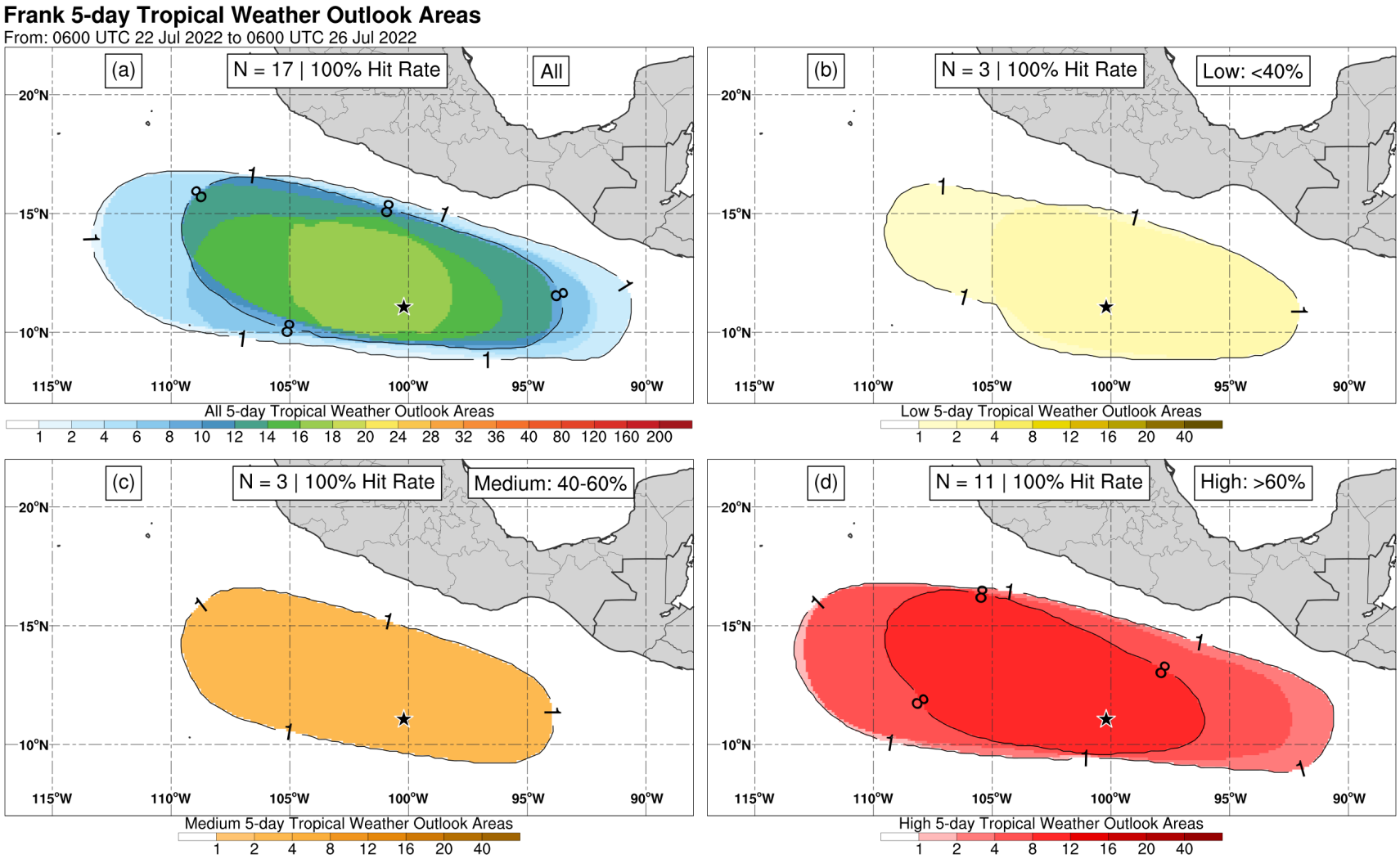


Figure 6. Composites of 5-day tropical cyclone genesis areas depicted in NHC's Tropical Weather Outlooks prior to the formation of Hurricane Frank for (a) all probabilistic genesis categories, (b) the low (<40%) category, (c) medium (40-60%) category, and (d) high (>60%) category. Frank's location of genesis is indicated by the black star.

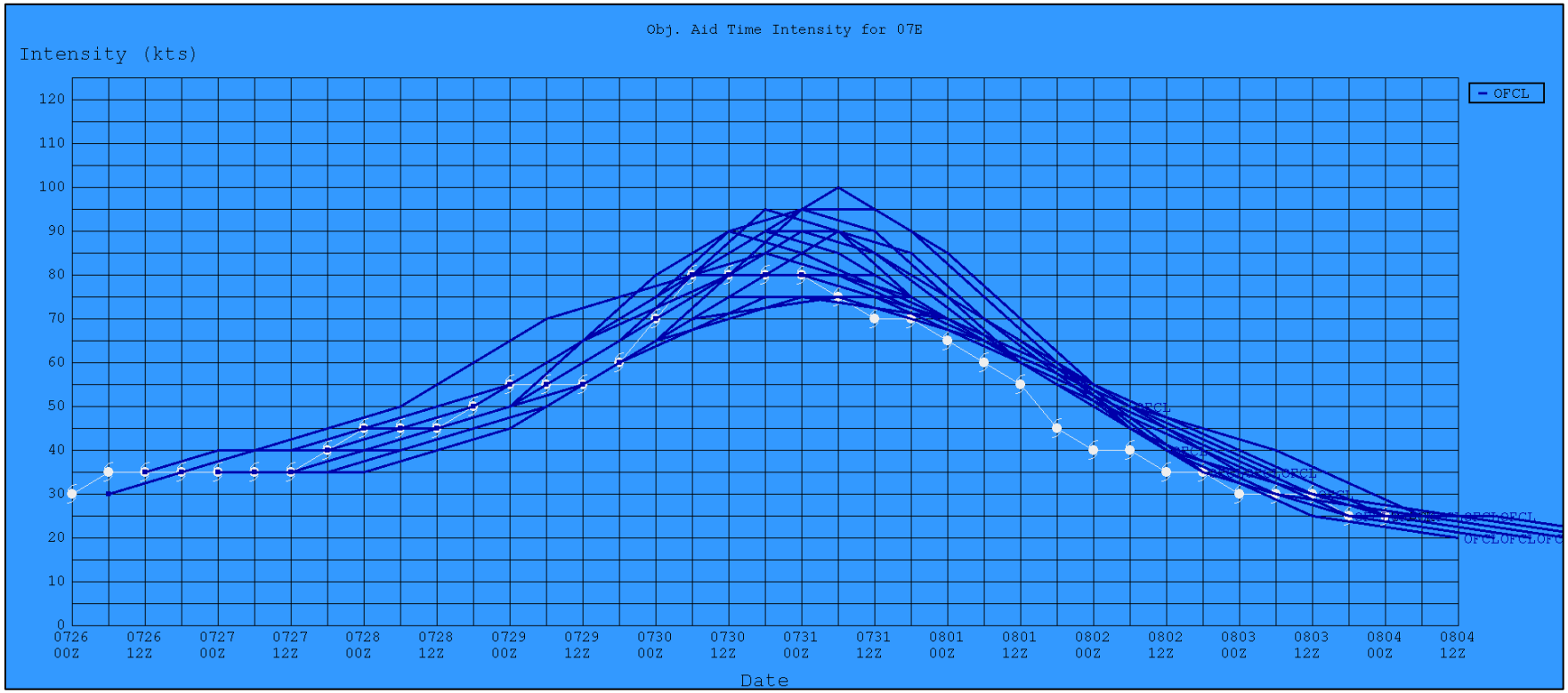


Figure 7. NHC intensity forecasts (kt) for Hurricane Frank from 0000 UTC 26 July to 0000 UTC 31 July. Best track intensity (kt) is shown by the white line.

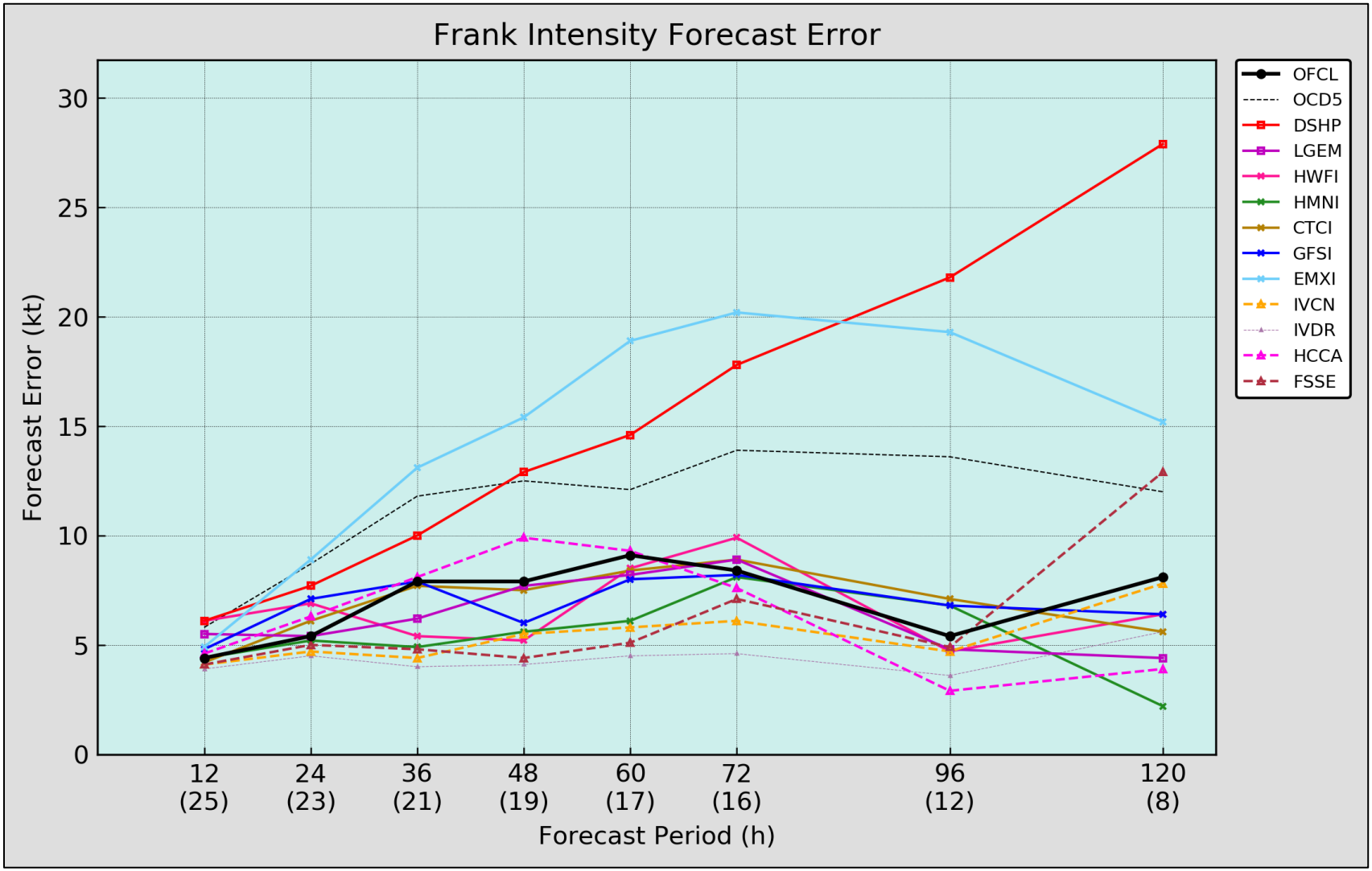


Figure 8. Intensity forecast errors (kt) of the official forecasts and selected models for Hurricane Frank, 26 July – 2 August 2022.