

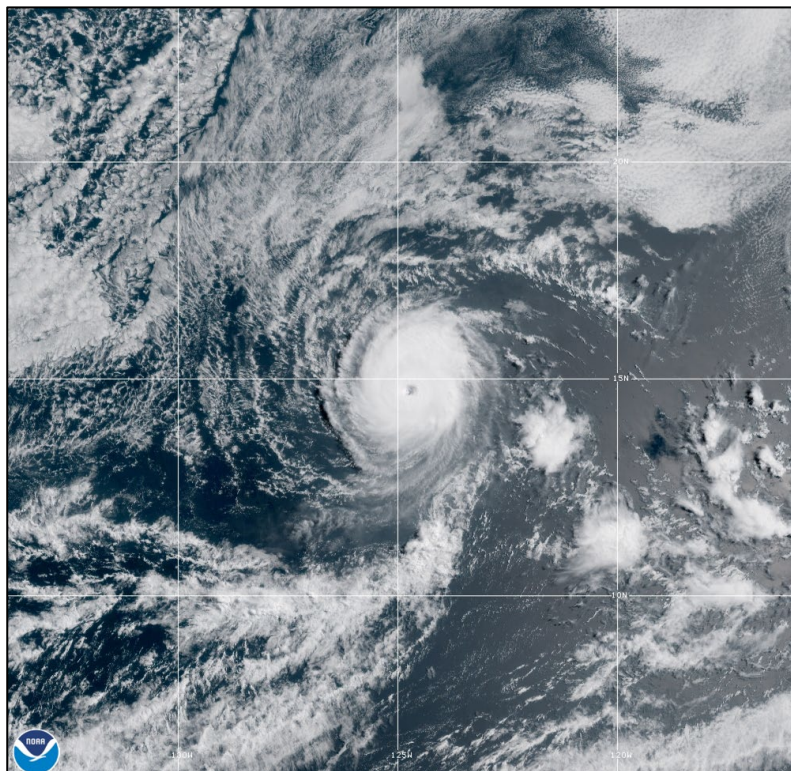


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE FELICIA (EP062021)

14-20 July 2021

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National Hurricane Center
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GOES-17 TRUE COLOR VISIBLE SATELLITE IMAGE OF HURRICANE FELICIA AROUND THE TIME OF ITS PEAK INTENSITY AT 1730 UTC 17 JULY. IMAGE COURTESY OF NOAA/NESDIS/STAR.

Felicia was a powerful but very compact category 4 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that remained out to sea and became a remnant low just before reaching the central Pacific basin.

Hurricane Felicia

14-20 JULY 2021

SYNOPTIC HISTORY

The system that became Felicia was first identified as an area of disturbed weather over Panama, Costa Rica, and the far eastern Pacific Ocean on 9 July. It is unclear if this disturbance originated from a tropical wave, however. The system moved generally westward to the south of Central America and southern Mexico during the next few days accompanied by disorganized showers and thunderstorms. Deep convection increased and became better organized early on 13 July when the broad low was centered about 350 n mi south-southwest of the coast of southern Mexico, but satellite images and scatterometer data indicated that the circulation was elongated and the system lacked a well-defined center at that time. However, the circulation gradually became better defined later that day, and it is estimated that a tropical depression formed by 0000 UTC 14 July when it was located about 500 n mi southwest of the southwestern coast of Mexico. 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 1¹.

Almost immediately after the cyclone formed, Felicia began to rapidly intensify. The system became a tropical storm 6 h after genesis and reached hurricane intensity just 24 h later, when it was located about 750 n mi southwest of the southern tip of the Baja California peninsula. During the first 24–30 h of the cyclone’s life, Felicia moved generally west-northwestward on the south side of a mid-level ridge. In favorable environmental conditions of low wind shear and relatively warm waters, Felicia continued to rapidly strengthen on 16 July. The eye of the hurricane became very circular late that day and was surrounded by a nearly symmetric ring of deep convection. Although the rate of intensification slowed by early 17 July, the hurricane continued to gain strength, and it reached its peak intensity of 125 kt (cover photo) around 1200 UTC that day when it was located about 950 n mi west-southwest of the southern tip of the Baja California peninsula. Despite being a powerful category 4 hurricane (on the Saffir-Simpson Hurricane Wind Scale), Felicia had a tiny wind field. Based largely on satellite derived data, Felicia’s tropical-storm-force winds were estimated to extend only up to 50 n mi from the center with hurricane-force winds covering a small region up to 15 n mi from the eye. Figure 4 shows a satellite image of both Hurricane Felicia and much weaker Tropical Storm Guillermo at 1500 UTC 17 July and indicates the significant size difference between those two tropical cyclones, helping illustrate how tiny Felicia was. During the 16–17 July period, Felicia moved more slowly westward as the ridge became reoriented to the northwest of the cyclone.

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.

Felicia turned back toward the west-northwest by early 18 July and began to weaken. In fact, the hurricane rapidly weakened at a similar rate to its intensification trend a couple of days prior. Now over cool waters below 26°C and in environmental conditions of stronger shear, Felicia weakened below major hurricane intensity by 0000 UTC 19 July when the eye was no longer discernible in geostationary satellite images. The rapid weakening trend continued through 19 July, and Felicia became a tropical storm by 1800 UTC that day. The associated convection largely dissipated late on 19 July due to the influences of cool waters and stable air. Although some convection briefly re-formed on 20 July, the overall weakening trend continued, and Felicia became a remnant low by 1800 UTC 20 July just before reaching the central Pacific basin, when it was located about 1000 n mi east of the Big Island of Hawaii.

The remnant low turned west-southwestward in the low-level trade wind flow and continued to slowly spin down during the next couple of days. Satellite data indicate that the low opened into a trough before 1800 UTC 22 July when it was located about 550 n mi southeast of the Big Island of Hawaii.

METEOROLOGICAL STATISTICS

Observations in Felicia (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), 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), Defense Meteorological Satellite Program (DMSP) satellites, and the Synthetic Aperture Radar were also useful in constructing the best track of Felicia.

There were no ship or buoy reports of tropical-storm-force winds associated with Felicia.

Felicia's estimated peak intensity of 125 kt at 1200 and 1800 UTC 17 July is based primarily on T6.5/127 kt Dvorak classifications from TAFB during those time periods. The estimated minimum pressure of 945 mb is based on the Knaff-Zehr-Courtney pressure-wind relationship.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Hurricane Felicia.

FORECAST AND WARNING CRITIQUE

The genesis of Felicia was fairly well forecast, but the cyclone formed a little sooner than anticipated. Table 2 provides the number of hours in advance of formation associated with the first NHC Tropical Weather Outlook (TWO) forecast in each likelihood category. The disturbance that became Felicia was first mentioned in the TWO with a low chance (<40%) of formation during the next 5 days 120 h prior to genesis. The 5-day probabilities reached the medium (40–60%) and high categories (>60%) 60 h and 36 h prior to when Felicia formed, respectively. Regarding the 2-day genesis probabilities, a low chance of genesis was shown 48 h, a medium chance 30 h, and a high chance 6 h before Felicia developed.

A verification of NHC official track forecasts for Felicia is given in Table 3a. The official forecast (OFCL) mean errors were quite low and were below the 5-yr means at all forecast times. The OCD5 errors were also below their 5-yr means, indicating that Felicia's track was easier to predict than average. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b, and forecast skill against OCD5 is illustrated in Fig. 5. The NHC OFCL track forecasts were quite skillful for the short forecast times, but were beaten by some of the consensus aids. The skill of the official forecast trailed for the longer lead times, as did the consensus aids. The highest performing models at 96 and 120 h were HMNI and GFSI, albeit for a small sample. The best overall forecast aid was GFEX, which outperformed the official forecast at most time periods. NVGI, CTCI, and EGRI were among the poorest performers for Felicia.

A verification of NHC official intensity forecasts for Felicia is given in Table 4a. Unlike the track forecasts, the official NHC intensity forecast errors were well above the 5-yr means, especially for the middle forecast time periods. A similar pattern is apparent in the OCD5 forecasts, and the high errors are associated with poor predictions during Felicia's rapid intensification and subsequent rapid weakening phases. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b, and forecast skill against OCD5 is illustrated in Fig. 6. The official forecasts had some skill through 96 h, but skill values were generally low and well below what was observed for track. HWFI was the best intensity model from 60 to 96 h, but it had no skill at most of the other forecast times. GFSI and EMXI had the largest errors, except at 120 h where their predictions were among the most accurate. Most of the models had a low bias for Felicia from 12 to 96 h (not shown).

No coastal watches and warnings were required for Felicia.

Table 1. Best track for Hurricane Felicia, 14–20 July 2021.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
14 / 0000	13.5	110.6	1007	30	tropical depression
14 / 0600	13.9	112.2	1006	35	tropical storm
14 / 1200	14.2	113.5	1004	45	"
14 / 1800	14.6	114.8	999	55	"
15 / 0000	14.9	116.0	997	60	"
15 / 0600	15.1	117.1	992	70	hurricane
15 / 1200	15.2	118.1	984	80	"
15 / 1800	15.3	119.0	979	90	"
16 / 0000	15.3	119.8	971	95	"
16 / 0600	15.2	120.5	966	100	"
16 / 1200	15.1	121.2	959	110	"
16 / 1800	14.9	122.0	954	115	"
17 / 0000	14.7	122.8	953	115	"
17 / 0600	14.6	123.5	950	120	"
17 / 1200	14.5	124.2	945	125	"
17 / 1800	14.7	124.9	945	125	"
18 / 0000	15.0	125.7	948	120	"
18 / 0600	15.3	126.6	950	120	"
18 / 1200	15.6	127.6	954	115	"
18 / 1800	15.9	128.5	959	110	"
19 / 0000	16.2	129.5	971	95	"
19 / 0600	16.3	130.5	979	80	"



Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
19 / 1200	16.3	131.7	990	65	"
19 / 1800	16.2	132.8	1000	55	tropical storm
20 / 0000	16.1	134.1	1003	45	"
20 / 0600	16.0	135.6	1005	40	"
20 / 1200	15.8	137.1	1006	35	"
20 / 1800	15.5	138.6	1008	30	low
21 / 0000	15.1	140.2	1008	30	"
21 / 0600	14.9	141.6	1008	30	"
21 / 1200	14.6	143.0	1009	30	"
21 / 1800	14.3	144.4	1009	30	"
22 / 0000	14.0	145.7	1009	25	"
22 / 0600	13.7	147.0	1009	25	"
22 / 1200	13.3	148.2	1010	20	"
22 / 1800					dissipated
17 / 1200	14.5	124.2	945	125	maximum wind and minimum pressure

Table 2. Number of hours in advance of formation of Felicia 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%)	48	120
Medium (40%-60%)	30	60
High (>60%)	6	36

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Felicia, 14–20 July 2021. 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	9.6	17.3	23.9	31.2	44.6	58.3	89.5	83.3
OCD5	26.2	60.9	97.3	126.4	146.3	157.5	230.1	303.9
Forecasts	24	22	20	18	16	14	10	6
OFCL (2016-20)	21.3	33.1	44.0	54.6	65.3	76.0	95.9	116.6
OCD5 (2016-20)	33.1	69.4	107.8	147.0	183.4	219.7	280.2	342.0

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Felicia, 14–20 July 2021. 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	9.3	17.4	22.3	26.3	37.8	58.3	95.8	88.1
OCD5	28.6	69.0	113.9	150.3	177.3	192.1	232.4	296.6
GFSI	14.5	27.4	40.9	52.5	55.6	57.4	81.6	87.3
HMNI	17.5	33.1	51.1	63.5	63.0	58.5	65.6	64.3
HWFI	13.4	24.3	35.5	39.8	43.1	60.7	146.7	170.4
EGRI	12.6	25.9	37.5	54.0	80.0	97.1	123.6	111.5
EMXI	13.4	23.3	31.2	35.1	52.9	82.7	103.1	85.4
CMCI	14.0	26.7	39.4	36.7	43.5	65.9	133.3	222.6
NVGI	21.5	41.4	62.5	81.4	95.6	104.6	117.1	138.9
CTCI	17.5	32.1	52.0	67.3	76.0	85.5	123.2	126.3
AEMI	15.5	29.0	41.9	42.8	45.4	59.0	116.0	131.4
HCCA	8.4	15.8	17.6	20.1	32.5	59.7	115.9	120.0
FSSE	10.8	17.3	21.4	24.7	41.2	66.9	113.0	119.5
TVCX	10.5	16.5	21.6	24.4	37.9	52.9	85.5	88.0
TVCE	11.1	20.0	26.1	28.2	36.8	47.5	80.9	83.4
TVDG	10.1	18.2	24.0	26.6	40.4	53.5	82.1	83.5
GFEX	10.2	17.2	22.1	24.2	37.3	54.5	75.7	74.2
Forecasts	18	16	14	12	10	8	6	4

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Felicia, 14–20 July 2021. 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	7.1	16.1	23.8	28.9	30.6	32.1	27.5	20.0
OCD5	9.0	18.6	28.0	33.7	35.6	37.6	32.9	13.8
Forecasts	24	22	20	18	16	14	10	6
OFCL (2016-20)	5.6	9.0	10.9	12.6	14.0	15.3	16.0	16.7
OCD5 (2016-20)	7.2	12.0	15.3	17.6	19.0	20.4	21.2	20.8

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Felicia, 14–20 July 2021. 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	6.7	15.5	23.2	29.0	31.2	34.1	22.1	18.0
OCD5	8.6	17.7	26.6	32.2	34.7	39.6	29.9	9.6
HWFI	12.9	21.8	28.2	28.7	25.5	25.6	15.0	39.0
HMNI	7.3	14.7	22.5	27.7	30.1	33.3	20.6	8.8
CTCI	10.5	20.7	27.2	29.9	28.9	31.8	29.6	16.2
DSHP	9.0	17.7	24.9	28.5	30.4	32.2	23.4	19.0
LGEM	9.8	18.8	25.1	28.9	30.9	34.2	26.1	18.0
HCCA	8.3	15.8	21.9	25.8	27.5	30.5	20.1	19.2
FSSE	8.7	16.8	25.2	28.5	28.5	30.8	22.6	10.0
IVCN	9.3	18.5	25.3	28.4	29.1	31.3	20.7	16.0
IVDR	9.5	19.2	26.1	29.4	30.0	32.1	20.9	14.6
GFSI	12.0	22.5	32.8	37.8	40.5	43.4	29.1	13.2
EMXI	13.2	23.6	32.2	38.8	44.4	44.7	28.3	9.6
Forecasts	21	19	17	15	13	11	7	5

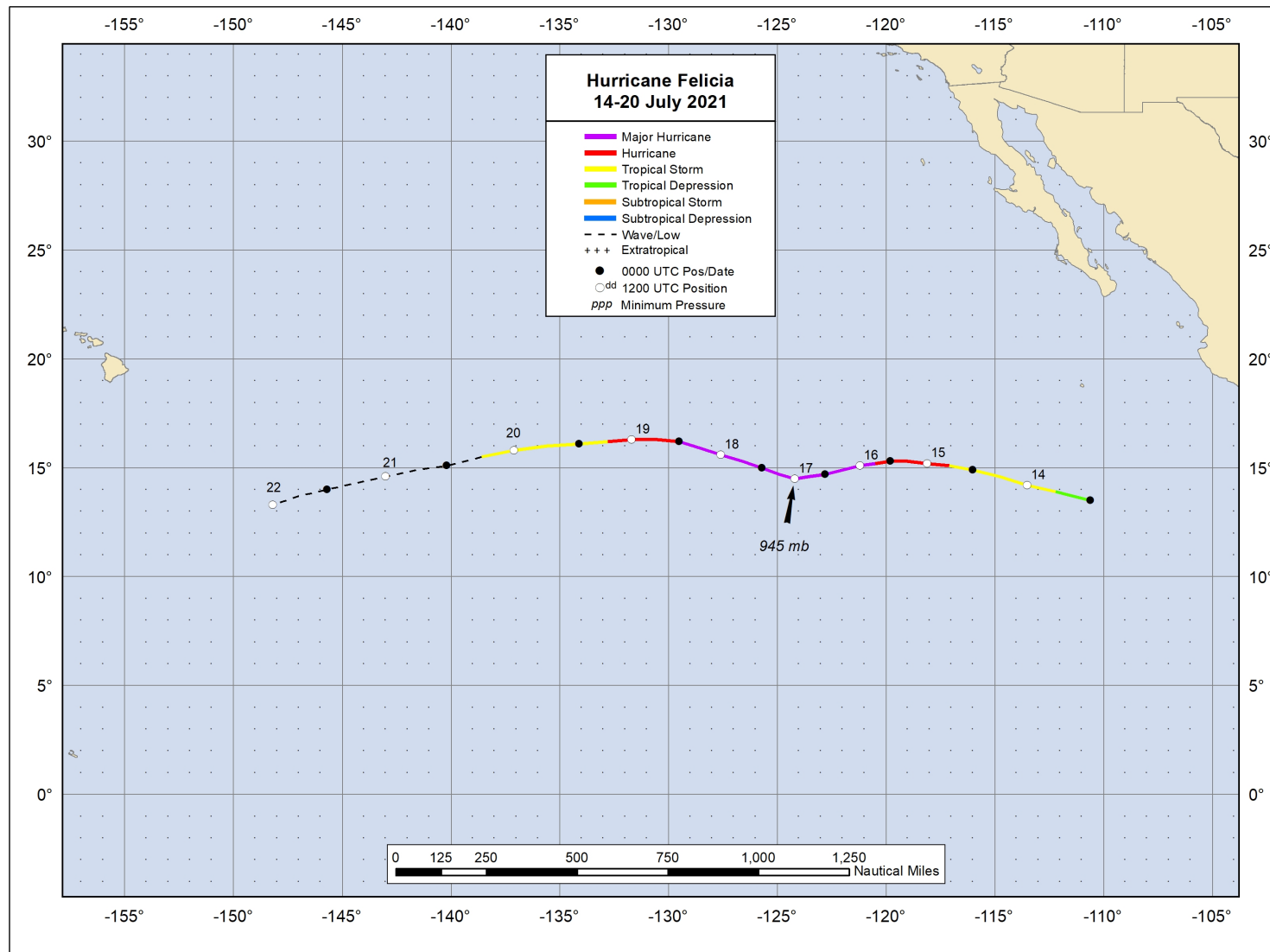


Figure 1. Best track positions form Hurricane Felicia, 14–20 July 2021.

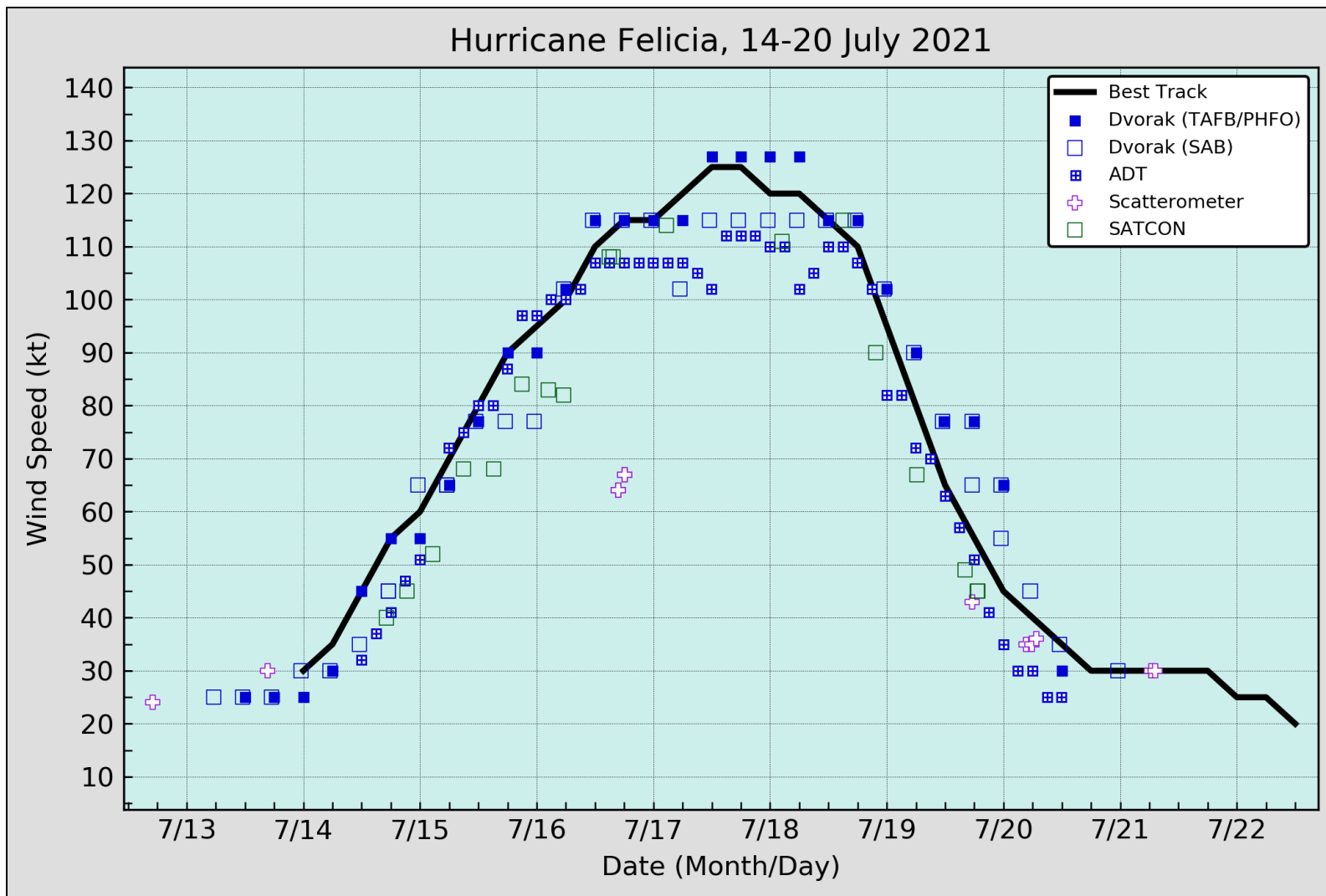


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Felicia, 14–20 July 2021. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

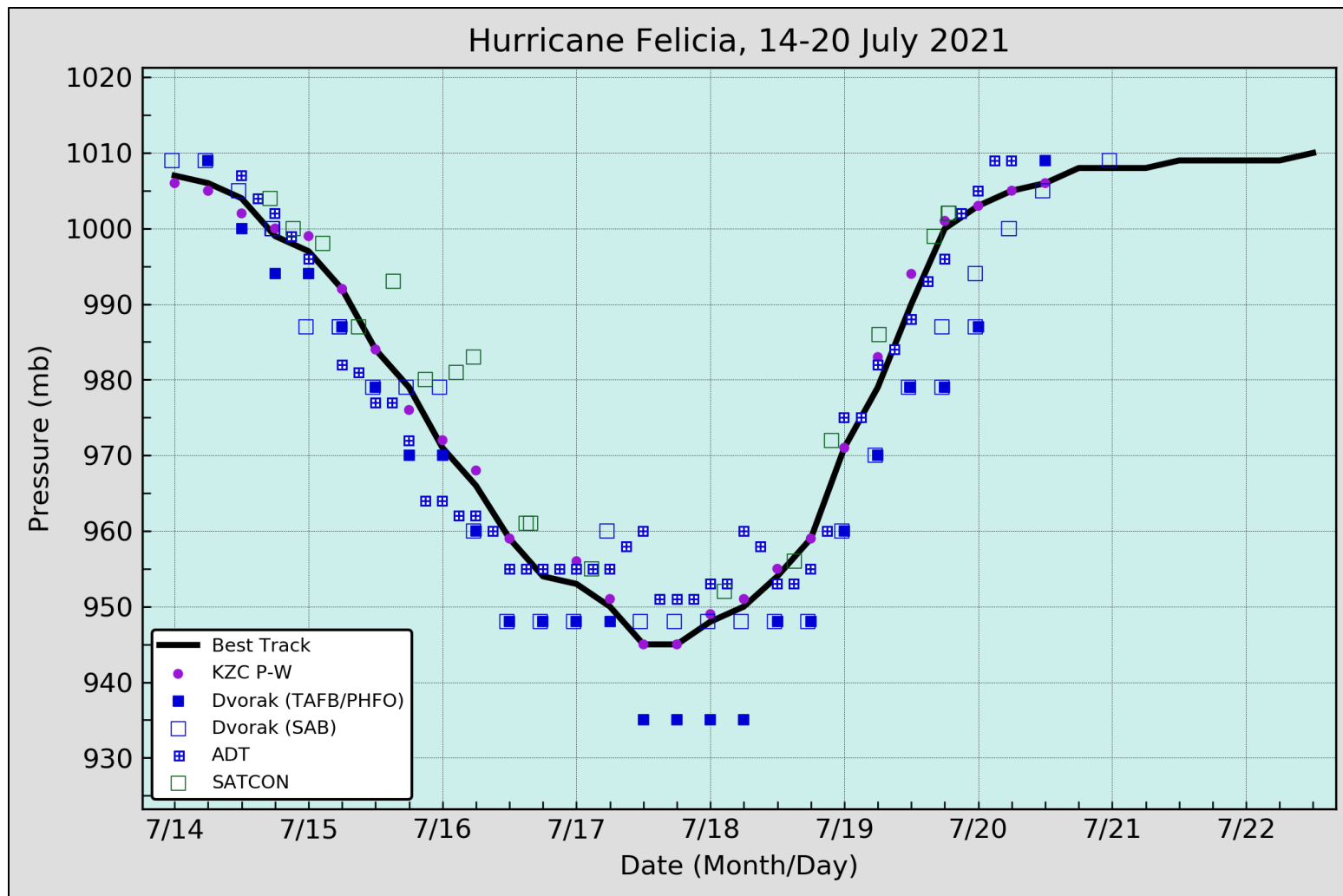


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Felicia, 14–20 July 2021. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological 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.

GOES-17 Band 14: Longwave Infrared Window - 2 km Resolution

Valid: 1500 UTC 17 Jul 2021

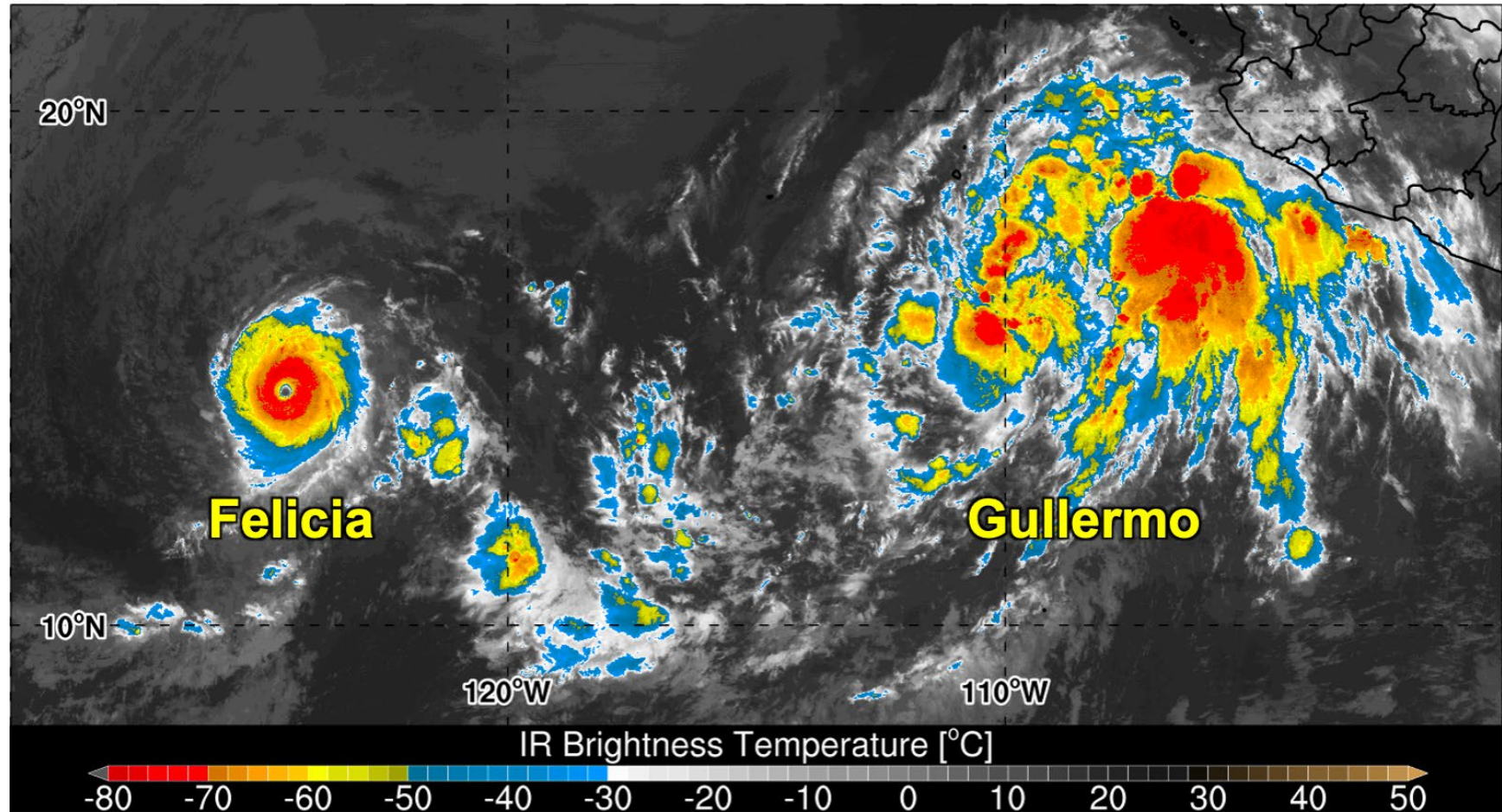


Figure 4. GOES-17 infrared satellite image of Hurricane Felicia (left) and Tropical Storm Guillermo (right) at 1500 UTC 17 July 2021.

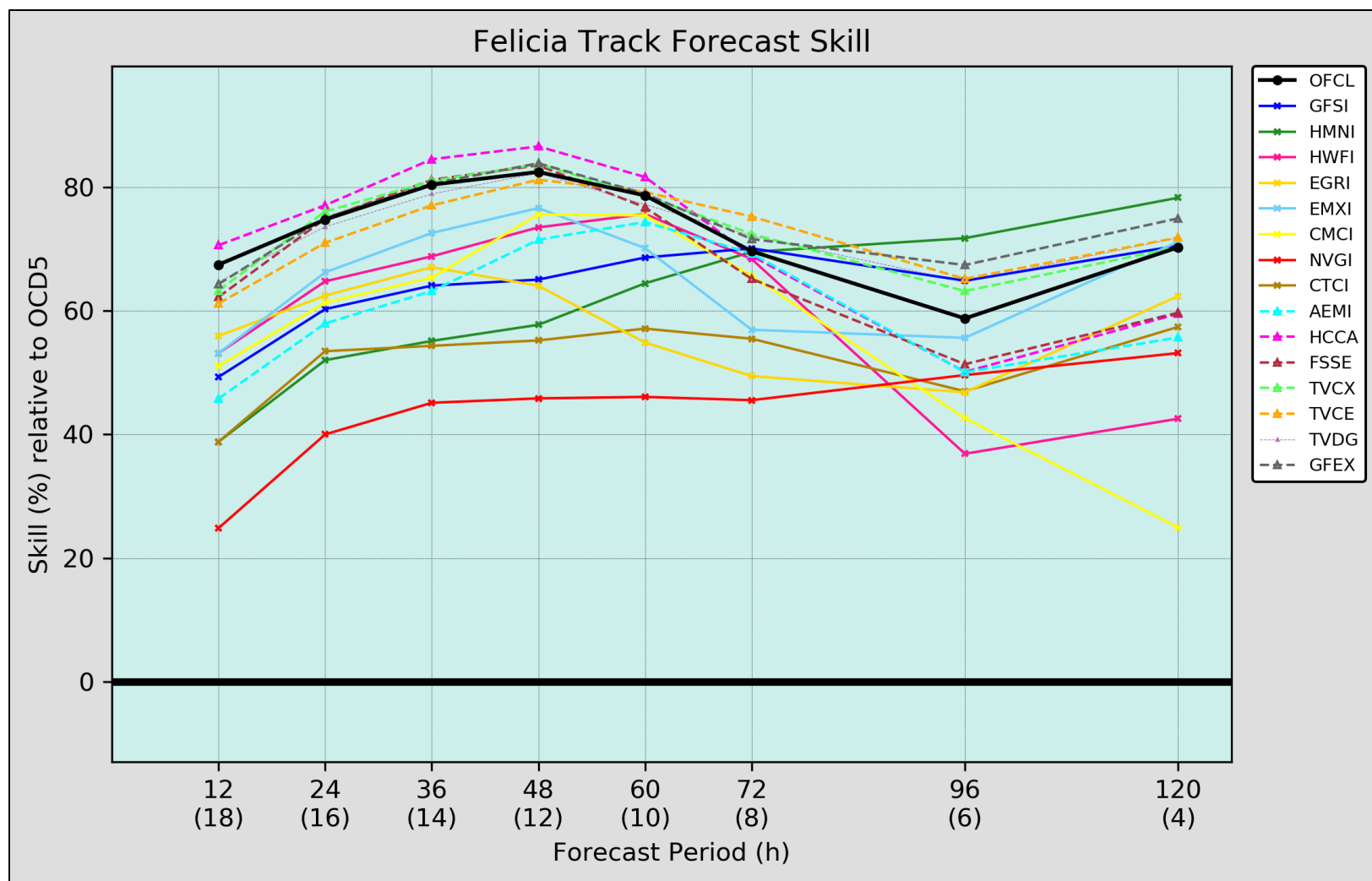


Figure 5. Track forecast skill of the official forecasts and selected models for Hurricane Felicia, 14–20 July 2021.

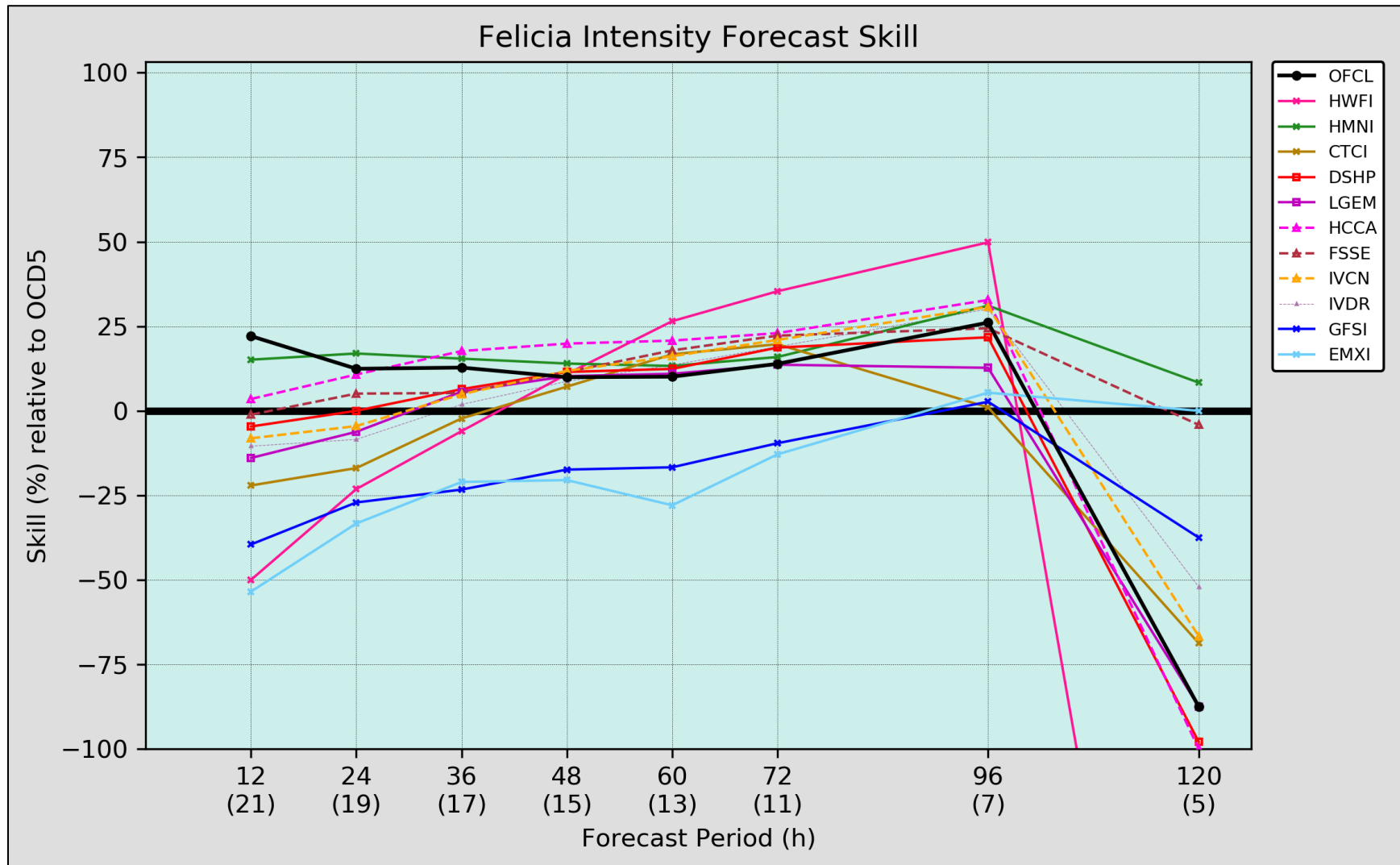


Figure 6. Intensity forecast skill of the official forecasts and selected models for Hurricane Felicia, 14–20 July 2021.