

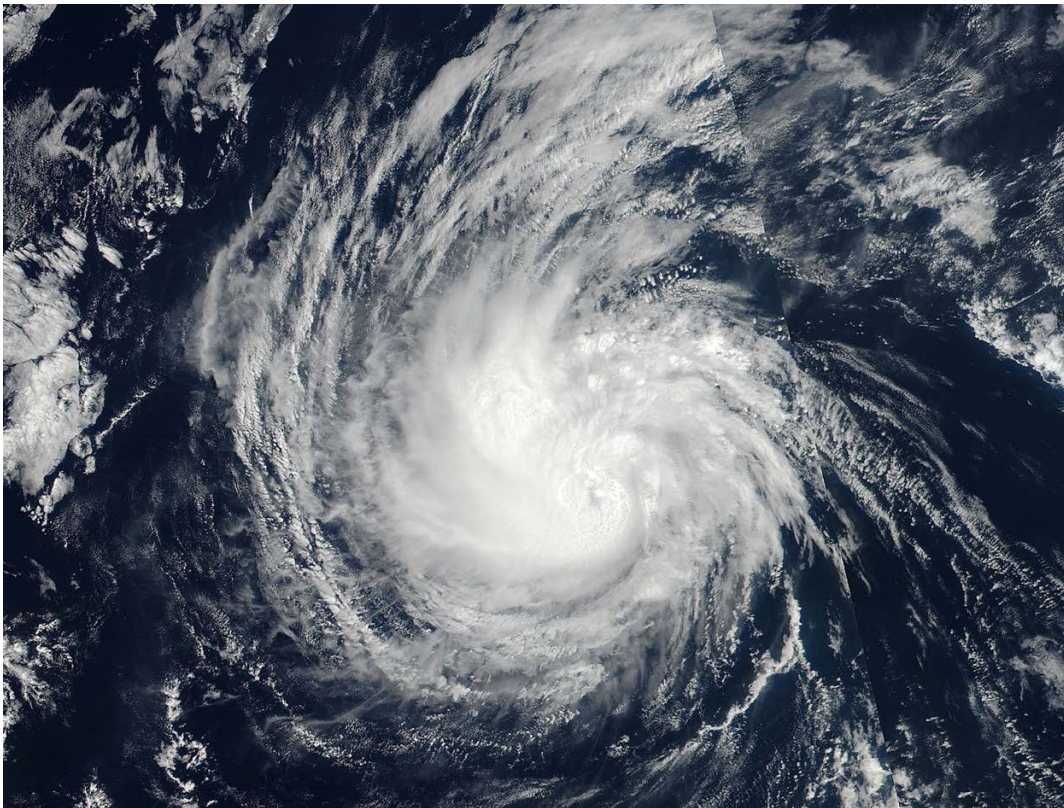


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE IRWIN (EP102017)

22 July – 1 August 2017

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National Hurricane Center
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VIIRS VISIBLE IMAGE OF IRWIN AT PEAK INTENSITY, 2154 UTC 25 JULY 2017

Irwin was a tropical cyclone that persisted over the open waters of the eastern North Pacific for 10 days and was briefly a category 1 hurricane (on the Saffir-Simpson Hurricane Wind Scale).

Hurricane Irwin

22 JULY – 1 AUGUST 2017

SYNOPTIC HISTORY

Irwin developed from a tropical wave that emerged off the west coast of Africa on 8 July (Fig. 1). The wave produced only intermittent convection while crossing the Atlantic and reached the east coast of Central America on 18 July. Convection increased as the wave continued westward across Central America and over the far eastern North Pacific for the next two days, resulting in the formation of a broad low pressure system by 1800 UTC 20 July. Frequent but disorganized pulses of deep convection continued for a couple more days while the low gradually became better defined. Early on 22 July, convection began to organize into bands and the low became well defined, resulting in the formation of a tropical depression around 0600 UTC, about 550 n mi south of the southern tip of the Baja California Peninsula. The “best track” chart of Irwin’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 1¹.

The depression moved generally westward along the southern periphery of a mid-level ridge extending over most of the eastern North Pacific for the first couple of days after genesis. Development of the cyclone was initially limited by moderate northwesterly shear associated with outflow from Tropical Storm Greg to the west. However, early on 23 July, the shear relaxed, allowing convection to redevelop closer to the low-level center, and it is estimated that the cyclone strengthened to tropical storm intensity around 0600 UTC 23 July. The ridge that initially steered Irwin toward the west weakened slightly on 24 July, causing the tropical storm to slow down and turn toward the west-northwest. Meanwhile, the shear remained low for the next 48 h allowing Irwin to steadily strengthen, and it reached hurricane strength around 0000 UTC 25 July and its peak intensity of 80 kt near 1800 UTC that same day, about 700 n mi southwest of the southern tip of the Baja California Peninsula.

To the east of Irwin, Hurricane Hilary had strengthened, and its outflow began to negatively affect Irwin on 26 July. Southerly wind shear quickly increased, causing Irwin to rapidly weaken back to tropical-storm strength. Around the same time, the tropical storm turned toward the west-southwest, steered initially by a low- to mid-level ridge over the central Pacific. Hilary would continue to have an impact on the track and intensity of Irwin for several days thereafter as it passed to the east and north of Irwin. Outflow from Hilary was a significant factor in keeping Irwin’s intensity low in an otherwise favorable environment. The interaction with Hilary also caused Irwin to become nearly stationary early on 28 July and complete a small anticyclonic loop over the subsequent 36 h. On 29 July, a weakness developed in the subtropical ridge, allowing Hilary and Irwin to begin lifting northward in tandem. As Hilary weakened due to cold waters

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 *bt*k directory, while previous years’ data are located in the *archive* directory.

farther north, the shear affecting Irwin relaxed, allowing the tropical storm to reintensify slightly. This trend would be short lived, however, as Irwin reached the same cold waters on 31 July, resulting in a rapid decrease of deep convection and the beginning of a steady weakening trend. Deep convection ceased shortly after 1200 UTC 1 August, and Irwin became a remnant low by 1800 UTC. The remnant low stalled over the open waters of the North Pacific for a couple of days while steadily spinning down until dissipation occurred around 1200 UTC 3 August.

METEOROLOGICAL STATISTICS

Observations in Irwin (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), and objective Advanced Dvorak Technique (ADT) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison (U-W CIMSS). 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 Irwin.

The 80-kt estimated peak intensity at 1800 UTC 25 July and 0000 UTC 26 July is based on a blend of Dvorak satellite-derived intensities from TAFB, SAB, and the UW-CIMSS ADT. An average of the various Dvorak fixes was used to determine the time at which Irwin reached its maximum intensity.

There were no ship reports of tropical-storm-force winds in association with Irwin.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The formation of Irwin was very well forecast. Table 2 provides the number of hours in advance of formation associated with the first NHC Tropical Weather Outlook forecast in each likelihood category. The low pressure system that would become Irwin was first introduced in the Tropical Weather Outlook with a low (<40%) 5-day chance of formation 126 h prior to genesis. The 5-day genesis probability was raised to the medium (40-60%) and high (>60%) categories 90 h and 60 h prior to formation, respectively. The disturbance was given a low 2-day genesis probability about three days prior to genesis, and the probability was increased to high about two days before formation occurred.

A verification of NHC official (OFCL) track forecasts for Irwin is given in Table 3a. Official forecast track errors were near, but generally lower than, the mean official errors for the previous 5-yr period. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Single-model errors were generally much higher than those of the official forecast for Irwin. Nearly all of the global models struggled to accurately capture the interaction of Irwin and Hilary, indicating at various times that the two cyclones would merge (Fig. 5). The dynamical hurricane models HWFI and HMNI also failed to correctly capture the interaction, forecasting instead that the two cyclones wouldn't interact at all, likely because they were unable to properly represent the intensification of Hilary in their parent domains. On the other hand, the simple consensus techniques TVCN and TVCX were fairly successful at forecasting the track of Irwin and were slightly better than OFCL at most forecast periods.

A verification of NHC official intensity forecasts for Irwin is given in Table 4a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period, particularly beyond 48 h. The lack of a substantial change in Irwin's intensity between 27 July and 1 August was a contributing factor in the accuracy of the official intensity forecasts. It is worth noting that OCD5 (climatology and persistence) errors were also very small, at least partially for the same reason, and OCD5 was actually better than OFCL at 96 and 120 h. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The simple consensus, IVCN, and corrected consensus aids HCCA and FSSE were generally the best performing models, except at 96 h and 120 h when OCD5 had the lowest error. The dynamical models HWFI and HMNI both had low errors at 12 h and 24 h, but had much higher errors at longer forecast ranges.

There were no coastal watches or warnings in association with Irwin.



Table 1. Best track for Hurricane Irwin, 22 July – 1 August 2017.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
22 / 0600	14.1	111.7	1006	30	tropical depression
22 / 1200	14.3	112.4	1006	30	"
22 / 1800	14.5	113.2	1006	30	"
23 / 0000	14.6	114.0	1006	30	"
23 / 0600	14.7	114.8	1005	35	tropical storm
23 / 1200	14.8	115.5	1004	35	"
23 / 1800	14.8	116.2	1003	40	"
24 / 0000	14.8	116.7	1001	45	"
24 / 0600	14.8	117.0	999	50	"
24 / 1200	14.9	117.3	996	55	"
24 / 1800	15.0	117.6	993	60	"
25 / 0000	15.2	118.1	990	65	hurricane
25 / 0600	15.4	118.6	986	70	"
25 / 1200	15.6	119.2	983	75	"
25 / 1800	15.8	119.8	979	80	"
26 / 0000	15.9	120.5	979	80	"
26 / 0600	15.8	121.2	987	70	"
26 / 1200	15.6	121.8	994	55	tropical storm
26 / 1800	15.3	122.5	999	50	"
27 / 0000	15.0	123	999	50	"
27 / 0600	14.9	123.5	999	50	"
27 / 1200	14.9	123.9	999	50	"
27 / 1800	14.9	124.2	999	50	"
28 / 0000	14.9	124.4	999	50	"
28 / 0600	14.9	124.6	998	50	"
28 / 1200	14.8	124.7	998	50	"
28 / 1800	14.7	124.7	998	50	"
29 / 0000	14.7	124.6	998	50	"
29 / 0600	14.8	124.5	998	50	"



Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
29 / 1200	15.0	124.4	998	50	"
29 / 1800	15.4	124.4	998	50	"
30 / 0000	16.0	124.5	997	55	"
30 / 0600	16.7	124.7	997	55	"
30 / 1200	17.4	124.9	997	55	"
30 / 1800	18.3	125.4	998	55	"
31 / 0000	19.2	126.0	999	55	"
31 / 0600	20.2	126.5	1000	50	"
31 / 1200	21.2	127.0	1001	50	"
31 / 1800	22.2	127.5	1002	50	"
01 / 0000	23.3	128.0	1004	45	"
01 / 0600	24.4	128.5	1006	45	"
01 / 1200	25.5	129.0	1008	35	"
01 / 1800	26.4	129.5	1008	30	low
02 / 0000	27.3	130.1	1009	30	"
02 / 0600	27.9	130.8	1009	30	"
02 / 1200	28.3	131.4	1010	25	"
02 / 1800	28.4	131.6	1011	20	"
03 / 0000	28.4	131.6	1012	20	"
03 / 0600	28.4	131.6	1013	15	"
03 / 1200	28.4	131.3	1013	15	"
03 / 1800					dissipated
25 / 1800	15.8	119.8	979	80	maximum winds and minimum pressure



Table 2. Number of hours in advance of formation of Irwin 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%)	66	126
Medium (40%-60%)	54	90
High (>60%)	42	60

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Irwin, 22 July – 1 August 2017. 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	20.4	31.8	42.8	55.6	72.6	93.1	120.3
OCD5	37.7	84.5	139.0	196.6	305.0	385.6	481.1
Forecasts	39	37	35	33	29	21	20
OFCL (2012-16)	22.2	33.9	43.8	54.8	80.0	108.9	145.1
OCD5 (2012-16)	35.7	72.0	112.2	150.2	217.0	271.0	340.2

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Irwin, 22 July – 1 August 2017. 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	20.3	31.6	44.1	58.5	76.4	99.9	137.5
OCD5	38.7	87.5	143.0	201.3	282.9	376.3	466.4
GFSI	24.0	37.8	55.8	78.3	95.6	142.3	208.1
HMNI	22.5	39.3	52.2	58.4	79.6	184.6	281.7
HWFI	22.4	36.1	50.3	65.0	80.5	155.9	248.9
EGRI	20.6	35.9	56.9	84.7	144.3	231.4	329.8
EMXI	22.6	36.8	50.2	65.6	105.1	184.1	265.5
CMCI	26.3	45.6	68.9	98.7	209.4	244.6	296.2
NVGI	26.8	49.5	72.1	100.7	147.6	188.4	239.9
AEMI	24.7	40.9	60.6	76.1	96.1	130.1	161.2
HCCA	21.4	35.1	52.7	72.5	97.3	105.3	100.9
FSSE	20.1	32.9	46.3	60.5	66.4	84.9	204.9
GFEX	20.9	33.5	45.5	63.6	95.4	150.6	202.2
TVCX	19.7	30.6	40.4	51.9	70.0	105.1	164.3
TVCN	20.0	29.8	40.6	51.2	64.0	94.2	157.0
TABS	33.0	77.0	127.9	169.5	187.8	202.4	189.5
TABM	27.6	54.9	87.8	117.0	115.9	156.4	221.1
TABD	28.1	50.4	70.4	90.0	110.8	172.5	234.1
Forecasts	36	34	32	30	18	15	13

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Irwin, 22 July – 1 August 2017. 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	5.0	7.2	7.9	9.4	10.2	8.3	6.5
OCD5	6.3	8.9	10.2	11.3	10.2	4.5	4.2
Forecasts	39	37	35	33	29	21	20
OFCL (2012-16)	5.8	9.4	11.8	13.2	15.0	15.7	14.9
OCD5 (2012-16)	7.6	12.2	15.7	18.1	20.6	21.8	20.0

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Irwin, 22 July – 1 August 2017. 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	5.4	7.4	7.9	9.8	8.8	9.4	6.0
OCD5	6.7	9.6	10.8	10.9	7.8	4.9	4.4
GFSI	6.8	8.6	9.7	12.2	13.1	16.0	15.9
HMNI	5.3	6.8	9.6	11.2	16.5	23.0	20.4
HWFI	5.3	6.2	5.1	6.8	14.5	16.3	12.3
HCCA	6.0	7.3	6.1	7.6	9.0	8.7	7.9
FSSE	5.1	6.6	6.6	8.5	8.6	10.1	13.6
DSHP	7.2	9.8	9.8	10.6	9.7	9.8	8.6
LGEM	7.1	10.4	11.6	12.6	11.3	10.4	11.5
IVCN	6.3	8.0	7.4	8.1	6.1	6.5	7.3
ECOI	6.5	7.8	8.5	10.0	11.3	12.3	14.9
Forecasts	35	33	31	30	24	16	10

800–600mb RH & Vort Anomalies (lat=7.5–17.5)

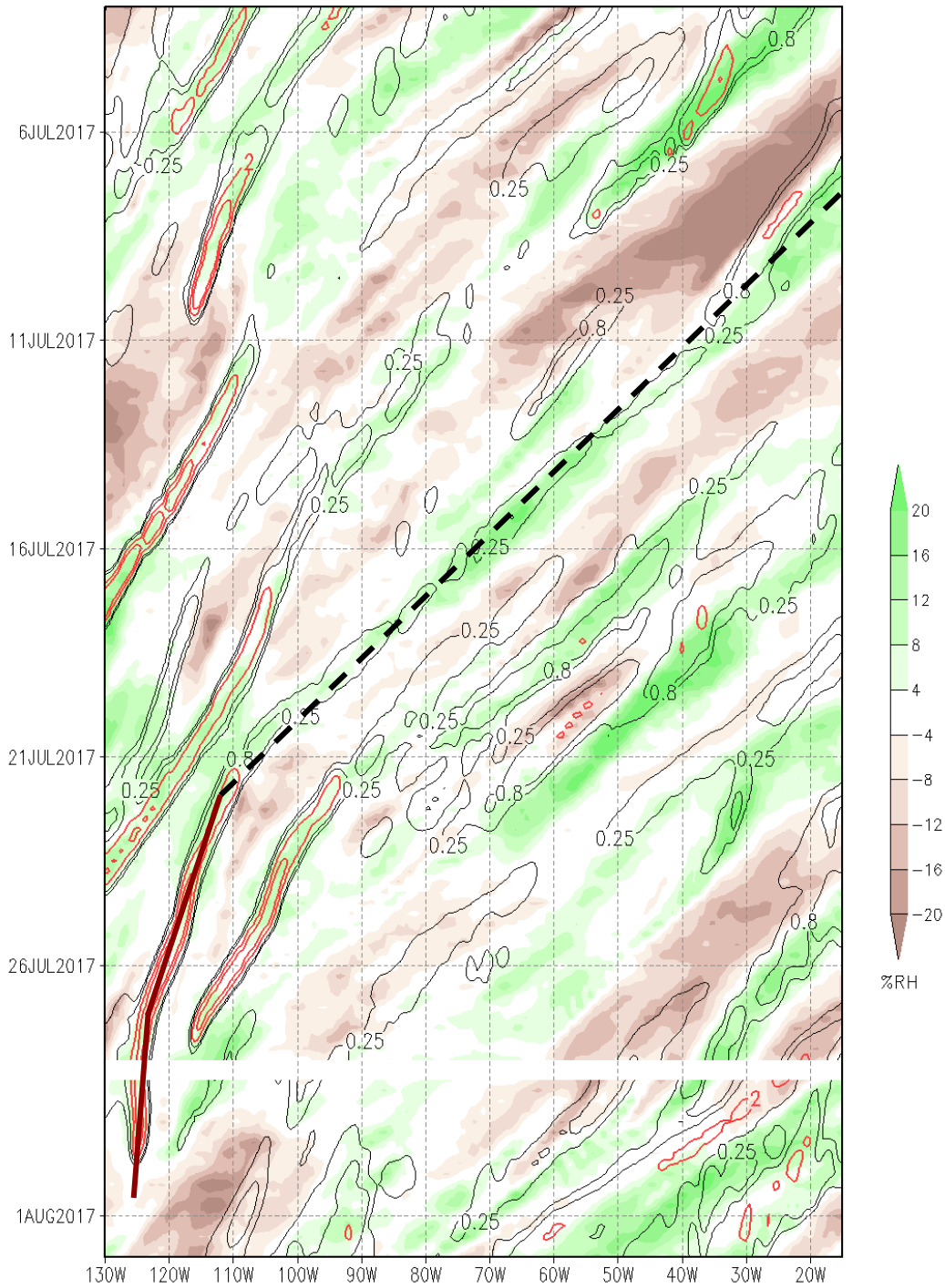


Figure 1. GFS analysis Hovmöller diagram of 800-600 mb relative humidity (shaded) and vorticity anomalies (contours, $\times 10^{-5} \text{ s}^{-1}$) from 7.5°N to 17.5°N and 130°W to 15°W, 4 July – 2 August 2017. The dashed black line approximately traces the axis of the wave from which Irwin developed. The solid dark red line shows the approximate path of Irwin after genesis.

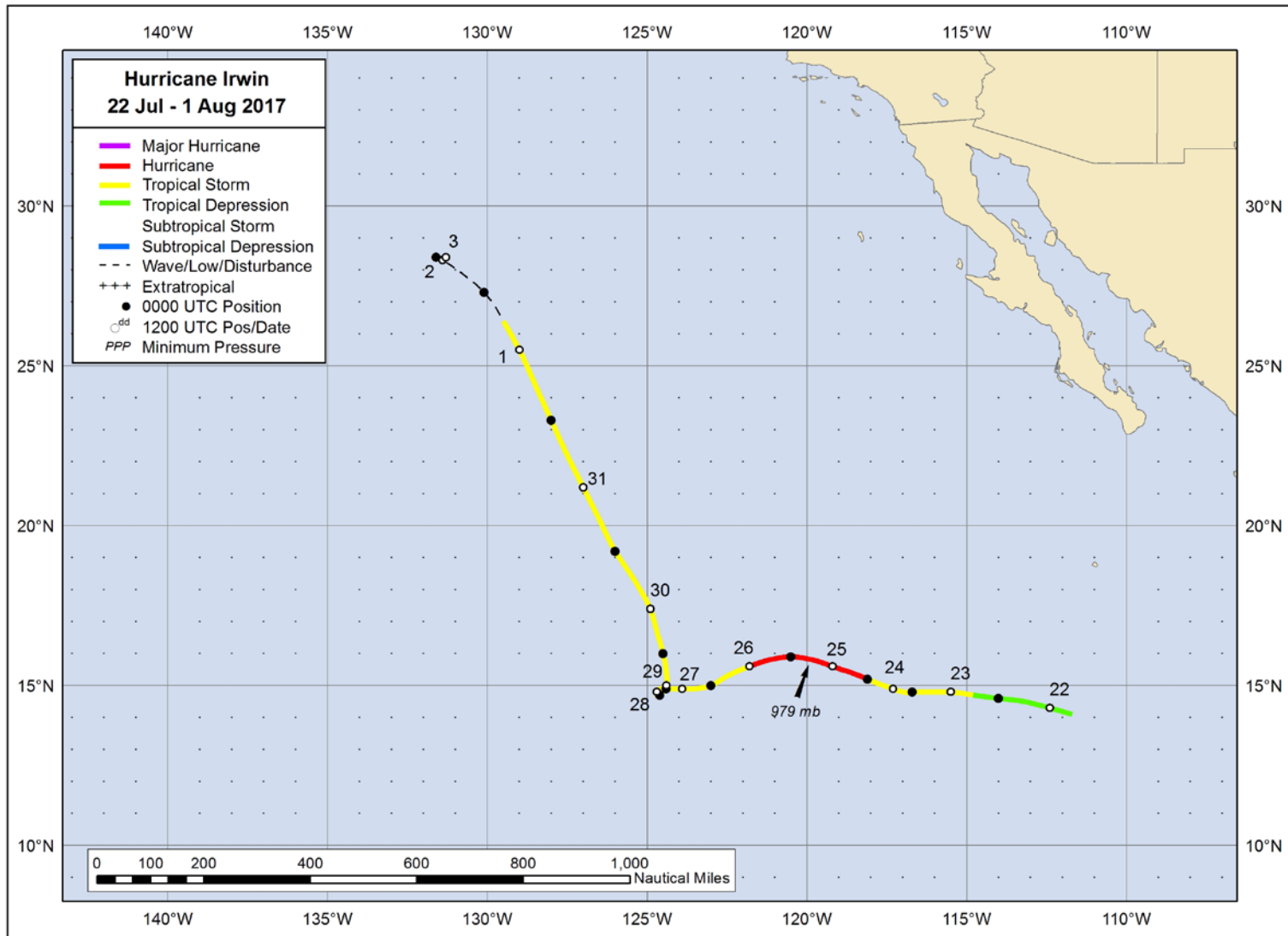


Figure 2. Best track positions for Hurricane Irwin, 22 July – 1 August 2017.

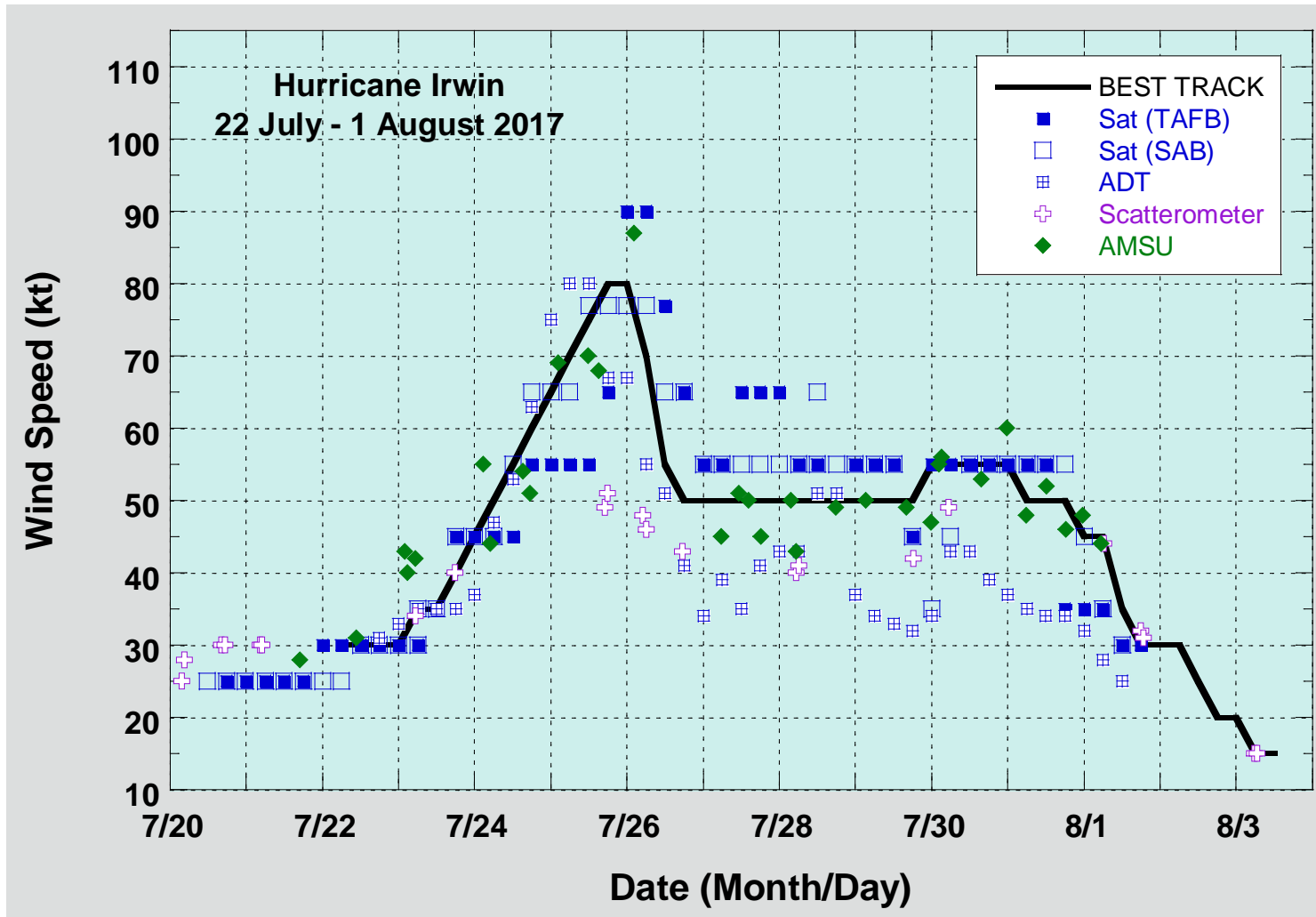


Figure 3. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Irwin, 22 July - 1 August 2017. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

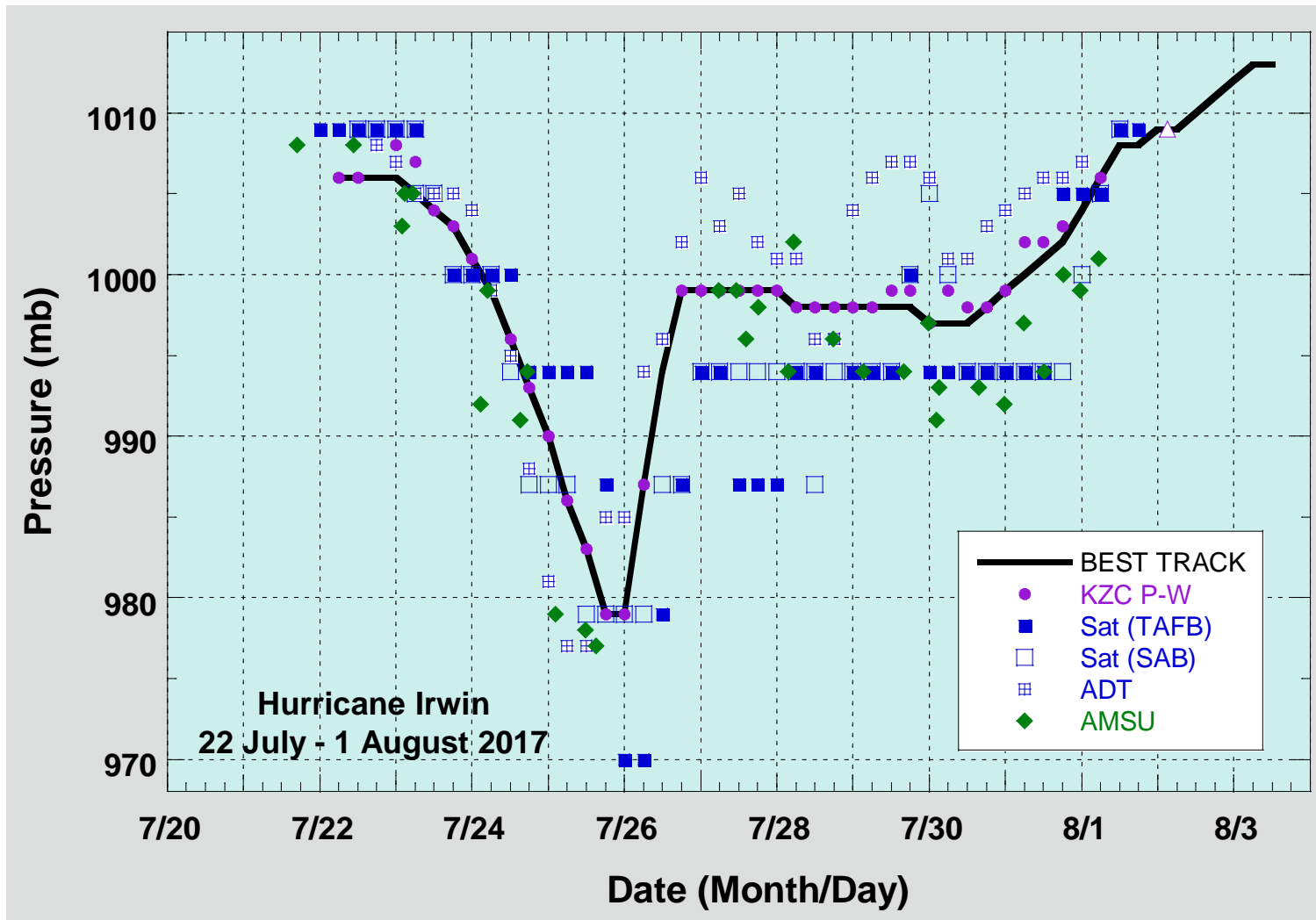


Figure 4. Selected pressure observations and best track minimum central pressure curve for Hurricane Irwin, 22 July - 1 August 2017. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.

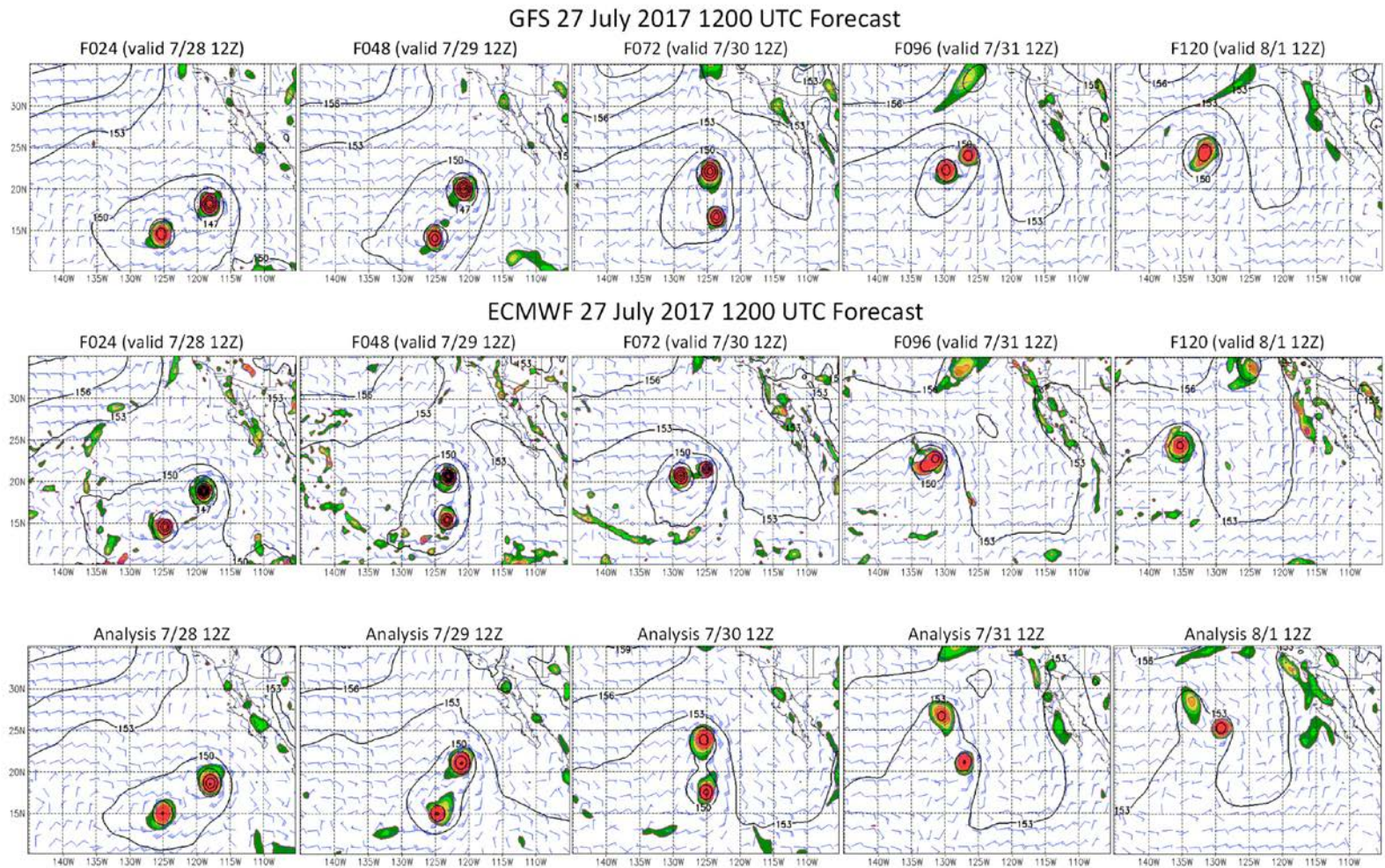


Figure 5. GFS (top row) and ECMWF (middle row) forecast 850-mb relative vorticity (shaded), geopotential height (dm, contours), and winds (kt, barbs), initialized 1200 UTC 27 July 2017. Both models forecast that Hilary and Irwin would merge in 96-120 h. GFS analyses (bottom row) show that the two cyclones never merged in reality, resulting in large model track errors.