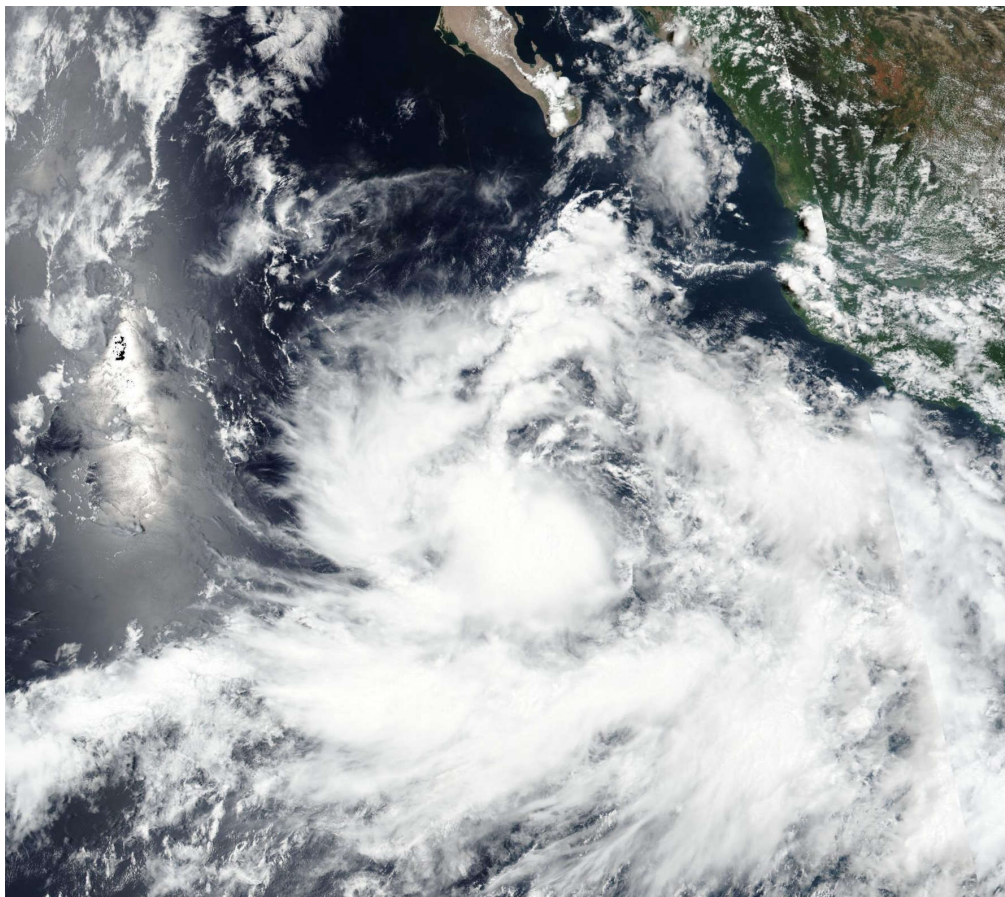# NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM KEVIN
(EP112021)

7 – 12 August 2021

Stacy R. Stewart
National Hurricane Center
2 December 2021

GOES-17 TRUE COLOR VISIBLE SATELLITE IMAGE OF TROPICAL STORM KEVIN AT 1800 UTC 8 AUG 2021, A FEW HOURS AFTER REACHING ITS PEAK INTENSITY SOUTH OF BAJA CALIFORNIA SUR. IMAGE COURTESY OF NOAA/NESDIS/STAR.

Tropical Storm Kevin remained over the open Pacific Ocean and did not directly affect mainland Mexico.

TROPICAL STORM KEVIN

7 – 12 AUGUST 2021

SYNOPTIC HISTORY

Kevin originated from a tropical wave that moved from the Atlantic basin across Central America on 31 July and entered the far eastern North Pacific basin early on 1 August. The broad disturbance, comprised of disorganized showers and thunderstorms, moved generally west-northwestward just south of the coasts of Central America and southern Mexico during the next several days. Deep convection increased and became better organized early on 6 August and scatterometer surface wind data indicated that a small, well-defined low-pressure system had developed about 160 n mi south of Zihuantanejo, Mexico. Deep convection pulsed for the next day or so, but finally became organized enough for the small low to be designated as a tropical depression by 1200 UTC 7 August when it was located about 200 n mi south-southwest of Manzanillo, 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 1[1].

Kevin underwent near-rapid strengthening during the ensuing 24-h period while the cyclone moved west-northwestward through a favorable environment consisting of modest northeasterly 850-200-mb vertical wind shear of around 12 kt, very high mid-level moisture content (700-500-mb relative humidity values >80%), and sea-surface temperatures of at least 29° C. However, that intensification trend was relatively short-lived; 6 h after Kevin reached its peak intensity of 55 kt, a slow but steady weakening trend began that was induced by a sharp increase in the vertical wind shear. By 1200 UTC 9 August, the shear magnitude had increased above 20 kt from an east-northeasterly direction, which displaced the deep convection primarily into the western semicircle. Kevin maintained a west-northwestward motion during this time, remaining well offshore the southwestern coast of Mexico. Kevin weakened to a tropical depression by 0600 UTC 12 August when the cyclone was located about 560 n mi west-southwest of the southern tip of the Baja California peninsula, and degenerated into a remnant low pressure system 6 h later. The remnant low continued on a west-northwestward track on 12-13 August, and then turned northwestward by early 14 August and maintained that motion until just after 1800 UTC 15 August when the system dissipated about 630 n mi west of the northern Baja California peninsula.

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[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.

METEOROLOGICAL STATISTICS

Observations in Kevin (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), and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Kevin.

Ship reports of tropical-storm-force winds associated with Kevin are listed in Table 2. In addition to the ship reports, Kevin passed close to the Mexican islands of Socorro and Clarion. Wind gusts to 30 kt were observed at 1730 UTC and 2030 UTC 9 August on Socorro Island, while on Clarion, tropical-storm-force wind gusts were observed on multiple occasions beginning at 1600 UTC 9 August and ending at 0900 UTC 10 August. The peak gust measured on Clarion Island was 37 kt at 0800 UTC 10 August.

Kevin's estimated peak intensity of 55 kt at 1200 UTC 8 August is based on consensus subjective and objective Dvorak intensity estimates T3.5/55 kt from TAFB, SAB, and the UW-CIMSS ADT with a 2-h lag time due to constraints; however, the ADT adjusted T-number was T3.5 at 1220 UTC (Note: Although Kevin was operationally assessed with a second peak intensity of 45 kt at 1800 UTC 10 August, the 45–47-kt ASCAT winds upon which that assessment was based were deemed unrepresentative of Kevin's tangential winds in post-analysis). The estimated minimum pressure of 994 mb at 1200 UTC 8 August is based on a blend of the Dvorak satellite pressure estimates and the Knaff-Zehr-Courtney pressure-wind relationship.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Tropical Storm Kevin.

FORECAST AND WARNING CRITIQUE

The formation of Kevin was forecast reasonably well in the long term, but genesis in the shorter term was not anticipated very well. Table 3 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 Kevin was first mentioned in the TWO with a low chance (<40%) of formation during the next 5 days 114 h prior to genesis. The 5-day probabilities reached the medium (40-60%) and high categories (>60%) 60 h and 30 h, respectively, prior to Kevin forming. The 2-day genesis probabilities were not impressive, with a

low, medium, and high chances of genesis predicted 30 h, 12 h, and 0 h, respectively, before Kevin developed into a tropical cyclone. The poor 2-day genesis predictions were due to the broad size of the disturbance and uncertainty as to whether the large circulation would be able to contract enough to produce a tropical cyclone.

A verification of NHC official (OFCL) track forecasts for Kevin is given in Table 4a. The official forecast mean track errors were below the 5-yr means at the 24-, 36-, and 48-h forecast times, and were near the 5-yr means at 60, 72, and 96 h. However, OCD5 errors were also below their 5-yr means, indicating that Kevin's track was easier to predict than average. A homogeneous comparison of the official track errors with selected guidance models is given in Table 4b. OFCL track forecasts were better than or comparable to the model guidance at the 12-, 24-, and 36-h forecast periods, but were bested by most of the model guidance at 48, 60, 72, and 96 h. The best performing track models were the NOAA HFIP Corrected Consensus Approach (HCCA) model, which outperformed OFCL at all forecast times, and the simple-consensus models TVCX and GFEX (GFS-ECMWF average). Surprisingly, the poorest performers for Kevin were the high-resolution regional models HWFI (interpolated HWRF) and HMNI (interpolated HMON), which are specifically designed for tropical cyclone forecasting.

A verification of NHC official intensity forecasts for Kevin is given in Table 5a, with intensity forecast skill depicted in Figure 4. The official NHC intensity forecasts were only slightly better than the 5-yr means at 12 and 24 h, but were noticeably worse than average at the 24- through 96-h forecast periods. In addition, OFCL intensity errors were also larger than the OCD5 climatology errors, an indication that the official NHC intensity forecasts were not skillful (Fig. 4). The reason for the poor OFCL performance was that the first eight intensity predictions called for Kevin to strengthen into a 70-75-kt hurricane, largely based on the NOAA HCCA intensity model. In contrast to its sterling forecast track performance, the HCCA model actually produced negative-skill intensity forecasts at 24, 36, and 48 h, which negatively affected the OFCL intensity forecasts. Not surprisingly, OFCL intensity forecasts were bested by most of the available intensity guidance, with the best performers being the GFS (GFSI), ECMWF (EMXI), and Canadian (CMCI) global models.

No coastal watches and warnings were required for Kevin.

ACKNOWLEDGEMENTS

Table 1.   Best track for Tropical Storm Kevin, 7 – 12 August 2021.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
06 / 1200	15.0	101.9	1009	25	low
06 / 1800	15.2	102.7	1009	25	"
07 / 0000	15.4	103.5	1009	25	"
07 / 0600	15.5	104.3	1008	30	"
07 / 1200	15.6	105.2	1007	30	tropical depression
07 / 1800	15.6	106.1	1005	35	tropical storm
08 / 0000	15.6	107.0	1003	40	"
08 / 0600	15.6	107.8	1001	45	"
08 / 1200	15.7	108.6	994	55	"
08 / 1800	15.7	109.4	996	50	"
09 / 0000	15.9	110.0	997	50	"
09 / 0600	16.1	110.6	1001	45	"
09 / 1200	16.7	111.0	1001	45	"
09 / 1800	16.9	111.7	1002	40	"
10 / 0000	17.3	112.7	1003	40	"
10 / 0600	17.9	113.5	1003	40	"
10 / 1200	18.3	114.3	1003	40	"
10 / 1800	18.7	114.9	1003	40	"
11 / 0000	19.2	115.4	1003	40	"
11 / 0600	19.8	115.8	1003	40	"
11 / 1200	20.6	116.5	1003	40	"
11 / 1800	21.1	117.1	1004	35	"
12 / 0000	21.6	117.8	1005	35	"
12 / 0600	22.2	118.8	1007	30	tropical depression
12 / 1200	22.8	119.9	1008	25	low
12 / 1800	23.2	121.1	1008	25	"
13 / 0000	23.7	122.3	1008	25	"
13 / 0600	24.1	123.4	1008	25	"
13 / 1200	24.8	124.7	1008	25	"
13 / 1800	25.5	125.7	1008	25	"
14 / 0000	26.5	126.8	1008	25	"
14 / 0600	27.5	127.7	1009	20	"
14 / 1200	28.6	128.4	1009	20	"
14 / 1800	29.5	128.8	1009	20	"
15 / 0000	30.3	129.1	1009	20	"
15 / 0600	30.7	129.1	1010	15	"
15 / 1200	30.8	128.8	1010	15	"

15 / 1800	30.8	128.6	1010	15	"
16 / 0000					dissipated
08 / 1200	15.7	108.6	994	55	maximum wind and minimum pressure

Table 2.   Selected ship reports with winds of at least 34 kt for Tropical Storm Kevin, 7 – 12 August 2021.

Date/Time (UTC)	Ship call sign	Latitude °N	Longitude °W	Wind dir/speed (kt)	Pressure (mb)
08 / 0500	9V3710	19.2	105.1	330 / 38	1012.0
09 / 2000	VROD3	21.8	109.8	320 / 48	1012.0
10 / 0000	VROD3	21.2	108.7	320 / 35	1011.0
10 / 0500	VROD3	20.4	107.5	020 / 42	1011.0
10 / 0600	VROD3	20.2	107.3	030 / 36	1012.0
10 / 0600	VROD3	20.2	107.2	030 / 40	1013.0
10 / 0600	VROD3	20.3	107.4	030 / 42	1012.0
10 / 0700	VROD3	20.1	107.1	030 / 39	1013.0
10 / 0700	VROD3	20.1	107.0	020 / 35	1013.0
10 / 0800	VROD3	19.9	106.9	030 / 36	1013.0

Table 3.   Number of hours in advance of formation of Kevin 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%)	30	114
Medium (40%-60%)	12	60
High (>60%)	0	30

Table 4a.   NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Kevin, 7 – 12 August 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	21.5	**21.1**	**29.6**	**42.9**	**63.5**	76.1	**82.3**	
OCD5	35.9	59.3	84.3	114.3	141.5	168.3	195.8	
Forecasts	18	16	14	12	10	8	4	
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 4b.   Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Kevin, 7 – 12 August 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	18.9	19.8	30.1	44.6	70.7	85.2	95.2	
OCD5	35.7	60.3	90.8	118.3	154.3	189.3	251.8	
GFSI	24.2	27.7	**29.3**	**34.2**	**44.4**	**56.1**	**57.7**	
EMXI	26.0	28.2	33.3	48.0	**67.8**	**78.7**	106.0	
CMCI	33.9	57.0	70.8	88.6	92.9	98.4	106.4	
NVGI	31.3	46.7	54.9	60.4	79.8	91.8	136.5	
AEMI	25.2	31.4	31.5	**37.8**	**58.8**	**70.0**	**95.0**	
HWFI	23.4	36.1	49.1	59.9	103.9	132.2	175.5	
HMNI	30.6	34.5	39.2	67.5	112.7	156.3	243.1	
CTCI	22.7	40.4	41.9	**35.1**	**38.5**	**67.9**	145.9	
HCCA	**18.2**	**18.6**	**21.4**	**35.0**	**60.9**	**75.8**	**88.9**	
FSSE	21.4	20.1	**22.4**	**27.5**	**52.9**	**81.7**	110.1	
TVCX	**17.2**	**18.4**	**23.3**	**38.8**	**65.9**	87.4	123.2	
GFEX	21.9	21.6	**18.6**	**31.0**	**52.6**	**66.5**	**76.1**	
TVCA	**15.4**	**17.1**	**21.7**	**38.1**	**64.5**	91.8	129.2	
TVCE	**16.0**	**17.6**	**23.7**	**41.2**	72.1	99.1	148.1	
TVDG	**18.3**	**17.2**	**24.0**	**41.3**	**68.3**	90.6	117.7	
TABD	30.5	41.1	57.7	64.1	88.1	95.3	**91.6**	
TABM	24.5	38.7	46.4	**37.1**	**37.1**	**79.7**	96.1	
TABS	36.2	80.7	105.9	113.5	112.6	144.1	155.9	
Forecasts	12	11	10	9	7	5	2	

Table 5a.   NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Kevin, 7 – 12 August 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	**3.6**	**8.1**	13.2	19.2	23.5	25.0	26.2	
OCD5	5.2	8.4	12.5	16.7	22.1	23.6	23.0	
Forecasts	18	16	14	12	10	8	4	
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 5b.   Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Kevin, 7 – 12 August 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 5a due to the homogeneity requirement.

| Model ID	Forecast Period (h)							
	12	24	36	48	60	72	96	120
OFCL	5.0	8.6	13.0	16.7	20.0	22.0	25.0	
OCD5	6.2	8.8	13.3	**16.2**	22.4	25.2	28.0	
GFSI	6.1	**6.9**	**6.8**	**7.2**	**7.7**	**7.0**	**3.5**	
EMXI	5.2	**5.8**	**4.0**	**3.0**	**1.9**	**2.2**	**4.5**	
CMCI	5.8	**5.8**	**7.1**	**8.4**	**10.7**	**11.2**	**8.5**	
NVGI	12.2	21.1	28.0	32.2	35.7	32.8	29.5	
HWFI	6.7	**7.5**	**10.3**	**13.7**	**19.9**	25.0	35.5	
HMNI	7.0	**6.5**	**8.9**	**13.0**	**17.3**	**20.8**	32.5	
CTCI	6.3	**6.8**	**10.0**	**14.3**	**19.6**	25.0	26.5	
AEMI	**4.6**	**4.5**	**6.0**	**7.9**	**10.6**	**16.2**	26.5	
HCCA	6.1	10.2	14.1	16.7	**17.7**	**17.8**	**18.0**	
FSSE	5.2	9.5	13.1	**16.2**	22.3	26.6	29.5	
DSHP	**4.4**	9.8	15.0	18.9	22.1	25.8	**21.5**	
LGEM	5.0	**7.5**	**10.1**	**11.8**	**11.3**	**12.2**	**10.0**	
ICON	5.3	**7.2**	**11.0**	**14.3**	**17.4**	**21.0**	25.0	
IVCN	5.2	**6.9**	**10.8**	**14.2**	**18.0**	**21.8**	25.5	
IVDR	5.5	**6.5**	**10.0**	**13.3**	**17.3**	**20.8**	25.0	
Forecasts	12	11	10	9	7	5	2	
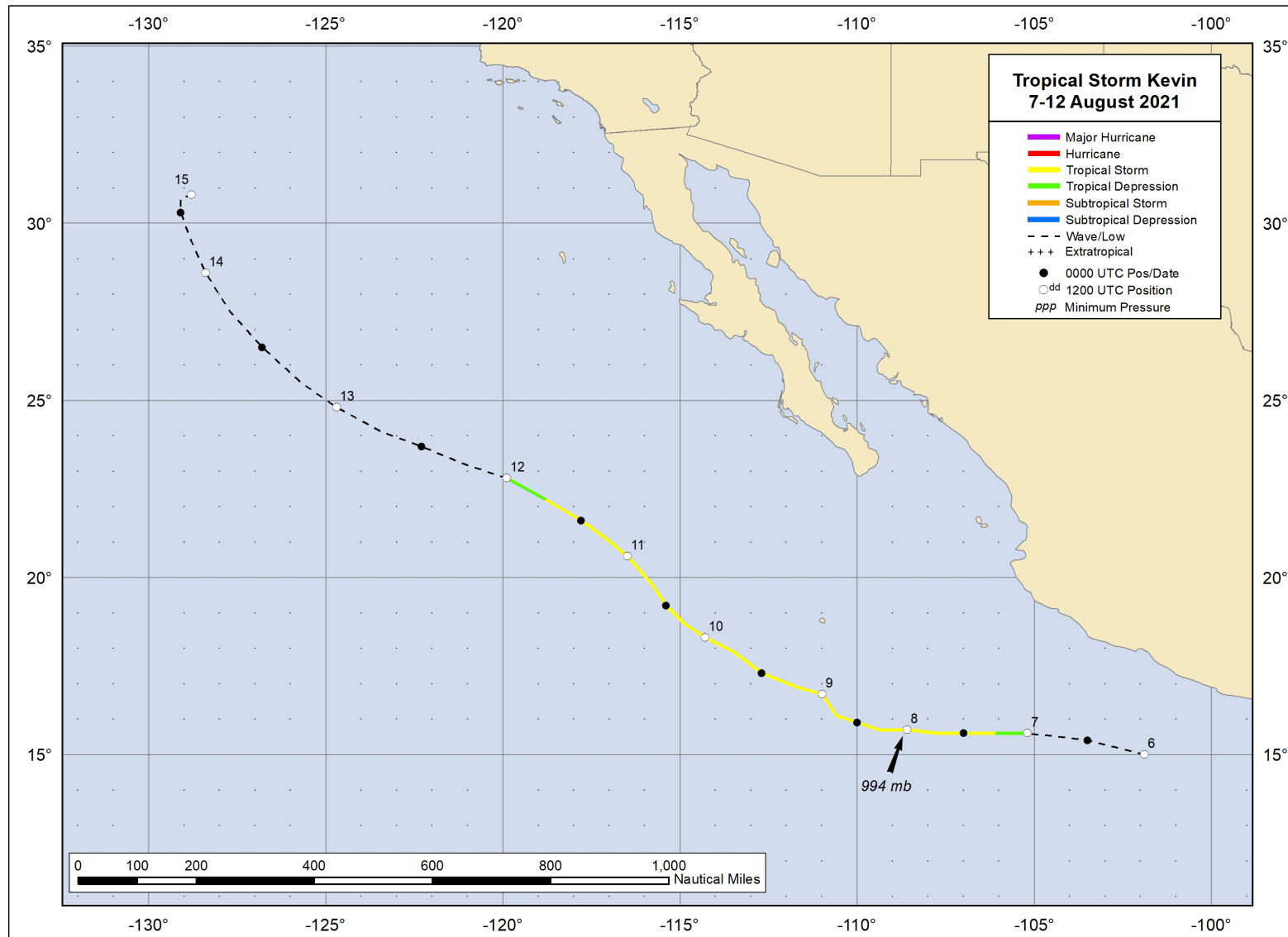
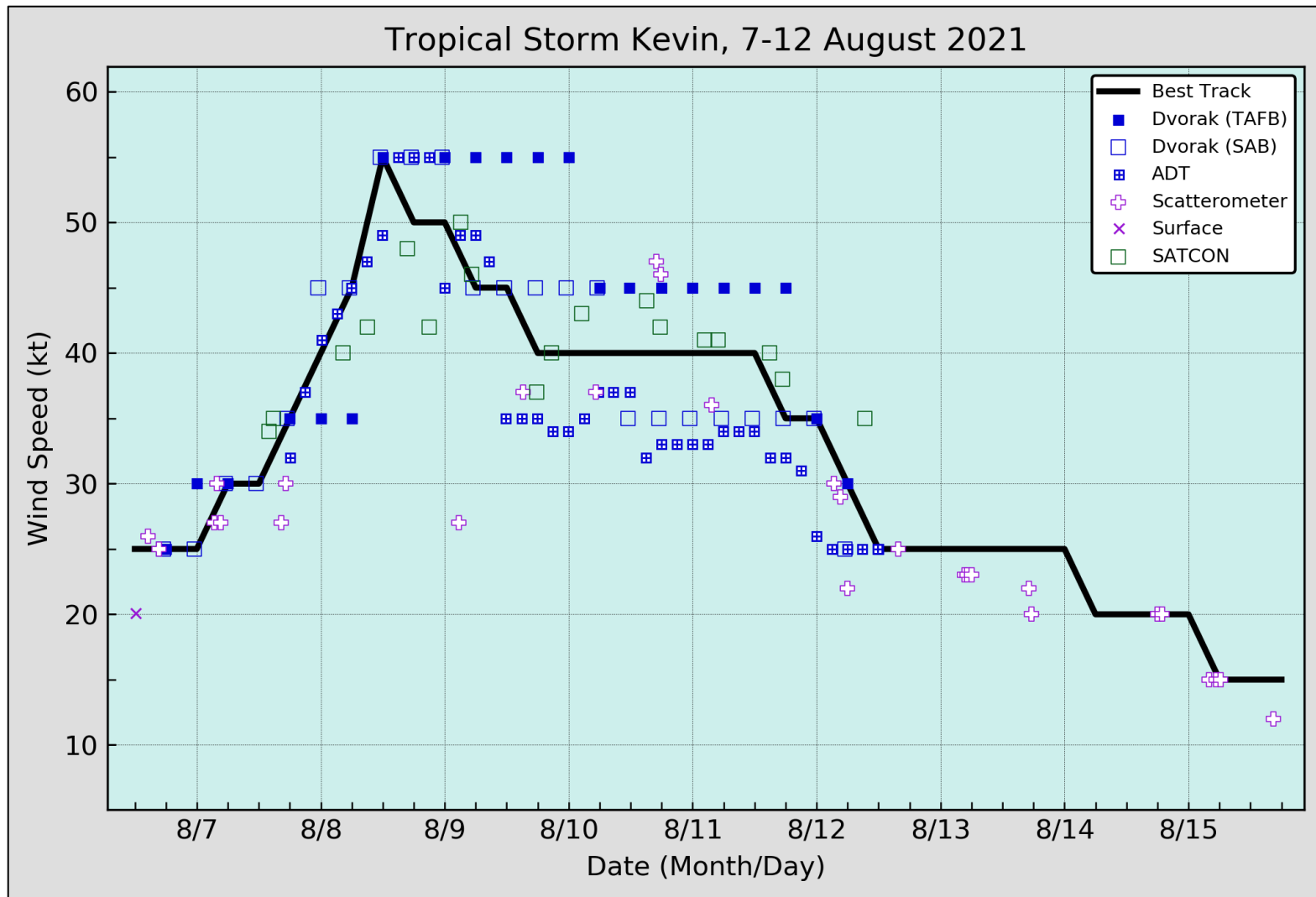Figure 1.   Best track positions for Tropical Storm Kevin, 7 – 12 August 2021.

Figure 2.   Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Kevin, 7 – 12 August 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.
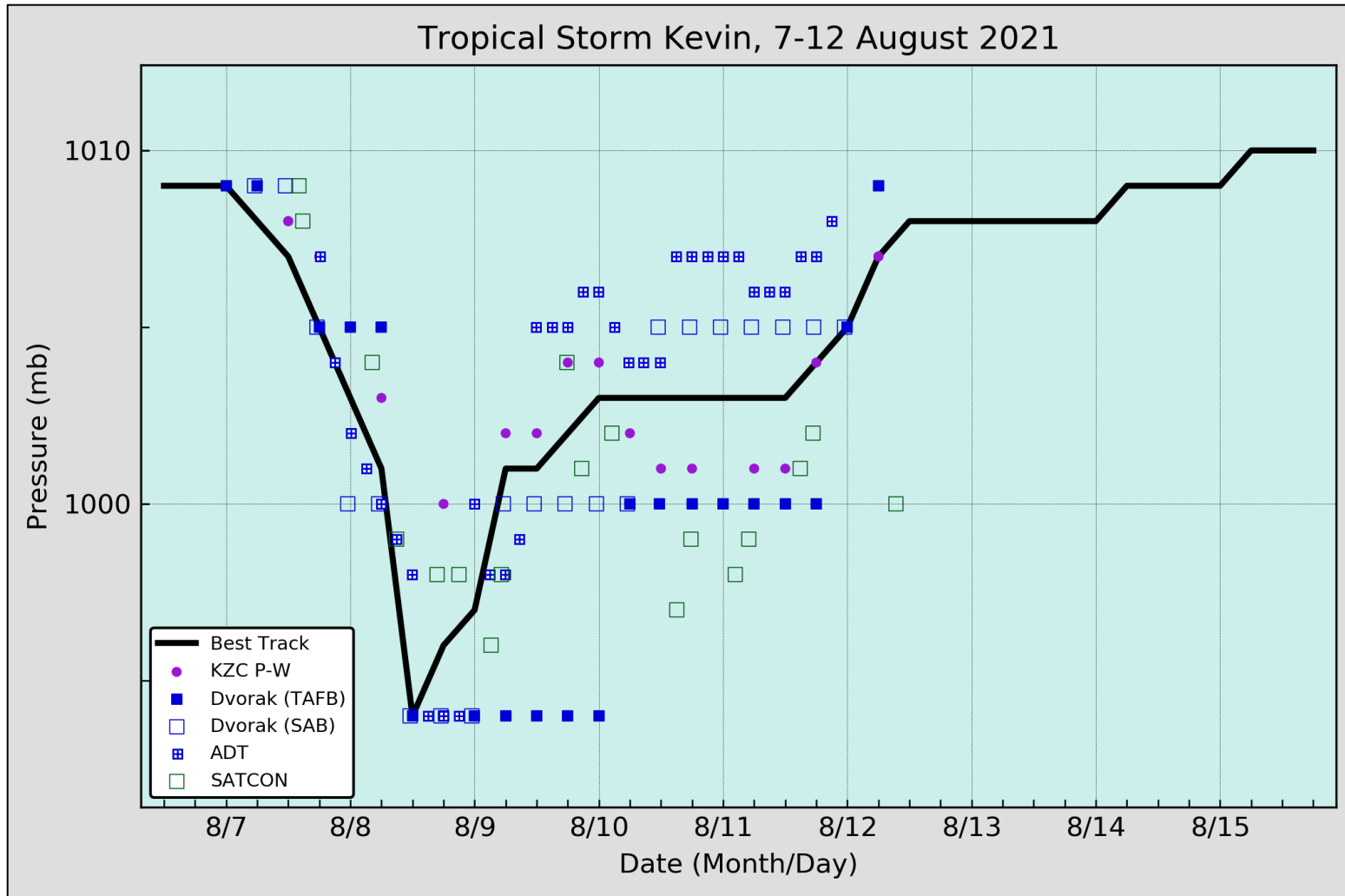
Figure 3.   Selected pressure observations and best track minimum central pressure curve for Tropical Storm Kevin, 7 – 12 August 2021. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.
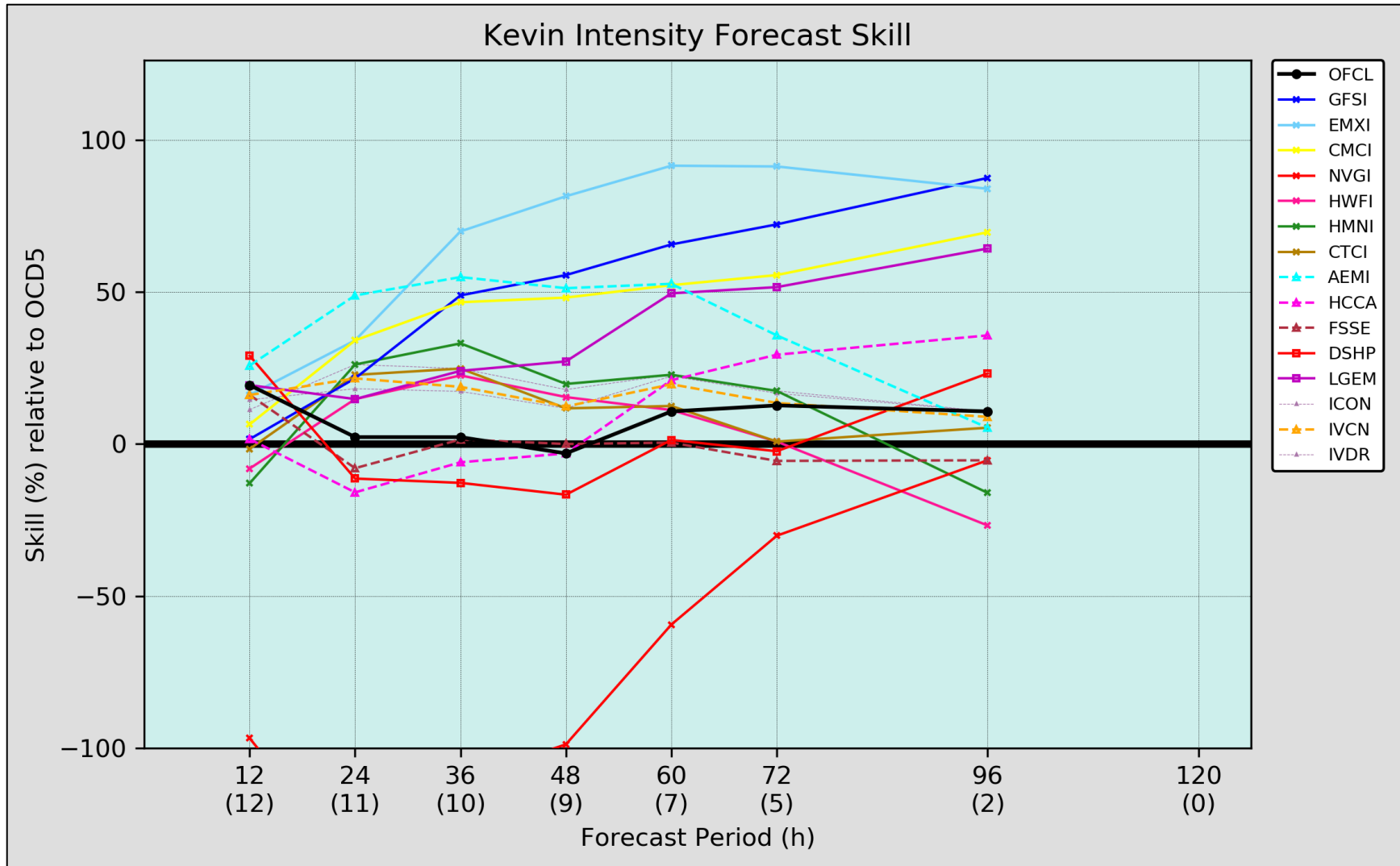
Figure 4.   Intensity forecast skill plot for Tropical Storm Kevin, 7 – 12 August 2021. The thin black line depicts OFCL skill.