NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM GREG

(EP072017)

17–26 July 2017

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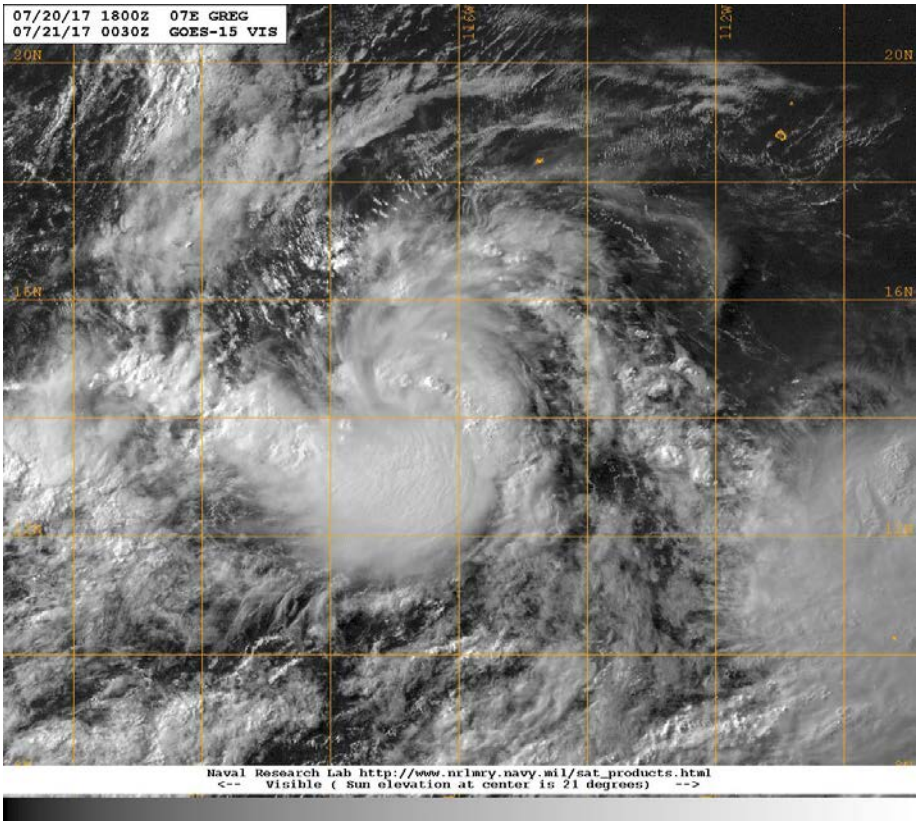

GOES-15 VISIBLE SATELLITE IMAGE OF TROPICAL STORM GREG NEAR ITS ESTIMATED MAXIMUM INTENSITY OF 50 KT AT 0030 UTC 21 JULY 2017. IMAGE COURTESY OF NAVAL RESEARCH LABORATORY.

Greg was a tropical storm that moved generally westward over the open waters of the east Pacific, with little change in strength, for much of its lifetime.

Tropical Storm Greg

17–26 JULY 2017

SYNOPTIC HISTORY

The origin of Greg can be traced back to a tropical wave that moved off the coast of Africa on 1 July. This wave spawned Tropical Depression Four over the tropical Atlantic, which dissipated prior to reaching the Leeward Islands. The wave continued westward and entered the Caribbean Sea on 9 July. It then crossed Central America and entered the eastern North Pacific Ocean on 13 July. Deep convection associated with the system increased while it moved near the Gulf of Tehuantepec on 14 July. As the area of disturbed weather moved west-northwestward to westward over the next couple of days, the cloudiness and thunderstorms gradually became a little better organized, with some evidence of banding features over the eastern and southern portions of the system. By 1200 UTC 17 July, the low-level circulation became well defined, marking the formation of a tropical depression centered about 300 n mi south 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].

Over the next few days, the tropical cyclone moved generally westward to the south of a large mid-tropospheric subtropical ridge that extended westward from the central United States over the east Pacific. Moderate, initially northwesterly vertical shear allowed for only slow strengthening, and the system became a tropical storm by 1200 UTC 18 July while centered about 350 n mi south-southwest of Manzanillo. For the next couple of days, Greg's intensity fluctuated between 35 and 40 kt. Environmental conditions remained only marginal for strengthening with persistent moderate shear and some dry air, and the storm was only able to strengthen to about 50 kt early on 21 July. Although the shear diminished over the next few days, the continued presence of dry air prevented any more intensification. Greg's core convection fluctuated considerably over the next several days while the system continued to move westward. By 24 July, the cyclone's convective structure deteriorated and, in response, a slow weakening trend began. Greg decayed to a tropical depression while turning toward the northwest, and it entered the central North Pacific basin on 26 July. Southwesterly shear over the cyclone became stronger while it moved over increasingly cooler waters. The system soon degenerated into a remnant low that turned westward and west-southwestward before opening up into a trough after 0600 UTC 27 July, well to the east-southeast of the Hawaiian Islands.

[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 Greg (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 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 Greg.

The estimated 50-kt maximum intensity of the storm around 0600 UTC 21 July is based on a blend of subjective and objective Dvorak estimates along with microwave imagery that showed a partial eyewall-like feature around that time. Otherwise, the Dvorak estimates from 19 to 24 July suggested little change in strength over that period.

There were no ship reports of winds of tropical storm force associated with Greg.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

Greg's genesis was well anticipated, especially in the long term (Table 2). It was first mentioned in the Tropical Weather Outlook (TWO) that an area of low pressure was expected to form a few hundred miles to the south of Mexico 114 h prior to formation, and the 120-h genesis probability was set to "low" (<40%). The 5-day probability was raised to a medium (40%-60%) chance 84 h before genesis and to a high (>60%) chance only 36 h prior to genesis. A 2-day genesis probability for the system was first introduced into the TWO 66 h before genesis, in the low category. The 2-day probability was raised to the medium category 48 h prior to genesis, and to high just 12 h before tropical cyclone formation.

A verification of NHC official track forecasts for Greg is given in Table 3a. Official forecast track errors were higher than the mean official errors for the previous 5-yr period at all forecast intervals, particularly at the 72 h and 96 h intervals. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The ECMWF (EMXI) and UKMET (EGRI) global models were the most successful individual models for track forecasting during Greg. The GFS (GFSI) on the other hand had very high errors, nearly double that of the official forecast at 96 h and 120 h. The HFIP Corrected Consensus Approach (HCCA) was the best consensus aid, with errors lower than the official forecast through 72 h.

A verification of NHC official intensity forecasts for Greg is given in Table 4a. The official intensity forecasts were good overall, with average errors lower than the mean official errors for the previous 5-yr period at all forecast periods. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The statistical-dynamical guidance (DSHP and LGEM) was best overall, while the dynamical guidance generally struggled, especially for forecast periods beyond 36 h. The one notable exception to this was the ECMWF (ECOI) which had errors nearly equal to or lower than the official forecast through 96 h. LGEM was better than the official forecast at all forecast periods after 12 h, while DSHP was superior to the official forecast at 36 h and beyond. COAMPS-TC (CTCI) was the best model at 12 h, but its errors quickly grew, resulting in the highest errors at 120 h. The high errors of the dynamical guidance were related to a high bias in the intensity forecast from those models (Fig. 4). By comparison, the statistical-dynamical models had less bias and lower overall error. The high intensity bias also likely contributed to the relatively large track error. Nearly all of the dynamical models had a northerly track bias since a stronger and deeper cyclone would have responded more to the upper-level southerly winds and moved farther north.

Due to the very short period that Greg was a tropical cyclone in the central Pacific basin, track and intensity verifications are not available for forecasts issued by the Central Pacific Hurricane Center.

No coastal watches or warnings were required for Greg.

Table 1. Best track for Tropical Storm Greg, 17–26 July 2017.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
17 / 1200	14.1	105.0	1008	30	tropical depression
17 / 1800	14.1	105.7	1007	30	"
18 / 0000	14.2	106.4	1007	30	"
18 / 0600	14.4	107.1	1007	30	"
18 / 1200	14.5	107.9	1006	35	tropical storm
18 / 1800	14.5	108.7	1006	35	"
19 / 0000	14.4	109.6	1006	35	"
19 / 0600	14.2	110.5	1006	35	"
19 / 1200	14.1	111.4	1005	40	"
19 / 1800	14.0	112.3	1005	40	"
20 / 0000	14.0	113.3	1006	35	"
20 / 0600	14.0	114.3	1006	35	"
20 / 1200	14.0	115.2	1005	40	"
20 / 1800	14.1	116.1	1003	45	"
21 / 0000	14.2	117.0	1000	50	"
21 / 0600	14.3	117.9	1000	50	"
21 / 1200	14.5	119.0	1001	45	"
21 / 1800	14.7	120.1	1001	45	"
22 / 0000	14.9	121.2	1001	45	"
22 / 0600	15.0	122.3	1001	45	"
22 / 1200	15.0	123.5	1001	45	"
22 / 1800	14.9	124.7	1001	45	"
23 / 0000	14.7	125.9	1001	45	"
23 / 0600	14.4	127.2	1001	45	"
23 / 1200	14.3	128.4	1001	45	"
23 / 1800	14.3	129.6	1001	45	"
24 / 0000	14.3	130.7	1001	45	"
24 / 0600	14.3	131.8	1003	40	"
24 / 1200	14.3	132.8	1003	40	"
24 / 1800	14.4	133.8	1003	40	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
25 / 0000	14.6	134.8	1003	40	"
25 / 0600	14.9	135.8	1003	40	"
25 / 1200	15.3	136.7	1005	35	"
25 / 1800	15.9	137.6	1005	35	"
26 / 0000	16.8	138.3	1006	30	tropical depression
26 / 0600	17.5	139.3	1007	30	"
26 / 1200	18.0	140.5	1008	25	"
26 / 1800	18.3	141.6	1008	25	low
27 / 0000	18.1	142.6	1009	25	"
27 / 0600	17.7	143.6	1009	25	"
27 / 1200					dissipated
21 / 0000	14.2	117.0	1000	50	maximum wind 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%)	66	114
Medium (40%-60%)	48	84
High (>60%)	12	36

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Greg, 17–26 July 2017. Mean errors for the previous 5-yr period are shown for comparison. Official errors were larger than the 5-yr means at all forecast periods.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	26.3	43.5	60.2	79.9	132.9	154.6	150.7
OCD5	28.4	54.2	84.8	113.2	172.6	232.1	327.7
Forecasts	35	33	31	29	25	21	17
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 Tropical Storm Greg, 17–26 July 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	24.5	40.6	57.0	72.3	132.3	146.8	151.6
OCD5	28.3	57.3	88.3	114.2	187.4	222.2	254.3
GFSI	34.2	54.8	77.7	99.5	186.0	257.8	294.5
EGRI	**24.1**	**40.1**	**53.3**	**62.0**	**81.5**	**87.5**	**125.3**
EMXI	**22.9**	**36.9**	**55.1**	**68.5**	**115.7**	**128.0**	**140.1**
CMCI	38.9	66.3	99.3	141.4	194.7	190.2	183.1
NVGI	35.7	72.7	110.4	146.0	244.0	291.1	307.7
AEMI	29.7	47.9	68.5	84.2	149.7	204.7	233.1
CTCI	32.3	52.6	75.5	102.2	192.4	252.0	293.8
HMNI	32.8	51.2	72.7	102.5	176.5	257.6	376.8
HWFI	35.1	54.8	73.1	90.3	177.4	259.3	346.6
HCCA	**23.2**	**37.9**	**53.5**	**63.7**	**117.1**	157.9	194.6
FSSE	26.7	42.9	62.5	80.3	144.9	195.3	244.3
TVCX	26.1	42.3	58.4	**70.4**	134.9	166.6	185.1
GFEX	26.1	44.1	63.8	78.0	144.2	179.6	199.4
TVCN	27.2	42.9	59.5	73.0	138.6	178.4	197.0
TABS	31.2	65.1	98.9	124.1	183.2	248.0	282.9
TABM	30.7	61.0	87.8	96.6	184.5	279.4	262.7
TABD	32.8	74.0	119.7	142.5	203.5	279.6	354.6
Forecasts	20	19	18	16	14	11	7

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Greg, 17–26 July 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	**3.3**	**5.9**	**7.9**	**9.3**	**10.6**	**11.9**	**14.7**
OCD5	4.1	6.4	8.1	9.3	12.7	14.8	14.5
Forecasts	35	33	31	29	25	21	17
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 Tropical Storm Greg, 17–26 July 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	3.3	6.3	10.0	12.2	12.5	11.0	15.0
OCD5	4.6	6.9	**8.7**	**9.3**	13.9	16.2	21.0
HWFI	4.3	8.2	12.6	16.4	20.8	20.6	23.4
HMNI	6.3	6.9	**8.9**	15.1	24.0	22.2	24.2
CTCI	3.6	6.7	**8.6**	15.1	24.0	25.7	32.6
DSHP	4.4	7.1	**9.5**	**8.8**	**8.1**	**6.5**	**12.0**
LGEM	4.3	**5.8**	**6.4**	**6.1**	**4.4**	**4.5**	**9.0**
IVCN	4.0	6.5	**8.3**	10.4	12.5	13.0	18.2
HCCA	4.8	9.3	12.8	14.6	15.3	15.2	19.6
FSSE	5.3	10.4	13.5	15.7	15.3	14.4	15.0
GFSI	4.3	8.5	**9.6**	**12.1**	13.3	15.9	16.8
ECOI	4.2	**5.4**	**6.2**	**7.3**	**9.4**	11.0	18.4
Forecasts	20	19	18	16	14	10	5

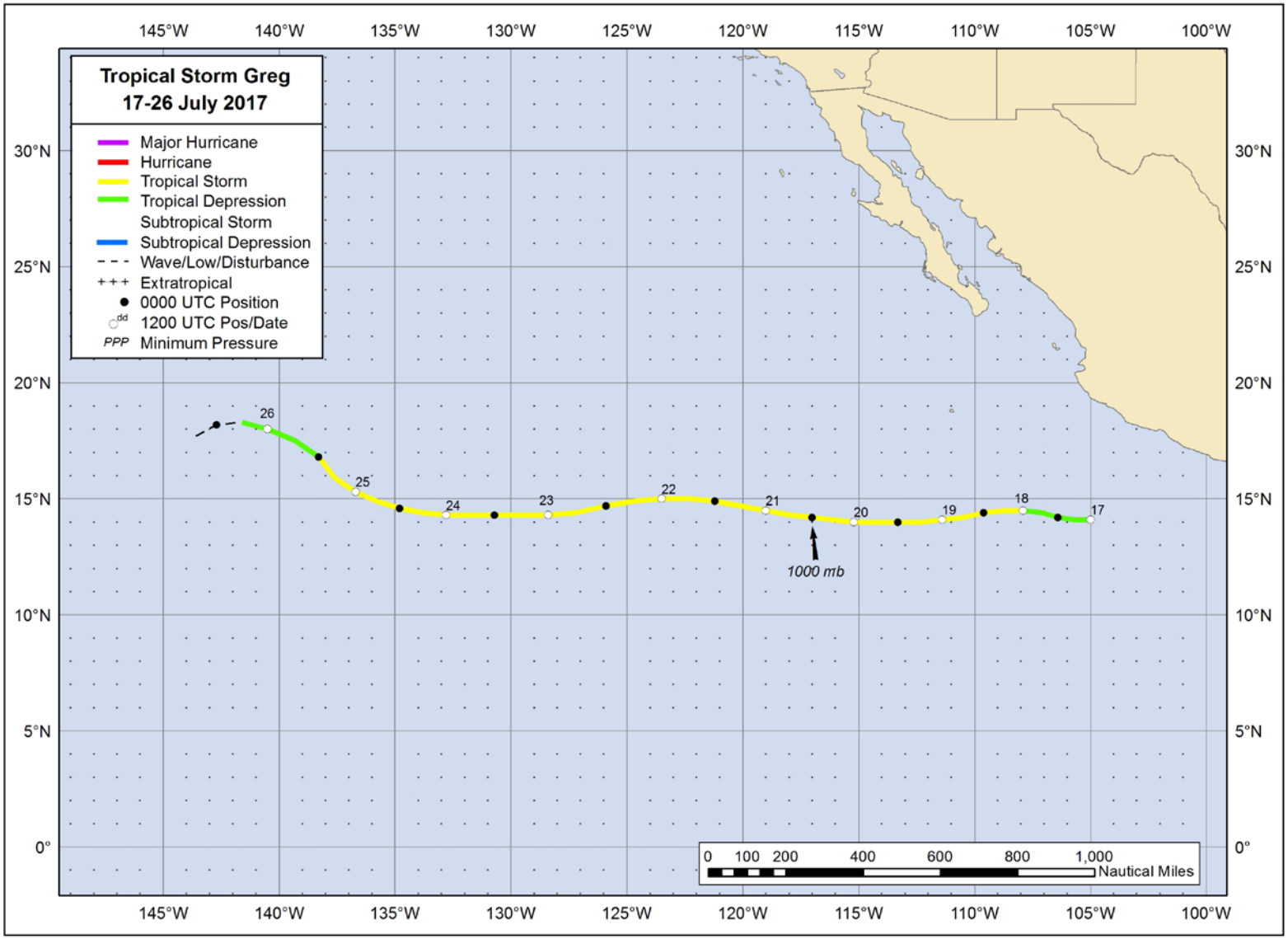

Figure 1. Best track positions for Tropical Storm Greg, 17–26 July 2017.

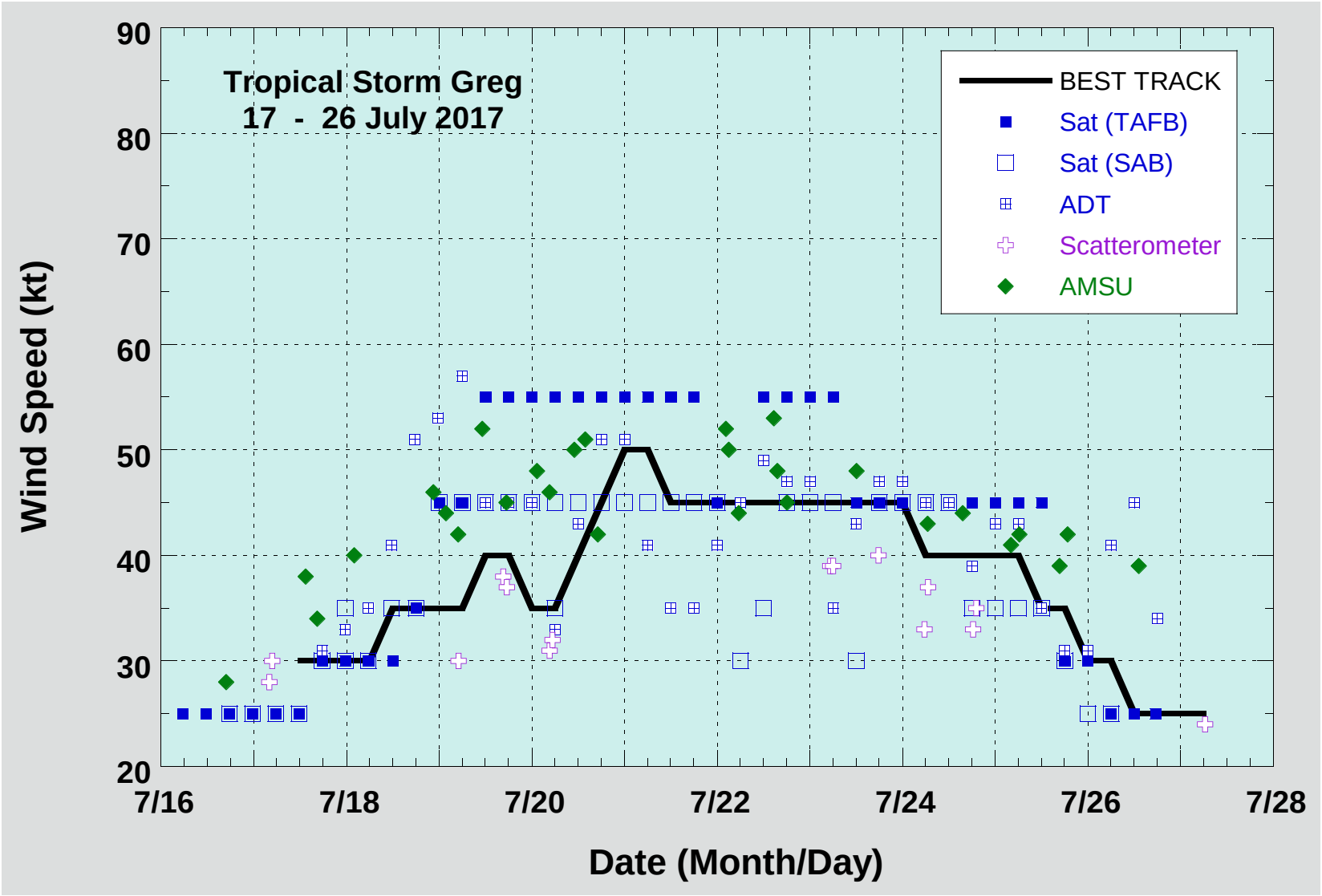

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Greg, 17–26 July 2017. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

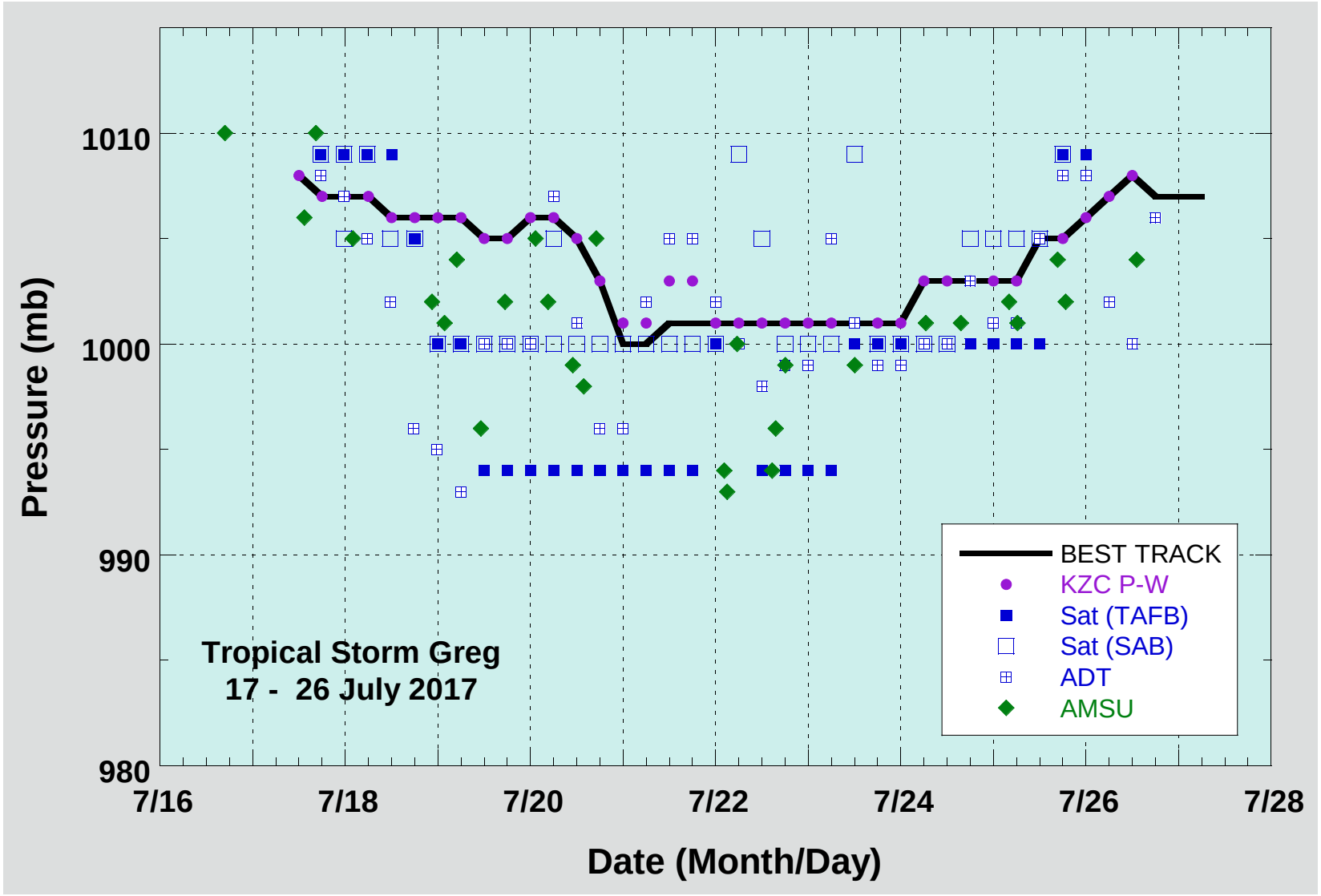

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Greg, 17–26 July 2017. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological 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.

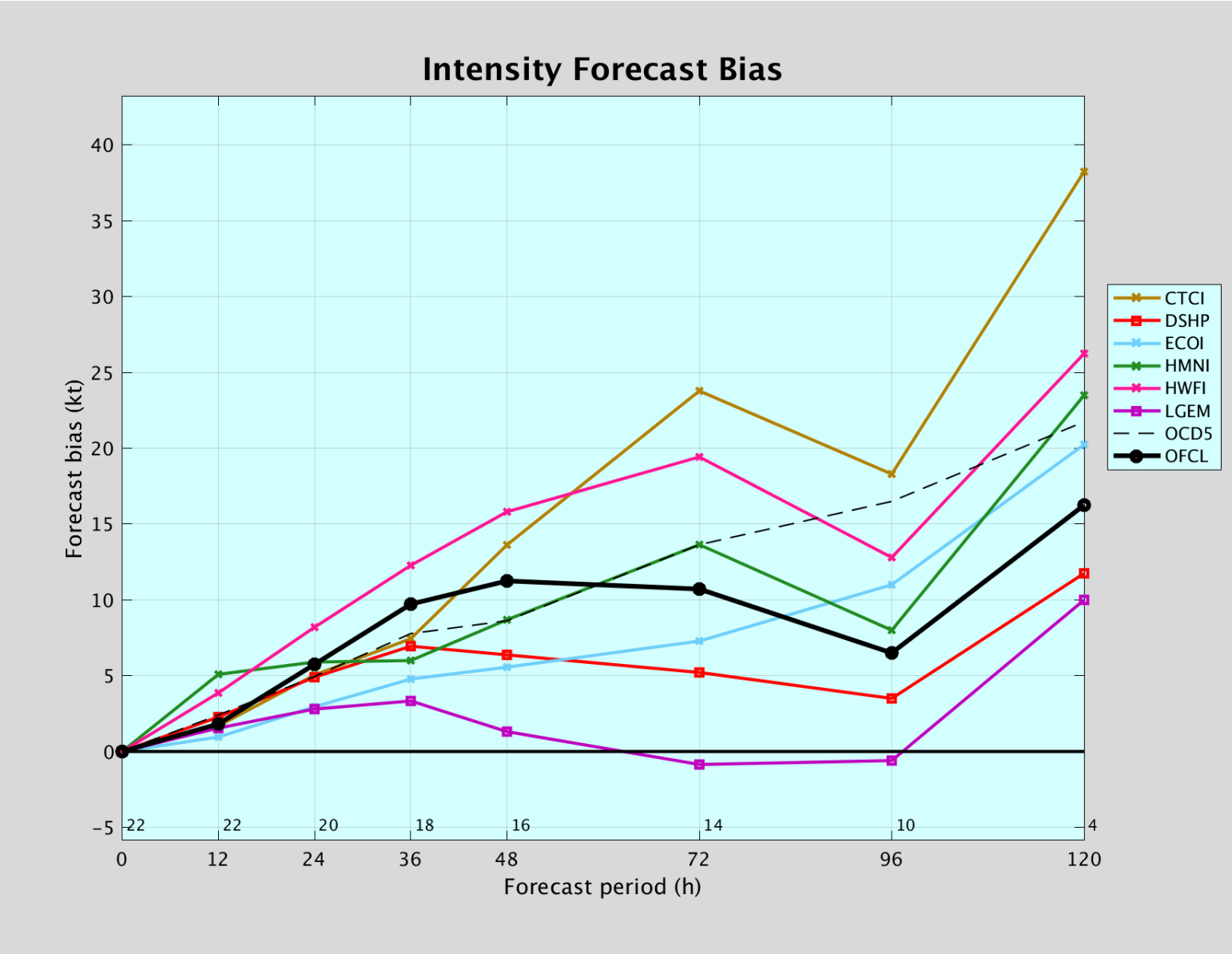

Figure 4. Selected model forecast intensity bias for Tropical Storm Greg, 17–26 July 2017. The statistical-dynamical models (DSHP and LGEM) had generally less bias and lower absolute error than the global or hurricane dynamical models.