NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE MARTIN

(AL162022)

1-3 November 2022

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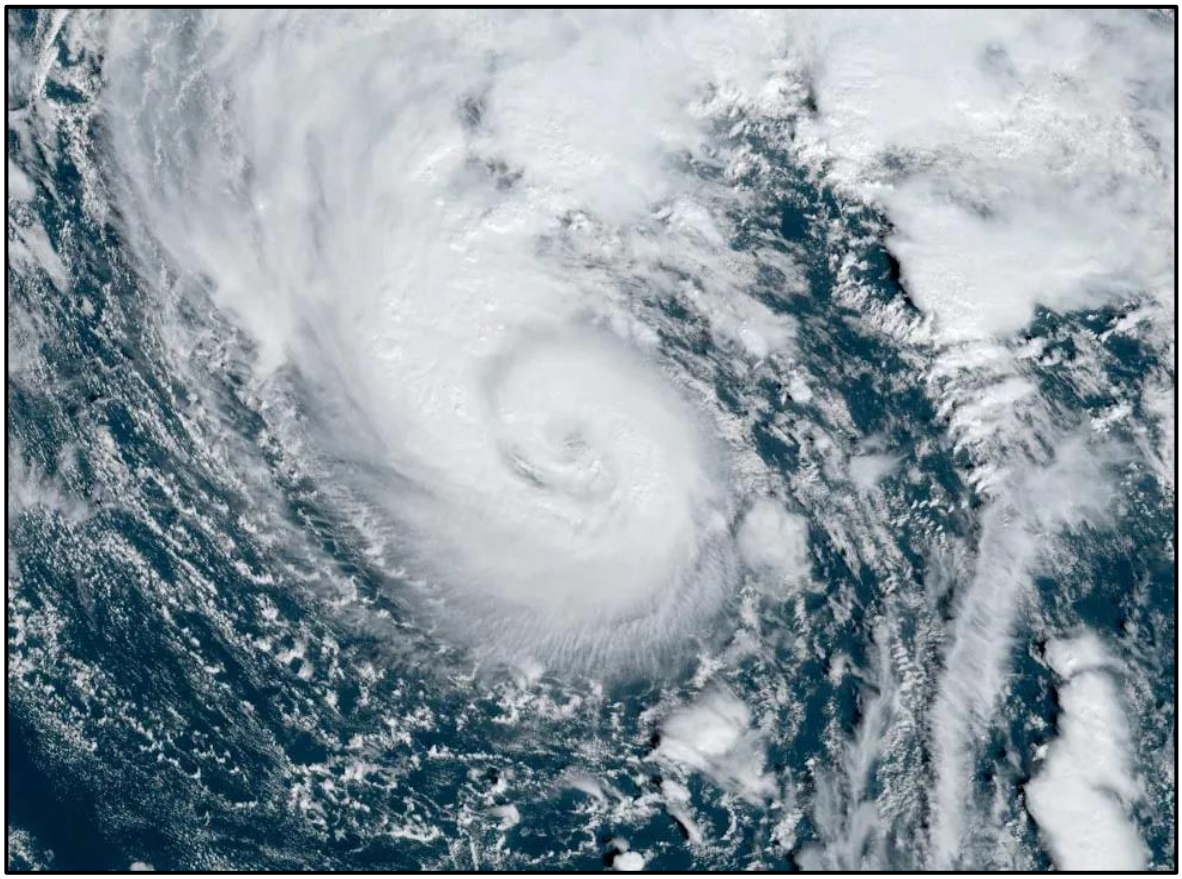

MARTIN AT 1420 UTC 2 NOVEMBER 2022 AS A 75-KT HURRICANE AS SEEN IN GOES-16 VISIBLE IMAGERY (IMAGE COURTESY OF NOAA/RAMMB/COLORADO STATE UNIVERSITY)

Martin was a late-season category 1 hurricane (on the Saffir-Simpson Hurricane Wind Scale) over the open Atlantic that had no impacts to land.

Hurricane Martin

1-3 NOVEMBER 2022

SYNOPTIC HISTORY

An upper-level shortwave trough helped to induce a surface trough roughly midway between the Bahamas and Bermuda late on 25 October. This surface trough produced disorganized convection over the next three days while moving slowly northeastward. By late 28 October, a non-baroclinic well-defined low developed about 150 n mi southwest of Bermuda along the trough axis. However, deep convection remained rather sparse and unorganized, and the system failed to develop into a tropical cyclone as it drifted north-northeastward over the next two days. Early on 30 October, the low merged with a frontal boundary while centered around 100 n mi north of Bermuda.

Subsequently from the remnants of this low, an extratropical cyclone developed along the frontal boundary late on 30 October a couple hundred n mi northeast of Bermuda. This extratropical system's peak winds reached strong gale force early on 31 October, but the system then began to occlude and weaken. By 1 November, the system had developed deep convection over its center, while the frontal boundaries became displaced a long distance to its east and north. At the same time, FSU Cyclone Phase Space model analyses suggested that the system had developed a non-frontal warm-core structure. Given these changes, the system evolved into a tropical storm around 1200 UTC 1 November while centered around 480 n mi east-northeast of Bermuda. The "best track" chart of Martin'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.

Martin initially moved toward the east around 10 kt, as it was embedded within mid-latitude westerlies in a split in the jet stream with faster westerlies both poleward and equatorward of the system. Even though the sea surface temperatures were a lukewarm 25°C (but 2°C warmer than average) and mid-level moisture was only marginally ample, the upper-level temperatures were quite cold, enabling organized deep convection to continue. Deep tropospheric vertical shear was 20-25 kt out of the southwest, but the effects of this moderate shear were tempered by Martin moving in the same direction as the shear vector, allowing the storm to steadily intensify. Martin became a hurricane around 1200 UTC 2 November while centered around 685 n mi south-southeast of Cape Race, Newfoundland, as a ragged eye developed within the central dense overcast (see cover figure). Martin had a single 24-h period of rapid intensification from a 45-kt tropical storm at 1800 UTC 1 November to a 75-kt Category 1 hurricane at 1800 UTC 2 November, which was the peak intensity of the system.

Late on 2 November and early on 3 November, Martin began accelerating toward the northeast as it was being swept up by a pronounced deep-layer trough over Atlantic Canada. At the same time, the hurricane underwent extratropical transition while quickly expanding in size. In the 24-h period ending at 0600 UTC 3 November, the maximum extent of tropical-storm-force

winds more than doubled in radius, growing from 100 to 240 n mi. By 1200 UTC 3 November, a cold front had reached Martin's center, and consequently the system became a large and strong extratropical cyclone centered around 635 n mi east of Cape Race.

Late on 3 November, post-tropical Martin turned toward the north while being captured by the deep-layer trough, reaching nearly 60 kt in forward speed. While Martin's peak winds gradually diminished after extratropical transition, the system's size continued to expand with the maximum extent of gale-force winds reaching 720 n mi on 4 November. This dramatic expansion in size with gradual peak wind reduction occurred in conjunction with a large drop in central pressure, reaching as low as 932 mb by 1200 UTC 4 November. Finally, by late on 4 November, post-tropical Martin abruptly slowed down as it merged and became absorbed by a developing extratropical cyclone to its north around 0000 UTC 5 November.

METEOROLOGICAL STATISTICS

Observations in Martin (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 Martin.

Ship reports of winds of tropical storm force associated with Martin are given in Table 2.

Martin's peak intensity of 75 kt from 1800 UTC 2 November to 0600 UTC 3 November is based on a blend of the SAB and TAFB Dvorak estimates. It is noted that the ADT and SATCON (which relies upon ADT) were biased low, likely because of the very high latitude and relatively warm cloud tops of the system. The minimum central pressure of 965 mb was primarily based upon the Knaff-Zehr-Courtney pressure-wind relationship.

Martin may have intensified when it transitioned into an extratropical cyclone. Model guidance had suggested that Martin would develop a sting jet at the surface near the time of extratropical transition and possibly reach an intensity of 90 kt. However, there was no observational evidence that this occurred.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Martin was poorly forecast. The extratropical cyclone from which Martin developed was only introduced into both the 48-h and 5-day Tropical Weather Outlook (TWO) 18 h prior to genesis with a low (less than 40%) chance of development (Table 3). This was subsequently boosted to a medium (40-60%) chance of development in both the 48-h and 5-day TWO 6 h before genesis. The system was upgraded to a high (greater than 60%) chance of development in both the 48-h and 5-day TWO only 3 h before genesis in a Special TWO issuance. There was a predecessor disturbance to Martin (see discussion above) that was introduced into the TWO with a low chance of genesis within five days at 0600 UTC 24 October, boosted to medium at 1800 UTC 26 October in both the 48-h and 5-day TWO, reduced to low at 1200 UTC 27 October, and removed from the TWO by 1800 UTC 30 October. Figure 4 shows that Martin's location of genesis only fell within the potential genesis areas depicted in NHC's Graphical Tropical Weather Outlook for those forecasts issued within 18 h of formation. All of the genesis forecasts issued for the predecessor disturbance to Martin indicated a formation area well to the southwest of the eventual genesis location.

A verification of NHC official track forecasts for Martin is given in Table 4. Official track forecast errors were lower than the mean official errors at 12 and 24 h for the previous 5-yr period and near average at 36 h.

A verification of NHC official intensity forecasts for Martin is given in Table 5. Official intensity forecast errors were comparable to the mean official errors at 12 h for the previous 5-yr period and were lower than the averages at 24 and 36 h. A homogeneous comparison of the official track and intensity errors with selected guidance models is not provided due to the small number of forecasts issued.

ACKNOWLEDGEMENTS

Figure 1 and 4 were graciously provided by John Cangialosi and Philippe Papin, respectively.

Table 1. Best track for Hurricane Martin, 1-3 November 2022.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
30 / 1800	34.2	64.0	1006	40	extratropical
31 / 0000	34.6	63.1	1004	45	"
31 / 0600	34.9	62.2	1004	45	"
31 / 1200	35.0	61.6	1004	40	"
31 / 1800	35.0	60.9	1004	40	"
01 / 0000	35.1	59.6	1004	35	"
01 / 0600	35.2	57.9	1002	35	"
01 / 1200	35.3	56.7	998	40	tropical storm
01 / 1800	35.3	55.4	993	45	"
02 / 0000	35.1	54.2	991	50	"
02 / 0600	35.0	53.0	989	55	"
02 / 1200	35.1	50.9	983	65	hurricane
02 / 1800	36.1	48.9	974	75	"
03 / 0000	38.0	46.4	970	75	"
03 / 0600	40.3	43.6	965	75	"
03 / 1200	43.7	38.8	960	75	extratropical
03 / 1800	49.0	35.3	950	75	"
04 / 0000	52.7	38.0	947	70	"
04 / 0600	54.7	37.7	936	65	"
04 / 1200	55.8	37.2	932	60	"
04 / 1800	56.5	36.5	939	55	"
05 / 0000					absorbed

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
03 / 0600	40.3	43.6	965	75	Maximum winds and minimum pressure (while a tropical cyclone)

Table 2. Selected ship reports with winds of at least 34 kt for Hurricane Martin, 1-3 November 2022.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
01 / 0800	9HJB9	29.9	53.7	210 / 37	1018.3
03 / 0000	WMKN	37.2	49.9	320 / 35	1000.8
03 / 0300	9HA461	32.9	45.6	220 / 35	1010.8
03 / 0600	WMKN	37.2	47.7	320 / 37	1003.9
03 / 1400	VRMU9	41.8	33.2	140 / 40	1008.0
03 / 1600	VRMU9	41.9	33.2	130 / 40	1005.0

Table 3. 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%)	18	18
Medium (40%-60%)	6	6
High (>60%)	3	3

Table 4. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Martin, 1-3 November 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	31.7	50.3	**43.1**					
OCD5	97.3	178.2	185.9					
Forecasts	6	4	2					
OFCL (2017-21)	23.6	35.5	47.6	61.4	78.2	91.3	125.6	172.1
OCD5 (2017-21)	45.5	98.3	156.7	213.7	252.4	316.9	403.6	484.6

Table 5. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Martin, 1-3 November 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	5.8	**2.5**	**5.0**					
OCD5	8.2	19.2	19.0					
Forecasts	6	4	2					
OFCL (2017-21)	5.4	8.0	9.5	10.9	11.0	12.1	13.1	14.7
OCD5 (2017-21)	7.0	11.1	14.5	17.1	18.0	20.2	21.9	22.1

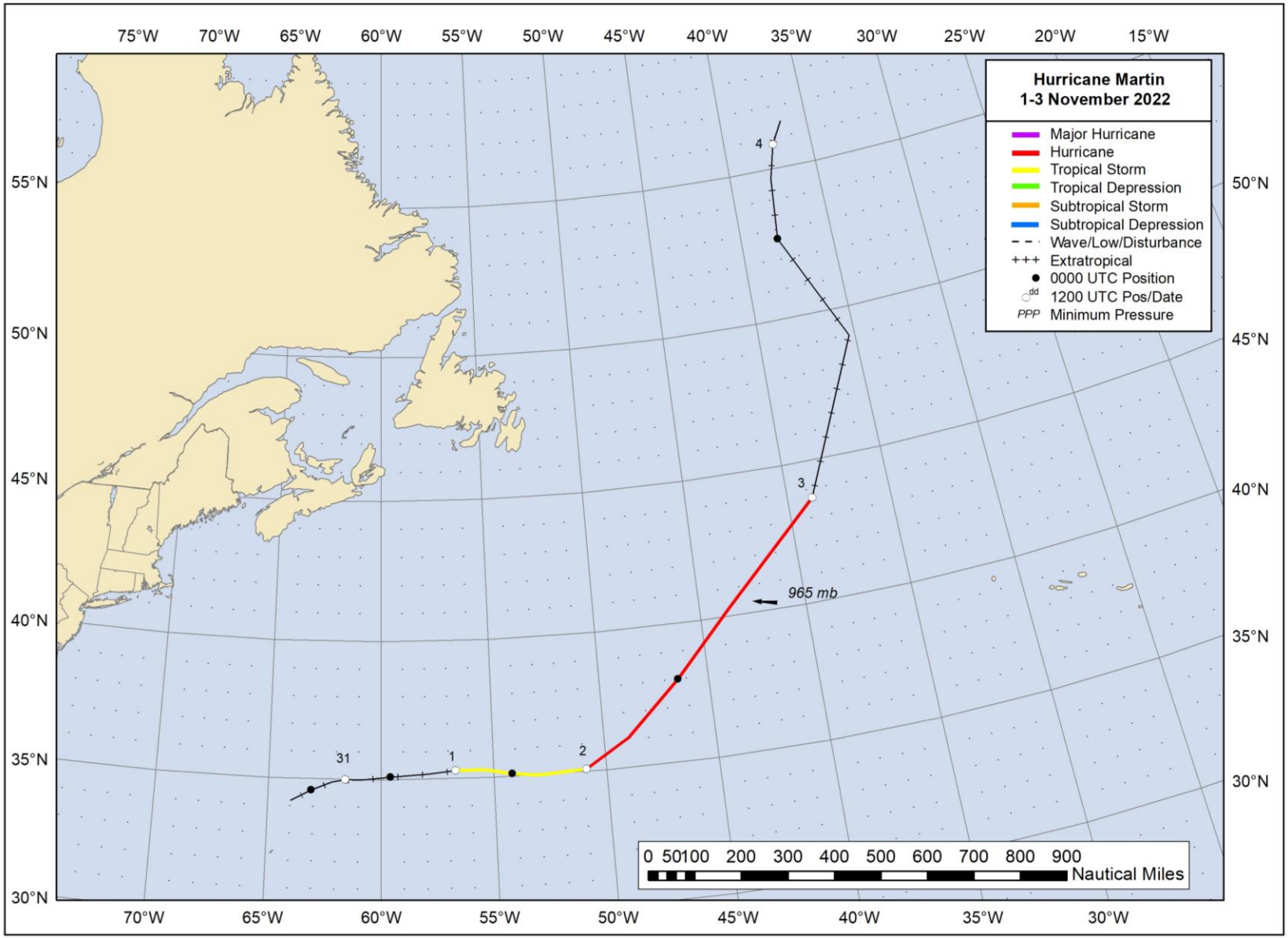

Figure 1. Best track positions for Hurricane Martin, 1-3 November 2022. Tracks during the extratropical stage are partially based on analyses from the NOAA Ocean Prediction Center.

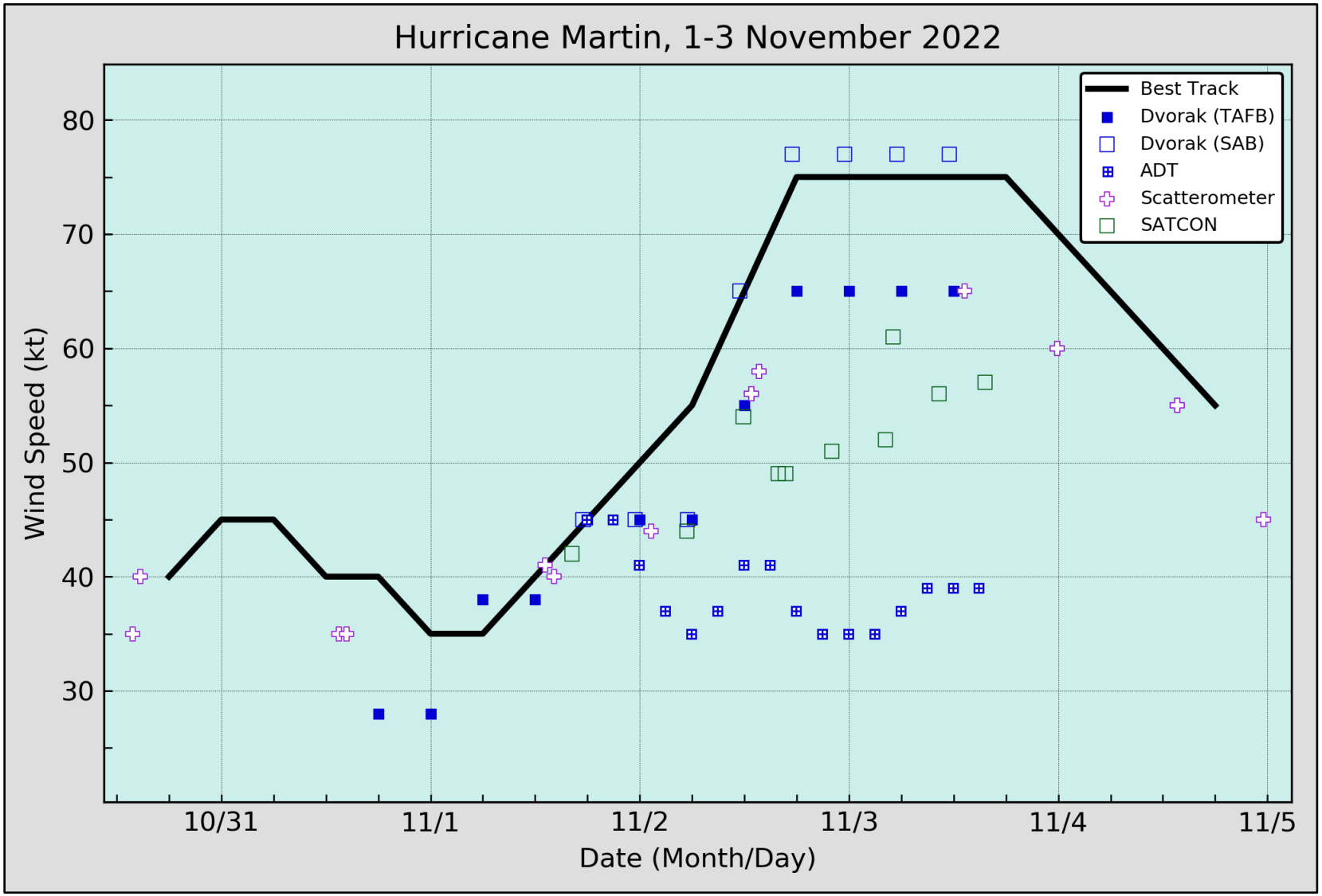

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Martin, 1-3 November 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

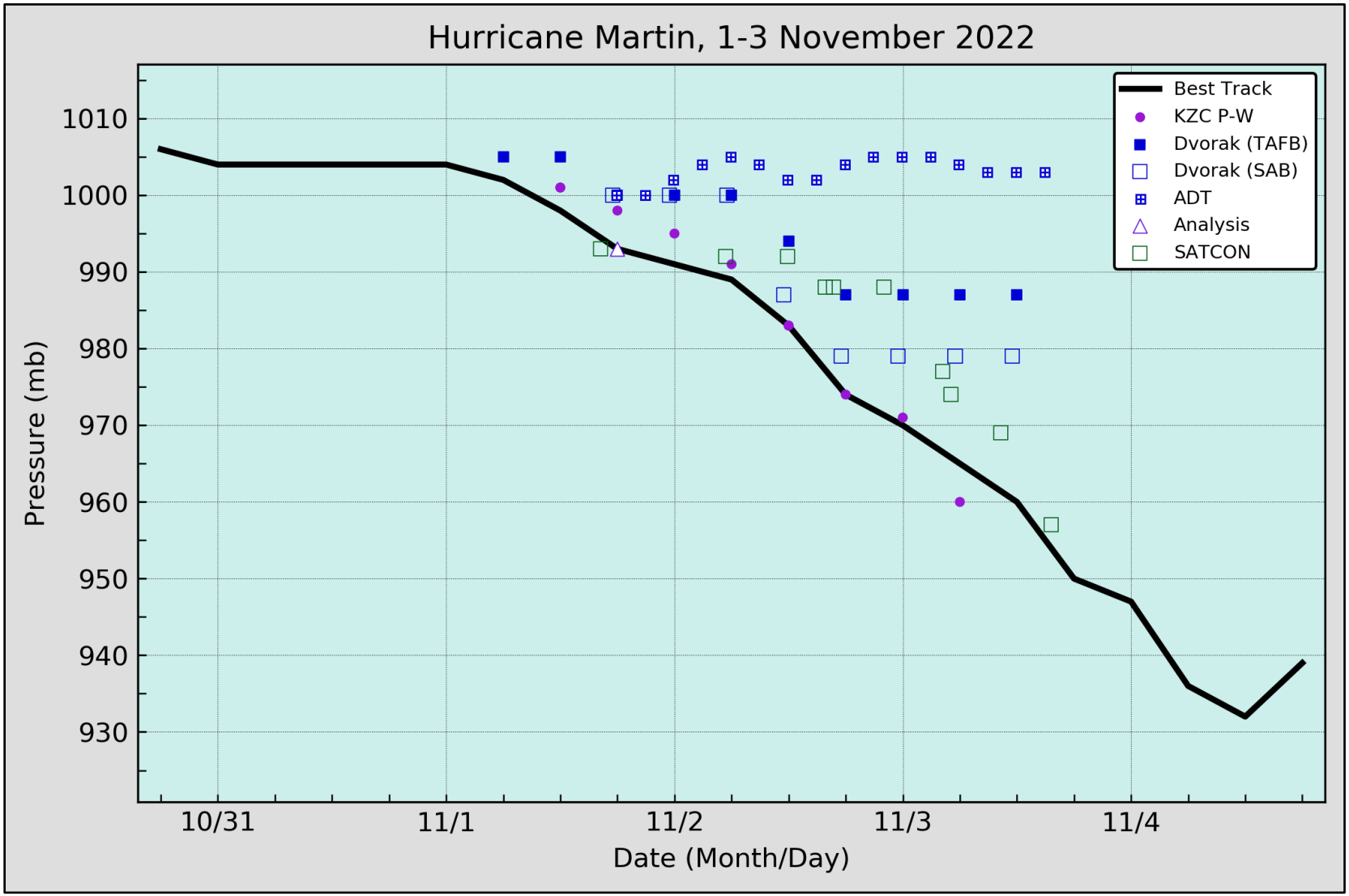

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Martin, 1-3 November 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological 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.

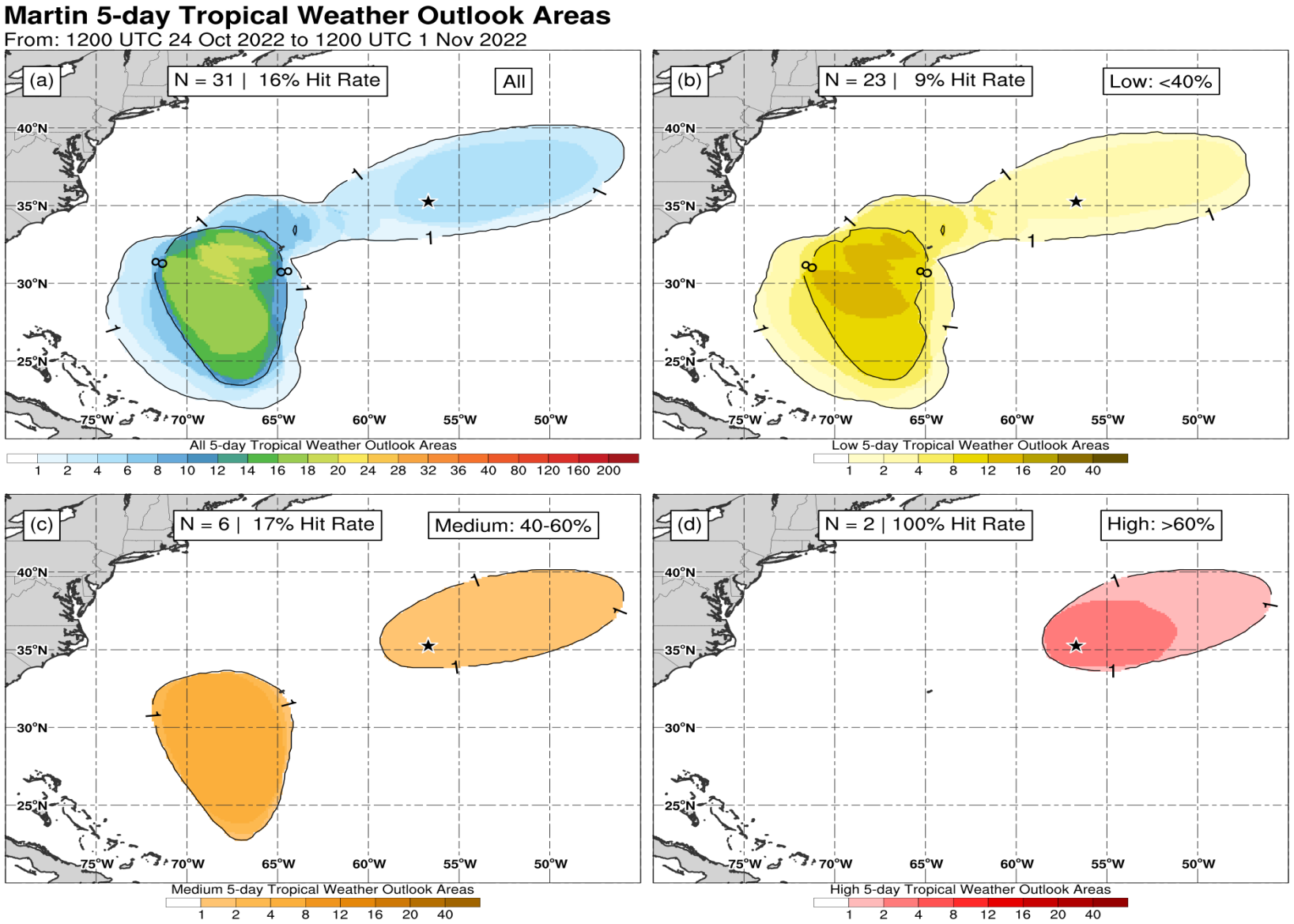

Figure 4. Composites of 5-day tropical cyclone genesis areas depicted in NHC's Tropical Weather Outlooks prior to the formation of Hurricane Martin for (a) all probabilistic genesis categories, (b) the low (<40%) category, (c) medium (40–60%) category, and (d) high (>60%) category. Martin's location of genesis is indicated by the black star.