NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM NEWTON

(EP152022)

21–25 September 2022

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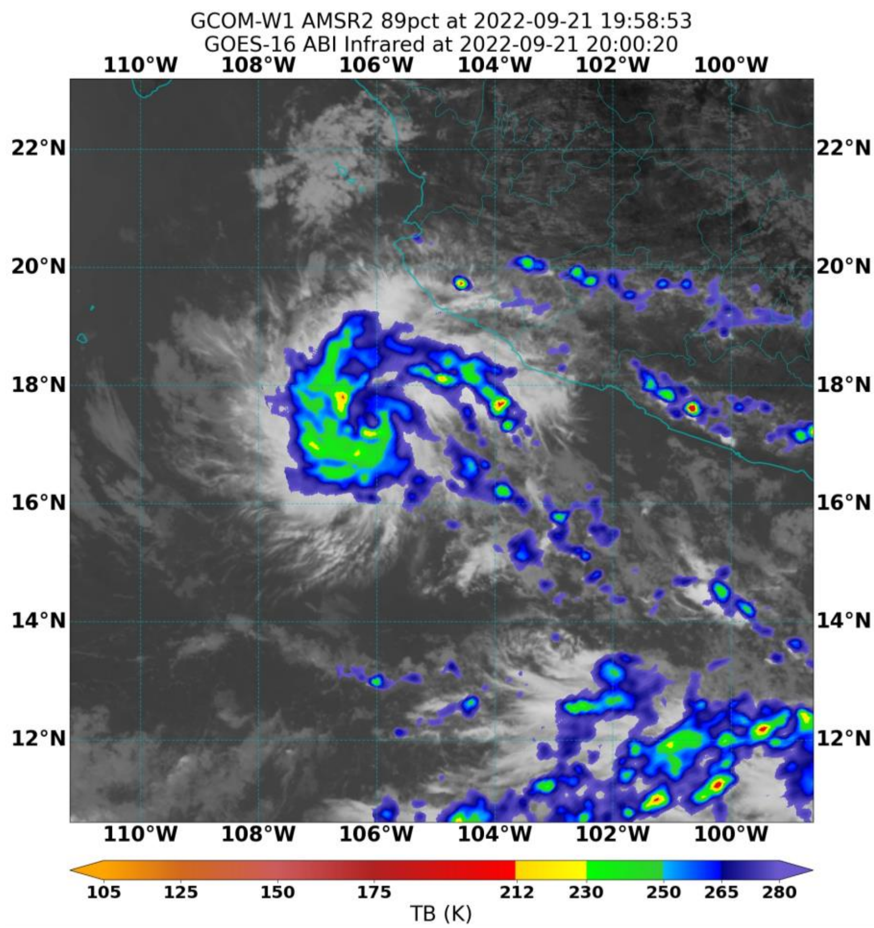

89-GHZ PCT AMSR2 MICROWAVE IMAGE AT 1958 UTC 21 SEPTEMBER. IMAGE CREDIT: NAVAL RESEARCH LABORATORY

Newton was a small tropical storm that moved away from Mexico into the central eastern North Pacific basin and did not directly affect land.

Tropical Storm Newton

21–25 SEPTEMBER 2022

SYNOPTIC HISTORY

The origins of Newton are rather complex. In the wake of Tropical Storms Lester and Madeline, conditions remained unsettled in the eastern Pacific on 17 September with widespread southwesterly monsoonal flow extending from the longitude of Madeline eastward to the coast of Central America. Within this flow, one area of disturbed weather formed on 17 September a few hundred miles south of the coast of Guatemala and El Salvador. However, this system struggled to maintain its identity over the next several days while embedded in the large-scale low-level southwesterly flow, and within moderate northeasterly vertical wind shear associated with a strong upper-level anticyclone positioned farther north. Early on 19 September, a large convective burst formed to the west of this initial feature along and just offshore of the coast of Mexico near the Gulf of Tehuantepec. As the initial system decayed further to the east, this area of convection persisted and propagated westward, leading to the formation of a new area of low pressure by early on 20 September. While convection continued later that day leading to the formation of a mid-level circulation, scatterometer data that afternoon suggested that the low did not yet possess a well-defined low-level circulation. An even more pronounced burst of deep convection formed early in the morning on 21 September, resulting in an improvement in the system's organization on both conventional and microwave satellite imagery. A tropical depression is estimated to have formed by 1200 UTC 21 September, about 135 n mi south of Manzanillo, Mexico. The depression continued to become better organized and became Tropical Storm Newton 6 h later. The "best track" chart of Newton'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].

Environmental conditions were initially favorable for Newton to intensify, as the system was embedded in vertical wind shear less than 10 kt, sea-surface temperatures between 27–28°C, and sufficiently high mid-level relative humidity. Thus, the storm quickly became better organized on 21 September, with microwave imagery (cover photo) suggesting that a formative inner core was developing as a small central dense overcast of deep convection persisted near the center. This improved structure contributed to a 25-kt increase in intensity between 1200 UTC 21 September and 1200 UTC 22 September, and Newton peaked as a 55-kt tropical storm at the end of this period. During this time, Newton maintained a west-northwest motion that gradually slowed as the primary steering influence, a large and extensive mid-level ridge located over Texas and northern Mexico, slowly weakened.

Newton's initial 24-h period of intensification was short-lived, as deep convection weakened near the center later on 22 September, possibly related to the storm ingesting dry,

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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.

more stable air from the north as sea-surface temperatures decreased near and to the north of the system. These factors led to Newton beginning a gradual weakening trend. While nocturnal bursts of deep convection occurred over the next several days, these bursts gradually became less organized and shorter lived. Newton passed just to the southwest of Socorro Island as a 40-kt tropical storm around 0000 UTC 24 September. Southerly vertical wind shear also began to increase later on 24 September, and Newton weakened to a tropical depression by 1800 UTC that day. At this point, Newton's circulation was becoming increasingly shallow, and the cyclone turned westward as it became steered by the low-level flow. One more convective burst during the overnight hours between 24–25 September maintained Newton's status as a tropical cyclone a little longer. However, by 1800 UTC 25 September, the remaining shower and thunderstorm activity lacked sufficient coverage or organization for Newton to be classified as a tropical cyclone, and the system degenerated into a remnant low at that time when it was located about 460 n mi to the southwest of the southern tip of the Baja California Peninsula.

The remnant low turned southwestward over the following 24–48 h as it became primarily steered by the low-level trade winds around an extensive low-level anticyclone located to its northwest. During this time, convection continued to pulse up and down, and occasionally it would briefly appear to become better organized. However, scatterometer data during this period suggested that the low-level circulation gradually became more diffuse, and the lack of convective persistence prevented Newton from regenerating as a tropical cyclone. On 28 September, the remnant low turned back westward as the low-level ridging became more positioned directly north of the system. Finally, by 0600 UTC 29 September, scatterometer data indicated that the remnant low had opened up into a trough more than 1000 n mi to the southwest of the southern tip of the Baja California Peninsula.

METEOROLOGICAL STATISTICS

Observations in Newton (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 Newton.

Winds and Pressure

Newton's peak intensity of 55 kt is based on a subjective satellite estimate of T3.5/55 kt from TAFB at 1200 UTC 22 September and an objective SATCON estimate of 52 kt at 1100 UTC 22 September. The estimated minimum pressure of 997 mb, also at 1200 UTC 22 September, is primarily based on the Knaff-Courtney-Zehr (KZC) pressure-wind relationship.

It should be noted that there was a large spread in satellite intensity estimates between 21–23 September, with SAB subjective Dvorak estimates never exceeding T2.5/35 kt over Newton's lifespan, and objective ADT estimates also remaining lower than the SATCON and TAFB intensity estimates over this period. Unfortunately, scatterometer data was largely unavailable during this time, except for a 32-kt peak wind retrieval from ASCAT-B at 0415 UTC 23 September. The large range in intensity estimates could possibly be attributed to the small size of Newton overall, which often makes assessing tropical cyclone intensity challenging without in-situ observations.

There were no ship reports of winds of tropical storm force associated with Newton. Even though Newton passed close to Socorro Island, the sustained winds and gusts reported by an automated observing site on the island remained well below tropical storm force.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Newton was not very well forecast, especially in the short-term. The potential for tropical cyclone development was first introduced in the Tropical Weather Outlook with a low chance (<40%) of development 90 h prior to genesis (Table 2) at 1800 UTC 17 September. However, over the next several days, this potential was not increased further, as a system located farther to the east was initially assessed with higher potential to develop. This evolution did not occur, and between 20–21 September, convection began to increase near the pre-Newton disturbance. Despite the improvement in organization, global model guidance struggled to properly depict the system, largely failing to indicate tropical cyclone development until it was already underway. The 5-day outlook was finally increased to medium (40–60%) on 0600 UTC 21 September, just 6 h before development. The system was assigned a low 2-day probability of formation only 24 h before development, and this probability was also raised to the medium category only 6 h before genesis. While several high-category (>60%) 2- and 5-day outlooks were issued later on 21 September, the final best track of Newton now shows that the system became a tropical cyclone at or before these outlooks were issued. The location of tropical cyclogenesis was also not well captured initially (Fig. 4), with less than half (44%) of all outlooks capturing the correct area since many outlook areas were placed too far to the south and east relative to Newton's genesis location.

A verification of NHC official track forecasts for Newton is given in Table 3a. Official track forecast errors were a little higher than the mean official errors for the previous 5-yr period between 12–48 h, but were a little lower than the mean official errors at 60–72 h. The OCD5 (climatology-persistence) errors were below the long-term means, suggesting that the track forecasts for Newton were easier than average, likely related to the climatological west-northwestward to westward track that the system took for most of its life as a tropical cyclone.

A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. In general, the official forecast beat nearly all the deterministic guidance, with the exception of the ECMWF (EMXI) at 12–24 h and COAMPS-TC (CTCI) at 60–72 h. The official track forecasts also performed well against the consensus guidance, though the HFIP Corrected Consensus Approach (HCCA) did outperform the official forecasts at 12–24 and 72 h, while the GFS ensemble mean (AEMI) bested the official forecasts at 24 and 36 h.

A verification of NHC official intensity forecasts for Newton is given in Table 4a. Official intensity forecast errors were much lower than the mean official errors for the previous 5-yr period at all forecast times. The official intensity forecasts beyond 24 h was particularly impressive, with forecast errors being two to three times lower than the 5-yr mean intensity error. This feat is made more impressive given that OCD5 errors were higher than their respective 5-yr mean at those lead times, suggesting that Newton's intensity was more challenging to forecast. The better-than-average intensity forecasts can largely be attributed to forecasters correctly anticipating that Newton would not continue intensifying beyond 55 kt due to the combination of dry air entrainment and lower sea-surface temperatures during the latter portion of the tropical cyclone's lifespan.

A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The only model to consistently outperform the official intensity forecasts was the HWRF (HWFI), which bested the official forecasts from 24–36 h and again at 72 h. While other deterministic and consensus guidance also beat the official forecasts at 72 h, it was only for a single verifying period. In contrast, the SHIPS guidance (DSHP) performed quite poorly with Newton, exhibiting the largest intensity errors of the entire guidance suite.

There were no coastal watches or warnings issued in association with Newton.

Table 1. Best track for Tropical Storm Newton, 21–25 September 2022.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
21 / 1200	16.9	104.3	1007	30	tropical depression
21 / 1800	17.2	105.4	1005	35	tropical storm
22 / 0000	17.4	106.6	1003	40	"
22 / 0600	17.5	107.5	999	50	"
22 / 1200	17.6	108.2	997	55	"
22 / 1800	17.8	108.8	998	50	"
23 / 0000	17.9	109.4	998	50	"
23 / 0600	17.9	109.9	1000	45	"
23 / 1200	18.0	110.4	1000	45	"
23 / 1800	18.1	110.9	1003	40	"
24 / 0000	18.5	111.5	1003	40	"
24 / 0600	18.9	112.1	1004	35	"
24 / 1200	19.1	112.8	1004	35	"
24 / 1800	19.3	113.6	1005	30	tropical depression
25 / 0000	19.5	114.4	1006	30	"
25 / 0600	19.5	115.2	1006	30	"
25 / 1200	19.2	116.0	1007	30	"
25 / 1800	18.6	116.7	1008	25	low
26 / 0000	17.9	117.5	1008	25	"
26 / 0600	17.2	118.1	1009	25	"
26 / 1200	16.6	118.6	1009	25	"
26 / 1800	16.1	119.2	1009	25	"
27 / 0000	15.6	119.7	1009	25	"
27 / 0600	15.1	120.3	1009	25	"
27 / 1200	14.6	120.8	1008	25	"
27 / 1800	14.2	121.4	1008	25	"
28 / 0000	13.9	122.2	1007	25	"
28 / 0600	13.7	123.0	1007	25	"
28 / 1200	13.7	123.8	1007	25	"
28 / 1800	13.7	124.6	1008	20	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
29 / 0000	13.9	125.2	1008	20	"
29 / 0600					dissipated
22 / 1200	17.6	108.2	997	55	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%)	30	90
Medium (40%-60%)	6	6
High (>60%)	-	-

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Newton, 21–25 September. 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	22.8	38.5	54.9	63.2	**60.5**	**67.7**		
OCD5	25.8	50.0	68.1	79.3	102.0	115.7		
Forecasts	14	12	10	8	6	3		
OFCL (2017-21)	21.9	33.8	45.6	56.9	74.8	79.9	99.5	121.3
OCD5 (2017-21)	35.8	72.3	112.7	155.0	198.7	239.0	309.2	372.2

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Newton, 21–25 September. 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	22.7	39.4	57.2	63.2	72.6	74.5		
OCD5	24.8	49.3	66.6	79.3	88.1	119.6		
GFSI	23.4	42.8	67.3	83.2	104.9	86.6		
EMXI	**20.5**	**39.3**	61.4	73.7	100.0	79.5		
NVGI	35.2	61.7	77.6	91.5	127.4	178.7		
HWFI	26.0	39.7	63.1	81.4	105.8	130.2		
HMNI	32.4	57.2	81.9	106.4	105.1	195.3		
CTCI	26.2	47.5	74.5	85.9	**47.7**	**49.4**		
HCCA	**20.9**	**37.0**	57.4	65.5	80.1	**71.9**		
AEMI	23.0	**36.3**	**55.0**	68.5	76.4	84.5		
GFEX	**21.0**	**37.6**	60.0	71.2	95.4	74.5		
TVCA	**22.2**	**39.1**	59.1	68.3	82.0	79.3		
TVCX	**21.3**	**38.9**	59.7	69.6	85.3	75.6		
TVDG	**22.1**	**38.6**	60.8	71.6	88.4	77.3		
TABS	27.4	46.4	76.7	100.9	125.6	164.4		
TABM	29.3	56.5	93.4	125.8	176.3	236.2		
TABD	38.1	72.5	111.0	152.5	207.0	246.3		
Forecasts	13	11	9	8	4	1	0	0

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Newton, 21–25 September 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	**3.6**	**5.0**	**5.5**	**4.4**	**2.5**	**3.3**		
OCD5	5.3	8.9	14.5	17.5	23.7	24.7		
Forecasts	14	12	10	8	6	3		
OFCL (2017-21)	5.5	9.1	11.1	12.9	15.3	15.6	16.4	17.0
OCD5 (2017-21)	7.0	12.2	15.8	18.6	20.4	21.2	22.3	21.8

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Newton, 21–25 September 2022. 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	3.8	5.0	6.1	4.4	1.2	5.0		
OCD5	5.5	9.0	15.0	17.5	27.0	28.0		
HWFI	3.9	**4.2**	**5.2**	6.0	2.5	**2.0**		
HMNI	5.3	7.1	9.6	7.2	2.2	**1.0**		
CTCI	7.2	7.6	8.3	7.6	1.8	7.0		
DSHP	4.9	7.3	11.2	11.0	13.2	7.0		
IVCN	4.8	6.1	8.2	7.2	5.8	**0.0**		
IVDR	5.1	6.4	8.2	7.8	4.5	**2.0**		
HCCA	5.2	6.9	8.4	7.2	3.8	**3.0**		
GFSI	6.8	8.8	10.8	10.8	7.0	8.0		
EMXI	5.2	6.1	6.9	6.4	3.2	**1.0**		
Forecasts	13	11	9	8	4	1	0	0

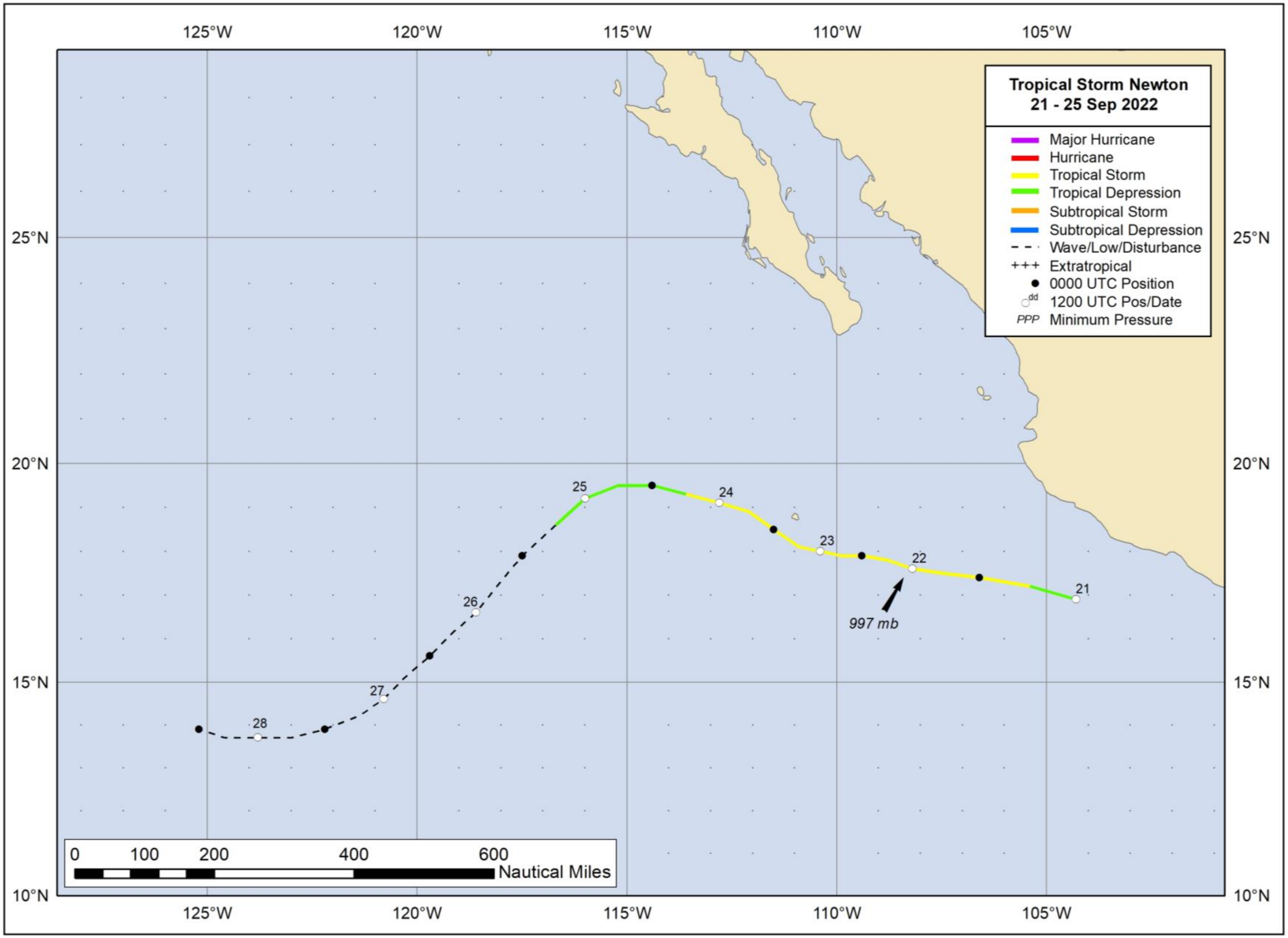

Figure 1. Best track positions for Tropical Storm Newton, 21–25 September 2022.

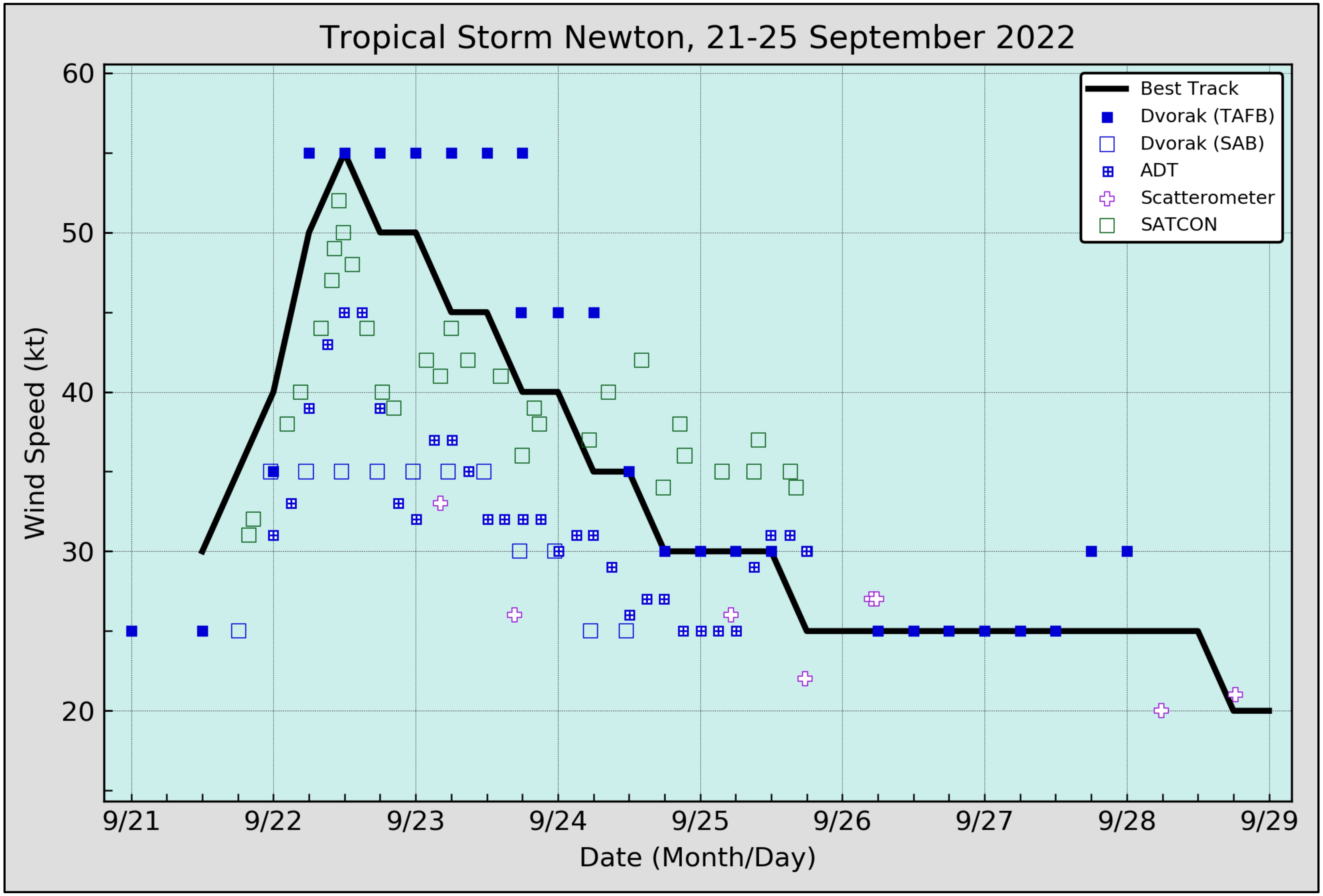

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Newton, 21–25 September 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

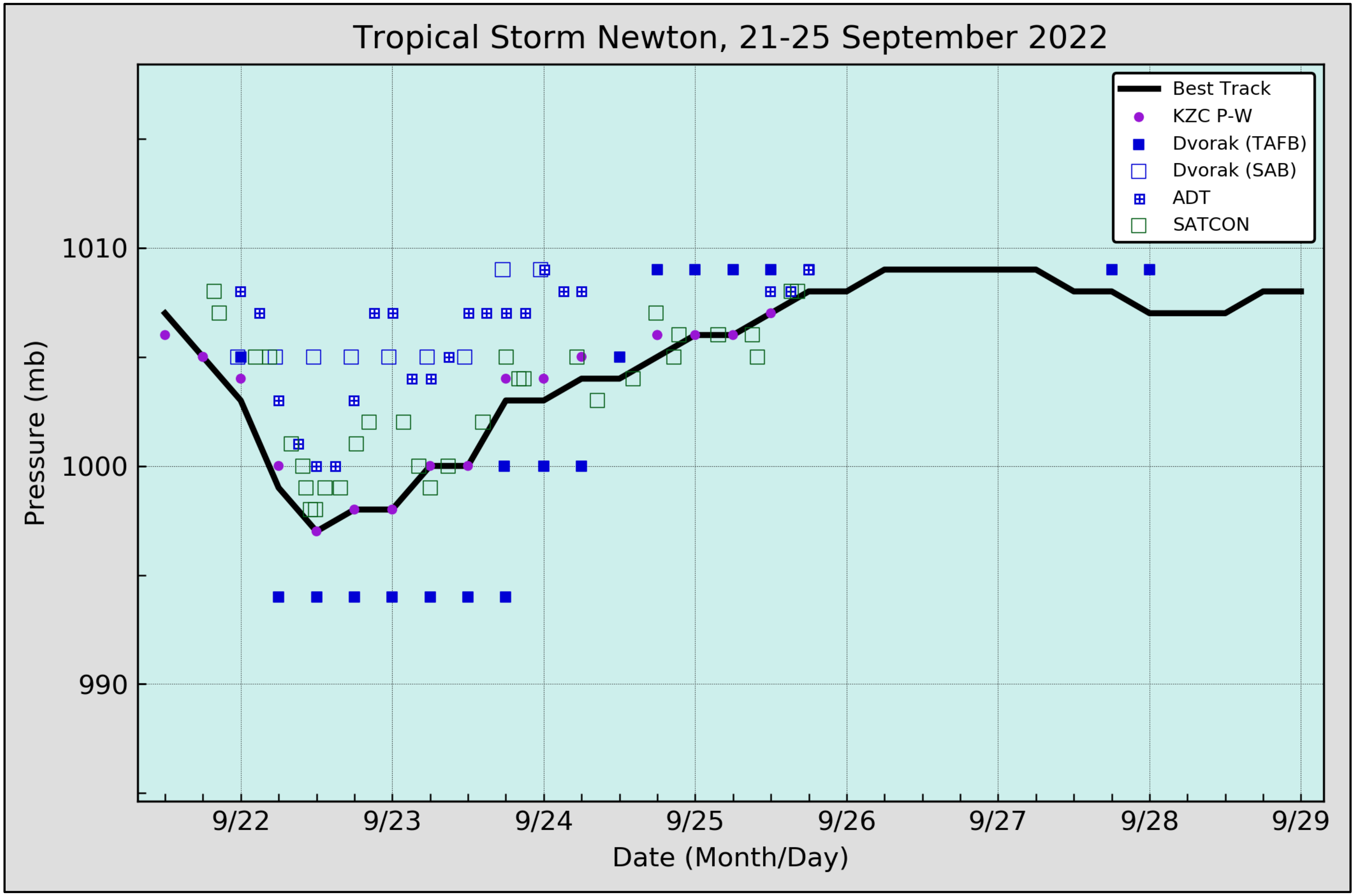

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Newton, 21–25 September 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.

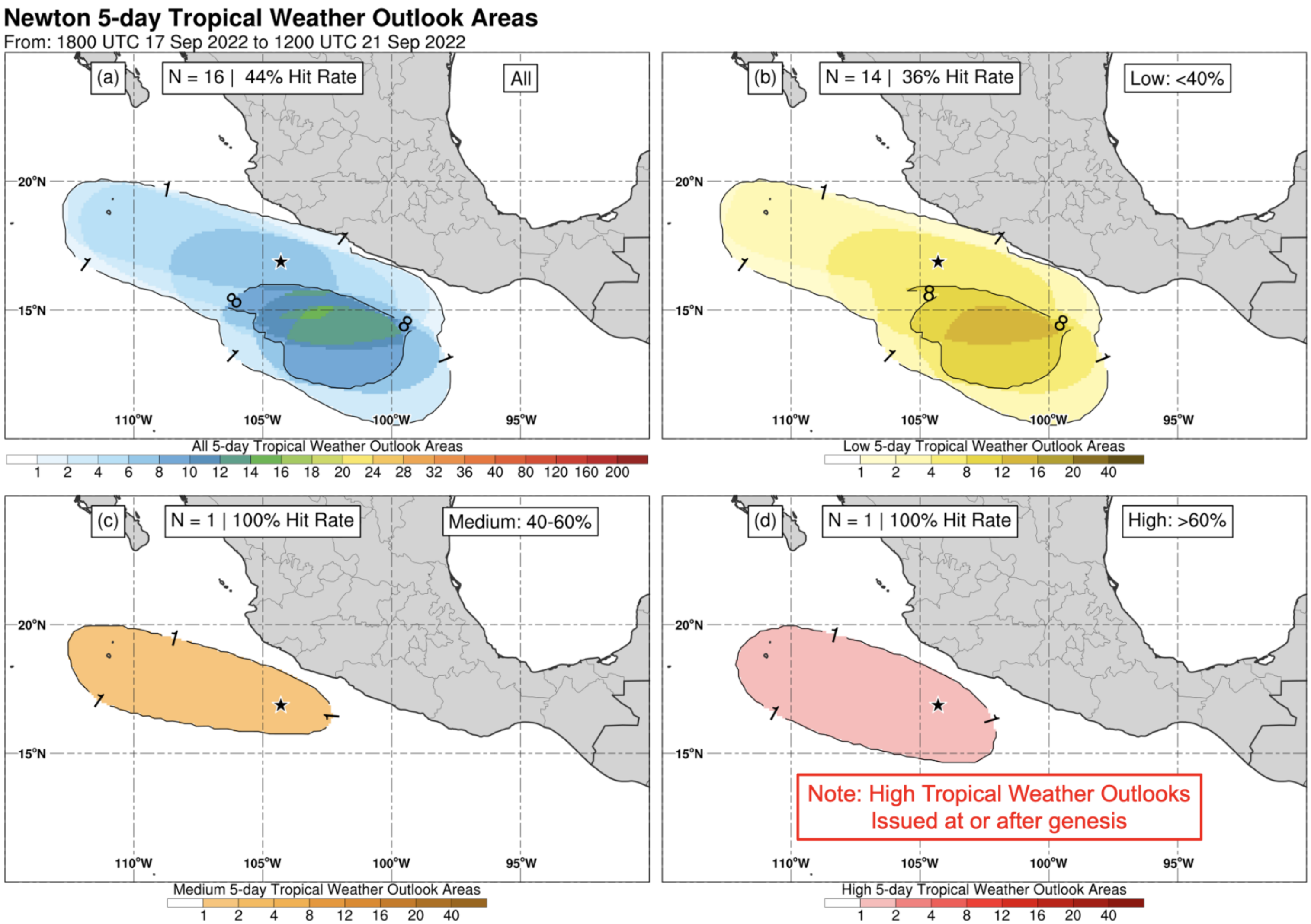

Figure 4. 5-day Tropical Weather Outlook genesis areas associated with the disturbance that developed into Tropical Storm Newton for (a) all probability areas (10–100%, multi-color shading), (b) low probability areas (< 40%, yellow shading), (c) medium probability areas (40–60%, orange shading), and (d) high probability areas (> 60%, red shading). The black star in each panel indicates the genesis location of Newton. Hit rate indicates the percentage of outlook areas where the genesis location was captured within.