NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT[1]

TROPICAL STORM BUD

(EP022024)

24–26 July 2024

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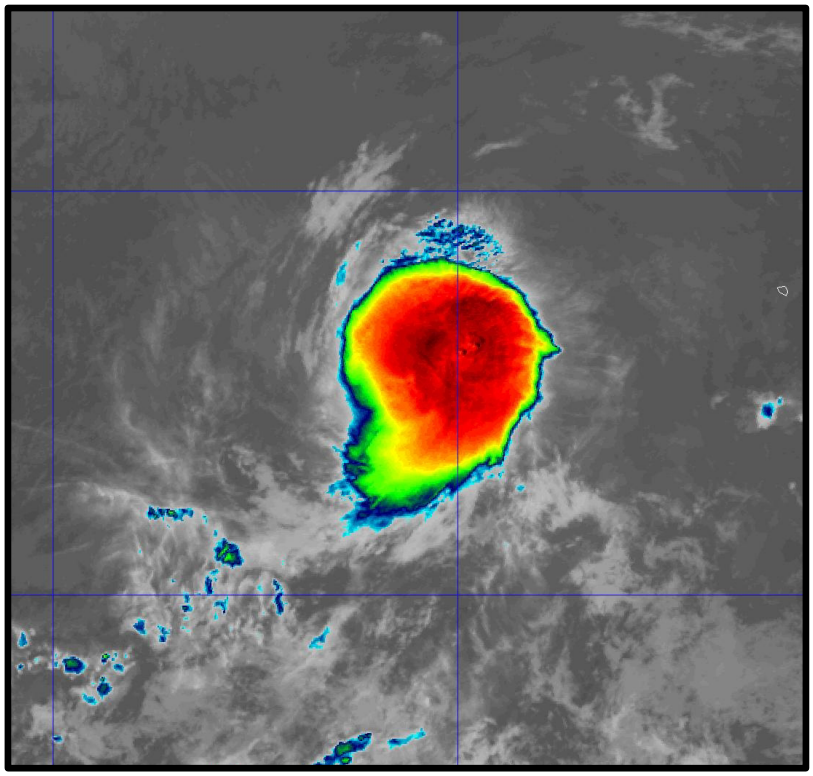

GOES-WEST INFRARED SATELLITE IMAGE OF TROPICAL STORM BUD AROUND THE TIME OF ITS PEAK INTENSITY AT 0900 UTC 25 JULY 2024.

Bud was a short-lived tropical storm that formed offshore of the Baja California peninsula and moved across Clarion Island.

[1] This is an abbreviated Tropical Cyclone Report since there were no coastal watches or warnings issued and no direct fatalities reported in association with Bud.

Tropical Storm Bud

24–26 JULY 2024

BEST TRACK

The "best track[2]" positions and intensities for Tropical Storm Bud are listed in Table 1. The best track chart of Bud's path is given in Fig. 1, with the wind and pressure histories along with available observations[3] shown in Figs. 2 and 3, respectively.

Origin

Bud's origins were likely related to a tropical wave that departed the west coast of Africa on 10 July. When this wave approached Central America on 19 July, its southern end began to interact with the monsoon trough over the far eastern Pacific. The combined feature gradually lifted northwestward over the next few days, and showers and thunderstorms began to organize a few hundred n mi south of Manzanillo, Mexico, on 23 July. Satellite data indicate that a well-defined low pressure system formed with sufficiently organized deep convection by 1200 UTC 24 July, marking the formation of a tropical depression about 400 n mi south of Cabo San Lucas, Mexico.

Peak Intensity and Minimum Pressure

Bud's peak intensity of 50 kt at 0600 and 1200 UTC 25 July is primarily based on a surface observation on Clarion Island, which reported maximum sustained winds of 49 kt and a gust of 63 kt at 0930 UTC 25 July. The weather station on the island reported sustained tropical-storm-force winds for a few hours. Upon further investigation, it is believed that Clarion Island was located within the region of maximum wind based on an ASCAT pass from 0523 UTC that showed the strongest winds 20–30 n mi north of Bud's center. The highest winds in that ASCAT pass were around 45 kt. In addition, another ASCAT pass around 1700 UTC that day showed peak winds between 40 and 45 kt, with the strongest winds remaining 20–30 n mi north of the center.

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[2] 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.

[3] Observations 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 Bud.

The estimated minimum pressure of Bud was 1001 mb at 0600 and 1200 UTC 25 July based on a combination of the Knaff-Zehr-Courtney (KZC) pressure-wind relationship and the Clarion Island observation of 1004 mb at 0930 UTC 25 July.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING VERIFICATION

Table 2 provides the number of hours in advance of formation with the first NHC Tropical Weather Outlook (TWO) forecast in each likelihood category. Figure 4 shows composites of 7-day TWO genesis areas prior to the formation of Bud. The genesis forecasts for Bud were quite poor. The system that became Bud was first mentioned in the TWO 180 h prior to genesis with a low chance (<40%) of development within 7 days. Likewise, the 2-day formation probabilities were introduced 48 h prior to genesis. However, the probabilities failed to reach the medium or high categories prior to formation. The challenging aspects to the genesis predictions were a combination of the relatively small size of Bud and limited time it had in conducive environmental conditions. The global model guidance also struggled to properly depict the system in the days leading to Bud's formation. Regarding the 7-day graphical TWO, 62% of the areas correctly captured the tropical cyclone's genesis location (Fig. 4).

A verification of NHC official track forecasts for Bud is given in Table 3. Official track forecast errors were greater than the mean official errors for the previous 5-yr period for a small number of forecasts at 12 and 24 h. A verification of NHC official intensity forecasts for Bud is given in Table 4. Official intensity forecast errors were also greater than the mean official errors for the previous 5-yr period for a small number of forecasts at 12 and 24 h. A homogeneous comparison of the official track and intensity errors with selected guidance models is not shown due to the small sample size of forecasts.

There were no coastal watches or warnings issued for Bud.

Table 1. Best track for Tropical Storm Bud, 24–26 July 2024.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
24 / 1200	16.3	110.5	1008	30	tropical depression
24 / 1800	16.9	111.7	1007	35	tropical storm
25 / 0000	17.4	112.8	1004	45	"
25 / 0600	17.8	114.0	1001	50	"
25 / 1200	18.1	115.2	1001	50	"
25 / 1800	18.4	116.4	1003	45	"
26 / 0000	18.7	117.5	1005	40	"
26 / 0600	18.9	118.5	1006	35	low
26 / 1200	19.1	119.3	1007	30	"
26 / 1800	19.2	120.1	1008	30	"
27 / 0000	19.3	121.0	1008	30	"
27 / 0600	19.3	122.0	1009	25	"
27 / 1200	19.2	123.0	1010	25	"
27 / 1800	19.0	123.8	1010	25	"
28 / 0000	18.5	124.6	1010	25	"
28 / 0600	17.8	125.4	1011	20	"
28 / 1200	17.0	126.3	1011	20	"
28 / 1800	16.1	127.3	1011	20	"
29 / 0000					dissipated
25 / 0600	17.8	114.0	1001	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	**168-Hour Outlook**
Low (<40%)	48	180
Medium (40%-60%)	-	-
High (>60%)	-	-

Table 3. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Bud, 24–26 July 2024. 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	25.6	57.9						
OCD5	17.8	20.7						
Forecasts	4	2						
OFCL (2019-23)	22.6	34.4	46.0	57.6	69.6	83.5	112.4	137.2
OCD5 (2019-23)	38.2	75.5	117.0	160.0	203.5	247.6	329.5	404.4

Table 4. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Bud, 24–26 July 2024. 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	11.2	10.0						
OCD5	9.5	0.0						
Forecasts	4	2						
OFCL (2019-23)	5.5	8.7	10.8	12.7	14.5	15.6	17.1	18.0
OCD5 (2019-23)	7.2	12.2	15.9	18.6	19.9	20.0	19.6	18.7

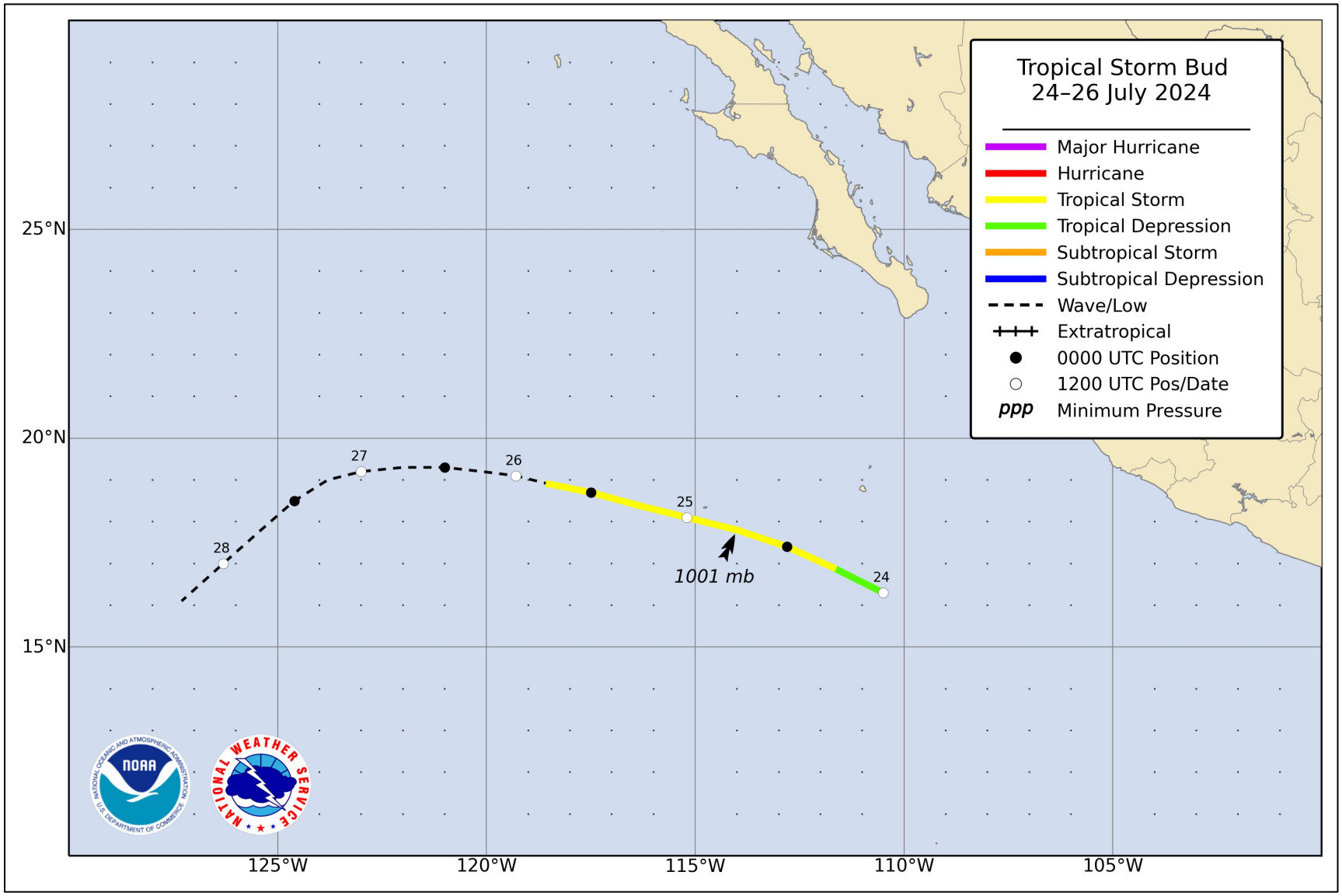

Figure 1. Best track positions for Tropical Storm Bud, 24–26 July 2024.

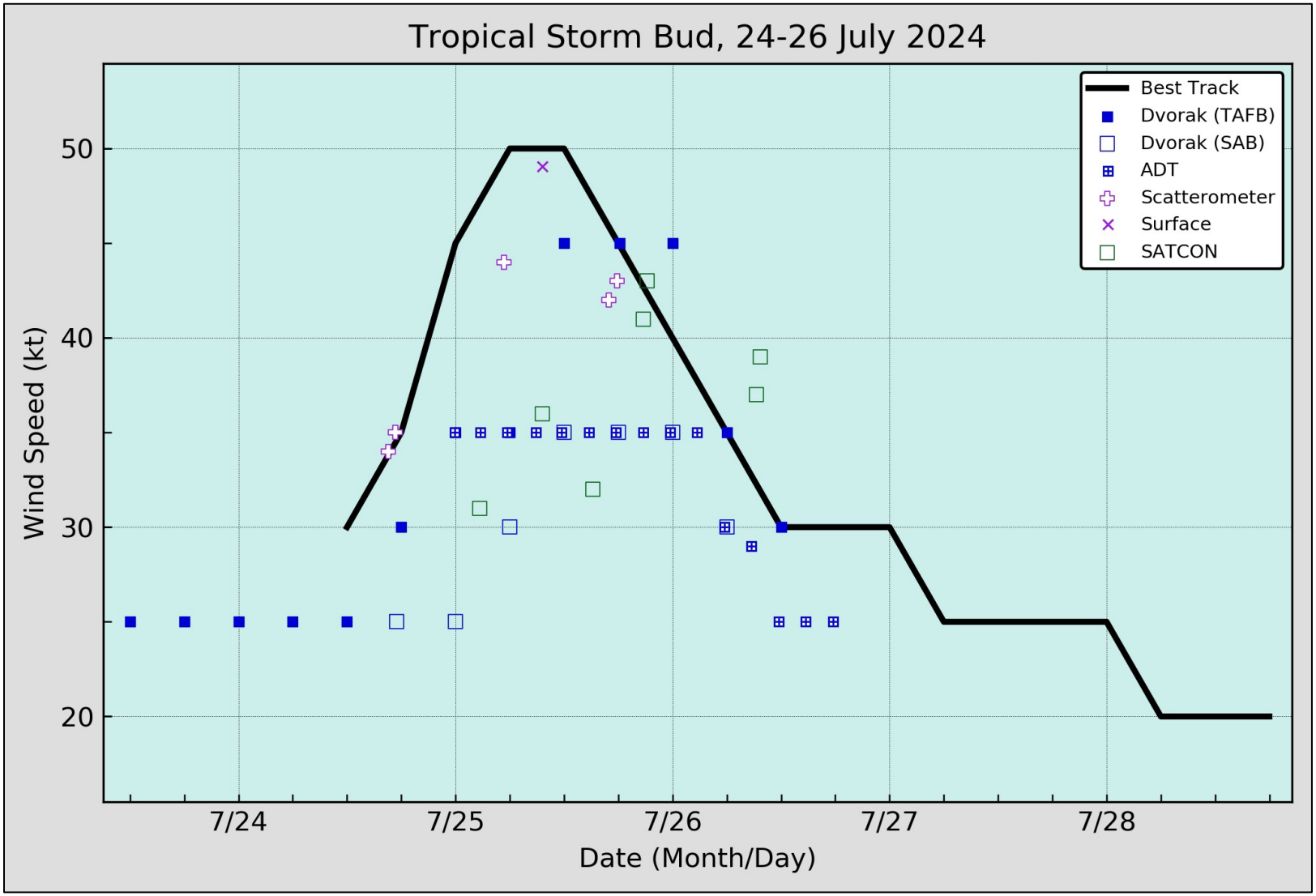

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Bud, 24–26 July 2024. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

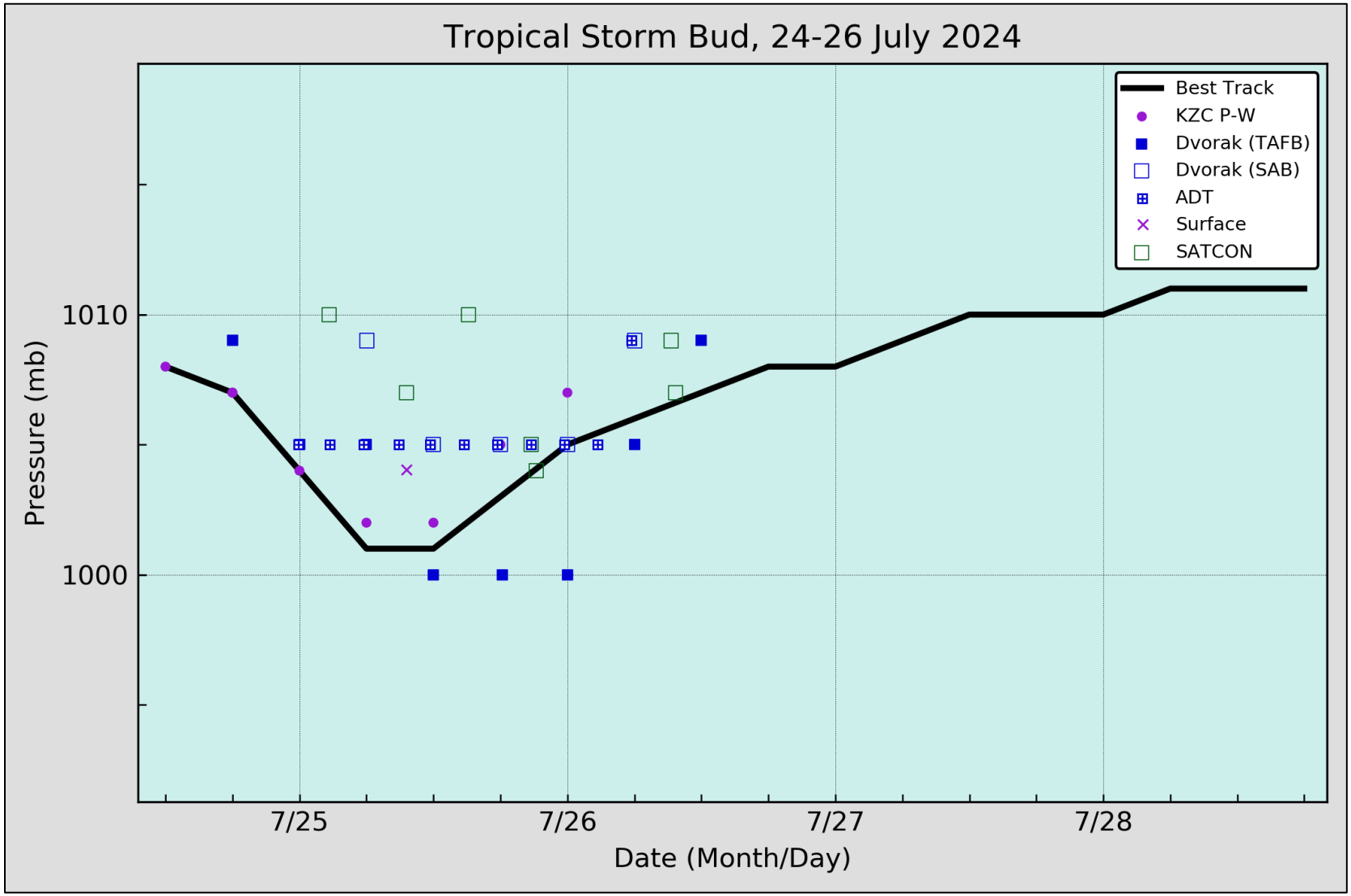

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Bud, 24–26 July 2024. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological 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.

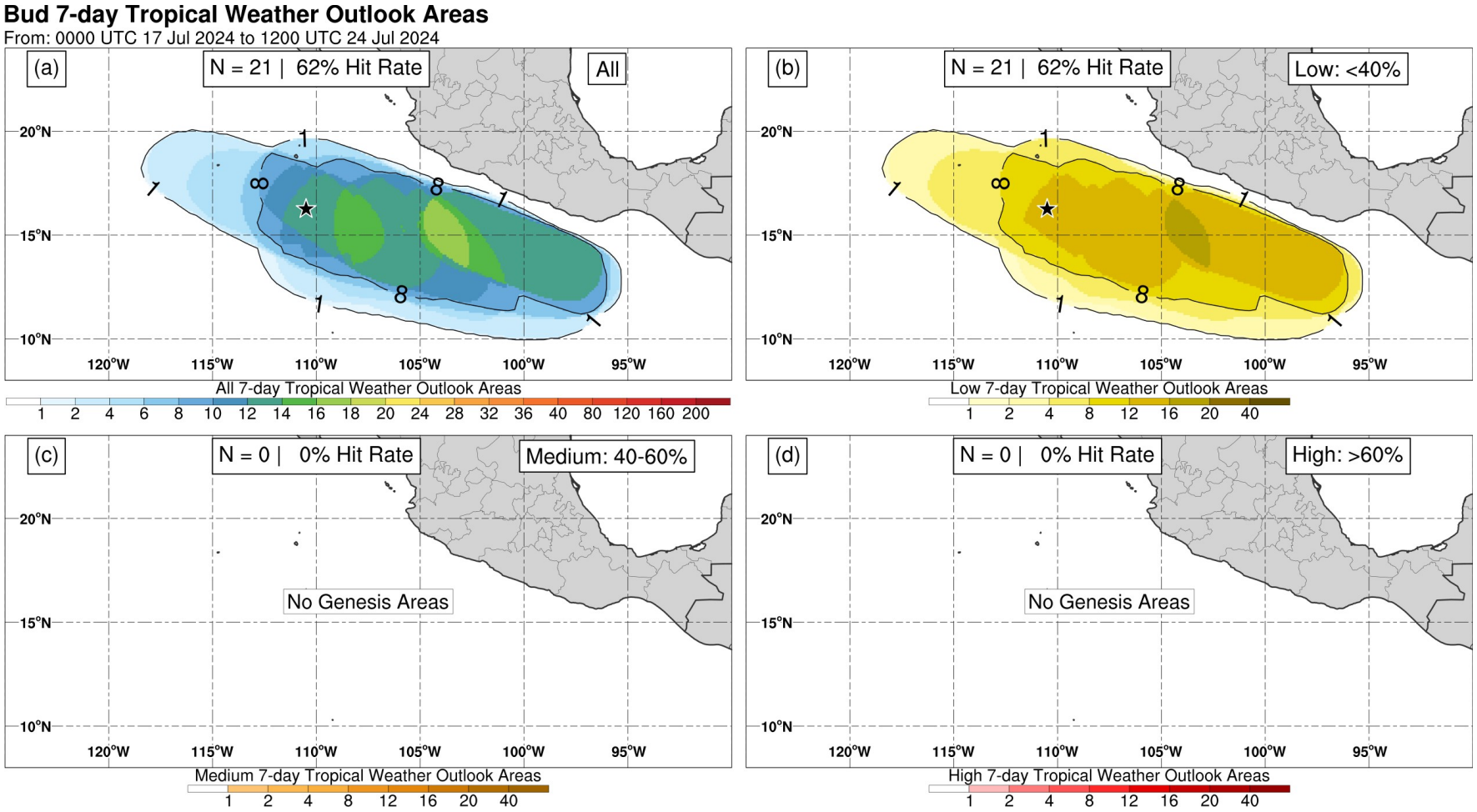

Figure 4. Composites of 7-day tropical cyclone genesis areas depicted in NHC's Tropical Weather Outlooks prior to the formation of Bud for (a) all probabilistic genesis categories, (b) the low (<40%) category, (c) medium (40–60%) category, and (d) high (>60%) category. The location of genesis is indicated by the black star.