

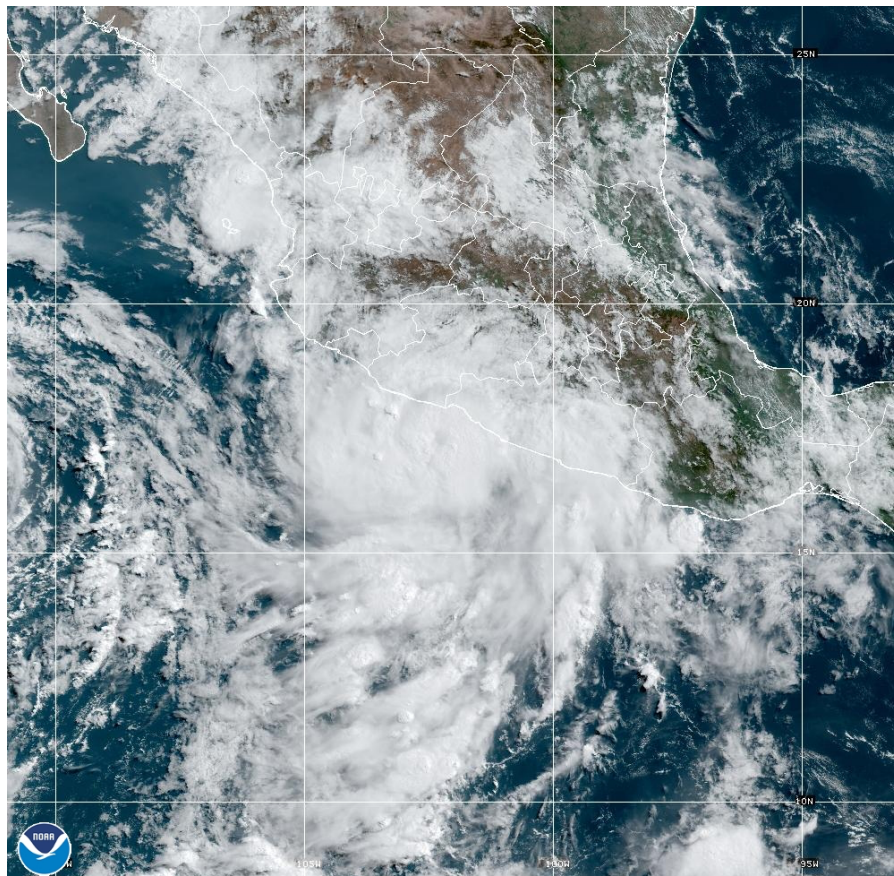


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE BEATRIZ (EP022023)

29 June- 1 July 2023

Eric S. Blake
National Hurricane Center
18 January 2024



GOES-16 GEOCOLOR IMAGE OF HURRICANE BEATRIZ AT 1500 UTC 30 JUNE 2023.
IMAGE COURTESY OF NOAA/NESDIS/STAR.

Beatriz was a category 1 hurricane that formed over the eastern Pacific near Mexico. The cyclone brought tropical-storm-force winds and locally heavy rainfall to portions of southwestern Mexico before it dissipated over the high terrain.

Hurricane Beatriz

29 JUNE- 1 JULY 2023

SYNOPTIC HISTORY

Beatriz formed from the same tropical wave that spawned Atlantic Tropical Storm Bret. After Bret dissipated over the central Caribbean Sea on 24 June, the wave continued westward, moving over Central America on 25 June. The wave entered the eastern Pacific on the next day and combined with a broad area of pre-existing low pressure. Plentiful but disorganized convection continued during the next two days while the system moved slowly westward to the south of Guatemala and southeastern Mexico. Banding features increased late on 28 June, and there was enough organized deep convection accompanying the now well-defined surface circulation to designate the system as a tropical depression at 0600 UTC 29 June when it was located about 210 n mi southeast of Acapulco, Mexico. The depression became a tropical storm 6 h later. The “best track” chart of Beatriz’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 1¹.

The storm moved west-northwestward to northwestward to the south of a ridge over Mexico during its lifetime. Almost immediately after genesis, Beatriz began to rapidly intensify in an environment of light-to-moderate northeasterly shear, very warm sea-surface temperatures and abundant middle-level moisture. Beatriz became a hurricane about 30 h after genesis and reached its peak intensity of 75 kt near 1800 UTC 30 June about 100 n mi southeast of Manzanillo. The hurricane then started weakening due to land interaction and a slight increase in shear. Beatriz passed close to Punta San Telmo, Mexico near 0000 UTC 1 July and made landfall as an estimated 55-kt tropical storm about 5 n mi west of Manzanillo International Airport near 0600 UTC. The system quickly weakened, with the mid-level circulation decoupling and moving westward away from the surface circulation, and Beatriz dissipated by 1200 UTC the same day over Mexico with no surface circulation apparent in visible satellite imagery or surface observations.

METEOROLOGICAL STATISTICS

Observations in Beatriz (Figs. 2 and 3) include subjective satellite-based Dvorak technique

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 *bt*k directory, while previous years’ data are located in the *archive* directory.

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. Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from one flight of the 53rd Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command. This flight provided a total of two center “fixes”. 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 Beatriz.

There were no ship or land reports of winds of tropical storm force in association with Beatriz.

Winds and Pressure

The 75-kt peak intensity of Beatriz is based on data from a reconnaissance aircraft. The aircraft reported a peak SFMR wind of 75 kt and 700-mb flight-level winds of 84 kt around 1800 UTC 30 June. A dropsonde released by the aircraft around this time measured a minimum pressure of 993 mb with 16-kt winds, which was the basis of the minimum pressure estimate of 992 mb. It does appear that most conventional satellite intensity estimates had a small low bias compared to the aircraft data.

Beatriz brought tropical-storm-force winds to portions of southwestern Mexico. However, there were no available surface observations near the area of landfall, so the 55-kt landfall intensity is highly uncertain and is based on satellite trends. It is also possible the surface center remained just offshore of southwestern Mexico as shown in operational advisories, but given the rapid demise, it seems most probable that Beatriz moved onshore and quickly dissipated.

Rainfall and Flooding

Beatriz produced areas of heavy rainfall and isolated flooding over portions of southwestern Mexico (Fig. 4). The highest rainfall report received was 199.5 mm (7.85 in) recorded in Acapulco, with slightly less in the landfall region in southwestern Mexico.

CASUALTY AND DAMAGE STATISTICS

There have been no reports of deaths or significant injuries in association with Beatriz. Media reports indicate that downed trees, power outages, and flooding occurred across portions

of the states of Colima, Michoacán, Jalisco and Sinaloa, but overall the damage was minor. There have been no monetary damage estimates received.

FORECAST AND WARNING CRITIQUE

The genesis of Beatriz was generally well predicted. The tropical wave from which Beatriz developed was introduced in the Tropical Weather Outlook 138 h prior to genesis (Table 2). The 7-day probabilities were raised to the medium (40-60%) and high (>60%) categories 102 and 60 h before genesis, respectively. A 2-day chance of formation was introduced into the outlook 78 h before formation, and the probabilities were raised to the medium and high categories 48 and 18 h before development, respectively. Beatriz's location of formation was well anticipated as every NHC genesis area correctly covered the formation point (Fig. 5).

A verification of NHC official track forecasts is given in Table 3a. Official track forecast errors through 48 h were lower than the mean official errors for the previous 5-year period. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. While the sample size is rather small, NHC forecasts beat the vast majority of the guidance.

A verification of NHC official intensity forecasts is given in Table 4a. The NHC intensity forecast errors were higher than the mean official errors for the previous 5-year period through 36 h, which shouldn't be surprising given Beatriz's rapid intensification. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. While NHC forecasts eventually did forecast rapid intensification, the event was already underway by that point, and NHC forecasts were beaten by several guidance aids, most notably the HAFS suite.

Coastal watches and warnings associated with Beatriz are given in Table 5. Note that Potential Tropical Cyclone advisories were initiated at 0300 UTC 29 June, one advisory before Beatriz became a tropical cyclone, so that watches could be issued for this threat.



Table 1. Best track for Hurricane Beatriz, 29 June–1 July 2023.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
29 / 0000	13.2	96.3	1007	25	low
29 / 0600	13.8	97.3	1006	30	tropical depression
29 / 1200	14.3	98.2	1004	35	tropical storm
29 / 1800	14.8	99.0	1003	40	"
30 / 0000	15.4	99.9	1002	45	"
30 / 0600	16.1	100.9	999	55	"
30 / 1200	16.8	101.8	994	70	hurricane
30 / 1800	17.5	102.7	992	75	"
01 / 0000	18.4	103.7	995	65	"
01 / 0600	19.2	104.6	999	55	tropical storm
01 / 1200					dissipated
30 / 1800	17.5	102.7	992	75	minimum pressure and maximum winds
01 / 0600	19.2	104.6	999	55	landfall 5 n mi west of Manzanillo International Airport



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%)	78	138
Medium (40%-60%)	48	102
High (>60%)	18	60



Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Beatriz. 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	18.7	26.0	32.2	42.0				
OCD5	26.5	61.7	87.8	109.6				
Forecasts	7	5	3	1				
OFCL (2018-22)	22.1	34.0	45.4	56.0	70.9	78.7	100.5	117.8
OCD5 (2018-22)	36.7	73.4	114.0	156.9	193.2	244.5	317.0	376.0



Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Beatriz. 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	19.7	15.9	27.6	42.0				
OCD5	26.5	36.5	70.0	109.6				
GFSI	36.7	56.0	93.3	96.7				
EMXI	16.5	24.9	34.8	46.9				
CMCI	48.8	35.4	62.1	75.3				
HMNI	44.0	60.5	90.4	115.3				
HWFI	41.9	42.4	75.8	83.0				
HFAI	26.8	25.8	29.0	42.6				
HFBI	27.9	34.2	51.5	80.0				
CTCI	35.3	37.5	46.5	46.9				
AEMI	33.7	51.0	85.0	85.7				
HCCA	22.5	14.9	14.6	0.0				
TVCX	24.1	29.6	42.9	48.3				
GFEX	20.5	36.6	50.5	56.6				
TVCE	25.2	28.3	45.6	55.2				
TVDG	24.6	35.1	48.1	54.3				
TABD	22.3	42.0	89.7	136.0				
TABM	19.5	19.7	38.3	58.0				
TABS	26.3	43.1	86.8	130.0				
Forecasts	6	2	2	1	0	0	0	0

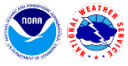


Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Beatriz. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

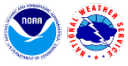
	Forecast Period (h)							
	12	24	36	48	60	72	96	120
OFCL	9.3	11.0	15.0	0.0				
OCD5	14.9	18.4	14.3	2.0				
Forecasts	7	5	3	1				
OFCL (2018-22)	5.4	8.9	11.0	12.8	14.3	15.8	17.0	17.6
OCD5 (2018-22)	6.9	12.1	15.9	18.6	18.7	21.0	22.3	22.1

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Beatriz. 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	8.3	10.0	15.0	0.0				
OCD5	12.5	20.5	14.3	2.0				
HWFI	8.5	8.5	14.3	23.0				
HMNI	13.2	15.2	10.3	5.0				
HFAI	3.8	9.5	16.7	1.0				
HFBI	4.0	6.5	23.0	5.0				
CTCI	8.0	10.8	10.3	4.0				
DSHP	10.3	13.5	8.3	14.0				
LGEM	12.2	21.0	12.7	4.0				
ICON	10.7	14.2	9.3	9.0				
IVCN	7.7	10.2	11.0	4.0				
IVDR	7.5	9.0	11.7	4.0				
HCCA	6.2	8.8	11.3	1.0				
GFSI	9.5	8.2	7.3	8.0				
EMXI	15.3	28.2	27.3	3.0				
Forecasts	6	4	3	1	0	0	0	0

Table 5. Watch and warning summary for Hurricane Beatriz, 29 June–1 July 2023.

Date/Time (UTC)	Action	Location
29 / 0300	Tropical Storm Watch issued	Lazaro Cardenas to Manzanillo
29 / 0300	Tropical Storm Warning issued	Punta Maldonado to Lazaro Cardenas
29 / 0900	Tropical Storm Watch discontinued	Lazaro Cardenas to Manzanillo
29 / 0900	Tropical Storm Watch issued	Punta San Telmo to Playa Perula
29 / 0900	Tropical Storm Warning modified to	Punta Maldonado to Punta San Telmo
29 / 1500	Tropical Storm Watch discontinued	All
29 / 1500	Tropical Storm Warning modified to	Punta Maldonado to Manzanillo
29 / 1500	Hurricane Watch issued	Lazaro Cardenas to Cabo Corrientes
29 / 2100	Tropical Storm Watch issued	Cabo Corrientes to Punta Mita
29 / 2100	Tropical Storm Warning modified to	Punta Maldonado to Zihuatanejo
29 / 2100	Hurricane Watch modified to	Playa Perula to Cabo Corrientes
29 / 2100	Hurricane Warning issued	Zihuatanejo to Playa Perula
30 / 0900	Tropical Storm Watch changed to Tropical Storm Warning	Cabo Corrientes to Punta Mita
30 / 0900	Tropical Storm Watch changed to Hurricane Watch	Cabo Corrientes to Punta Mita
30 / 0900	Tropical Storm Watch issued	Punta Mita to San Blas
30 / 0900	Tropical Storm Warning modified to	Acapulco to Zihuatanejo
30 / 0900	Hurricane Watch modified to	Cabo Corrientes to Punta Mita
30 / 0900	Hurricane Warning modified to	Zihuatanejo to Cabo Corrientes
30 / 1500	Tropical Storm Watch issued	Las Islas Marias
30 / 1500	Tropical Storm Warning modified to	Tecpan de Galeana to Zihuatanejo
30 / 2100	Tropical Storm Warning discontinued	Tecpan de Galeana to Zihuatanejo
1 / 0300	Hurricane Warning modified to	Lazaro Cardenas to Cabo Corrientes
1 / 0900	Tropical Storm Warning modified to	Manzanillo to Punta Mita



Date/Time (UTC)	Action	Location
1 / 0900	Hurricane Watch discontinued	All
1 / 0900	Hurricane Warning discontinued	All
1 / 1800	Tropical Storm Watch discontinued	All
1 / 1800	Tropical Storm Warning discontinued	All

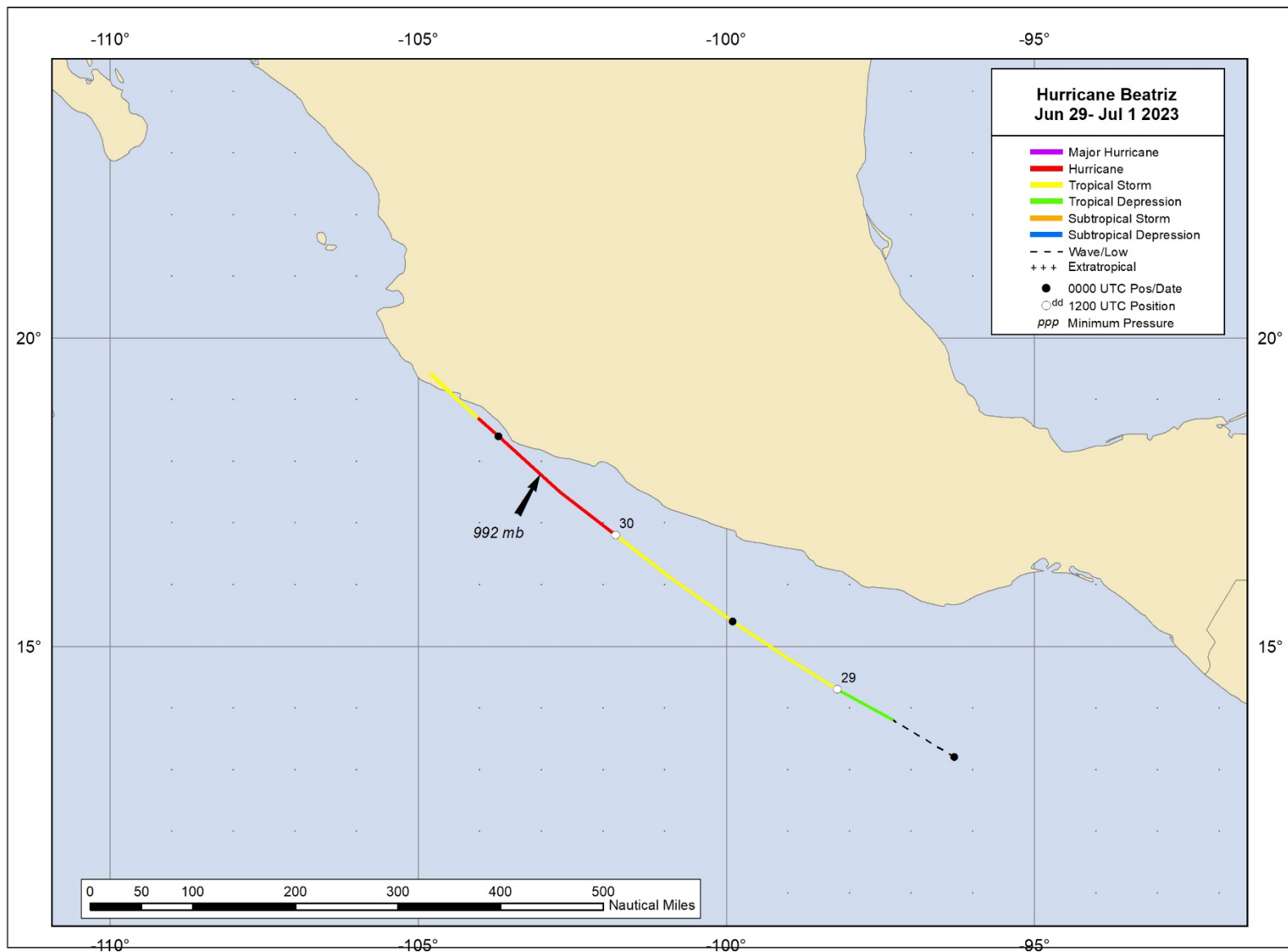


Figure 1. Best track positions for Hurricane Beatriz, 29 June–1 July 2023.

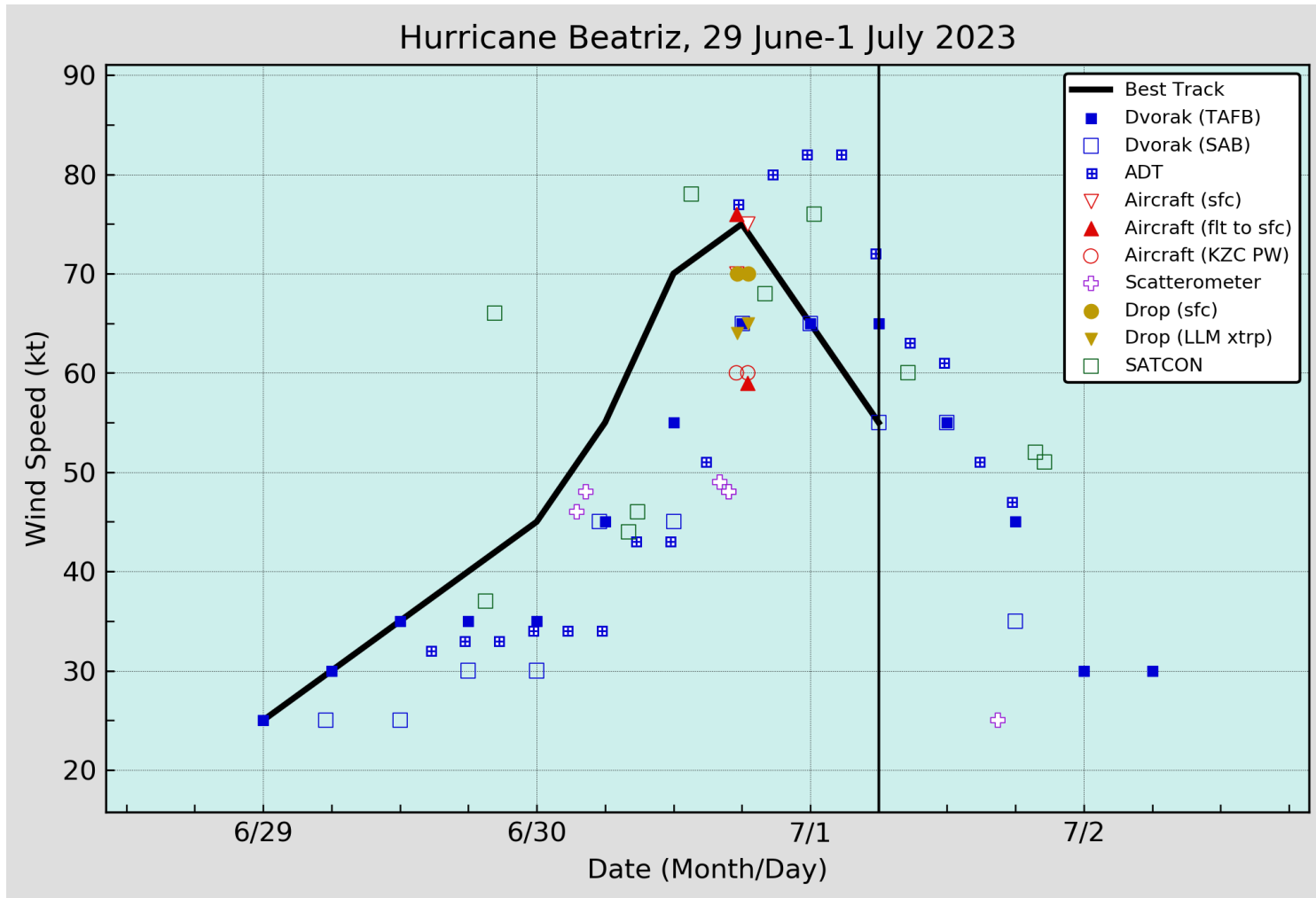


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Beatriz, 29 June–1 July 2023. Aircraft observations have been adjusted for elevation using 90% adjustment factors for observations from 700 mb. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM). 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, and the solid vertical line corresponds to landfall.

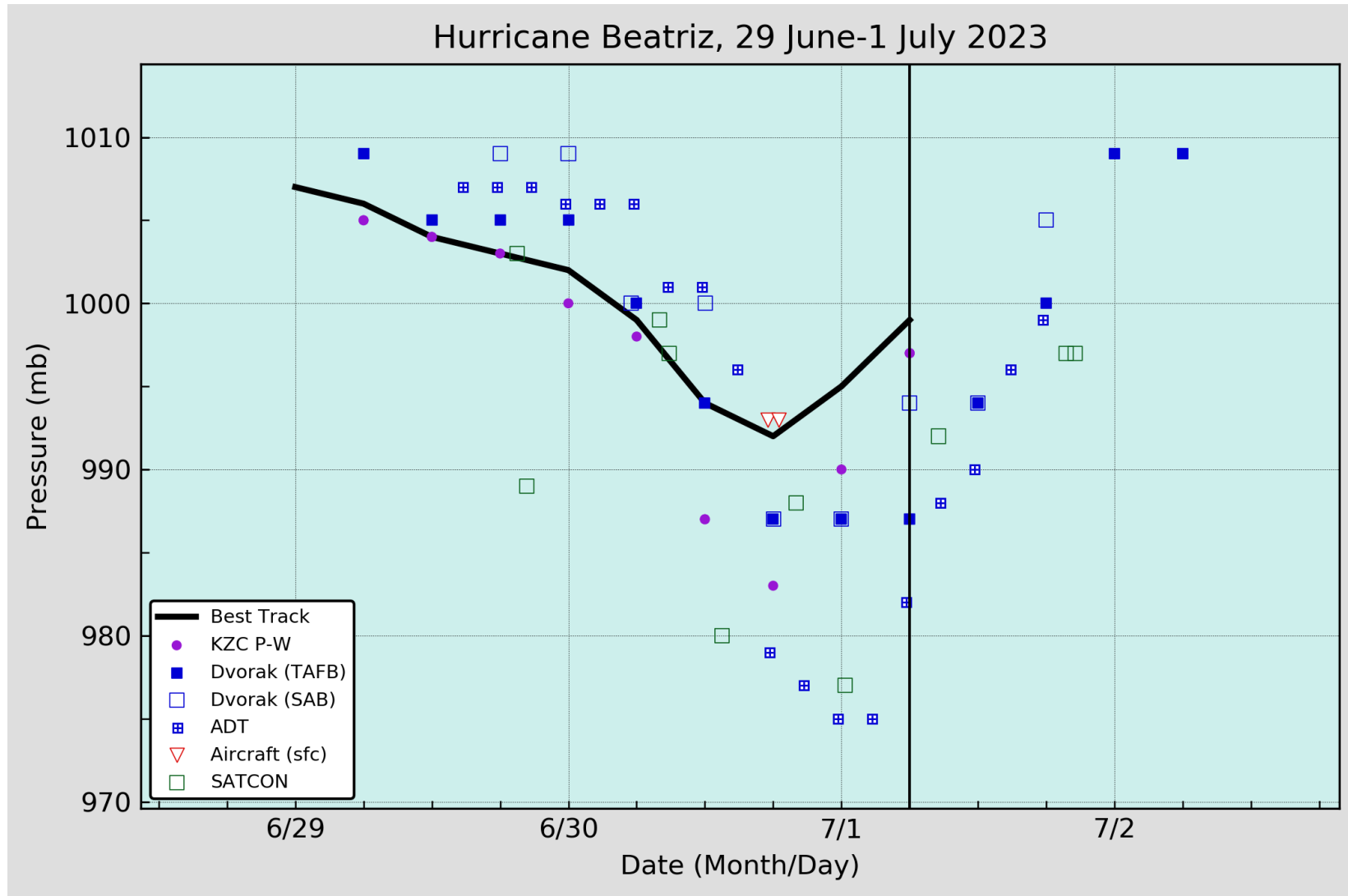


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Beatriz, 29 June–1 July 2023. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological 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, and the solid vertical line corresponds to landfall.

Precipitación acumulada (mm) del 29 de junio al 1 de julio de 2023 por el huracán Beatriz

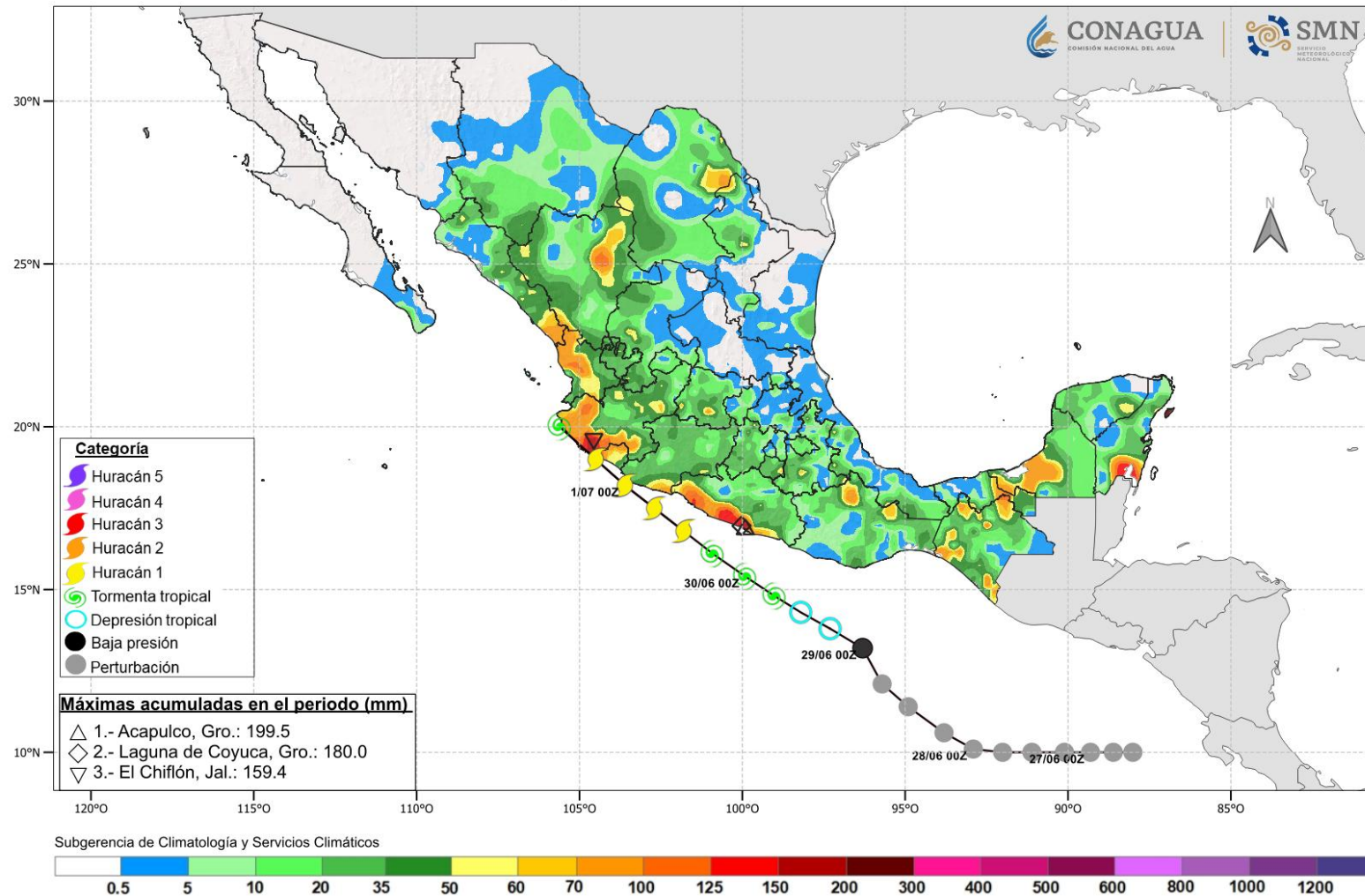


Figure 4. Storm total rainfall analysis (in mm) from Mexico during Hurricane Beatriz from 29 June- 1 July 2023. Image courtesy of Conagua SMN. Not all of the rainfall depicted is directly related to Beatriz, and the track shown is the operational best track.

Beatriz 7-day Tropical Weather Outlook Areas

From: 1800 UTC 23 Jun 2023 to 0600 UTC 29 Jun 2023

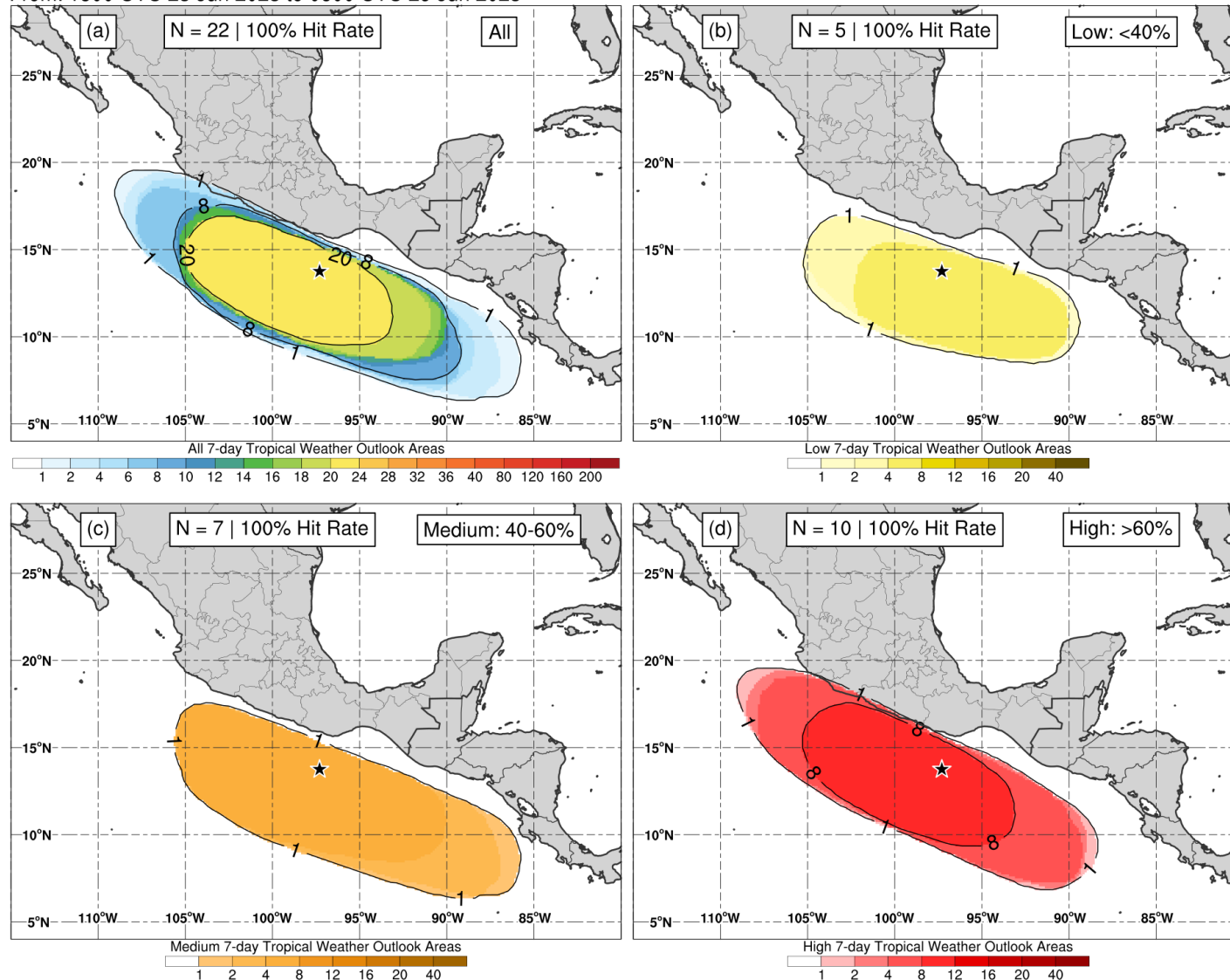


Figure 5. Composites of 7-day tropical cyclone genesis areas depicted in NHC's Tropical Weather Outlooks prior to the formation of Beatriz for (a) all probabilistic genesis categories, (b) the low (<40%) category, (c) medium (40–60%) category, and (d) high (>60%) category. The location of genesis is indicated by the black star.