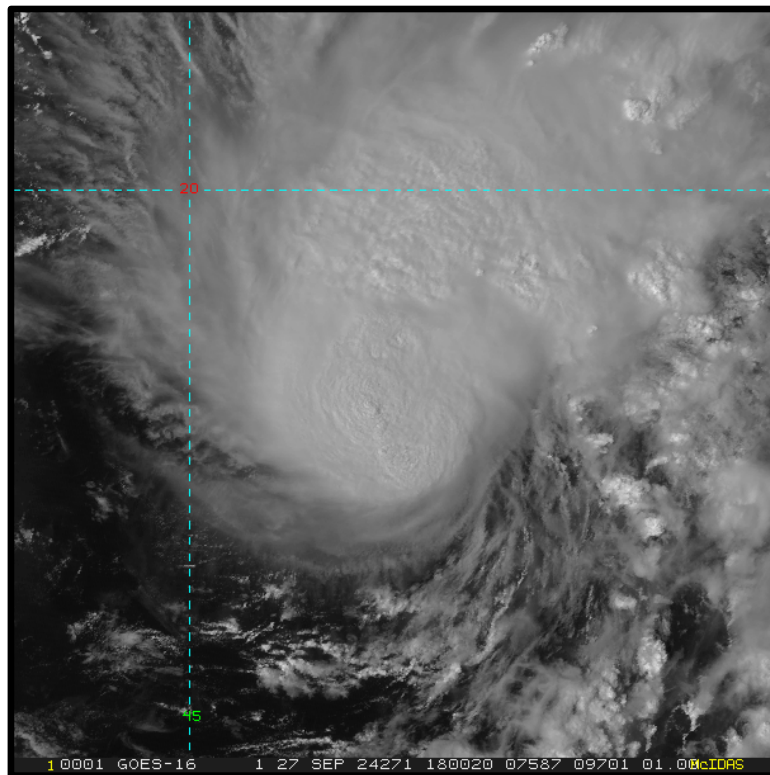# NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT[1]

TROPICAL STORM JOYCE
(AL112024)
27–30 September 2024

John P. Cangialosi
National Hurricane Center
12 December 2024

GOES-16 VISIBLE SATELLITE IMAGE OF TROPICAL STORM JOYCE AROUND THE TIME OF ITS PEAK INTENSITY AT 1800 UTC 27 SEPTEMBER 2024.

Joyce was a relatively short-lived tropical storm over the central Atlantic that did not affect land.

---

[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 Joyce.

Tropical Storm Joyce

27–30 SEPTEMBER 2024

BEST TRACK

The "best track[2]" positions and intensities for Tropical Storm Joyce are listed in Table 1. The best track chart of Joyce'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

Joyce's origins can be traced back to a tropical wave that departed the west coast of Africa on 22 September. The wave passed through the Cabo Verde Islands on 24 September with gusty winds and disorganized showers and thunderstorms. The associated thunderstorm activity increased during the next couple of days while the system moved west-northwestward over the east-central tropical Atlantic. Satellite data indicate that a well-defined low pressure system formed with sufficiently organized deep convection by 0600 UTC 27 September, marking the formation of a tropical depression over the tropical central Atlantic about 1150 n mi east of the northern Leeward Islands.

Peak Intensity and Minimum Pressure

Joyce's peak intensity of 45 kt from 1800 UTC 27 September to 1200 UTC 28 September is primarily based on a blend of objective and subjective Dvorak estimates that ranged from 35 to 55 kt during that time. In addition, an ASCAT pass at 0022 UTC 28 September had peak winds between 40 and 45 kt, which also supports the 45-kt peak intensity.

The estimated minimum pressure of Joyce of 1001 mb from 1800 UTC 27 September to 0600 UTC 28 September is based on a blend of the Knaff-Zehr-Courtney (KZC) pressure-wind relationship and the Dvorak pressure-wind relationship.

---

[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 Joyce.

CASUALTY AND DAMAGE STATISTICS

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

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 Joyce. The genesis forecasts for Joyce were quite good. The system was first mentioned in the TWO 144 h prior to genesis with a low chance (<40%) of development within 7 days. Likewise, the 2-day formation probabilities were introduced 96 h prior to genesis. The probabilities reached the medium and high categories in the 7-day TWO 132 h and 96 h before formation, respectively. The lead times for the 2-day TWO were 60 h and 30 h for the medium and high categories, respectively. Regarding the 7-day graphical TWO, all of the areas correctly captured the tropical cyclone's genesis location (Fig. 4).

A verification of NHC official track forecasts for Joyce is given in Table 3a. Official track forecast errors were lower than the mean official errors for the previous 5-yr period for all verifying times, except 36 h where the errors were slightly above the mean. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The only models that consistently outperformed the official forecasts were the consensus aids TVCA and TVCX.

A verification of NHC official intensity forecasts for Joyce is given in Table 4a. Official intensity forecast errors were well below the mean official errors for the previous 5-yr period for all verifying forecasts. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. No model consistently outperformed the official forecasts, but most of the guidance had relatively low errors for Joyce. One exception was HMNI, which had a significant high bias for a small number of forecasts that verified at 48 and 60 h.

There were no coastal watches or warnings issued for Joyce.

Table 1.   Best track for Tropical Storm Joyce, 27–30 September 2024.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
27 / 0600	17.1	41.5	1007	30	tropical depression
27 / 1200	17.8	42.5	1005	35	tropical storm
27 / 1800	18.2	43.4	1001	45	"
28 / 0000	18.8	44.3	1001	45	"
28 / 0600	19.3	45.0	1001	45	"
28 / 1200	19.7	45.7	1002	45	"
28 / 1800	20.2	46.4	1003	40	"
29 / 0000	20.6	47.1	1004	40	"
29 / 0600	21.1	47.8	1004	40	"
29 / 1200	21.6	48.4	1005	40	"
29 / 1800	22.0	48.9	1006	35	"
30 / 0000	22.1	49.5	1006	30	tropical depression
30 / 0600	22.5	49.5	1006	30	"
30 / 1200	22.6	49.0	1006	30	"
30 / 1800	22.5	48.8	1006	30	"
1 / 0000					dissipated
27 / 1800	18.2	43.4	1001	45	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%)	96	144
Medium (40%-60%)	60	132
High (>60%)	30	96

Table 3a.   NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Joyce, 27–30 September 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	**19.3**	**36.2**	50.3	**55.9**	**55.8**	**42.6**		
OCD5	25.4	50.7	76.8	101.6	149.5	219.0		
Forecasts	12	10	8	6	4	2		
OFCL (2019-23)	23.9	36.5	49.3	63.4	79.2	93.4	132.9	190.4
OCD5 (2019-23)	45.7	97.1	153.0	205.4	254.9	297.8	372.7	439.1

Table 3b.　　Homogeneous comparison of selected track forecast guidance models (in n mi) for Joyce, 27–30 September 2024. 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	13.2	34.4	45.3	48.0	61.4			
OCD5	14.6	50.5	78.7	108.8	168.5			
GFSI	17.3	41.0	52.6	52.4	**53.1**			
EMXI	21.8	38.5	48.4	65.4	100.7			
HWFI	**12.6**	38.1	62.0	60.8	**40.0**			
HMNI	17.2	**32.9**	62.4	112.1	220.5			
HFAI	28.8	45.9	88.2	110.2	258.6			
HFBI	22.6	**34.3**	54.3	100.1	130.1			
EGRI	25.2	46.5	63.4	92.6	148.5			
CMCI	17.2	**33.9**	**41.5**	**43.5**	**60.1**			
AEMI	20.2	40.9	59.1	61.3	78.4			
HCCA	**13.1**	**33.1**	47.0	50.2	**49.4**			
TVCA	**12.4**	**27.9**	**39.9**	**38.4**	**33.7**			
FSSE	19.1	**34.1**	52.1	61.1	84.8			
TVCX	**11.8**	**27.5**	**38.4**	**36.3**	**31.2**			
GFEX	18.1	36.5	48.0	59.3	74.1			
Forecasts	8	8	6	4	2			

Table 4a.   NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Joyce, 27–30 September 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	**2.9**	**3.0**	**3.8**	**3.3**	**3.8**	**2.5**		
OCD5	5.4	11.1	17.2	24.2	31.2	34.0		
Forecasts	12	10	8	6	4	2		
OFCL (2019-23)	5.0	7.3	8.5	9.7	10.4	10.9	12.9	15.5
OCD5 (2019-23)	6.6	10.2	13.1	15.6	17.2	18.6	21.8	22.6

Table 4b.   Homogeneous comparison of selected intensity forecast guidance models (in kt) for Joyce, 27–30 September 2024. 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.

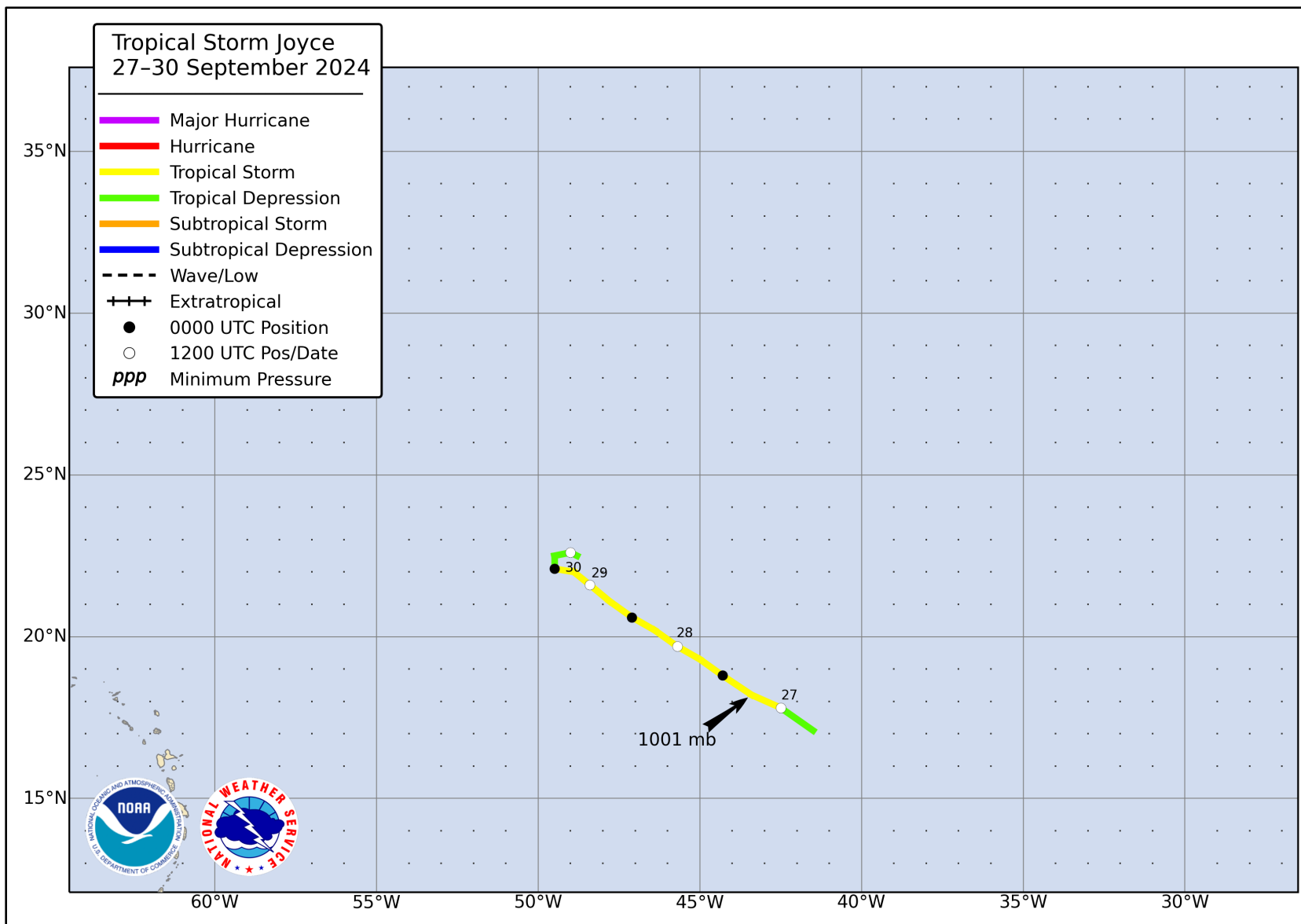| Model ID	Forecast Period (h)							
	12	24	36	48	60	72	96	120
OFCL	2.5	1.9	3.3	3.8	0.0			
OCD5	5.9	11.1	16.8	24.2	30.0			
HWFI	**2.4**	4.1	4.0	**2.0**	4.5			
HMNI	5.5	4.1	7.2	15.0	24.5			
HFAI	4.6	5.6	3.5	5.5	13.0			
HFBI	3.0	4.6	4.3	4.5	8.5			
DSHP	3.9	4.0	5.5	8.0	9.5			
LGEM	3.9	3.2	3.3	5.8	7.0			
HCCA	**1.6**	2.5	**1.5**	4.2	5.0			
FSSE	2.8	3.1	**1.5**	**2.5**	2.0			
GFSI	2.8	3.4	4.7	4.0	7.0			
EMXI	**2.1**	2.9	3.3	**2.5**	6.0			
Forecasts	8	8	6	4	2			

Figure 1.   Best track positions for Tropical Storm Joyce, 27–30 September 2024
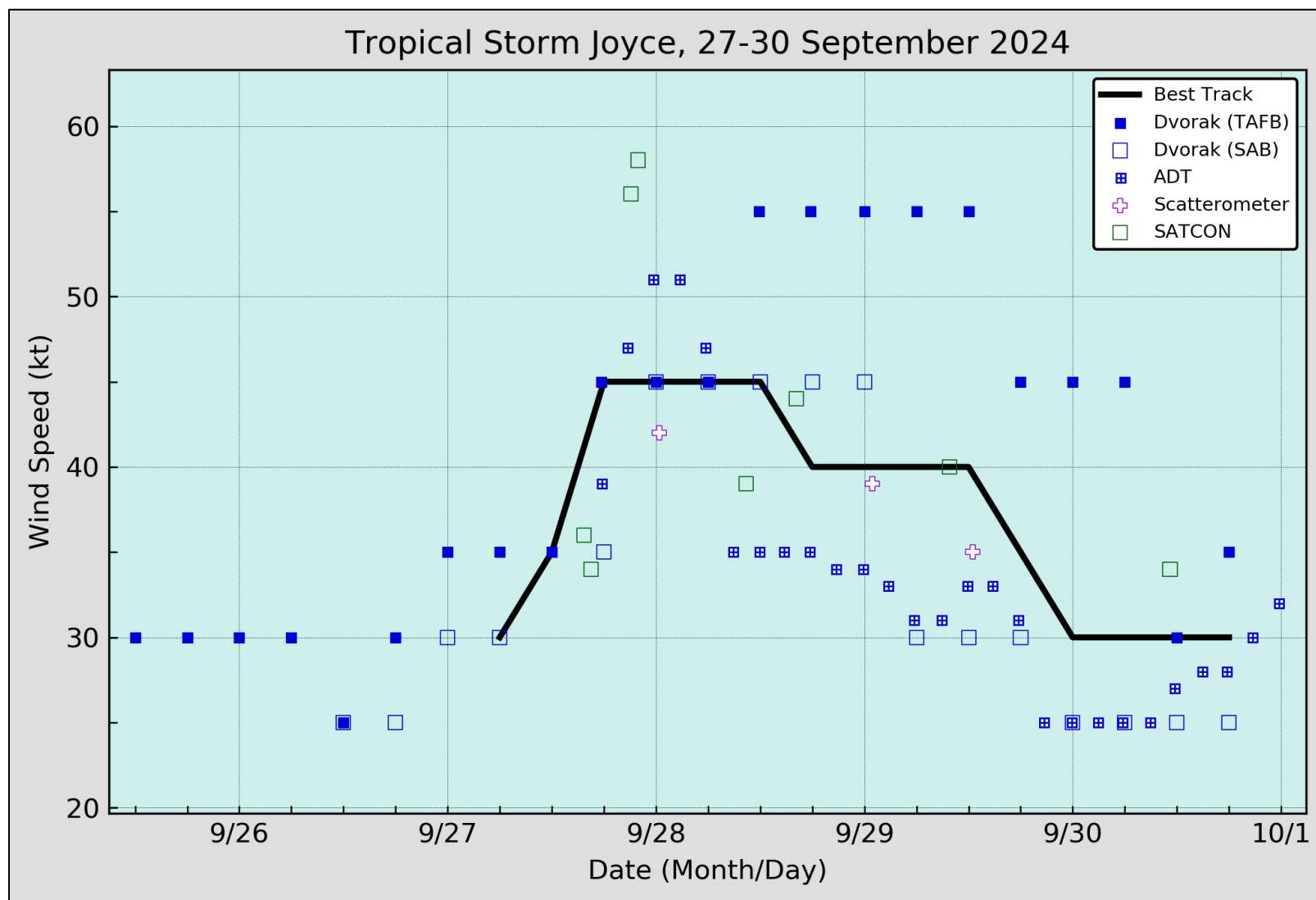
Figure 2.   Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Joyce, 27–30 September 2024. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.
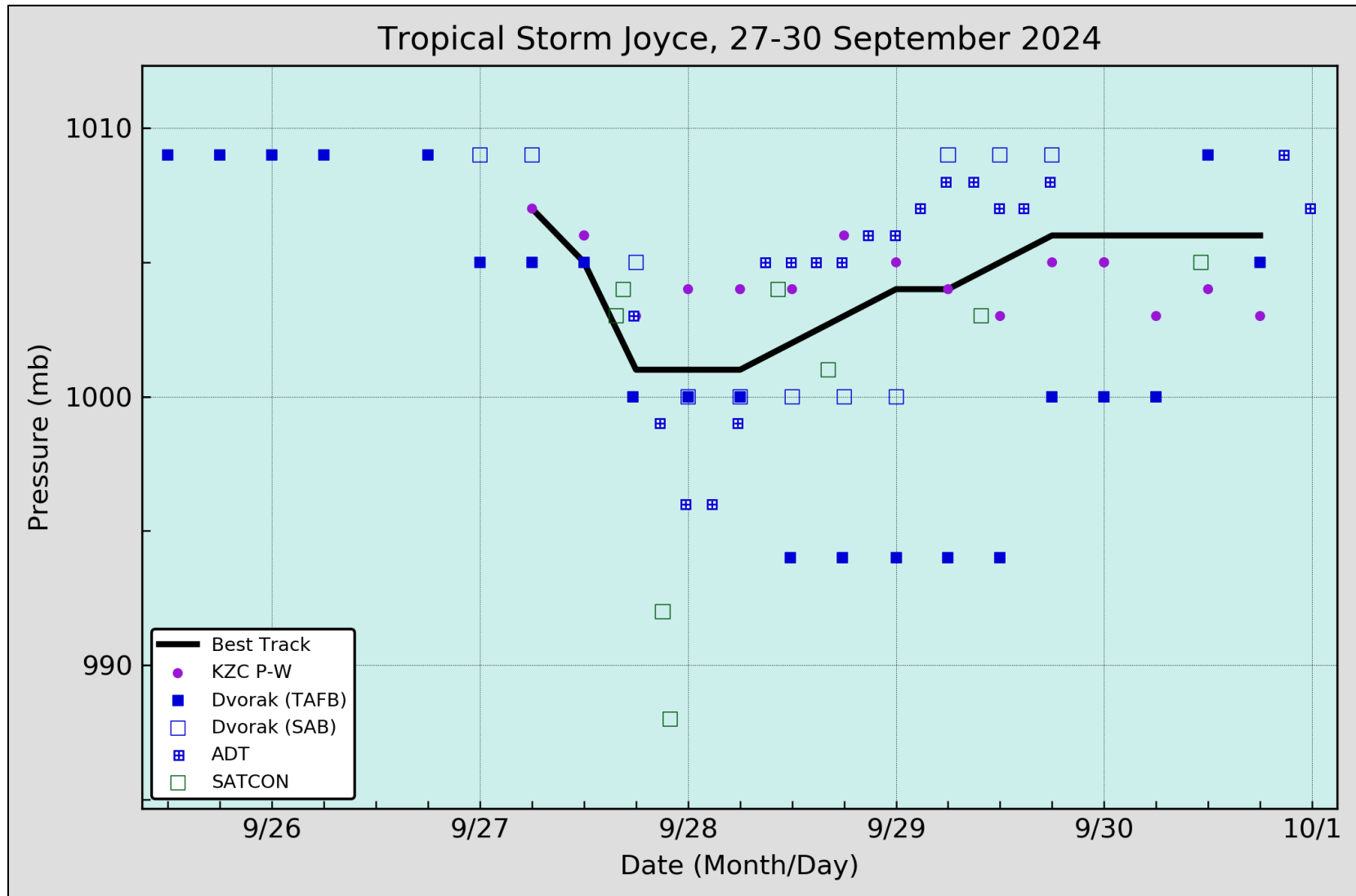
Figure 3.   Selected pressure observations and best track minimum central pressure curve for Tropical Storm Joyce, 27–30 September 2024. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.
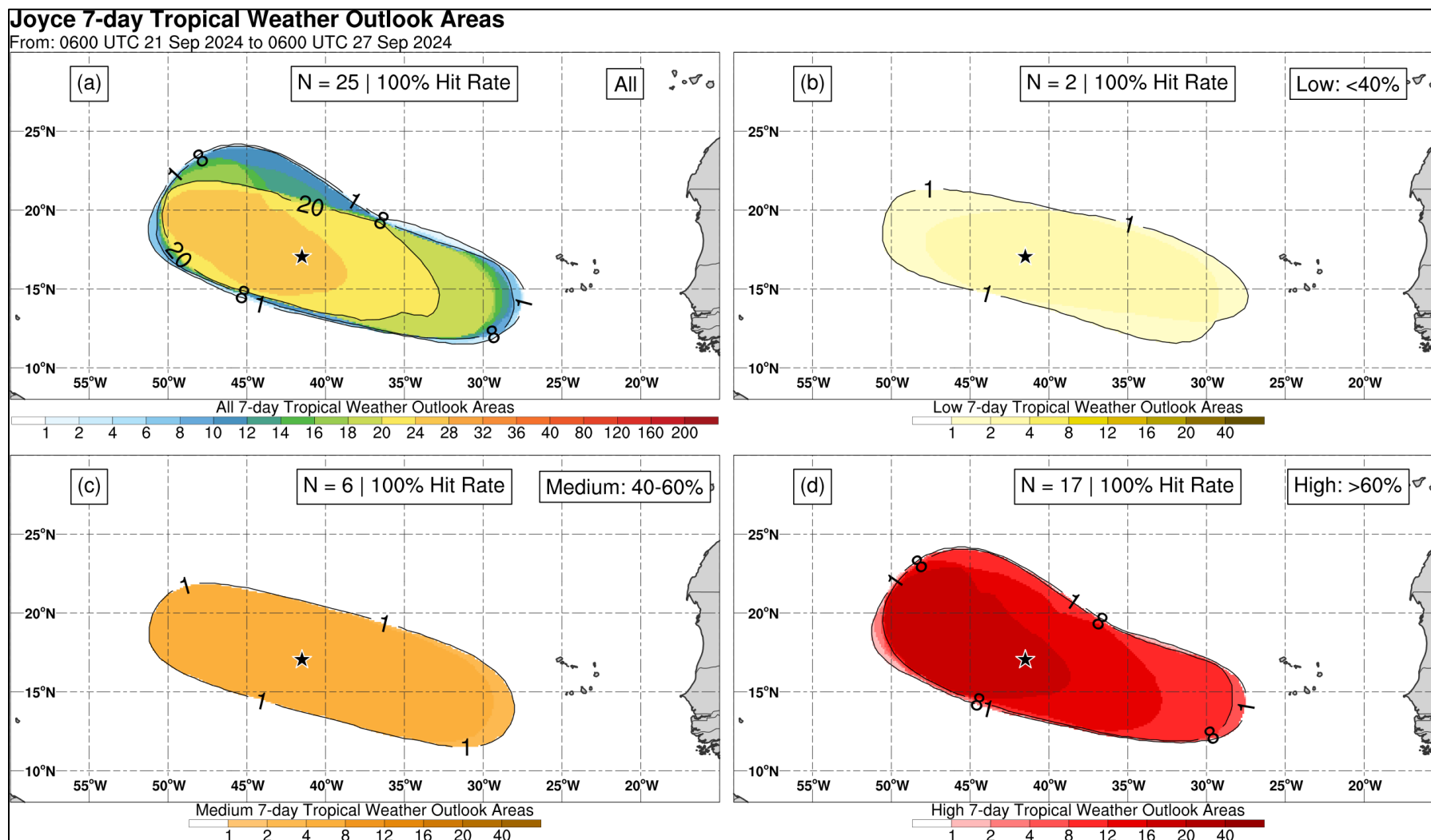
Figure 4. Composites of 7-day tropical cyclone genesis areas depicted in NHC's Tropical Weather Outlooks prior to the formation of Joyce for (a) all probabilistic genesis categories, (b) the low (<40%) category, (c) medium (40–60%) category, and (d) high (>60%) category. The location of genesis is indicated by the black star.