

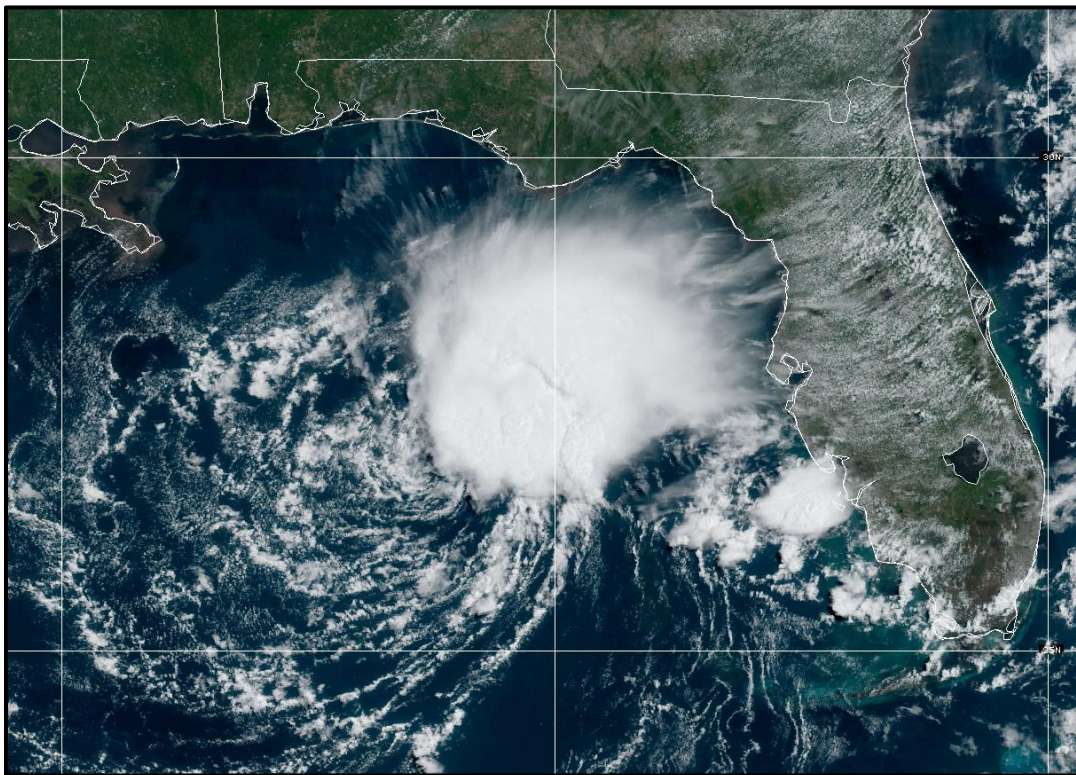


# NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT<sup>1</sup>

## TROPICAL STORM ARLENE (AL022023)

1–3 June 2023

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National Hurricane Center  
13 July 2023



GOES-16 GEOCOLOR IMAGE OF TROPICAL STORM ARLENE AT 1500 UTC 2 JUNE 2023.  
IMAGE COURTESY OF NOAA/NESDIS/STAR.

Arlene was a short-lived tropical storm that made an unusual southward track over the eastern Gulf of Mexico. It remained offshore and did not directly impact land.

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<sup>1</sup> This is an abbreviated Tropical Cyclone Report since there were no coastal watches or warnings issued and no direct fatalities reported in association with Arlene.

# Tropical Storm Arlene

1–3 JUNE 2023

## BEST TRACK

The “best track<sup>2</sup>” positions and intensities are listed in Table 1. The best track chart of Arlene’s path is given in Fig. 1, with the wind and pressure histories along with available observations<sup>3</sup> shown in Figs. 2 and 3, respectively. Observations include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from four aircraft missions into Arlene by the U.S. Air Force Reserve Command’s 53<sup>rd</sup> Weather Reconnaissance Squadron (Fig. 4). These missions provided 11 center fixes for Arlene from 1–3 June.

There were no land-based or ship reports of tropical-storm-force winds associated with Arlene. NOAA buoy 42039, located over the northeastern Gulf of Mexico, briefly reported a peak 1-minute wind of 33 kt on the morning of 1 June with a gust of 45 kt at 1330 UTC that day. These transient conditions were associated with nearby convection and deemed not representative of Arlene’s intensity.

### Origin

Arlene had non-tropical origins. It developed after convection associated with a mid- to upper-level trough induced surface low formation over the eastern Gulf of Mexico on 31 May.

### Peak Intensity and Minimum Pressure

Arlene’s peak intensity of 35 kt from 0600 UTC 2 June to 0000 UTC 3 June is supported by scatterometer winds and reconnaissance data from the Air Force Hurricane Hunters on 2 June. ASCAT-B and -C passes at 0222 UTC and 0314 UTC 2 June, respectively, showed several wind barbs greater than 30 kt in the northern semicircle of Arlene. Later that day, the aircraft measured 925-mb flight-level winds of 46 kt and 53 kt at 1405 UTC and 1628 UTC, respectively, which reduces to a surface intensity of 35–40 kt using the standard 75% reduction factor for that pressure level (Franklin et al. 2003). The peak intensity was set at the lower end of these estimates since the strongest flight-level winds occurred outside of deep convection, where there was likely less efficient vertical mixing of these winds down to the surface. On a subsequent flight,

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<sup>2</sup> 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.

<sup>3</sup> Observations include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), 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 Arlene.

the plane reported 850-mb flight-level winds of 45 kt at 2256 UTC 2 June, which reduces to a 36-kt surface intensity. The peak SFMR retrievals during these flights ranged from 32–38 kt, although the highest winds were likely rain contaminated.

The minimum central pressure of 998 mb is based on a 2311 UTC 2 June dropsonde that reported a surface pressure of 999 mb with 8-kt winds.

## CASUALTY AND DAMAGE STATISTICS

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

## 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 5 shows composites of 7-day TWO genesis areas for each category prior to the formation of Arlene. Note that the medium and high TWO forecasts were issued at or after the time of genesis determined in post-analysis. The shorter-than-normal lead times were likely attributable to Arlene's non-tropical origins and inconsistent signals in the model guidance as to whether the marginally favorable environmental conditions would support the genesis of a short-lived tropical cyclone.

A verification of NHC official track forecasts for Arlene is given in Table 3. A verification of NHC official intensity forecasts for Arlene is given in Table 4. Due to Arlene's brief existence as a tropical cyclone and the small number of forecasts issued, no meaningful comparisons can be made with the model track or intensity guidance.

There were no coastal watches or warnings issued for Arlene.

## REFERENCES

Franklin, J. L., M. L. Black, and K. Valde, 2003: GPS Dropwindsonde Wind Profiles in Hurricanes and Their Operational Implications. *Wea. Forecasting*, **18**, 32–44, [https://doi.org/10.1175/1520-0434\(2003\)018<0032:GDWPIH>2.0.CO;2](https://doi.org/10.1175/1520-0434(2003)018<0032:GDWPIH>2.0.CO;2).

## ACKNOWLEDGEMENTS

Lisa Bucci created the aircraft reconnaissance map (Fig. 4), and Philippe Papin created the composite TWO verification graphic (Fig. 5).



Table 1. Best track for Tropical Storm Arlene, 1–3 June 2023.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
31 / 1800	26.4	85.9	1009	20	low
01 / 0000	26.7	85.7	1008	20	"
01 / 0600	27.2	85.8	1008	25	"
01 / 1200	27.7	86.2	1007	30	tropical depression
01 / 1800	28.0	86.5	1007	30	"
02 / 0000	27.7	86.5	1006	30	"
02 / 0600	27.3	86.4	1004	35	tropical storm
02 / 1200	27.0	86.3	1002	35	"
02 / 1800	26.7	86.0	1000	35	"
03 / 0000	25.9	85.7	998	35	"
03 / 0600	25.0	85.6	999	30	tropical depression
03 / 1200	24.4	85.3	1000	25	low
03 / 1800	23.9	85.0	1001	25	"
04 / 0000	23.5	84.1	1002	25	"
04 / 0600	23.3	83.0	1002	25	"
04 / 1200					dissipated
03 / 0000	25.9	85.7	998	35	maximum winds and minimum pressure



Table 2. Number of hours in advance of formation of Arlene 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%)	42	42
Medium (40%-60%)	0	0
High (>60%)	-	-

Table 3. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Arlene, 1–3 June 2023. 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	26.5	40.8	<b>34.8</b>					
OCD5	60.6	151.1	381.7					
Forecasts	5	3	1					
OFCL (2018-2022)	23.8	35.7	47.8					
OCD5 (2018-2022)	46.4	99.2	157.4					



Table 4. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Arlene, 1–3 June 2023. 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	<b>2.0</b>	<b>1.7</b>	<b>0.0</b>					
OCD5	3.8	2.3	0.0					
Forecasts	5	3	1					
OFCL (2018-2022)	5.1	7.6	8.9					
OCD5 (2018-2022)	6.8	10.7	13.9					

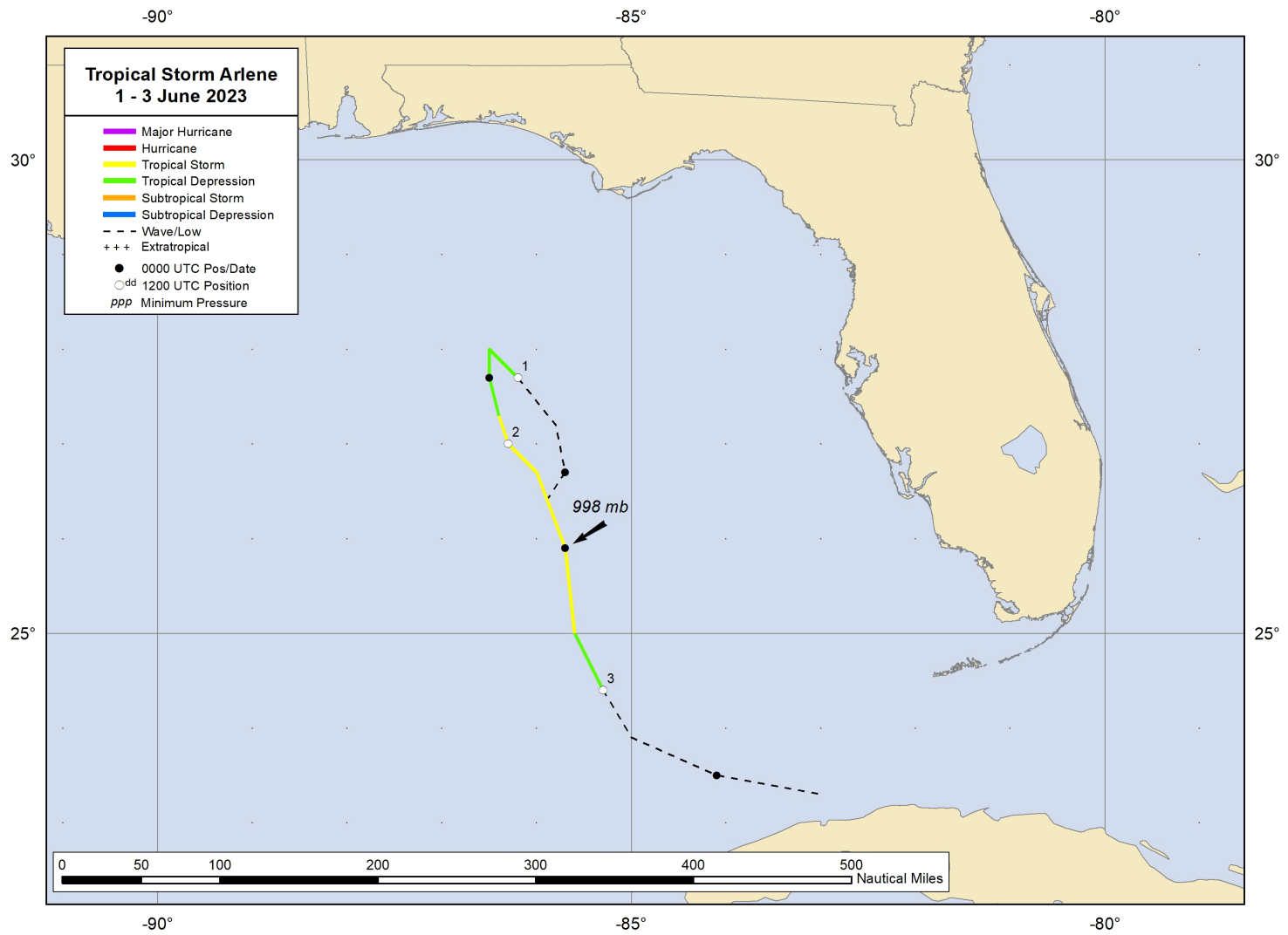


Figure 1. Best track positions for Tropical Storm Arlene, 1–3 June 2023.

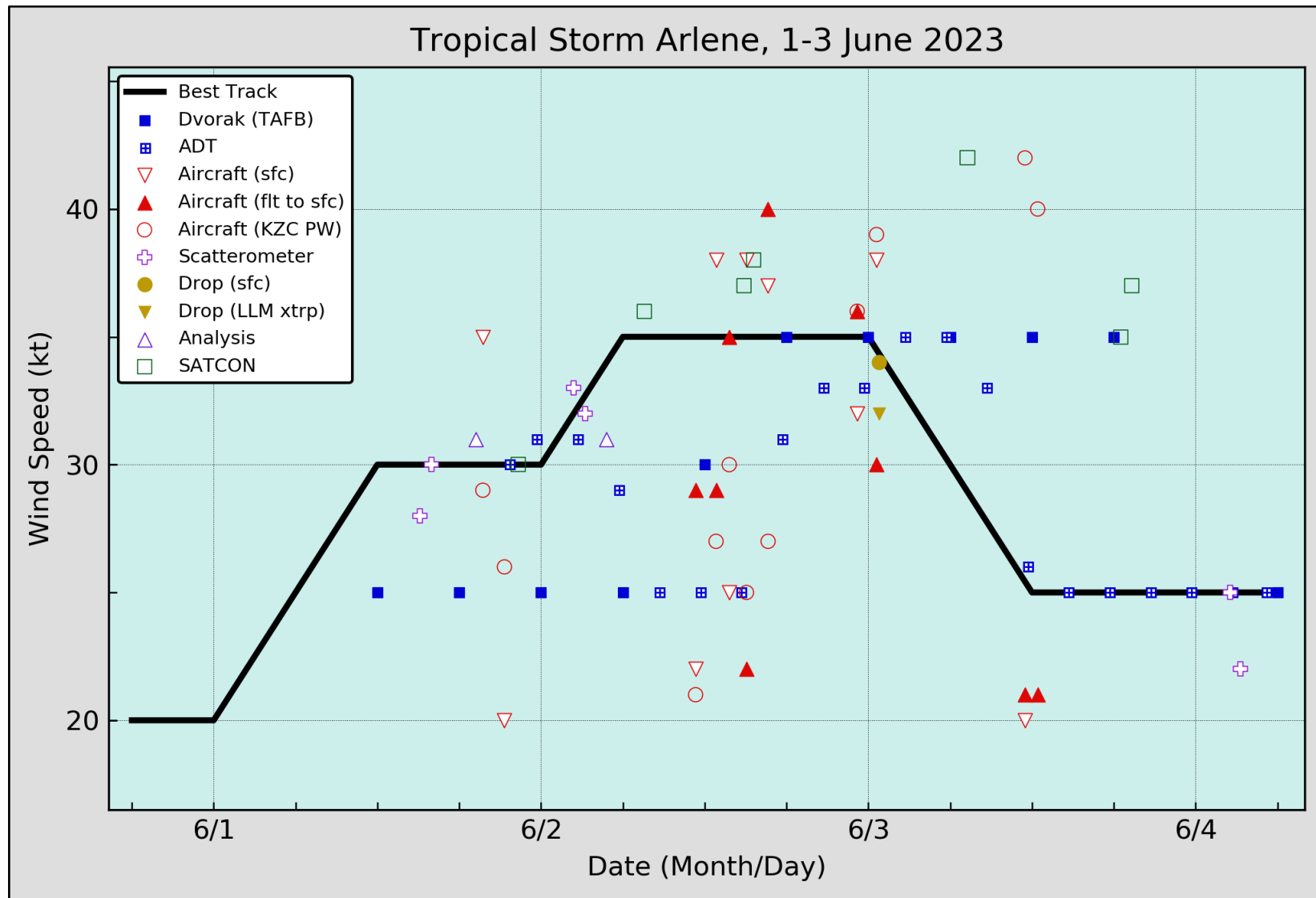


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Arlene, 1–3 June 2023. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.



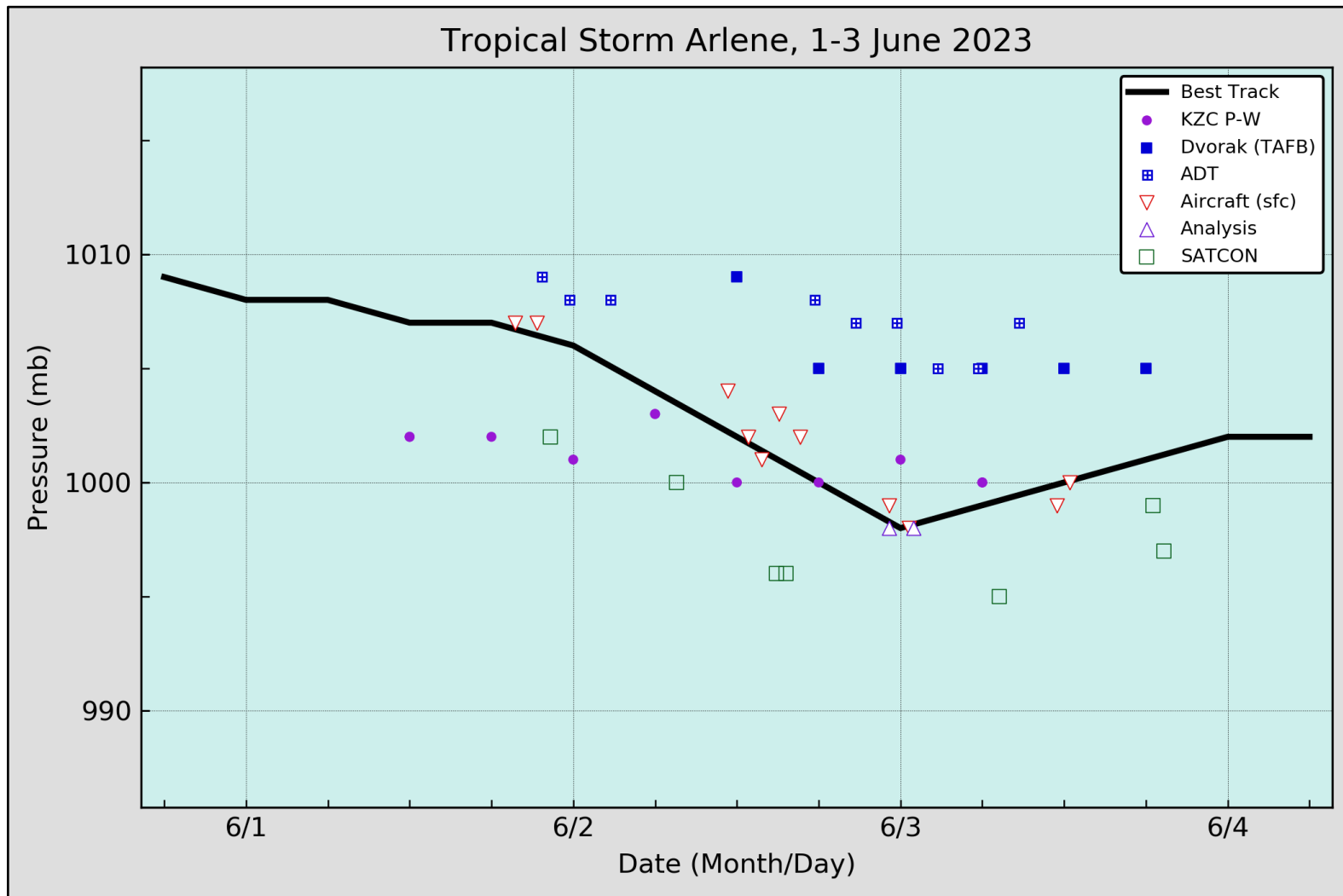


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Arlene, 1–3 June 2023. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological 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.

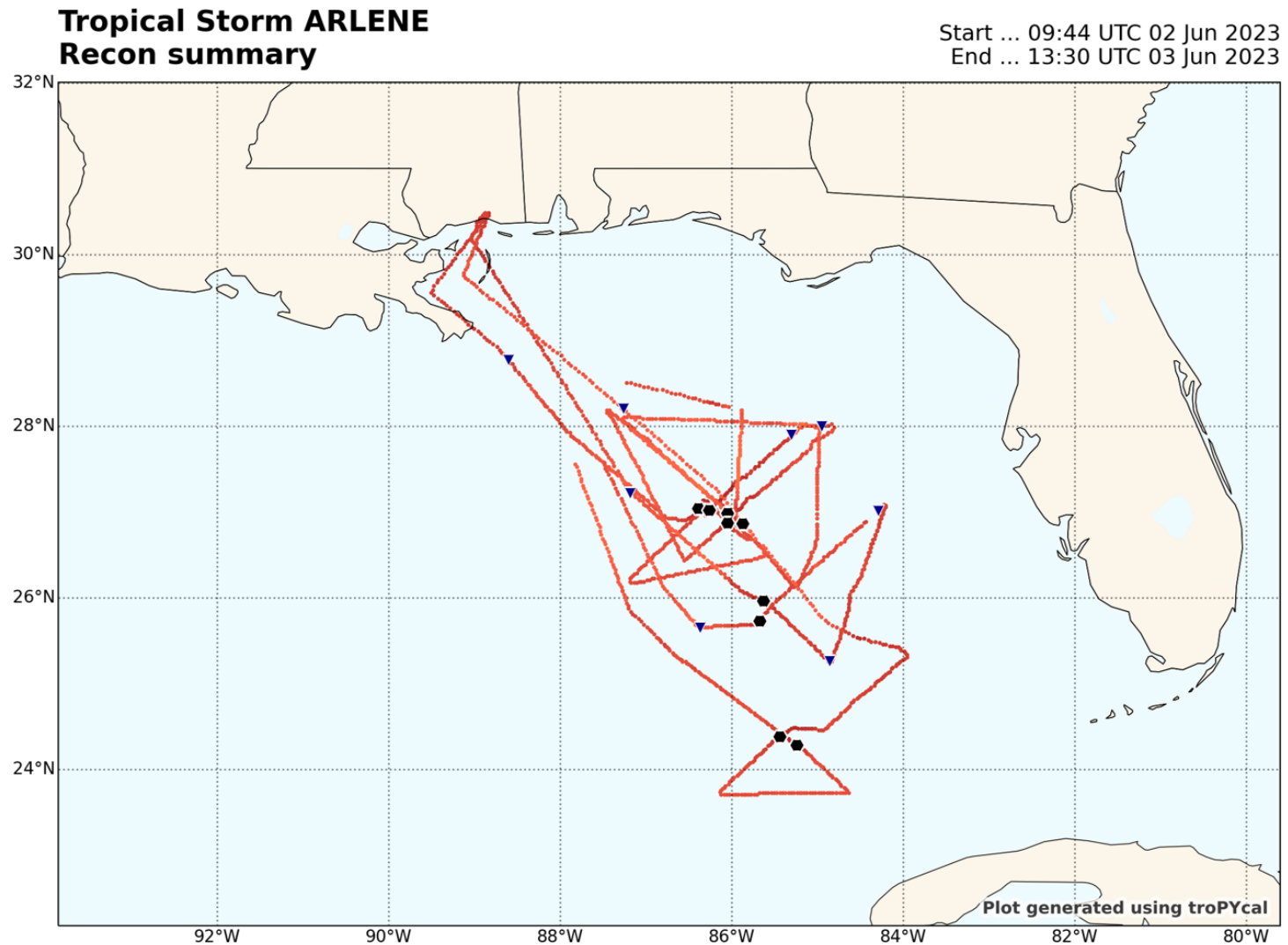


Figure 4. Air Force Reserve Hurricane Hunter aircraft flight tracks (red) from reconnaissance missions into Arlene on 2–3 June 2023 (invest mission on 1 June not shown). The black markers denote center fixes and the blue triangles indicate dropsonde locations.

### Arlene 7-day Tropical Weather Outlook Areas

From: 1800 UTC 30 May 2023 to 1800 UTC 1 Jun 2023

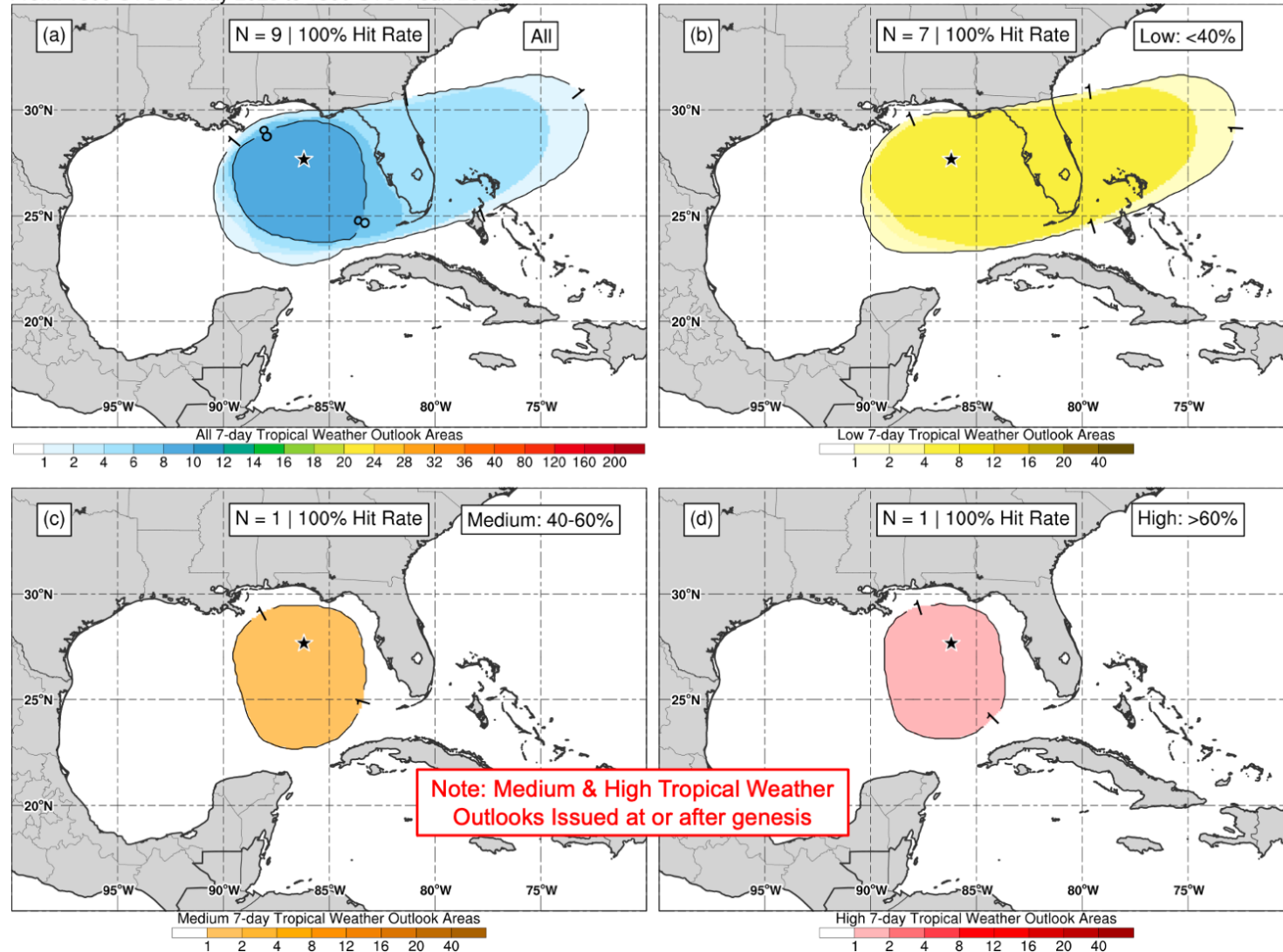


Figure 5. Composites of 7-day tropical cyclone genesis areas depicted in NHC’s Tropical Weather Outlooks prior to the formation of Tropical Storm Arlene for (a) all probabilistic genesis categories, (b) the low (<40%) category, (c) medium (40–60%) category, and (d) high (>60%) category. Arlene’s location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