NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM ARLENE

(AL012017)

19 – 21 April 2017

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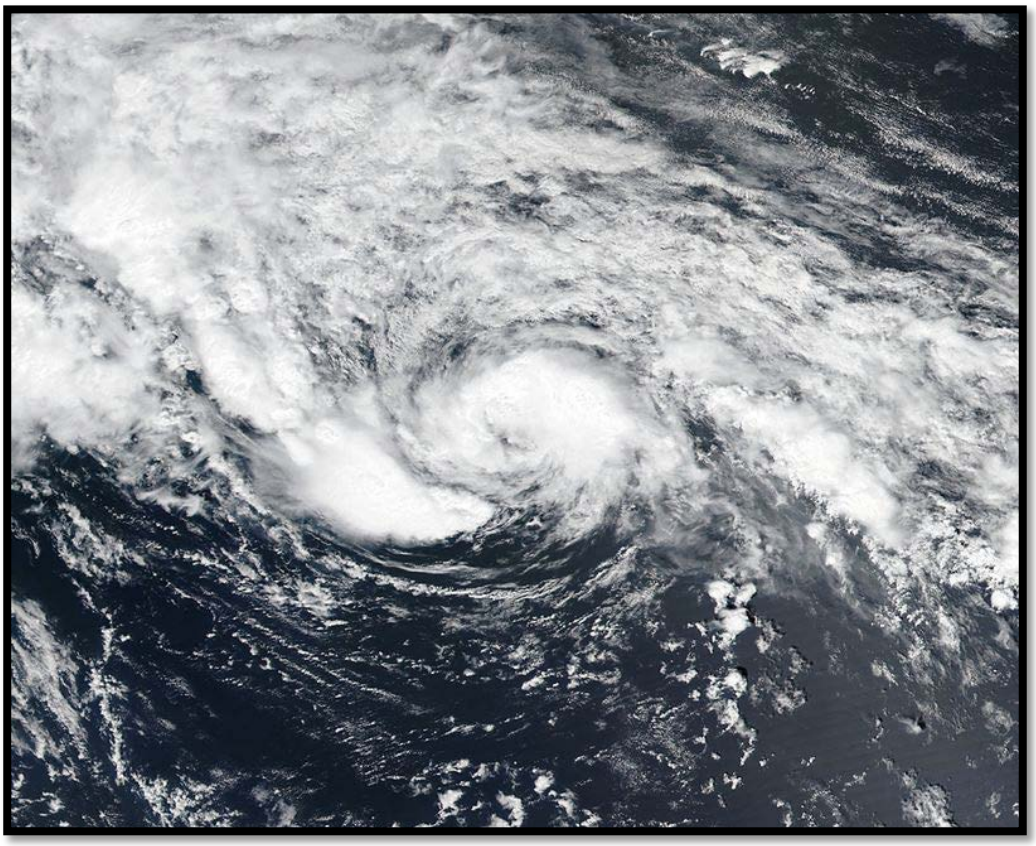

VISIBLE SATELLITE IMAGE OF TROPICAL STORM ARLENE AT 1712 UTC 20 APRIL 2017 FROM THE SUOMI NATIONAL POLAR-ORBITING PARTNERSHIP SATELLITE.

Tropical Storm Arlene was only the second tropical storm on record to form in the month of April (Ana in 2003 being the first). Arlene was short lived and meandered over the central Atlantic Ocean.

Tropical Storm Arlene

19 – 21 APRIL 2017

SYNOPTIC HISTORY

Arlene's origins were non-tropical. A large and strong extratropical low developed about 750 n mi east of Bermuda early on 16 April. The extratropical low moved southeastward later that day and became cut off from the surrounding flow. While the low slowed down, it weakened and gradually lost its frontal characteristics. Satellite images indicate that frontal features dissipated on 18 April, and deep convection formed in bands to the north and east of the well-defined center by 0000 UTC the next day. Since the surface low was underneath an upper-level low and had a large radius of maximum winds, the cyclone is classified as a subtropical depression at the time of genesis. The "best track" chart of the cyclone'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].

The subtropical depression was located about 850 n mi southwest of the Azores Islands at the time of genesis and was moving east-northeastward. Despite the cyclone being over very cool 20˚ C sea surface temperatures and within a moderate vertical wind shear environment, deep convection gradually increased near the center during the next several hours after formation, due to an unstable atmosphere. In addition, scatterometer data indicated that the wind field contracted later on 19 April, and it is estimated that the cyclone made the transition to a tropical depression by 0000 UTC 20 April. While the system underwent tropical transition, it turned to the northeast and north in response to a developing extratropical cyclone located several hundred miles to its west.

The system strengthened to a tropical storm 6 h later and continued to intensify during the next 18 h, reaching a peak intensity of 45 kt by 0000 UTC 21 April, when it was located about 700 n mi west of the Azores. The satellite appearance of Arlene at peak intensity consisted of a small eye-like feature surrounded by a compact area of deep convection (cover image) in the warm sector of the extratropical low to its west. While Arlene gained strength, it turned northwestward while it rotated around the larger extratropical low. Arlene began to lose tropical characteristics shortly after reaching its peak intensity, and it became extratropical once again around 1200 UTC 21 April when it moved westward into the cold sector of the extratropical cyclone. The post-tropical cyclone associated with Arlene turned southward and then eastward during the next day or so and gradually weakened before dissipating shortly after 1800 UTC 22 April about 1000 n mi west-southwest of the Azores. Fig. 4 shows the evolution of Arlene and its interaction with the extratropical low using a sequence of visible satellite images.

[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.

METEOROLOGICAL STATISTICS

Observations in Tropical Storm Arlene (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), and objective Advanced Dvorak Technique (ADT) 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 Tropical Storm Arlene.

There were no ship or land reports of winds of tropical storm force associated with Arlene.

The estimated maximum wind speed of 45 kt at 0000 and 0600 UTC 21 April is based on Dvorak classifications of 3.0/45 kt from TAFB and SAB.

Tropical cyclones in the Atlantic basin during the month of April are very rare events, with the only other April tropical storm in history being Ana in 2003. It should be noted, however, that this type of storm was practically impossible to detect prior to the weather satellite era, and the Dvorak technique beginning in the 1970s.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

A Special Tropical Weather Outlook on this out-of-season system was first issued about 30 h before genesis with a low (<40%) probability of formation during the next 2 days. The probability remained in the low category until a subtropical depression formed (Table 2). The global models provided some useful guidance in showing a developing low pressure area, though it was unclear if they showed the development of a tropical cyclone (or subtropical cyclone).

A verification of NHC official track forecasts for Tropical Storm Arlene is given in Table 3a and a homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Given the short life span of Arlene, there were six NHC forecasts that verified at 12 h and only two at 24 h. For this very small sample, the NHC track forecasts were larger than the 5-yr means and were beaten by EMXI and some of the consensus aids.

A verification of NHC official intensity forecasts for Tropical Storm Arlene is given in Table 4a, and a homogeneous comparison of the official intensity errors with selected guidance models

is given in Table 4b. For the small number of verifying forecasts, the NHC intensity errors were also larger than the 5-yr means and had a low bias, as most of the forecasts did not call for Arlene to strengthen. Much of the guidance had lower errors than the official forecasts.

There were no coastal watches and warnings associated with Arlene.

Table 1. Best track for Tropical Storm Arlene, 19 – 21 April 2017.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
16 / 0600	35.8	50.3	992	55	extratropical
16 / 1200	35.1	49.5	989	55	"
16 / 1800	34.4	48.7	986	55	"
17 / 0000	33.7	47.8	987	50	"
17 / 0600	33.2	47.0	988	45	"
17 / 1200	32.7	46.1	989	45	"
17 / 1800	32.3	45.3	991	40	"
18 / 0000	32.1	44.7	993	40	"
18 / 0600	31.9	44.4	994	35	"
18 / 1200	31.6	44.1	995	35	"
18 / 1800	31.1	43.5	996	30	"
19 / 0000	31.1	42.6	996	30	subtropical depression
19 / 0600	31.3	41.8	996	30	"
19 / 1200	31.7	41.1	996	30	"
19 / 1800	32.1	40.4	996	30	"
20 / 0000	32.8	39.6	996	30	tropical depression
20 / 0600	33.8	39.2	994	35	tropical storm
20 / 1200	35.4	39.6	994	35	"
20 / 1800	37.3	40.7	992	40	"
21 / 0000	39.0	43.0	990	45	"
21 / 0600	40.0	46.3	990	45	"
21 / 1200	39.9	49.3	990	45	extratropical
21 / 1800	38.5	50.8	992	40	"
22 / 0000	36.3	51.2	994	40	"
22 / 0600	34.7	50.0	996	40	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
22 / 1200	32.8	48.7	999	35	"
22 / 1800	31.9	46.4	1001	30	"
23 / 0000					dissipated
21 / 0000	39.0	43.0	990	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	120-Hour Outlook
Low (<40%)	30	30
Medium (40%-60%)	-	-
High (>60%)	-	-

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Arlene. 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	72	96	120
OFCL	52.1	85.3					
OCD5	138.1	301.8					
Forecasts	6	2					
OFCL (2012-16)	24.9	39.6	54.0	71.3	105.8	155.4	208.9
OCD5 (2012-16)	47.3	103.9	167.8	230.3	343.1	442.6	531.0

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Arlene. 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	72	96	120
OFCL	41.7	85.3					
OCD5	127.9	301.8					
GFSI	52.5	103.4					
HWFI	46.4	119.1					
EMXI	**34.4**	**66.2**					
CMCI	126.4	257.9					
AEMI	49.4	96.3					
HCCA	**40.2**	86.7					
TVCX	**39.4**	**83.0**					
GFEX	42.4	**84.0**					
TVCA	43.0	90.5					
TABS	74.1	152.7					
TABM	77.5	177.2					
TABD	82.4	193.8					
Forecasts	4	2					

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Arlene. 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	72	96	120
OFCL	7.5	10.0					
OCD5	11.0	24.5					
Forecasts	6	2					
OFCL (2012-16)	5.5	8.2	10.5	12.0	13.4	14.0	14.5
OCD5 (2012-16)	7.1	10.5	13.0	15.1	17.4	18.2	20.6

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Arlene. 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	72	96	120
OFCL	7.5	5.0					
OCD5	12.3	22.0					
HWFI	**3.8**	**0.0**					
HCCA	**3.8**	**0.0**					
DSHP	**3.5**	5.0					
LGEM	**5.3**	**3.0**					
IVCN	**3.8**	**1.0**					
GFSI	**5.3**	**1.0**					
EMXI	**4.5**	**0.0**					
Forecasts	4	1					

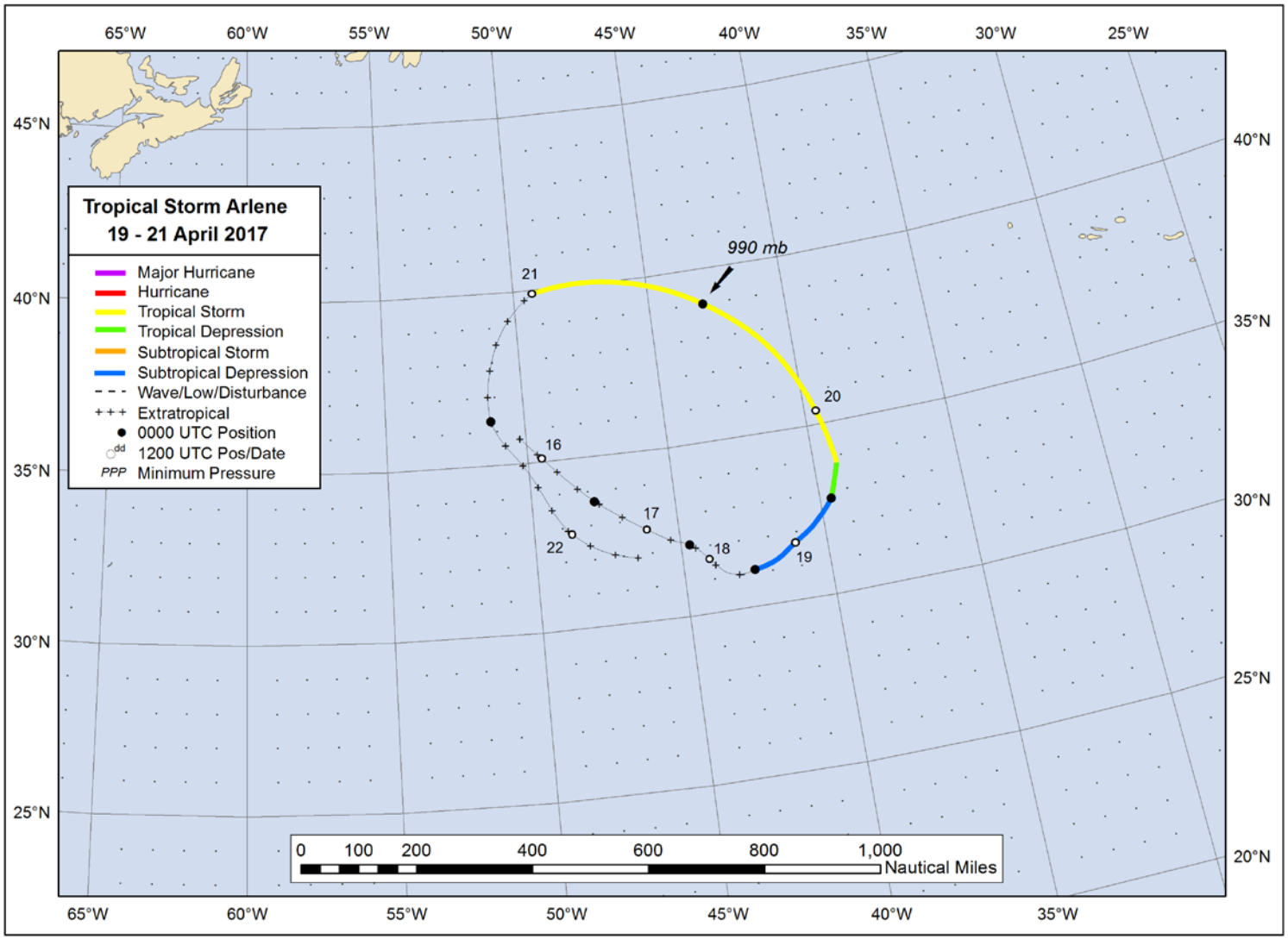

Figure 1. Best track positions for Tropical Storm Arlene, 19 – 21 April 2017.

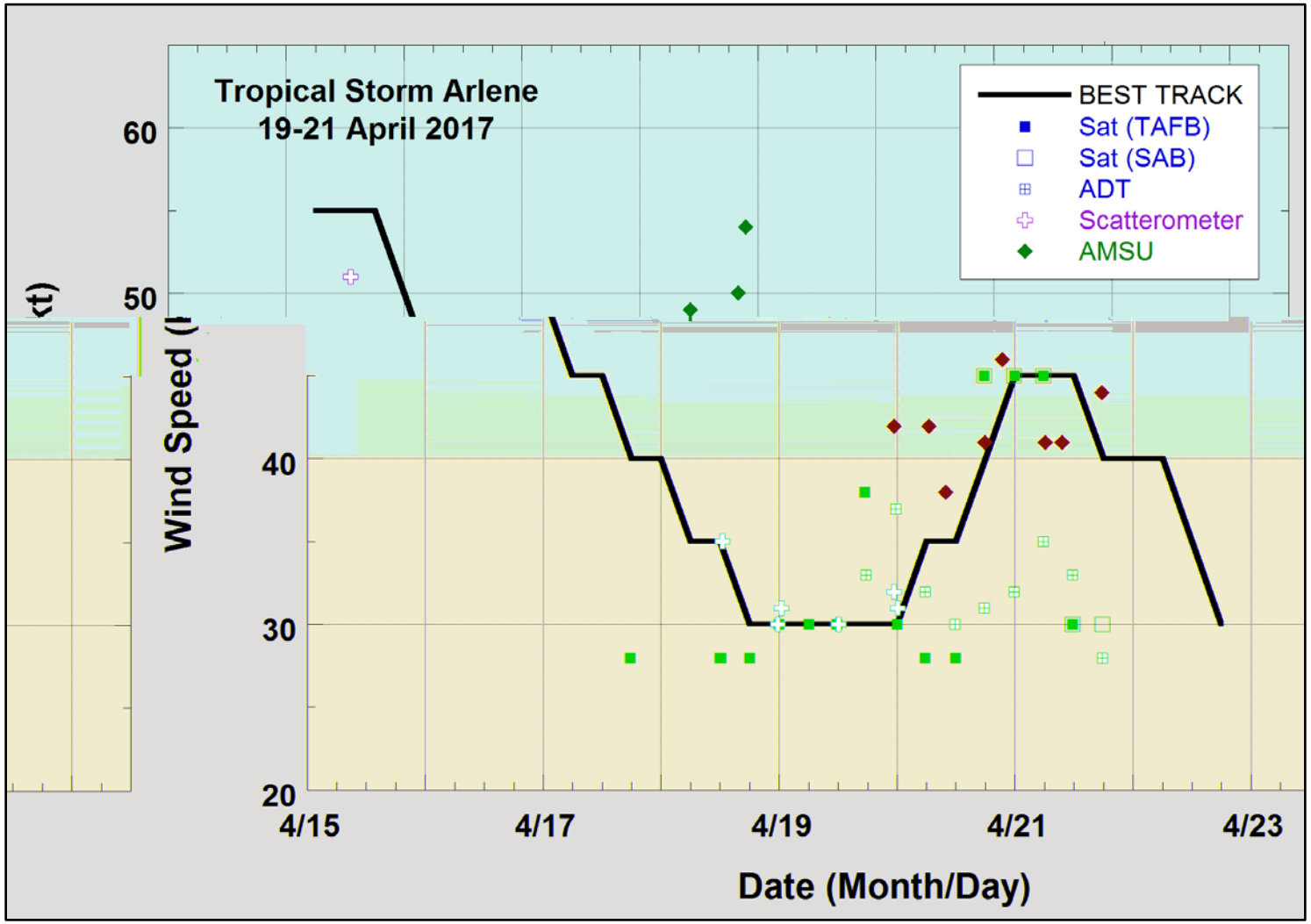

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Arlene, 19 – 21 April 2017. Advanced Dvorak Technique (ADT) estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

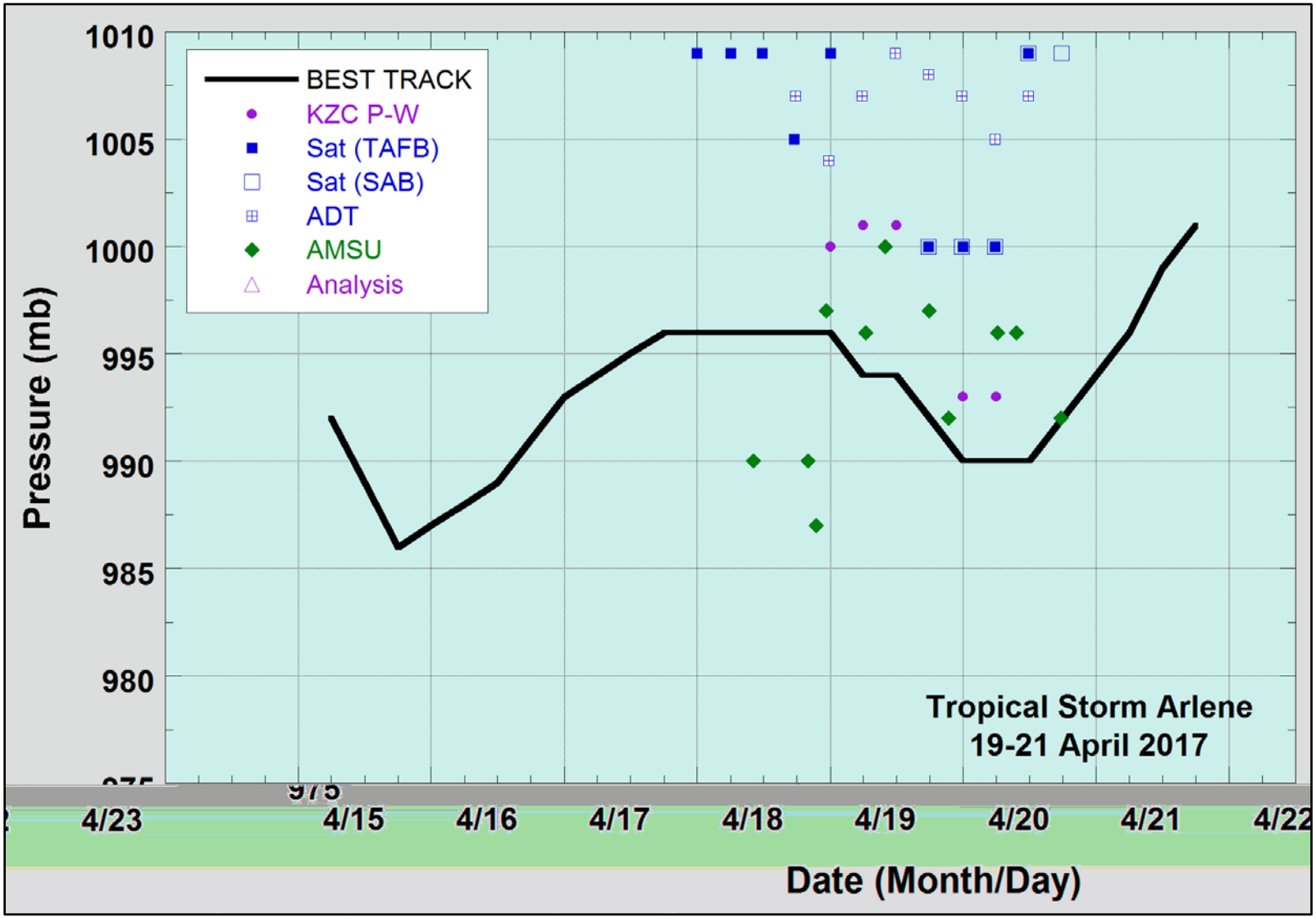

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Arlene, 19 - 21 April 2017. Advanced Dvorak Technique (ADT) estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.

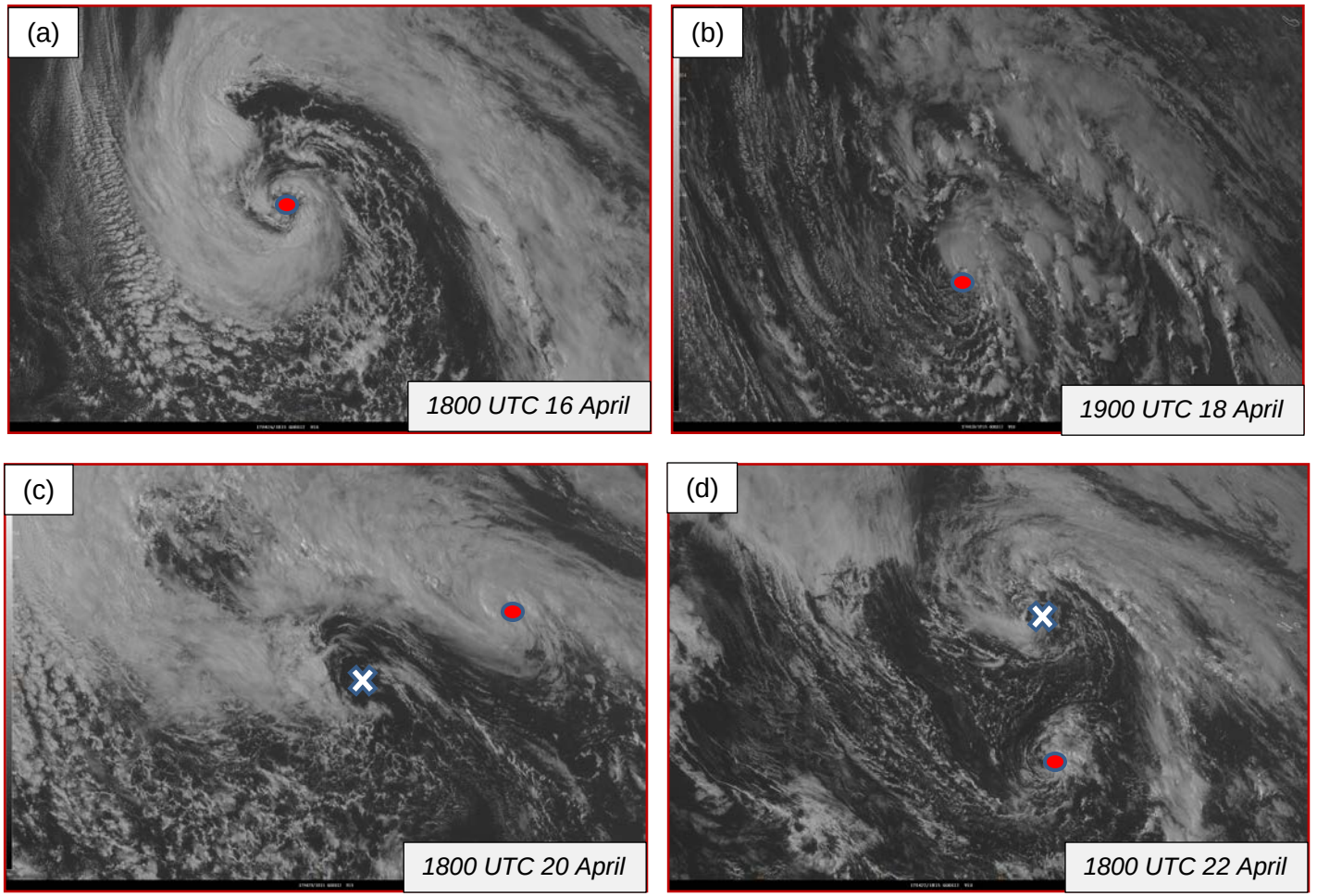

Figure 4. GOES-E visible satellite images of Arlene, as (a) an extratropical storm at 1800 UTC 16 April, (b) around the time of transition to a subtropical depression at 1900 UTC 18 April, (c) a tropical storm at 1800 UTC 20 April, and (d) a weakening extratropical cyclone (d) at 1800 UTC 22 April. The red dot represents the center of Arlene, and the white 'X' marks the center of the extratropical low that interacted with Arlene.