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Garcia-Rubio, Gabriela

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Tropical Cyclone Report
Tropical Storm Arlene
8-13 June 2005
Lixion A. Avila and Daniel P. Brown

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Arlene made landfall on the Florida Panhandle just west of Pensacola, causing minimal damage.

a. Synoptic History

The origin of Arlene is not clear but it appears to be associated with the interaction of the Intertropical Convergence Zone (ITCZ) and a tropical wave. The ITCZ near 90°W was centered over Central America during the first few days of June. This zone became a little more convectively active when a westward moving tropical wave moved across Central America on 5-6 June. Thereafter, another tropical wave, this one a little more vigorous, moved across the western Caribbean Sea on 7-8 June, resulting in pressure falls and a significant increase in cloudiness and thunderstorms over the region. Vertical wind shear gradually relaxed as an upper-level ridge developed over the large area of disturbed weather. The system became better organized and it is estimated that a tropical depression formed at 1800 UTC 8 June just north of the northeastern coast of Honduras. Very deep convection developed in cyclonically curved bands to the north and east of the center of circulation and the depression became Tropical Storm Arlene at 0600 UTC 9 June, about 150 n mi west-southwest of Grand Cayman.

Arlene began to move slowly northward with steady intensification and its center crossed western Cuba very near Cabo Corrientes with winds of 45 knots early 10 June. These winds were confined to rain bands in the eastern semicircle, primarily over water. Once in the Gulf of Mexico, Arlene moved between the north and north-northwest and continued to strengthen. The cyclone reached its peak intensity of 60 knots and a minimum pressure of 989 mb at 0100 UTC 11 June over the northeastern Gulf. Thereafter, dry air began to enter the circulation and deep convection diminished considerably, resulting in a gradual weakening. Arlene made landfall as a 50-kt tropical storm just west of Pensacola, Florida about 1900 UTC 11 June. Arlene continued to weaken as it moved northward, farther inland. It turned northeastward and became extratropical at 1800 UTC 13 June just northeast of Flint, Michigan and was absorbed by a front at 1200 UTC 14 June. The “best track” chart of the tropical 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.

b. Meteorological Statistics

Observations in Arlene (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch

(SAB) and the U. S. Air Force Weather Agency (AFWA), as well as flight-level observations from flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command and the NOAA P-3. The latter included surface wind data from the Stepped Frequency Microwave Radiometer (SFMR). Microwave satellite imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA QuikSCAT, and Defense Meteorological Satellite Program (DMSP) satellites were also useful during Arlene. Table 2 includes ship observations with winds of at least 34 knots and Table 3 shows selected surface observations including rainfall and storm surge. The strongest 1-min sustained wind reported by a land station was 41 knots at Punta del Este, on the Isle of Youth, Cuba. The strongest gust was 52 knots and occurred at fire station at Navarre, Florida. After landfall, Arlene spread 3 to 7 inches of rain over the central and eastern United States according to data provided by the Hydrometeorological Prediction Center (HPC).

Arlene was characterized by its large circulation and the lack of inner convective core. In fact, there were various centers rotating around a larger gyre throughout the storm's lifetime. The cyclone was very asymmetric with the strongest winds confined to rain bands to the north and east of the circulation center. Only just prior to landfall, satellite pictures revealed a more symmetric cloud pattern which was more typical of a tropical cyclone.

c. Casualty and Damage Statistics

The NWS forecast office in Miami reported that a Russian exchange student died in a rip current triggered by Arlene on 10 June at Miami Beach. Reports from NWS forecast offices indicate that there was little or no damage caused by Arlene.

d. Forecast and Warning Critique

Arlene's track forecast errors were much smaller than the average official track errors for the 10-yr period 1995-2004¹. The United Kingdom model (UKMET) outperformed the official forecast at all times except at 12 hours. There were just a few 96-h and no 120-h forecasts to verify. Table 4 lists the forecast errors for a selection of track forecast models. Average official intensity errors were 7, 9, 7, 9, 9 and 5 kt for the 12, 24, 36, 48, 72, and 96 h forecasts, respectively. For comparison, the average official intensity errors over the 10-yr period 1995-2004 are 6, 10, 12, 15, 18, and 20. Global models were very good in forecasting the development of a tropical cyclone in the northwestern Caribbean Sea a few days in advance.

Track models were quite clustered, reducing the uncertainty of the forecast. However, because Arlene had a large area of tropical storm force winds to the north and east of the center, the tropical storm warning area was also large. Arlene also was forecast to be very near hurricane strength and taking into consideration the general uncertainty in intensity forecasting, a hurricane warning was issued for a small portion of the area already in place tropical storm warning. A summary of the coastal watches and warnings is included in Table 5.

¹ Errors given for the 96 and 120 h periods are averages over the four-year period 2001-4.

Table 1. Best track for Tropical Storm Arlene, 8-13 June 2005.

Date/Time (UTC)	Latitude (EN)	Longitude (EW)	Pressure (mb)	Wind Speed (kt)	Stage
08 / 1800	16.9	84.0	1004	25	Tropical depression
09 / 0000	17.4	83.9	1003	30	"
09 / 0600	18.2	83.9	1003	35	tropical storm
09 / 1200	19.0	84.0	1002	35	"
09 / 1800	19.7	84.1	1002	35	"
10 / 0000	20.4	84.2	1001	40	"
10 / 0600	21.2	84.4	1000	45	"
10 / 1200	23.0	84.8	1000	50	"
10 / 1800	24.9	85.1	995	55	"
11 / 0000	26.5	85.6	990	60	"
11 / 0600	27.7	86.8	993	60	"
11 / 1200	28.9	87.2	990	55	"
11 / 1800	30.1	87.5	991	50	"
12 / 0000	31.4	87.6	994	30	Tropical depression
12 / 0600	32.7	87.7	998	25	"
12 / 1200	35.0	88.0	1003	20	"
12 / 1800	37.0	87.8	1005	20	"
13 / 0000	38.5	87.5	1006	20	"
13 / 0600	40.5	86.0	1006	20	"
13 / 1200	42.0	85.0	1005	20	low
13 / 1800	43.0	84.0	1005	20	extratropical
14 / 0000	43.7	81.1	1003	20	"
14 / 0600	44.8	77.6	1001	20	"
14 / 1200					Absorbed by front
10/ 0800	21.8	84.5	1000	45	Landfall near Cabo Corrientes, western Cuba
11 / 1900	30.3	87.5	991	50	Landfall near and just west of Pensacola
11 / 0100	26.5	85.6	989	60	minimum pressure

Table 2. Selected ship reports with winds of at least 34 kt for Tropical Storm Arlene, 8-13 June 2005.

Date/Time (UTC)	Ship call sign	Latitude (EN)	Longitude (EW)	Wind dir/speed (kt)	Pressure (mb)
08 / 2100	ZCDG8	19.4	80.7	070 / 35	1004.2
09 / 0900	3FFL8	19.4	81.8	140 / 40	1005.0
09 / 1800	3FFL8	18.9	81.2	200 / 40	1008.0
09 / 2245	ELWX5	20.7	86.7	350 / 38	1003.2
09 / 2345	ELWX5	20.6	86.3	350 / 39	1002.6
10 / 0045	ELWX5	20.5	85.9	350 / 42	1002.1
10 / 0045	SHIP	20.5	85.9	350 / 42	1002.1
10 / 0145	ELWX5	20.4	85.6	340 / 39	1002.2
10 / 0700	C6FM9	25.3	79.8	090 / 35	1011.0
10 / 1300	C6FM6	25.2	86.8	040 / 36	1004.0
10 / 1400	KGBE	24.5	84.1	120 / 40	1001.3
10 / 1500	C6FM5	24.0	85.0	330 / 35	1001.5
10 / 1600	VRWG6	25.8	87.8	*** / 38	1007.0
10 / 1645	ELWX5	19.8	82.2	170 / 35	1007.6
10 / 1800	ZCDG8	23.1	83.7	220 / 47	1004.2
10 / 1800	3FPS9	24.0	82.3	160 / 58	1004.0
10 / 1800	KGBE	25.1	83.8	150 / 40	1009.0
10 / 1800	VRWG6	25.6	87.1	*** / 35	1004.0
10 / 1845	ELWX5	20.2	82.7	170 / 37	1006.0
10 / 1900	C6FM6	26.1	87.3	040 / 37	1004.0
10 / 2000	FWYF1	25.6	80.1	120 / 38	1011.1
10 / 2100	ZCDG8	23.5	82.7	160 / 35	1005.1
10 / 2100	C6FM5	25.6	84.0	180 / 40	1000.5
10 / 2100	V7HD2	27.7	87.9	060 / 37	1015.5
10 / 2200	C6FM6	26.2	88.6	040 / 37	1004.0
10 / 2200	V7HD2	27.7	87.9	060 / 42	1008.0
10 / 2300	C6FM9	25.9	79.7	100 / 35	1011.0
10 / 2300	ELXL3	28.0	88.1	060 / 37	1007.0
11 / 0000	ZCDG8	23.9	80.6	180 / 45	1006.3
11 / 0000	3FPS9	24.5	80.8	120 / 35	1008.0
11 / 0000	C6FM5	26.3	83.5	140 / 51	1004.0
11 / 0000	WFKW	27.5	88.7	060 / 38	1006.8
11 / 0000	V7HD2	27.7	87.9	080 / 35	1008.0
11 / 0050	42039	28.8	85.6	080 / 35	1005.0
11 / 0100	C6FM6	26.1	89.2	040 / 37	1004.0
11 / 0200	ELXL3	28.0	88.1	070 / 40	1005.0
11 / 0300	C6FM5	27.0	83.2	120 / 42	1005.0
11 / 0400	ELXL3	28.0	88.1	060 / 36	1004.0
11 / 0600	SGOF1	29.4	84.9	080 / 36	1005.1
11 / 0650	42039	28.8	85.6	100 / 35	999.0
11 / 0700	SGOF1	29.4	84.9	110 / 37	1004.8
11 / 0800	SGOF1	29.4	84.9	100 / 37	1004.2
11 / 0900	SGOF1	29.4	84.9	110 / 38	1004.4
11 / 1000	SGOF1	29.4	84.9	120 / 36	1004.4
11 / 1100	SGOF1	29.4	84.9	110 / 35	1004.5

Table 3. Selected surface observations for Tropical Storm Arlene 8-13 June, 2005.

	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) ^c	Storm tide (ft) ^d	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) ^a	Sustained (kt) ^b	Gust (kt)			
Cuba								
Cuba Francia	10/0900	1003.3	10/0200	30	38			6.56
Nueva Gerona	10/0900	1003.3	10/0205	29	38			
Santa Fe	10/0800	1001.9	10/0700	32	41			6.00
Punta del Este	10/0900	1002.9	10/0725	41	43			5.63
Cabo San Antonio	10/0920	1001.6						
Santa Lucia	10/1200	1001.0						0.68
Isabel Rubio	10/0920	999.9						2.97
San Juan y Martinez	10/1310	1001.4						4.45
Pinar del Rio	10/1100	1000.5						6.81
La Palma	10/1000	1001.0	10/1015		42			3.69
Paso Real de San Diego	10/1110	1005.5						5.31
Bahia Honda	10/1100	1002.3	10/1150		35			4.09
Casa Blanca	10/1000	1004.4	10/1100	35	41			2.01
Florida								
Dry Tortugas, Fort Jefferson National Park Service			10/1600	39	48			2.70
Key West (EYW)	10/2353	1005.7	11/0303	32	41			
Key West NAS (NRB)			11/0129		40			
Carysfort Reef Light			10/1000	30	35			
Duck Key			09/2200		44			
Marathon Curry Hammock State Park								2.81
Key Largo John Pennekamp State Park								2.80
Miami (MIA)			10/1700		36			4.08
Miami Beach (MBF)			10/1800		37			
Tamiami Airport (TMB)			10/1100		38			
Flamingo (FLM)			10/1400		39			
Fort Lauderdale (FLL)								2.23
West Palm Beach (PBI)								1.58
Naples (APF)								6.25

Clewiston							4.15
Hollywood							2.65
Homestead							4.20
Immokalee							2.78
Marco Island							3.86
Fort Myers (FMY)							2.28
Fort Myers (RSW)							1.87
Buckingham							1.25
Punta Gorda							1.20
Fort Ogden							1.45
Winterhaven							1.75
Lakeland							1.55
Fort Meade							1.34
Tampa Dam							1.76
Pinellas Park							2.30
Suwannee							1.27
Tallahassee (TLH)	11/1853	1007.4					2.05
Panama City (PFN)	11/1453	1002.9					2.06
Apalachicola (AAF)	11/0956	1004.3	11/1021		39		2.57
Destin (DTS)	11/1854	1000.0	11/1844		39		
Tyndall AFB (PAM)	11/1355	1003.7	11/1542		34		
Cross City (CTY)	11/1853	1008.9					0.65
Marianna (MAI)							1.33
Pensacola (PNS)	11/1927	991.9	11/1913	33	44		
Hurlburt AFB (HRT)	11/1910	999.0	11/1915		40		
Elgin AFB (VPS)			11/1947		43		
Pensacola NAS (NPA)	11/1856	991.5	11/1656		39		
Whiting Field NAS (NSE)	11/1955	994.9	11/1951		47		3.29
Fort Walton Beach			11/1709		38		
Santa Rosa Beach			11/1623		33		
Shalimar			11/1824		36		
Navarre Fire Station			11/1910		52		
Crestview			11/2029		36		
Gulf Breeze	11/1850	994.2					3.56
Pensacola (WEAR-TV)	11/1924	988.8					3.38
Pace							4.42
Molina (Escambia River)							3.02

Dowling Park								4.95
Marianna								2.25
Mayo								2.13
Monticello								1.10
Panacea								2.13
St. Marks								3.67
Sea Hag Marina								3.90
Tallahassee Airport								1.46
Walton County						5		
Bay County						3		
Gulf County						3		
Franklin County						3		
Wakulla County						3-4		
Jefferson County						2		
Pensacola USCG								3.90
Santa Rosa Sound								2.69
Destin								3.33
Georgia								
Albany								1.64
Blairsville								3.96
Clayton								5.31
Choestoe								4.93
Crisp County Power Dam								4.12
Fort Gaines								1.53
Georgetown								1.55
Leesburg								2.10
Nacoochee								4.27
Pine Mountain								6.10
Sautee								4.59
Tifton								2.21
Valdosta								1.51
Alabama								
Dothan (DHN)	11/2053	1005.2						1.50
Evergreen Airport (GZH)	11/2231	997.6	11/2323		36			3.06

Mobile (MOB)	11/2130	999.3						4.52
Brookley Field (BFM)	11/2036	998.3						
Dauphin Island			11/1416		35		2.71	3.73
Bay Minette	11/2115	995.3						3.10
Atmore	11/2025	994.6						3.25
Geneva								1.97
Alberta								4.60
Brewton								3.65
Jackson								3.17
Robertsdale								3.53
Thomasville								3.55
Wallace								3.80
Whatley								3.30
Mobile (NWS Office)								5.06
Millers Ferry Dam								6.77
Magnolia Springs								3.09
East Fowl River								3.80
Mobile (2 south)								5.81
Semmes								3.82
Silverhill (3 south)								3.22
Perdido Pass							3.69	
Mobile State Docks							3.03	
Cedar Point							2.82	
Bayou La Batre							3.10	
Mobile (Middle Bay)							2.89	
Mississippi								
Pascagoula (PQL)	11/2036	1000.7						1.74
Gulfport (GPT)	11/2216	1002.7						
Aberdeen Lock and Dam								6.77
Mobile NWS office								5.06
Buoys and CMAN sites								
FWYF1 (Fowey Rocks C-Man) (25.6°N 80.1°W)	11/0100	1010.1	10/2000	34	43			
MLRF1 (Molasses Reef C-Man) (25.0°N 80.4°W)	11/0100	1008.8	10/0200	32	40			

LONF1 (Long Key C-Man) (24.8°N 80.9°W)	11/0000	1008.1	10/0900		36			
SMKF1 (Sombrero Key C-Man) (24.6°N 81.1°W)	10/2200	1008.3	11/0110	34	39			
SANF1 (Sand Key C-Man) (24.5°N 81.9°W)	10/2200	1005.5	10/0010	32	38			
SGOF1 (Tyndall AFB Tower C) (29.4°N 89.9°W)	11/0800	1004.2	11/0900		46			
APCF1 (Apalachicola C-MAN) (29.7°N 85.0°W)	11/1330	1005.5	11/1000		38			
SHPF1 (Shell Point C-MAN) (30.1°N 84.3°W)	11/1654	1007.6						
DPIA1 (Dauphin Island C-MAN) (30.3°N 88.1°W)	11/1905	997.8	11/1520	35	43			
42056 (19.9°N 85.1°W)	09/2217	1001.7	09/0450		35			
42036 (28.5°N 84.5°W)	11/1050	997.7	11/0650		41			
42039 (28.8°N 86.0°W)	11/0650	1002.5	11/0350		45			
42040 (29.2°N 88.2°W)	11/1350	998.6	11/1350	34	43			
42007 (30.1°N 88.8°W)	11/1810	1000.7	11/1748		37			

^a Date/time is for sustained wind when both sustained and gust are listed.

^b Except as noted, sustained wind averaging periods for C-MAN and land-based ASOS reports are 2 min; buoy averaging periods are 8 min.

^c Storm surge is water height above normal astronomical tide level.

^d Storm tide is water height above National Geodetic Vertical Datum (1929 mean sea level).

^e 2 min average

^f 5 min average

^g 10 min average

^h Record incomplete due to instrument failure.

ⁱ Water height above mean lower low water.

Table. 4. Preliminary forecast evaluation (heterogeneous sample) for Arlene, 8-13, June 2005. Forecast errors (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verification includes the depression stage, but does not include the extratropical stage, if any.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	51 (14)	118 (14)	191 (13)	286 (11)	534 (7)	692 (3)	
GFNI	44 (10)	70 (10)	83 (9)	102 (7)	124 (3)		
GFDI	40 (14)	83 (14)	111 (13)	124 (11)	136 (7)	160 (3)	
GFDL	35 (12)	69 (12)	108 (12)	134 (10)	127 (6)	101 (2)	
GFDN	51 (10)	85 (10)	102 (10)	120 (8)	151 (4)		
GFSI	37 (12)	70 (12)	96 (11)	186 (8)	375 (4)		
GFSO	33 (12)	60 (12)	86 (11)	140 (9)	342 (5)	479 (1)	
NGPI	38 (10)	49 (10)	63 (9)	99 (7)	189 (3)		
NGPS	43 (12)	63 (12)	75 (10)	110 (8)	221 (4)		
UKMI	32 (12)	44 (12)	54 (11)	64 (9)	122 (5)	89 (1)	
UKM	32 (7)	35 (7)	52 (6)	69 (5)	108 (3)	31 (1)	
A98E	51 (14)	102 (14)	164 (13)	231 (11)	397 (7)	521 (3)	
A9UK	45 (7)	95 (7)	149 (6)	200 (5)	372 (3)		
BAMD	45 (14)	81 (14)	102 (13)	113 (11)	141 (7)	165 (3)	
BAMM	44 (14)	91 (14)	137 (13)	165 (11)	203 (7)	337 (3)	
BAMS	60 (14)	136 (14)	207 (13)	273 (11)	344 (7)	445 (3)	
CONU	34 (12)	53 (12)	63 (11)	85 (9)	77 (5)	86 (1)	
GUNA	32 (10)	46 (10)	62 (9)	99 (7)	100 (3)		
FSSE	33 (11)	52 (11)	57 (9)	96 (8)	140 (5)		
OFCL	32 (14)	51 (14)	67 (12)	72 (11)	117 (7)	213 (3)	
NHC Official (1995-2004 mean)	42 (3400)	75 (3116)	107 (2848)	138 (2575)	202 (2117)	236 (649)	

Table 5. Watch and warning summary for Tropical Storm Arlene 8-13 June, 2005.

Date/Time (UTC)	Action	Location
08 / 2100	Tropical Storm Watch issued	Western Cuba for the Province of Pinar Del Rio and the Isle of Youth
09 / 0300	Tropical Storm Warning replaced Tropical Storm Watch	Western Cuba for the Province of Pinar Del Rio and the Isle of Youth
09 / 1200	Tropical Storm Warning extended	Western Cuba for the Province of Pinar Del Rio, the Isle of Youth, the City of Havana, and the Havana Province.
09 / 1500	Tropical Storm Warning issued	Cayman Islands
09 / 1500	Tropical Storm Warning issued	Dry Tortugas
09 / 2100	Tropical Storm Warning discontinued	Cayman Islands
10 / 0900	Tropical Storm Watch issued	Morgan City to Indian Pass
10 / 1500	Tropical Storm Warning discontinued	for Cuba
10 / 1500	Tropical Storm Warning issued	Grand Isle to St. Marks including Lake Pontchartrain
10 / 1500	Hurricane Watch issued	Pearl River to Panama City
10 / 2100	Tropical Storm Warning extended	Grand Isle to Steinhatchee River including Lake Pontchartrain
10 / 2100	Hurricane Watch extended	Pearl River to Indian Pass
10 / 2100	Tropical Storm Watch discontinued	Morgan City to Grand Isle
11 / 0300	Hurricane Warning issued	Pascagoula to Destin
11 / 0300	Tropical Storm Warning discontinued	Dry Tortugas
11 / 1500	Tropical Storm Warning discontinued	Ochlocknee River to Steinhatchee River
11 / 2100	Hurricane Watches and Warnings discontinued	All
11 / 2100	Tropical Storm Warning modified	Alabama/Mississippi border to Panama City
12 / 0300	Tropical Storm Warning discontinued	All

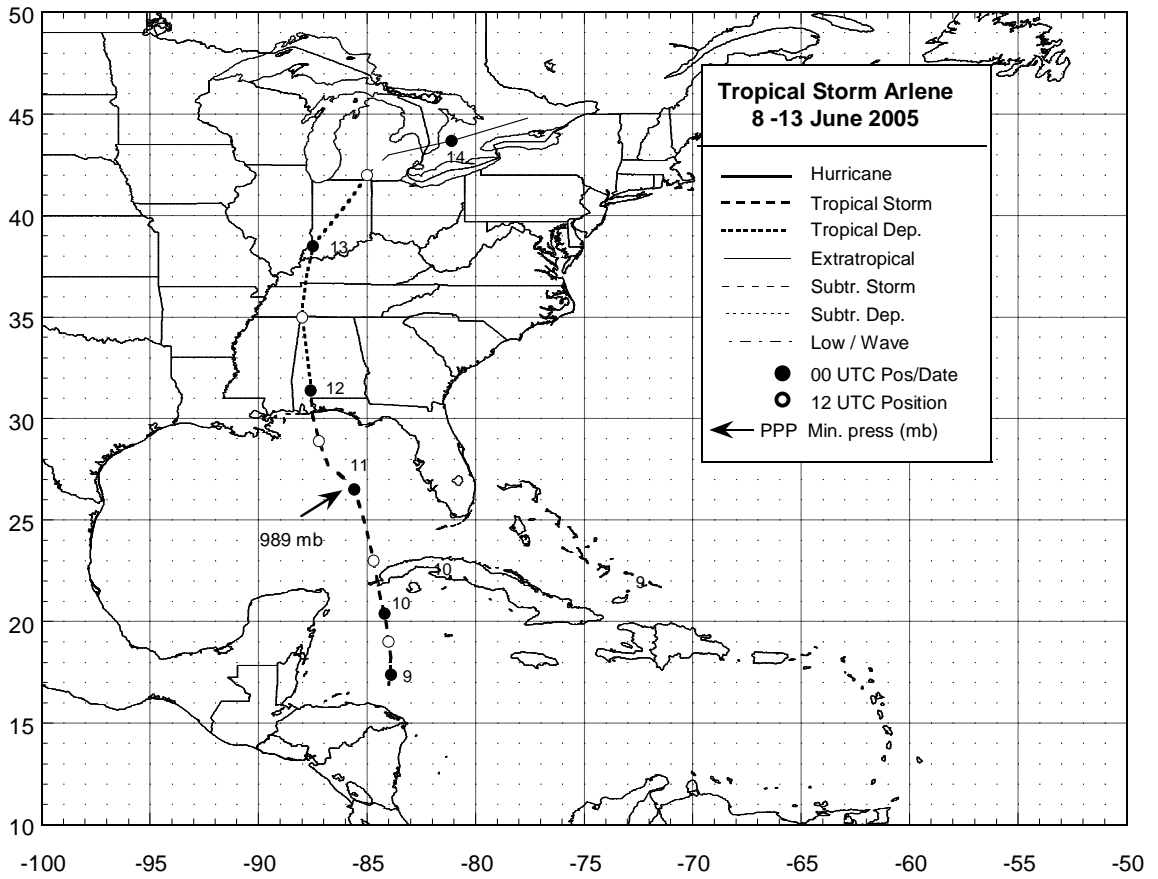


Figure 1. Best track positions for Tropical Storm Arlene 8-13 June, 2005. Positions after landfall were adjusted using data from the Hydrometeorological Prediction Center (HPC).

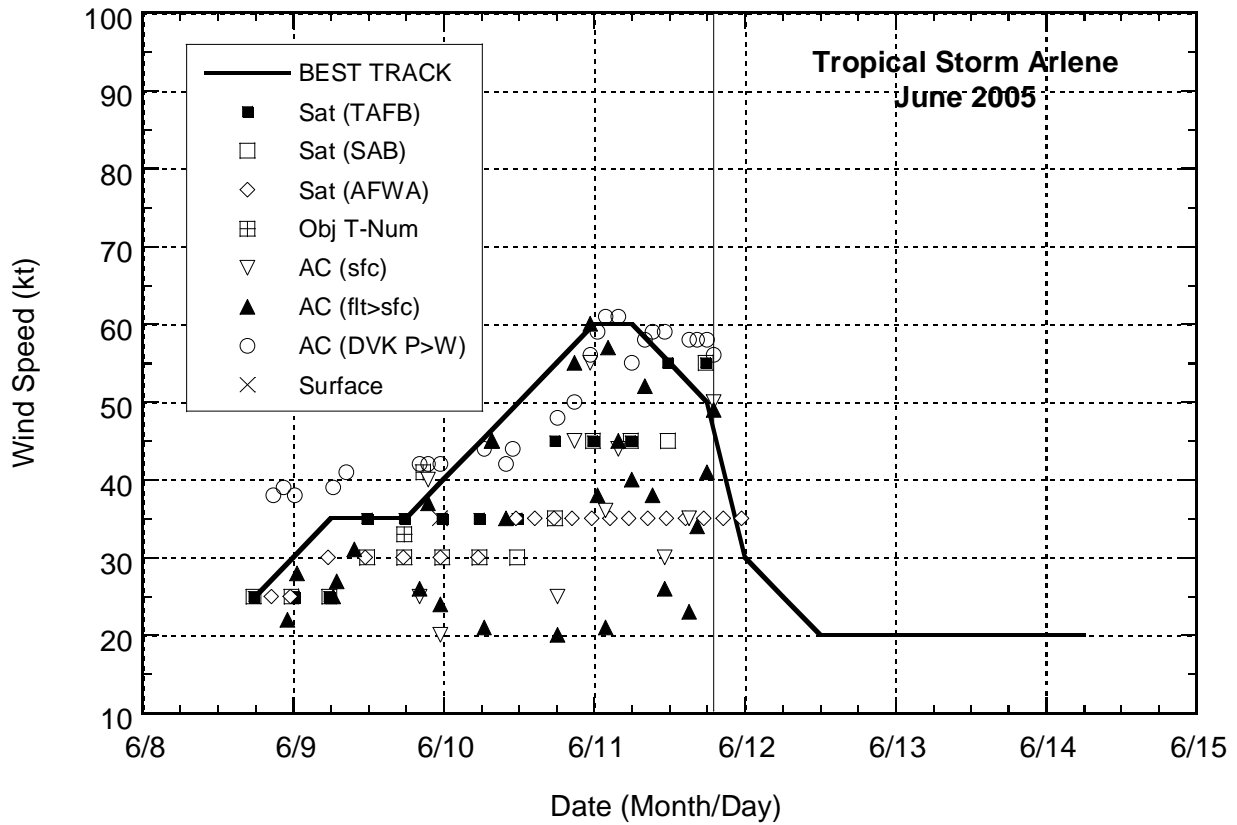


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Arlene, 8-13 June, 2005. Aircraft observations have been adjusted for elevation using 80% reduction factors for observations from 1500 ft or less. Wind best track after landfall was completed using HPC estimates. Vertical black line marks the landfall time.

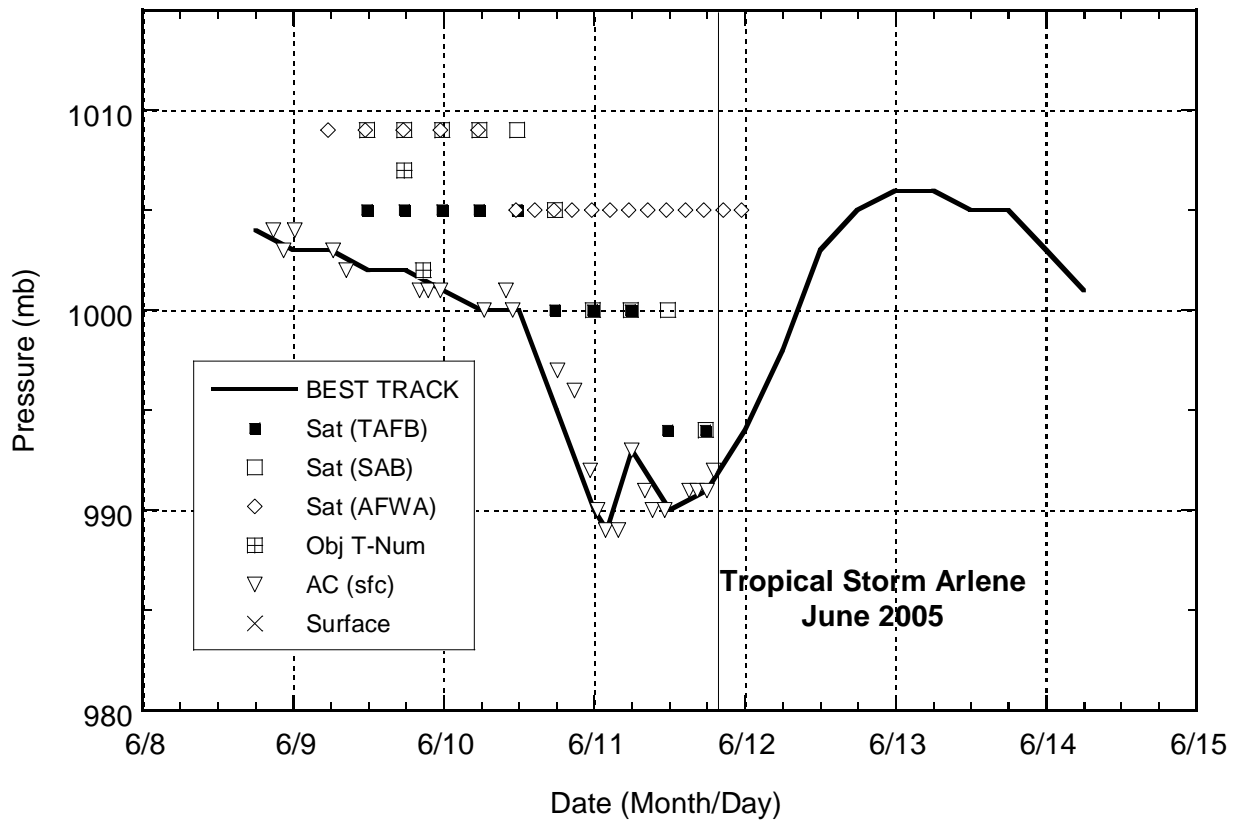


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Arlene, 8-13 June, 2005. Pressure best after landfall was completed using HPC estimates. Vertical black line marks the landfall time.