

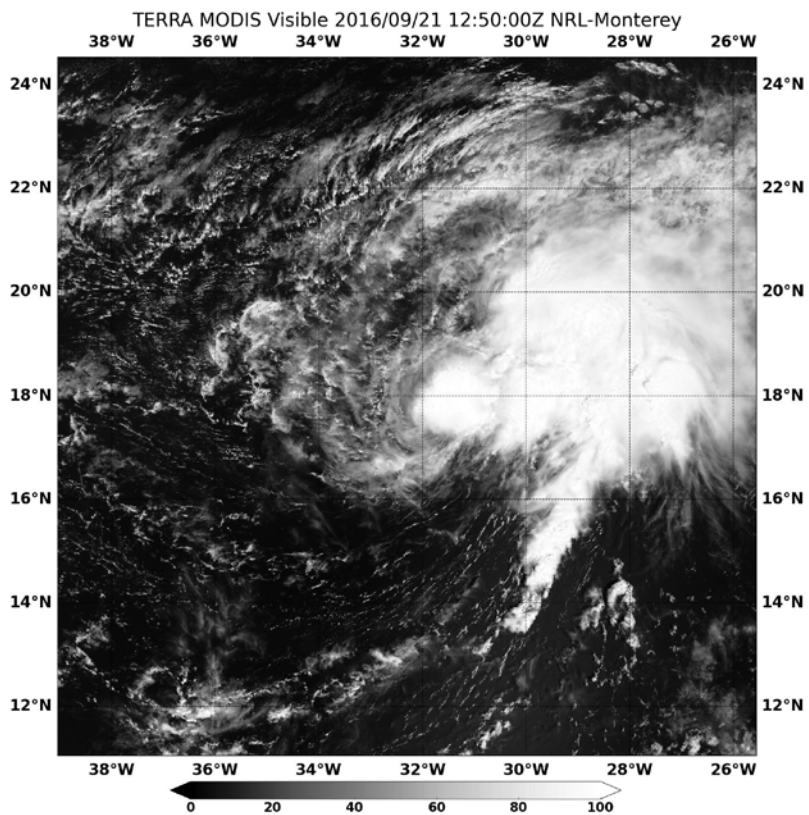


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM LISA (AL132016)

19 – 25 September 2016

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National Hurricane Center
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MODIS VISIBLE IMAGE OF LISA FROM THE NASA TERRA SATELLITE AT 1250 UTC 21 SEPTEMBER. IMAGE COURTESY OF NRL/MONTEREY CA.

Lisa was an uneventful tropical storm over the eastern tropical Atlantic.

Tropical Storm Lisa

19 – 25 SEPTEMBER 2016

SYNOPTIC HISTORY

Lisa developed from a tropical wave and an associated low pressure area that moved westward from the coast of Africa on 16 September. The system showed signs of organization while it was southeast and south of the Cabo Verde Islands on 17-18 September, although subsequent development was slow due to an elongation of the wind circulation. Early on 19 September, the circulation became better defined in the southwestern portion of the low pressure area, and the associated convection became better organized. It is estimated that a tropical depression formed near 1200 UTC that day about 195 n mi west-southwest of the southern Cabo Verde Islands. 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 1¹.

Steered by a low- to mid-level ridge to the north, the cyclone initially moved west-northwestward. A turn toward the northwest occurred early on 20 September, and this general motion toward a weakness in the ridge continued for the next three days. The depression became a tropical storm early on 20 September, and Lisa reached an estimated peak intensity of 45 kt the next day while centered about 375 n mi west of the Cabo Verde Islands. Increasing upper-level winds between an upper-level trough to the northwest of Lisa and an upper-level ridge to the southeast subsequently caused southwesterly vertical shear that prevented additional development. Lisa fluctuated in intensity through 24 September, with a second estimated peak intensity of 45 kt occurring during a convective burst on 22 September. By late on 24 September, however, ongoing shear and dry air entrainment caused the convection to dissipate, with Lisa weakening to a tropical depression near 0000 UTC 25 September and to a remnant low 6 h later.

While Lisa was weakening, a deep-layer trough and associated surface frontal system moved eastward across the central Atlantic and amplified the break in the ridge. As a result, the remnants of Lisa turned northward and then northeastward on 25-26 September. Although the low acquired gale-force winds late on 25 September, it subsequently degenerated to a trough later that day about 700 n mi west-southwest of the western Azores.

METEOROLOGICAL STATISTICS

Observations in Lisa (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* 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), 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 Lisa.

The estimated peak intensity of 45 kt is based on a combination of Dvorak satellite estimates and scatterometer data. There were no surface observations of tropical-storm-force winds from Lisa.

As the remnants of Lisa recurved northeastward on 25-26 September, scatterometer data indicated that the system had gale-force winds, and there was some convection near the center. However, this increase in organization did not keep the circulation from degenerating to a trough, and it does not appear Lisa regained tropical cyclone status during this period.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Lisa was generally well forecast (Table 2). The tropical wave that spawned Lisa was first mentioned in the Tropical Weather Outlook as having a low (< 40%) to medium (40-60%) chance of development about 5 days before genesis, and most of the other genesis categories show good lead times as well. The one exception is that the short range probability, which only reached a high chance (> 60 %) at the time of genesis.

A verification of NHC official track forecasts for Lisa is given in Table 3a. Official forecast track errors were greater than the mean official errors for the previous 5-yr period even though the corresponding climatological errors (OCD5) were lower than the 5-yr average. Examination of the individual forecasts (not shown) suggests that the early forecasts moved the cyclone too far west of the actual track. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Several of the track guidance models had lower errors than the official forecasts, with the best overall performers being the TVCX and TVCA consensus models.

A verification of NHC official intensity forecasts for Lisa is given in Table 4a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period, with none of the errors exceeding 6 kt. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. As good as the official forecasts were, the



consensus models ICON, IVCN, and NOAA corrected consensus (HCCA) all had lower errors for the 24-48 h period.

No coastal watches or warnings were issued for Lisa.



Table 1. Best track for Tropical Storm Lisa, 19 – 25 September 2016.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
19 / 0600	13.2	26.7	1008	25	low
19 / 1200	13.4	27.3	1007	30	tropical depression
19 / 1800	13.6	27.8	1007	30	"
20 / 0000	13.9	28.4	1007	30	"
20 / 0600	14.4	29.3	1007	30	"
20 / 1200	15.1	30.0	1006	35	tropical storm
20 / 1800	16.0	30.7	1004	40	"
21 / 0000	16.7	31.3	1004	40	"
21 / 0600	17.2	31.7	1002	45	"
21 / 1200	17.7	32.1	1002	45	"
21 / 1800	18.3	32.4	1004	40	"
22 / 0000	18.9	32.7	1005	40	"
22 / 0600	19.3	33.3	1004	40	"
22 / 1200	19.7	33.8	999	45	"
22 / 1800	20.3	34.2	999	45	"
23 / 0000	20.9	34.8	1003	40	"
23 / 0600	21.5	35.4	1007	35	"
23 / 1200	22.0	35.9	1008	35	"
23 / 1800	22.4	36.3	1009	35	"
24 / 0000	22.9	36.8	1009	35	"
24 / 0600	23.6	37.4	1007	40	"
24 / 1200	24.4	38.1	1007	40	"
24 / 1800	24.9	39.2	1009	35	"
25 / 0000	25.4	40.4	1011	30	tropical depression
25 / 0600	26.5	41.4	1011	30	low
25 / 1200	27.6	42.5	1012	30	"
25 / 1800	28.9	42.5	1013	35	"
26 / 0000	29.8	42.1	1014	40	"
26 / 0600	30.6	41.2	1014	40	"



26 / 1200	31.6	40.5	1014	40	"
26 / 1800					dissipated
22 / 1200	19.7	33.8	999	45	minimum pressure and maximum wind



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%)	78	126
Medium (40%-60%)	48	120
High (>60%)	0	48



Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Lisa, 19 – 25 September 2016. 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	31.1	58.7	84.8	113.5	166.6	214.0	268.2
OCD5	37.3	60.5	90.1	122.6	193.5	284.9	386.5
Forecasts	20	18	16	14	10	6	2
OFCL (2011-15)	28.4	45.0	60.4	77.1	113.1	157.8	210.0
OCD5 (2011-15)	48.3	101.5	161.5	222.6	329.8	412.6	483.9

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Lisa, 19 – 25 September 2016. 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	31.1	58.2	83.2	108.6	155.2	186.9	223.9
OCD5	35.9	55.9	82.4	110.6	170.5	246.1	295.9
GHMI	27.2	39.4	74.7	120.4	173.3	198.5	195.0
HWFI	34.7	65.0	97.1	139.2	211.1	286.1	304.0
GFNI	48.4	81.3	111.1	137.8	161.0	159.4	68.2
COTI	42.2	72.8	101.3	122.3	155.7	203.0	165.8
GFSI	31.5	49.9	67.2	89.3	127.0	182.8	299.5
EMXI	36.9	74.1	103.0	123.6	193.7	226.9	207.7
CMCI	46.6	86.1	121.7	149.8	153.1	153.3	68.2
NVGI	52.4	91.4	122.3	140.3	130.5	81.9	94.6
AEMI	33.6	55.1	76.6	96.1	129.3	131.1	106.0
UEMI	32.6	54.7	70.3	89.2	116.6	103.2	110.1
HCCA	31.8	56.4	80.5	103.6	167.6	217.9	249.3
TVCX	29.6	51.6	75.3	98.7	138.2	174.4	216.8
GFEX	33.8	60.3	84.9	106.2	154.7	195.0	252.1
TVCA	28.0	49.0	71.7	96.3	133.2	169.8	217.0
LBAR	39.5	75.4	114.3	153.1	221.5	244.8	270.6
TABS	42.7	87.0	130.2	156.0	159.2	163.6	306.7
TABM	38.1	74.9	107.7	131.2	128.2	165.1	167.6
TABD	47.7	112.3	171.4	211.7	291.9	362.8	550.1
Forecasts	19	17	15	13	9	5	1



Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Lisa, 19 – 25 September 2016. 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	4.8	5.6	4.4	5.7	5.5	4.2	2.5
OCD5	5.4	8.3	7.6	11.1	13.8	19.7	22.0
Forecasts	20	18	16	14	10	6	2
OFCL (2011-15)	6.2	9.4	11.5	13.3	14.6	14.6	15.8
OCD5 (2011-15)	7.3	10.8	13.3	15.3	17.7	17.8	17.6

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Lisa, 19 – 25 September 2016. 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	4.8	5.6	4.4	5.7	5.5	4.2	2.5
OCD5	5.4	8.3	7.6	11.1	13.8	19.7	22.0
DSHP	5.7	7.1	7.3	9.2	10.1	10.3	18.5
LGEM	6.3	7.4	5.5	7.7	8.3	7.5	12.0
ICON	4.6	4.9	4.1	5.6	5.7	6.3	9.0
IVCN	4.4	4.8	4.3	5.6	6.5	7.0	9.0
HCCA	4.9	4.8	4.1	5.5	4.3	4.8	3.0
HWFI	4.9	5.2	6.4	7.7	9.5	9.7	3.5
GHMI	4.0	5.2	9.1	8.7	10.8	9.8	13.0
GFNI	5.6	5.9	8.8	11.1	10.3	7.3	16.5
COTI	5.8	5.6	5.1	8.6	9.1	9.7	10.5
GFSI	6.4	6.9	4.9	4.8	5.6	7.7	10.5
EMXI	4.9	6.7	7.2	7.3	6.5	6.3	5.0
CMCI	5.1	6.2	5.3	6.0	4.1	7.5	11.5
NVGI	5.1	6.2	4.9	4.9	4.6	7.0	4.5
Forecasts	20	18	16	14	10	6	2

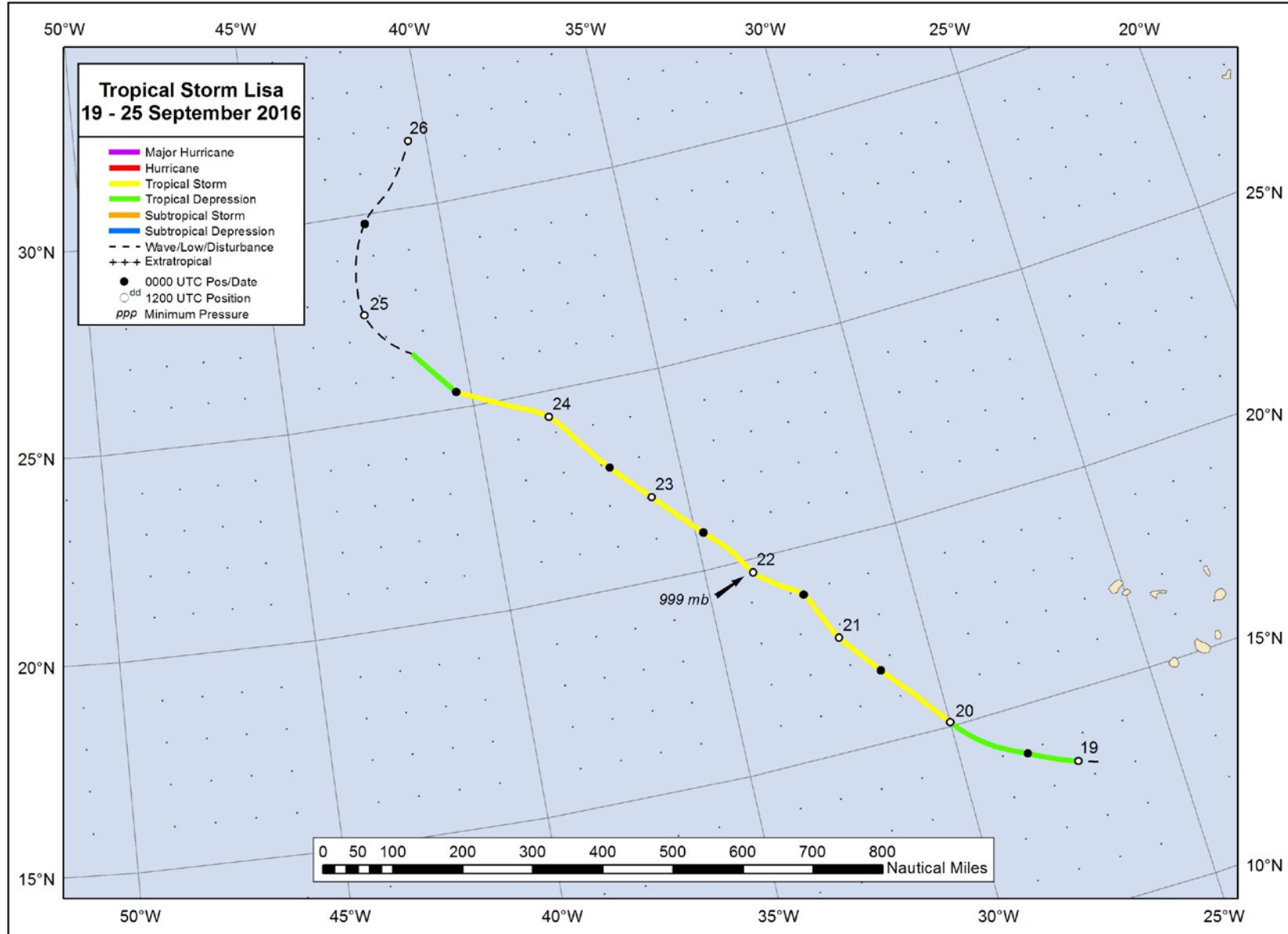


Figure 1. Best track positions for Tropical Storm Lisa, 19 – 25 September 2016.

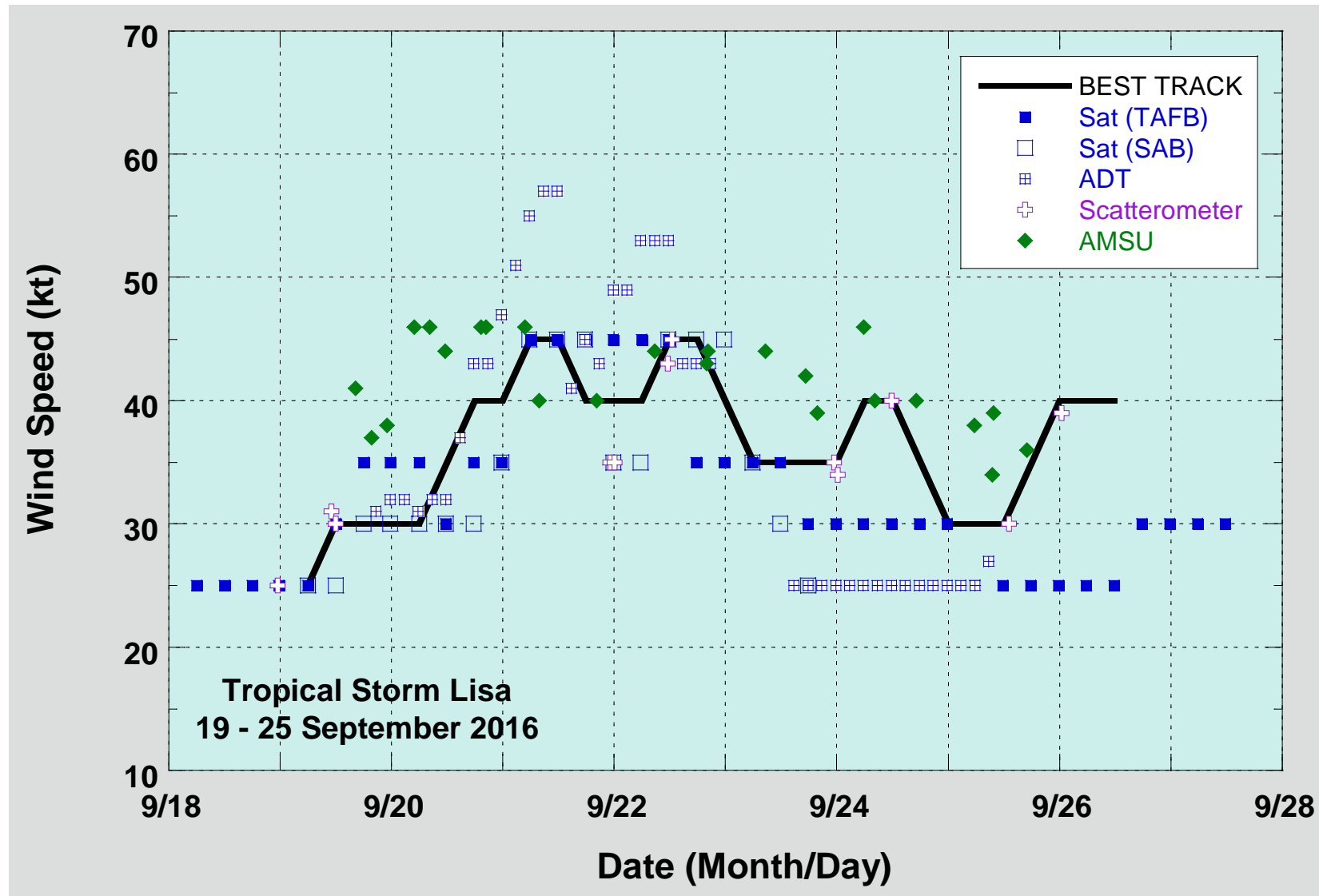


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Lisa, 19 – 25 September 2016. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

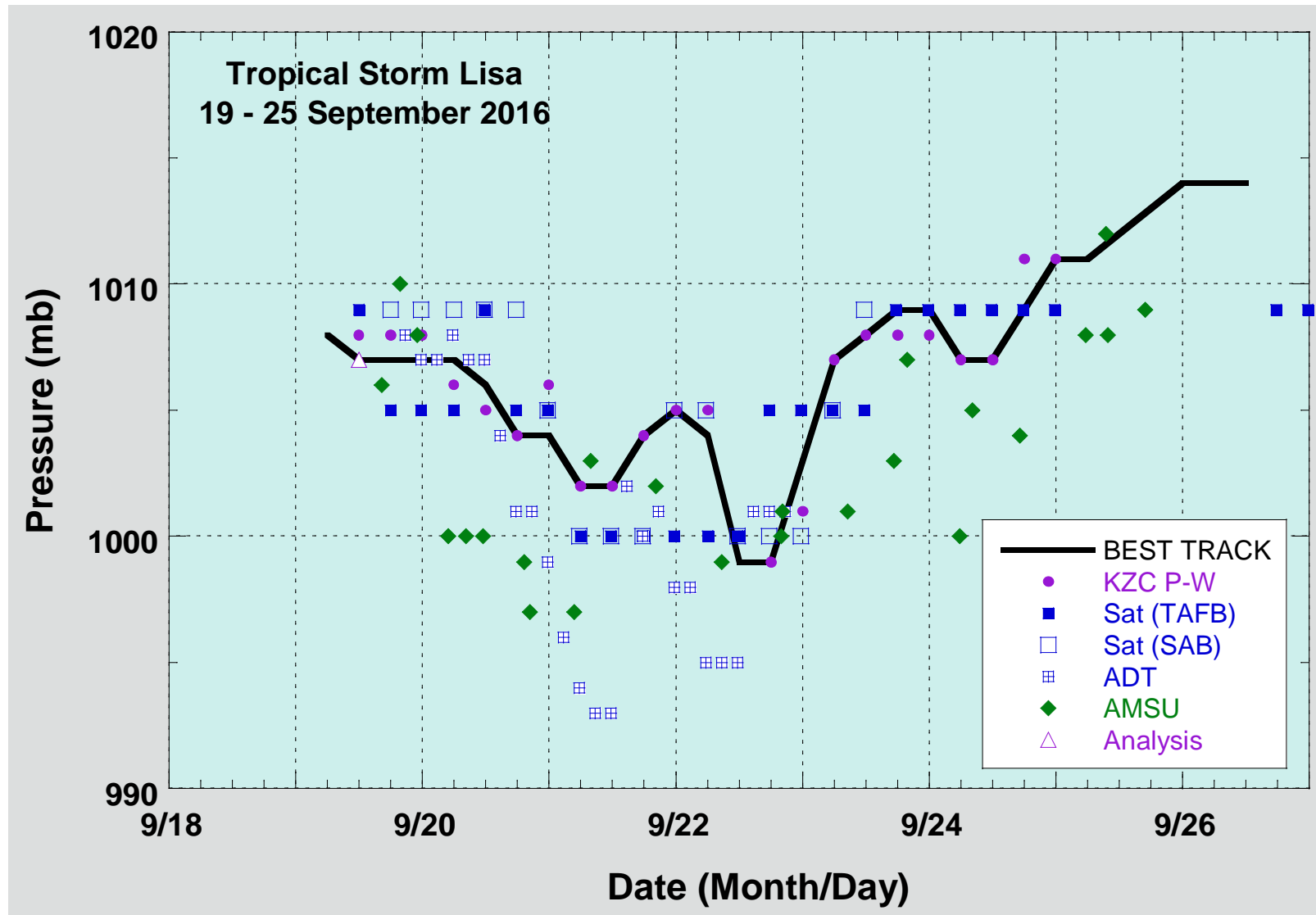


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Lisa, 19 – 25 September 2016. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for 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.