NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE LESTER

(EP132016)

24 August–7 September 2016

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VISIBLE SATELLITE IMAGE OF HURRICANE LESTER NEAR PEAK INTENSITY AT 2325 UTC 29 AUGUST 2016 FROM NASA-NOAA'S SUOMI NPP SATELLITE. IMAGE COURTESY OF NASA GODDARD RAPID RESPONSE TEAM.

Lester was a long-lived hurricane that reached category 4 strength (on the Saffir-Simpson Hurricane Wind Scale) over the eastern North Pacific basin. The tropical cyclone weakened in the central Pacific and passed north of the Hawaiian Islands as a category 1 hurricane.

[1] Original report date 11 January 2017. Updated 31 July 2018 to include analysis from CPHC.

Hurricane Lester

24 AUGUST–7 SEPTEMBER 2016

SYNOPTIC HISTORY

The precursor disturbance from which Lester formed can be traced to a tropical wave that departed the west coast of Africa on 11 August. The wave was accompanied by a broad low pressure area during its trek across the Atlantic, although the associated thunderstorm activity remained minimal. The wave crossed Central America on 19 August and moved over the far eastern North Pacific Ocean early the next day. While the system was passing to the south of the southern coast of Mexico a couple of days later, the large-scale environment become more conducive for development due to the arrival of the rising branch of the Madden-Julian Oscillation. Showers and thunderstorms associated with the tropical wave began to increase, and a broad area of low pressure formed several hundred n mi south-southeast of Manzanillo, Mexico, on 22 August. Thunderstorm activity began to show signs of organization the next day, and by 0600 UTC 24 August the system acquired a well-defined circulation, marking the formation of a tropical depression about 335 n mi south-southwest of Manzanillo. 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[2].

The depression moved west-northwestward along the southwestern side of a mid-level ridge that was centered near the northwestern coast of the Gulf of Mexico, and gradually strengthened while it traversed 29°C waters and remained within an area of light to moderate northwesterly shear. The depression became a tropical storm around 0600 UTC 25 August when it was located about 420 n mi south of the southern tip of the Baja California peninsula. Deep convection continued to become organized in bands during the next 12 h, and Lester reached an intensity of 50 kt by 1800 UTC 25 August. However, an upper-level cyclonic shear axis to the northwest of the tropical storm produced a slight increase in shear, and the upper-level outflow became restricted over the northern semicircle of the storm, inhibiting development for the next 12 h. The tropical storm neared a break in the subtropical ridge during this time and Lester's forward motion slowed.

Around 1200 UTC 26 August the northwesterly shear began to subside, which resulted in a significant increase in the convective banding of the tropical cyclone, and Lester became a hurricane by 0000 UTC 27 August about 460 n mi southwest of the southern tip of the Baja California peninsula. An eye then became apparent in infrared satellite pictures, becoming more distinct later that day. The hurricane turned westward and continued to intensify while a strong mid- to upper-level ridge built to the north of the tropical cyclone. Lester's intensity reached 90 kt by 1200 UTC 27 August. During the following 24 h, Lester's cloud pattern deteriorated

[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.

unexpectedly and the cyclone weakened. Although it's not clear why Lester weakened, microwave satellite data suggest that some dry mid-level air may have wrapped around the southwestern and southern portions of the circulation, causing the southern eyewall to erode (Fig. 4).

Late on 28 August, a period of rapid intensification began while the hurricane continued to move westward over 27°C waters and in very low vertical wind shear conditions. The eye became visible once again shortly after 0000 UTC 29 August, and it cleared out by 1200 UTC when Lester is estimated to have become a major hurricane. Lester's intensity reached 115-kt (category 4) 6 h later, while the cyclone was centered about 1160 n mi west-southwest of the southern tip of the Baja California peninsula. Lester weakened by 0600 UTC 30 August, but it did not appear to go through an eyewall replacement. Rather, microwave satellite imagery (Fig. 5) suggests that dry air once again caused some erosion of Lester's inner core. The hurricane again recovered and re-strengthened to its estimated peak intensity of 125 kt at 0600 UTC 31 August (front cover). Lester continued westward and weakened slightly before moving into the central North Pacific basin shortly after 1800 UTC 31 August.

After crossing into the central Pacific, Lester continued to move just north of due west to the south of a large deep-layer subtropical anticyclone. At the same time, the eye became less distinct in satellite imagery and Lester weakened to a category 2 hurricane by 0600 UTC 1 September. However, about 15 h later, the eye began to become better defined once again, with vigorous deep convection redeveloping in the eyewall. As a result, Lester re-strengthened and reached an intensity of 110 kt (category 3) around 0000 UTC 2 September (Fig. 6) when it was located about 550 n mi east of Hilo, Hawaii. An aircraft operated by the 53rd Weather Reconnaissance Squadron (53WRS) of the U.S. Air Force Reserve Command, which had been deployed to reconnoiter Hurricane Madeline just a few days earlier, conducted the first of four missions into Lester 6 h later. Based on these observations, it was apparent the hurricane had started to track toward the west-northwest. In addition, data from this mission indicated that Lester's intensity had decreased to 100 kt. This weakening trend may have been the result of Lester moving across the cool SSTs due to upwelling from Hurricane Madeline, which had intensified to a 115-kt hurricane as it traversed the same area just a few days earlier. In addition, southwesterly vertical wind shear slowly increased during the next two days as Lester continued moving toward the west-northwest at 12 to 15 kt. By 0000 UTC 4 September, the tropical cyclone had weakened to a 65-kt hurricane, and 6 h later Lester was downgraded to a tropical storm.

The tropical storm began to turn toward the northwest after passing well north of the Hawaiian Islands late on 4 September. At the same time, Lester continued to slowly weaken, with maximum sustained winds decreasing to 45 kt by 1800 UTC 4 September. However, sporadic deep convection redeveloped near the core of the tropical storm about 12 h later, and the intensity increased to 50 kt where it remained for the next day and a half. As Lester continued rounding the western side of the subtropical ridge during the second half of 6 September, the tropical cyclone turned northward while gradually weakening as it moved over significantly cooler SSTs of 23-24°C. Early on September 7, Lester's low-level circulation center became exposed due to increasing southwesterly vertical wind shear. The cyclone's structure was also becoming asymmetric according to satellite imagery, with sporadic thunderstorms developing southeast of the center. It is estimated that Lester became an extratropical cyclone by 1800 UTC that day. The extratropical cyclone dissipated nearly 1200 n mi north-northwest of the Hawaiian Islands around

0600 UTC 8 September when it was absorbed by a much larger extratropical low near the Gulf of Alaska.

METEOROLOGICAL STATISTICS

Observations in Lester (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). Observations in the central Pacific basin include Dvorak satellite intensity estimates from the Central Pacific Hurricane Center, the Joint Typhoon Warning Center, and flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from flights of the 53rd Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command. There were also two synoptic surveillance missions conducted by the NOAA G-IV aircraft. Objective satellite intensity estimates were also available from the Advanced Dvorak Technique (ADT) 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 Lester.

The 125-kt estimated peak intensity of Lester at 0600 UTC 31 August is based on a blend of subjective Dvorak classifications of 6.5/127 kt and 6.0/115 kt, from SAB and TAFB, respectively, and an objective ADT CI-number of 6.6/130 kt from UW/CIMSS. Lester's peak intensity of 110 kt in the Central Pacific basin at 0000 UTC 2 September is based on subjective Dvorak satellite intensity estimates of T6.0/115 kt from CPHC, JTWC and SAB, as well as T6.1/117 kt from UW-CIMSS ADT. The minimum pressure of 957 mb at the same time is based on the Knaff-Zehr-Courtney (KZC) pressure-wind relationship for an intensity of 110 kt.

The 53WRS conducted four reconnaissance missions into Hurricane Lester at the 700-mb level when the tropical cyclone was located to the east and east-northeast of the Hawaiian Islands on 2 and 3 September, respectively. Those missions resulted in 9 center fixes. Maximum flight-level winds of 110 kt were observed at 0752 UTC 2 September. The strongest SFMR surface wind measured during the missions was 100 kt during the same initial flight on 2 September.

The lowest surface pressure measured in the eye of Lester by a dropwindsonde was 964 mb at 0610 UTC 2 September. However, the dropwindsonde also reported a surface wind speed of 6 kt, so the minimum central pressure at that time was estimated to be 963 mb.

The only report of sustained tropical-storm-force winds in association with Lester over the eastern Pacific was from an automated weather station on Clarion Island which reported a sustained wind of 46 kt with a gust to 62 kt shortly after 1800 UTC 26 August. At that time, the center of Lester was located a little less than 90 n mi west-southwest of the island. The station reported a minimum pressure of 1003.2 mb at the time of Lester's closest approach.

The only known surface observations of near tropical-storm-force winds from Lester over the central Pacific were from NOAA National Data Buoy Center (NCBC) buoy 51000 located

northeast of the Hawaiian Islands. This buoy reported a 10-min mean wind speed at 5-meter elevation of 31.3 kt (equivalent to a 34 kt 1-min sustained wind at 10 meters) at 1750 UTC 3 September. This buoy also reported a peak wind gust of 39 kt.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Lester in the eastern Pacific.

There were some impacts from Lester in the Hawaiian Islands while the hurricane passed north of the state. Large swell generated by the hurricane resulted in surf of 10 to 20 feet along the eastern facing shores of the islands. Lifeguards conducted numerous water rescues, but there were no reports of serious injuries.

FORECAST AND WARNING CRITIQUE

The genesis of Lester was not well anticipated. The potential for tropical cyclone formation was first introduced as a low chance (<40%) of development into the 5-day Tropical Weather Outlook (TWO) at 0600 UTC 22 August, only 2 days before formation occurred (Table 2). The potential for development was raised to the medium category (40–60%) 6 h later, and to the high category (>60%) about 30 h before the system became a tropical depression. The 2-day probabilities did not reach the medium category until 0000 UTC 23 August, and only reached the high category 6 h prior to tropical cyclone formation. The global models did not indicate development until 2 to 3 days before formation occurred, which contributed to the poor NHC genesis forecasts.

A verification of NHC official track forecasts for Lester is given in Table 3a. The NHC track forecasts for Lester were very good, with average official forecast track errors about half as large as the 5-year mean. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The NHC forecasts beat all of the individual dynamical models, although several of the consensus models had slightly lower average errors. The NOAA corrected consensus model (HCCA) had the lowest mean errors through 36 h, and the TVCX consensus model (GFSI, EGRI, GHMI, HWFI, and double-weighted EMXI) was the best performer at 72, 96, and 120 h.

The NHC intensity forecast errors for Lester were well above the long-term means (Table 4a). The OCD5 errors were also well above their 5-year means, which suggests that the intensity forecasts for Lester were more difficult than normal. Several fluctuations in Lester's strength between 27 August and 2 September likely contributed to the large OCD5 errors. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The NHC forecasts had lower errors than the statistical models (SHIPS and LGEM) but were beaten by the CTCI and HWFI dynamical models at all lead times except at 12 h. Although the early NHC forecasts predicted that Lester would become a hurricane, the forecasts did not anticipate

that Lester would become a category 2 hurricane on 27 August (Figure 7). The NHC forecasts and the model guidance (not shown) also did not predict the rapid strengthening that occurred on 28–29 August, nor the peak intensity of 125 kt that Lester reached on 31 August. Although Lester was in a low-shear environment, it was thought that intrusions of dry air and relatively cool sea surface temperatures (about 27°C) would limit further strengthening.

A verification of CPHC official track forecasts for Lester is given in Table 5a. Official forecast track errors were lower than the mean official errors for the most recent 5-yr period (note that the 2015 statistics are unavailable at the time of this report, so the 2010–14 means are shown) for all forecast times. This is indicative of the rather well behaved motion that Lester exhibited as it tracked through the central Pacific. A homogeneous comparison of the official track errors with selected guidance models is given in Table 5b. The official track forecast errors were generally similar to, or in some cases worse, than the model guidance errors. The variable consensus model TVCX had lower mean errors than the official forecast for all of the 12–120 h forecast periods, while the GFEX had lower errors during the 24 to 120 h forecast periods. In addition, the HWRF model (HWFI) had lower mean errors than the official forecast through 96 h, while the FSSE had lower mean errors through 72 h. The GFS model had lower mean errors than the official forecast for all time periods, except for the 36 and 48 h time periods. The variable consensus model TVCE also had lower errors for all times, except for the 48 and 72 h forecasts. Finally, the variable consensus model, TCON, had lower mean errors at 12 and 24 h, while the ECMWF (EMXI) model had lower mean errors at 96 and 120 h.

A verification of CPHC official intensity forecasts for Lester is shown in Table 6a. Official forecast intensity errors were lower than the mean official errors for the most recent 5-yr period (2010–14 values are shown) for all forecast times from 24 to 120 h. Only the 12-h intensity forecast error was higher than the 5-yr mean. A homogeneous comparison of the official intensity forecast errors with selected guidance models is given in Table 6b. The DSHP and FSSE had lower mean intensity errors than the official forecasts for 12 h, as well as the 72-120 h forecasts. The LGEM model had lower mean intensity errors for the 72 and 96 h time periods. The variable consensus models, ICON and IVCN, as well as the HWRF model, had lower mean errors at 12 h.

There were no coastal tropical cyclone watches or warnings issued for Lester in the eastern Pacific basin. A Hurricane Watch was issued by CPHC for the Big Island of Hawaii, Maui, Molokai, Lanai, and Kahoolawe at 1500 UTC 1 September (Table 7). This was followed by the issuance of a Hurricane Watch for the island of Oahu, which includes the city of Honolulu, at 0300 UTC 2 September. As it became clear that Lester was going to pass well north of the eastern end of the Hawaiian Island chain, the Hurricane Watch for the Big Island of Hawaii was cancelled at 1500 UTC 2 September. The Hurricane Watch for the remainder of the Hawaiian Islands was discontinued 24 h later when it was evident that Lester posed no direct threat to any land areas in the archipelago.

Table 1. Best track for Hurricane Lester, 24 August–7 September 2016.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
24 / 0600	14.3	107.4	1007	25	tropical depression
24 / 1200	14.7	108.5	1007	25	"
24 / 1800	15.1	109.5	1006	30	"
25 / 0000	15.5	110.4	1006	30	"
25 / 0600	16.0	111.3	1005	35	tropical storm
25 / 1200	16.4	112.3	1003	45	"
25 / 1800	16.6	113.0	1001	50	"
26 / 0000	16.8	113.6	1001	50	"
26 / 0600	17.1	114.2	1001	50	"
26 / 1200	17.4	114.7	997	55	"
26 / 1800	17.6	115.3	994	60	"
27 / 0000	17.8	116.1	989	65	hurricane
27 / 0600	17.8	116.9	982	75	"
27 / 1200	17.8	117.8	975	85	"
27 / 1800	17.9	119.0	969	95	"
28 / 0000	17.9	120.3	973	90	"
28 / 0600	17.9	121.6	977	85	"
28 / 1200	17.8	122.9	983	75	"
28 / 1800	17.8	124.2	983	75	"
29 / 0000	17.8	125.6	980	80	"
29 / 0600	17.9	127.1	969	95	"
29 / 1200	18.0	128.6	960	105	"
29 / 1800	18.0	129.9	952	115	"
30 / 0000	18.1	131.2	953	115	"
30 / 0600	18.1	132.5	957	110	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
30 / 1200	18.1	133.8	961	105	"
30 / 1800	17.9	135.0	961	105	"
31 / 0000	17.8	136.0	948	120	"
31 / 0600	17.7	137.0	944	125	"
31 / 1200	17.7	138.1	948	120	"
31 / 1800	17.9	139.3	953	115	"
01 / 0000	18.1	140.6	959	105	"
01 / 0600	18.1	141.8	967	95	"
01 / 1200	18.2	143.0	971	90	"
01 / 1800	18.3	144.2	964	100	"
02 / 0000	18.6	145.4	957	110	"
02 / 0600	18.9	146.6	963	100	"
02 / 1200	19.4	147.8	968	95	"
02 / 1800	19.9	149.2	974	90	"
03 / 0000	20.4	150.5	977	85	"
03 / 0600	20.9	151.7	979	80	"
03 / 1200	21.5	153.2	982	75	"
03 / 1800	22.0	154.6	989	70	"
04 / 0000	22.5	156.0	993	65	"
04 / 0600	23.0	157.3	998	55	tropical storm
04 / 1200	24.0	158.7	1000	50	"
04 / 1800	25.0	159.7	1002	45	"
05 / 0000	26.1	160.7	1002	45	"
05 / 0600	27.2	161.9	1000	50	"
05 / 1200	28.3	163.3	1000	50	"
05 / 1800	29.3	164.3	1000	50	"
06 / 0000	30.3	165.0	1000	50	"
06 / 0600	31.6	165.7	999	50	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
06 / 1200	32.6	166.3	999	50	"
06 / 1800	33.6	166.5	999	50	"
07 / 0000	34.6	166.4	1001	45	"
07 / 0600	35.7	166.3	1001	45	"
07 / 1200	36.9	165.8	1001	45	"
07 / 1800	38.1	165.0	1001	45	extratropical low
08 / 0000	40.1	164.1	1001	45	"
08 / 0600					dissipated
31 / 0600	17.7	137.0	944	125	minimum pressure and maximum winds

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%)	36	48
Medium (40%-60%)	30	42
High (>60%)	6	30

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Lester, 24 August–7 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	**14.4**	**21.3**	**27.8**	**31.4**	**44.0**	**56.5**	**82.9**
OCD5	25.8	50.5	84.1	118.9	205.6	311.2	439.2
Forecasts	29	29	29	29	29	29	29
OFCL (2011-15)	23.4	36.4	47.2	59.4	89.0	123.6	159.5
OCD5 (2011-15)	36.6	74.2	116.5	159.7	245.6	331.1	427.4

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Lester, 24 August–7 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	14.4	22.2	28.6	32.7	43.1	52.3	76.2
OCD5	26.1	51.9	87.3	123.8	213.4	316.5	439.9
GFSI	15.3	24.7	35.9	45.3	65.5	80.1	110.0
GHMI	22.7	43.9	65.2	82.0	114.5	152.0	213.5
HWFI	15.4	25.2	34.6	42.9	59.0	72.9	91.1
EGRI	20.9	35.5	43.6	51.4	71.7	95.5	132.2
EMXI	15.1	24.0	32.6	39.7	47.5	61.1	91.1
CMCI	19.6	36.8	56.0	83.8	139.0	214.1	317.0
CTCI	15.6	24.8	32.9	37.3	44.1	66.1	99.7
GFNI	21.4	41.3	56.4	69.8	94.4	130.6	202.7
AEMI	15.9	29.3	43.4	56.9	83.8	104.3	136.5
HCCA	**12.8**	**20.5**	**28.5**	32.7	43.1	57.0	89.0
FSSE	**13.1**	**21.9**	30.6	34.2	47.0	62.6	98.5
TVCX	**14.3**	23.0	30.9	35.7	**41.9**	**44.8**	**59.4**
TCON	15.6	25.1	34.8	41.1	52.4	64.7	93.0
GFEX	**13.4**	22.7	31.1	38.8	50.7	59.3	83.4
TVCE	**14.2**	23.4	31.5	36.2	43.6	**46.5**	**62.0**
BAMD	26.6	47.4	71.4	96.8	149.5	196.0	239.1
BAMM	26.2	46.0	66.4	87.4	126.9	156.6	176.0
BAMS	37.8	67.5	90.6	107.8	125.2	136.0	179.7
Forecasts	25	25	25	25	25	25	25

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Lester, 24 August–7 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	9.5	15.3	16.0	16.7	19.8	21.4	23.3
OCD5	11.2	17.9	20.8	27.3	37.6	37.3	36.6
Forecasts	29	29	29	29	29	29	29
OFCL (2011-15)	5.9	9.8	12.5	14.0	15.5	16.3	14.9
OCD5 (2011-15)	7.7	12.8	16.4	18.8	21.1	20.9	19.7

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Lester, 24 August–7 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	10.2	16.6	17.6	18.0	20.8	22.6	21.8
OCD5	12.0	19.8	22.6	29.0	39.6	39.1	35.2
GFSI	10.5	**14.6**	**14.7**	**14.1**	21.3	25.7	29.7
GHMI	14.2	22.9	27.8	30.1	26.9	25.9	24.6
HWFI	10.7	**15.9**	**15.7**	**13.4**	**16.9**	**19.0**	**20.7**
EMXI	12.2	**16.2**	**17.5**	**17.4**	23.4	30.3	33.6
GFNI	12.8	18.3	21.8	24.5	26.3	29.8	29.6
CTCI	10.8	**15.2**	**16.8**	**17.8**	**18.3**	**19.4**	**16.3**
DSHP	10.9	17.9	19.6	22.9	31.0	32.0	28.2
LGEM	11.0	18.4	21.2	24.5	31.1	29.8	26.1
ICON	11.2	17.8	19.8	22.1	25.3	25.0	22.3
IVCN	11.0	17.0	18.6	20.8	23.7	23.6	**20.5**
FSSE	10.7	16.8	**17.2**	18.0	24.0	24.6	23.7
HCCA	10.5	18.1	18.8	**15.7**	21.8	**20.6**	**19.9**
Forecasts	25	25	25	25	25	25	25

Table 5a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Lester, 24 August–7 September 2016. Mean errors for the previous 5-yr period are shown for comparison. Official intensity forecast errors that are smaller than the 5-yr mean intensity errors are shown in bold face type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	**14.8**	**20.9**	**24.8**	**32.0**	**68.3**	**117.7**	**174.9**
OCD5	25.5	61.6	118.1	183.3	358.1	504.2	637.6
Forecasts	25	23	21	19	15	11	7
OFCL (2010-14)	27.9	44.1	56.7	73.9	132.3	183.7	258.9

Table 5b. Homogeneous comparison of select track forecast guidance model errors (n mi) for Hurricane Lester, 24 August–7 September 2016. Errors smaller than the CPHC official track forecast errors (OFCL) are shown in boldface type.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	14.8	20.9	24.8	32.0	68.3	117.7	174.9
OCD5	25.5	61.6	118.1	183.3	358.1	504.2	637.6
GFSI	**14.7**	**19.5**	25.5	36.9	**66.8**	**100.1**	**115.4**
GHMI	19.7	33.6	44.3	61.4	113.7	194.3	294.1
HWFI	**13.8**	**16.7**	**21.9**	**29.1**	**56.0**	**104.3**	207.4
EGRI	18.6	36.4	60.3	92.2	188.5	282.5	458.8
EMXI	17.1	25.7	29.1	36.8	71.1	**99.4**	**143.9**
CMCI	21.6	40.5	68.0	94.7	210.8	382.8	555.8
AEMI	15.7	27.2	44.8	68.9	148.6	288.5	419.6
FSSE	**14.1**	**19.3**	**23.3**	**31.6**	**65.2**	128.2	190.6
TVCX	**13.9**	**18.8**	**23.4**	**31.5**	**63.3**	**100.5**	**126.0**
TCON	**14.5**	**20.6**	26.8	40.3	82.3	132.5	230.3
GFEX	15.2	**19.5**	**22.9**	**28.7**	**60.7**	**93.0**	**110.2**
TVCE	**13.7**	**19.0**	**23.6**	34.7	68.6	**102.3**	**123.8**
BAMD	31.8	51.9	63.0	69.2	82.4	**98.1**	**132.3**
BAMM	25.1	49.3	77.9	108.7	183.3	234.6	290.9
BAMS	30.1	64.1	103.6	155.5	291.8	410.3	533.5
Forecasts	25	23	21	19	15	11	7

Table 6a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Lester, 24 August–7 September 2016. Mean errors for the previous 5-yr period are shown for comparison. Official intensity forecast errors that are smaller than the 5-yr mean intensity errors are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	6.8	**8.5**	**8.3**	**7.1**	**7.3**	**8.6**	**5.0**
OCD5	9.7	14.7	17.9	13.7	17.1	18.3	6.0
Forecasts	25	23	21	19	15	11	7
OFCL (2010-14)	4.8	8.6	11.6	13.8	18.5	19.3	20.4

Table 6b. Homogeneous comparison of select intensity forecast guidance model errors (kt) for Hurricane Lester, 24 August – 7 September 2016. Errors smaller than the CPHC official forecast errors (OFCL) are shown in boldface type.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	6.8	8.5	8.3	7.1	7.3	8.6	5.0
OCD5	9.7	14.7	17.9	13.7	17.1	18.3	6.0
GFSI	6.9	10.3	13.8	16.7	23.5	27.4	27.0
GHMI	6.8	9.9	11.1	10.2	12.4	14.1	15.1
HWFI	**6.2**	9.0	10.8	12.3	15.9	19.7	17.3
EMXI	8.5	12.7	17.2	21.4	28.1	24.9	35.9
DSHP	**6.0**	8.7	9.3	8.2	**6.9**	**4.7**	**3.9**
LGEM	**6.7**	10.1	11.3	10.9	**6.0**	**4.3**	5.0
ICON	**6.1**	8.7	9.7	9.3	9.7	10.7	10.0
IVCN	**6.0**	8.7	9.6	9.2	9.8	10.5	9.9
FSSE	**5.7**	8.9	9.3	8.3	**6.4**	**4.5**	7.0
Forecasts	25	23	21	19	15	11	7

Table 7. Wind watch and warning summary for Hurricane Lester, 24 August–7 September 2016.

Date/Time (UTC)	Action	Location
01 / 1500	Hurricane Watch issued	Big Island of Hawaii, Maui, Molokai, Lanai and Kahoolawe
02 / 0300	Hurricane Watch issued	Oahu
02 / 1500	Hurricane Watch discontinued	Big Island of Hawaii
03 / 1500	Hurricane Watch discontinued	Maui, Molokai, Lanai, Kahoolawe and Oahu

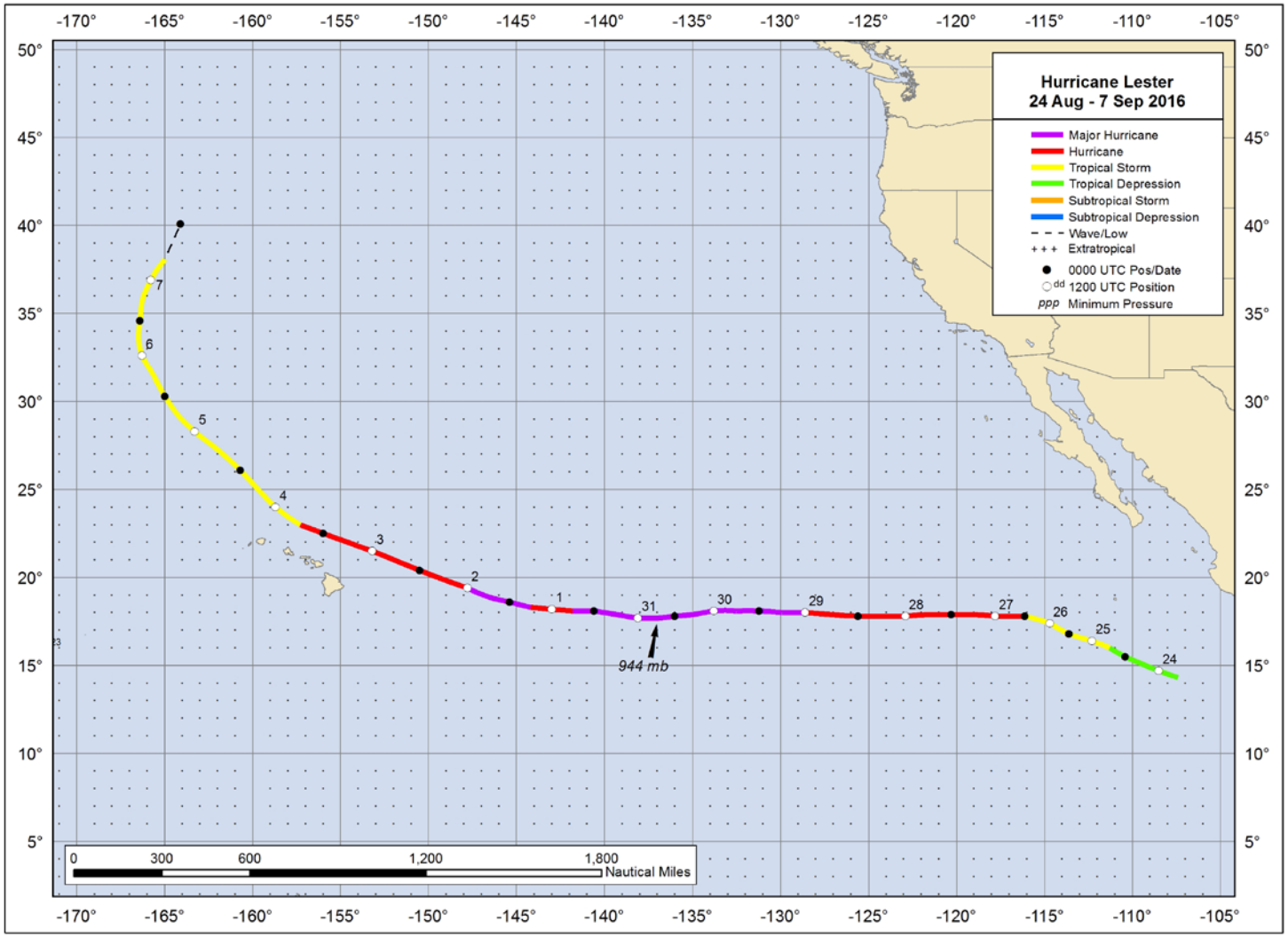

Figure 1. Best track positions for Lester, 24 August–7 September 2016.

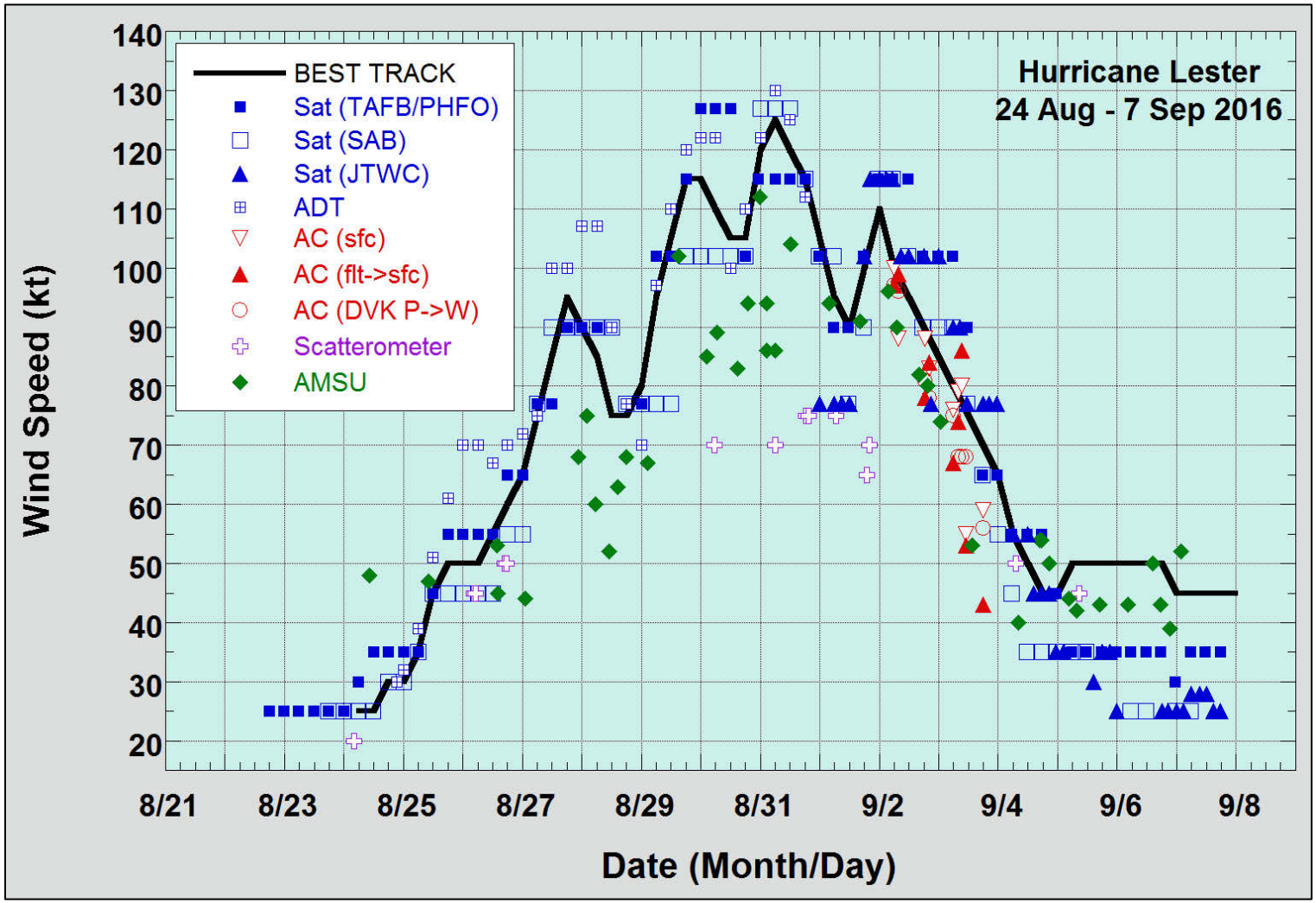

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Lester, 24 August–7 September 2016. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM). 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.

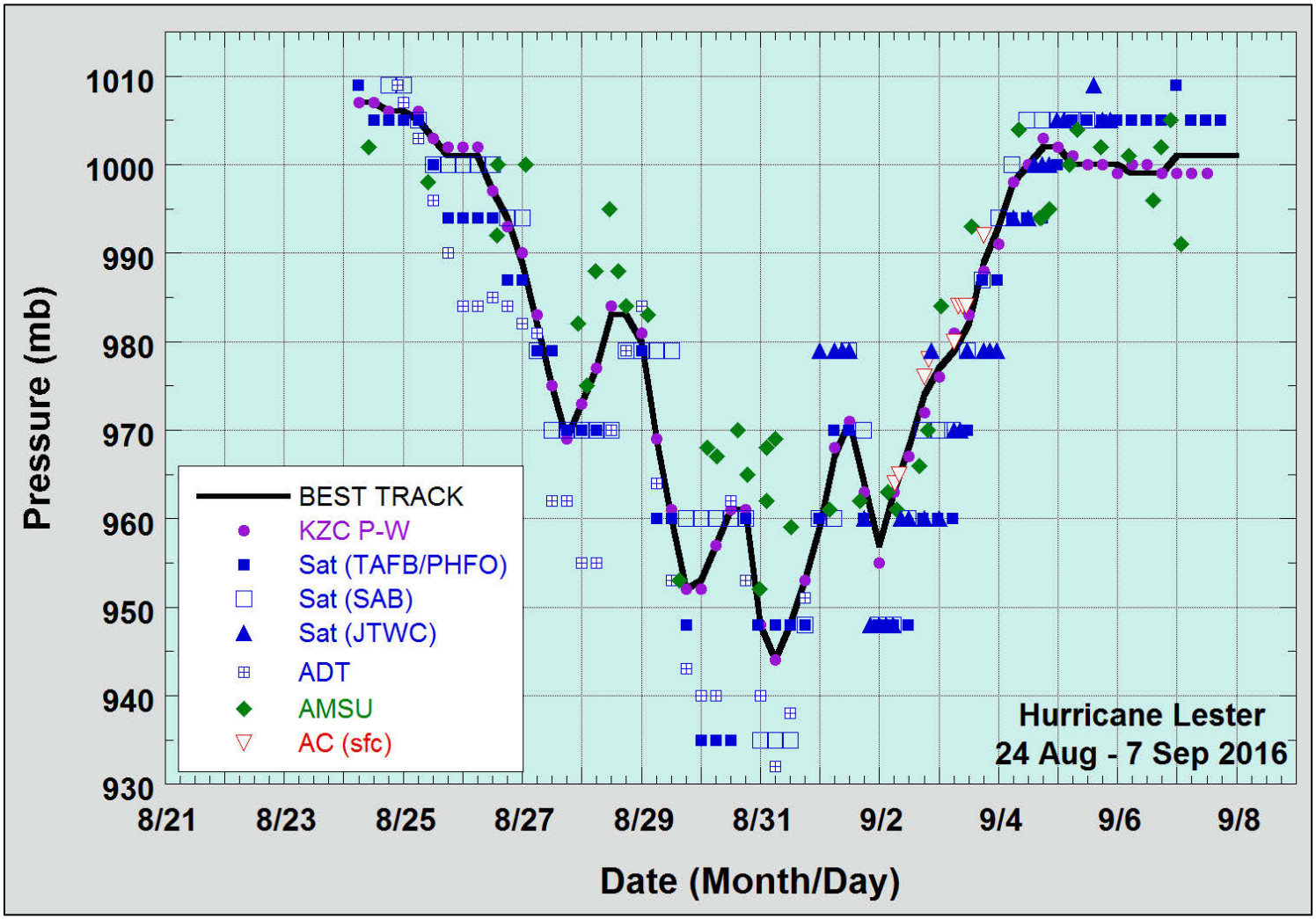

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Lester, 24 August–7 September 2016. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for 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.

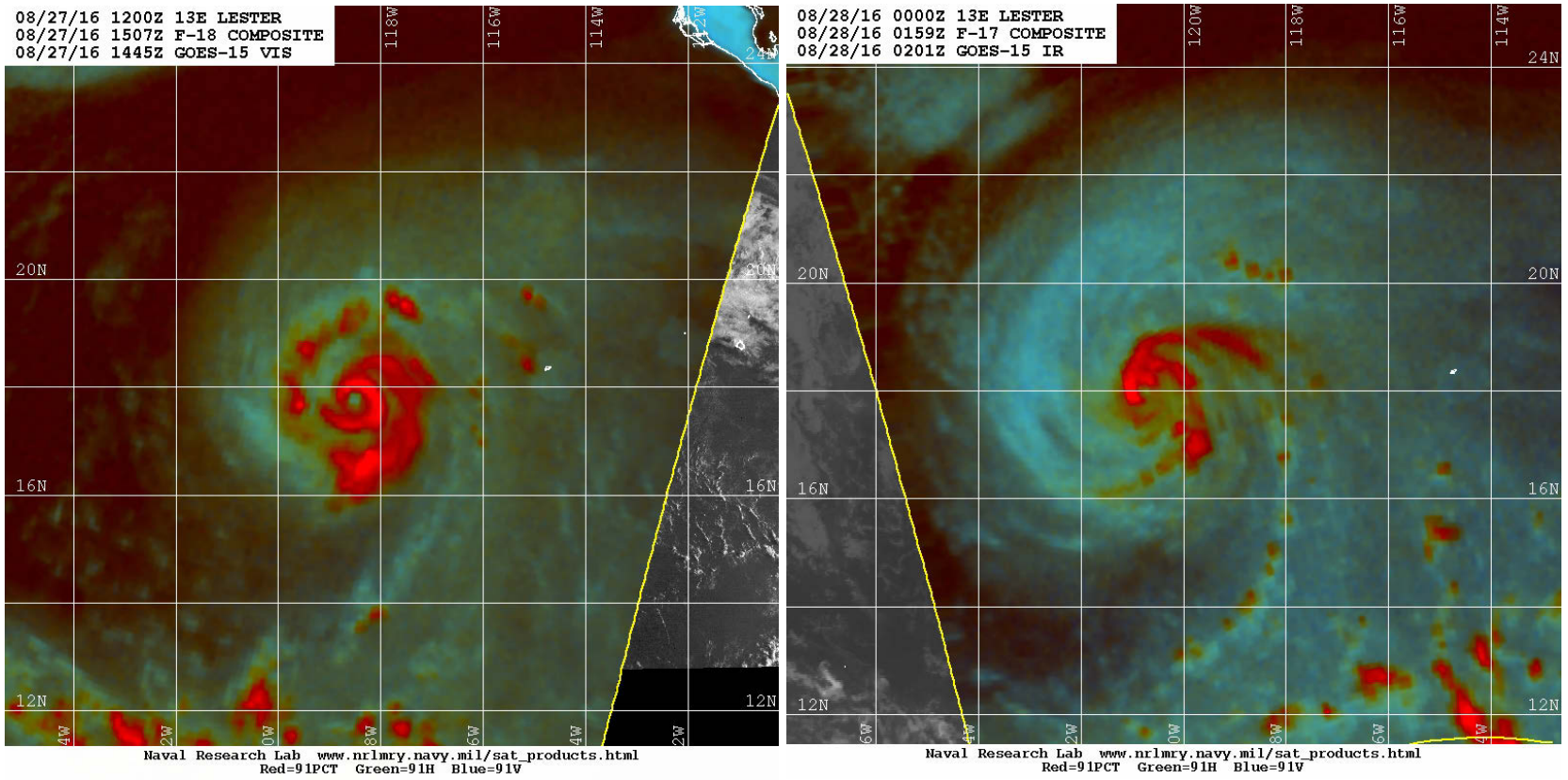

Figure 4. 91-GHz color-composite microwave imagery of Hurricane Lester at 1507 UTC 27 August (left) and 0159 UTC 28 August (right). Note the erosion of the convection within the southern and southeastern portions of the eye during that time. Images courtesy of the Naval Research Laboratory.

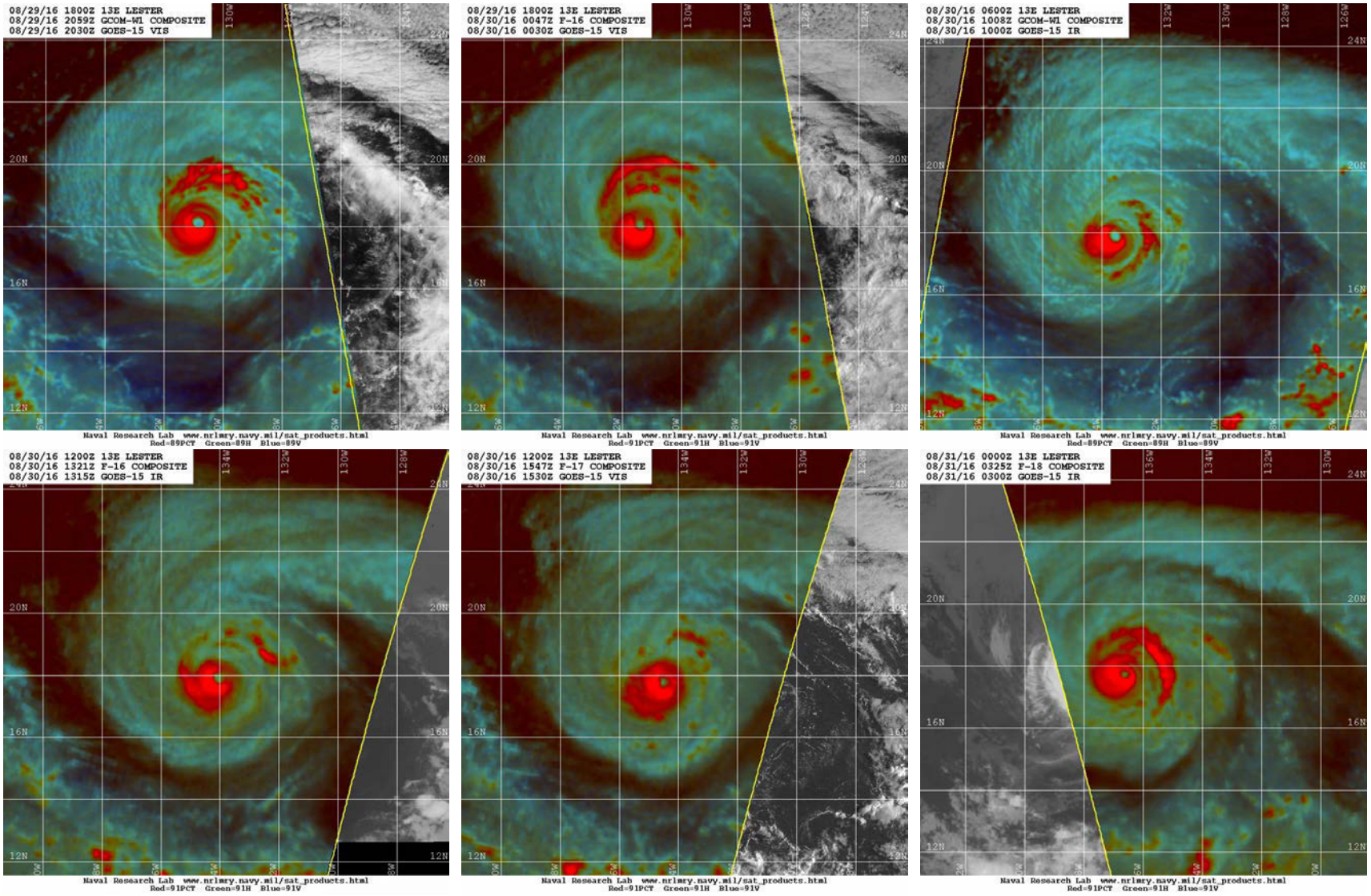

Figure 5. Series of 89- to 91-GHz color-composite microwave images of Hurricane Lester from 2059 UTC 29 August (top left) to 0325 UTC 31 August (bottom right). Note the erosion of the convection over the northeastern eyewall between 0047 UTC and 1321 UTC 30 August. This caused Lester to weaken, before it re-strengthened and reached a peak intensity of 125 kt at 0600 UTC 31 August (near the time of the final image). Images courtesy of the Naval Research Laboratory.

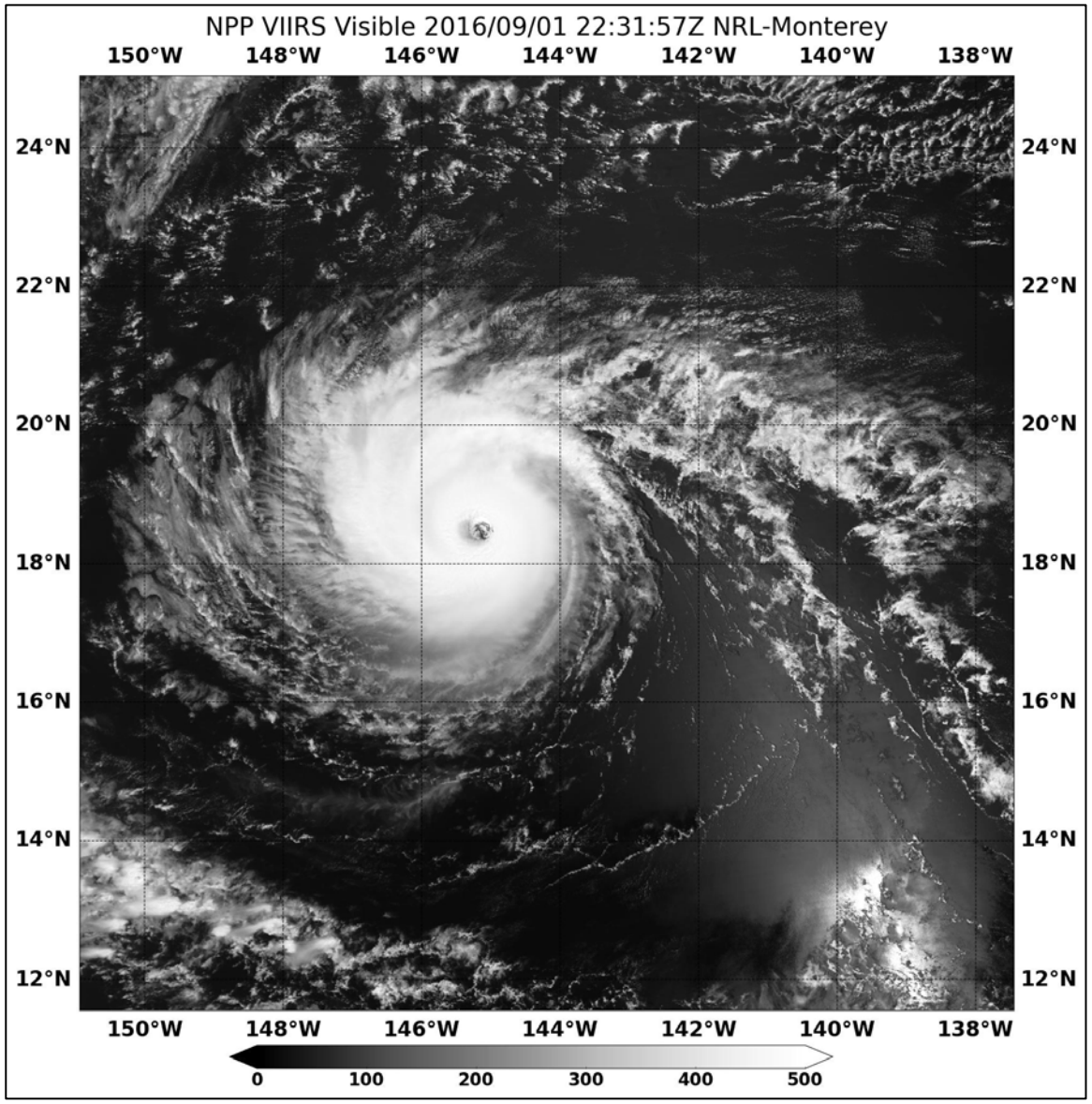

Figure 6. Visible Infrared Imaging Radiometer Suite (VIIRS) Image of Lester at 2232 UTC 1 September 2016 near the time of its peak intensity over the central Pacific basin. Image courtesy of the Naval Research Laboratory.

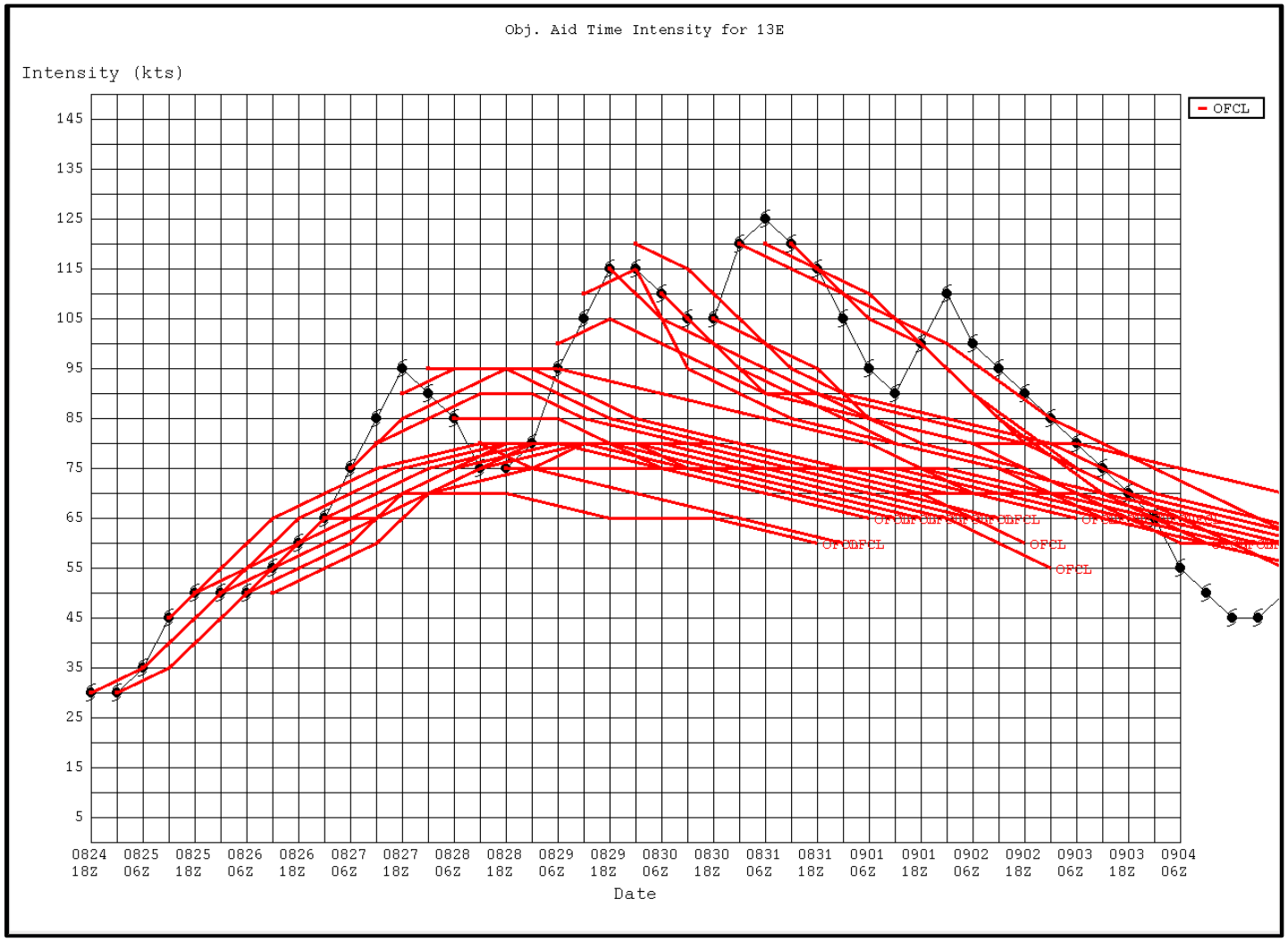

Figure 7. NHC intensity forecasts (red) and the final best-track intensities (white) of Hurricane Lester from 1800 UTC 24 August through 1800 UTC 31 August. Note that the NHC forecasts failed to predict the magnitude of Lester's peak intensity on 27 August, 29 August, and 31 August.