Tropical Cyclone Report
Hurricane Leslie
(AL122012)
30 August – 11 September 2012

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Leslie was a long-lived tropical cyclone but a short-lived category 1 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that skirted Bermuda and made landfall as a strong extratropical storm along the Burin Peninsula of southeastern Newfoundland. Hurricane Leslie was also the eighth tropical storm to form in August, tying a record for most named storms in a month.

a. Synoptic History

Leslie formed from a vigorous tropical wave that moved off of the west coast of Africa late on 26 August. The wave was accompanied by a broad surface low that gradually became better defined over the next several days as the system moved quickly westward over the tropical Atlantic. On 29 August, bands of showers and thunderstorms became better organized and more concentrated around the well-defined low-level circulation center, and this convective development trend continued for the next 24 h. Dvorak satellite classifications and scatterometer surface wind data indicated that a tropical depression formed around 0000 UTC 30 August when the system was located about 1300 n mi east-southeast of the northern Leeward 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 1[1].

Convective organization continued to increase and the cyclone strengthened into a tropical storm 12 h later. After acquiring tropical storm status, Leslie turned west-northwestward along the southern periphery of a deep-layer subtropical ridge and maintained that motion for the next 48 h. Environmental conditions remained favorable during that period, and the cyclone gradually strengthened to near hurricane status. However, by early on 1 September, modest north-northwesterly vertical wind shear occurring on the west side of an upper-level trough began to affect Leslie and the cyclone's intensity leveled off at 60 kt, with a ragged eye-like feature occasionally evident in satellite imagery. That strength was maintained for the next 24 h before the 850-200 mb vertical wind shear increased to more than 20 kt by early on 2 September. The stronger shear caused Leslie to weaken to 50 kt, despite being over sea-surface temperatures (SST) greater than 29^{o} C, and that intensity was maintained for the next 24 h. Early on 3 September, the tropical storm turned northwestward and slowed down markedly as it approached

[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.

a weakness in the Bermuda high pressure ridge centered about 300 n mi north of the Leeward Islands. As Leslie gradually turned northward into this weakness, a high-latitude omega-type blocking pattern developed south of Atlantic Canada; the associated ridging pattern strengthened and steadily surrounded the cyclone. The blocking pattern resulted in weak steering currents that caused Leslie to drift slowly northward at forward speeds less than 4 kt for the next four days. As the steering currents weakened, so did the deep-layer shear, allowing Leslie to strengthen into a 70-kt hurricane and also expand horizontally by 1200 UTC 5 September (Fig. 4), when the cyclone was located about 420 n mi south-southeast of Bermuda. However, the favorable combination of moderate vertical shear, northwesterly upper-level diffluent flow, and very high SSTs (Fig. 5a) was short-lived.

The very slow northward motion resulted in the creation of a large wake of cold water beneath the cyclone that began as early as 4 September (Fig. 5b). By late on 5 September significant cold upwelling halted the intensification process, and a slow weakening trend ensued. Leslie weakened to a 55-kt tropical storm by 0600 UTC 8 September and it maintained that intensity for the next 42 h while the strong blocking pattern remained intact. Upwelling that was induced by Leslie's relatively large circulation and slow forward speed resulted in sea-surface temperatures cooling to as low as 23^{o} C (Fig. 5c) – a decrease of more than as 6^{o} C – by 9 September. Although the tropical storm's intensity decreased during this 5-day period, its circulation expanded to more 1000 n mi in diameter and the tropical-storm-force wind field also increased to an average radius of about 150 n mi, which is more than twice the average radius for a typical category 1 hurricane.

By early 9 September, the blocking pattern began to break down and shifted eastward as a broad mid- to upper-level trough and associated cold front slowly emerged off of the east coast of the United States. In response to the increasing southerly steering flow ahead of the trough, Leslie moved northward at a forward speed of 8-10 kt. The cyclone made its closest point of approach to Bermuda at around 1800 UTC 9 September when Leslie passed about 115 n mi east of the island. Leslie buffeted Bermuda with tropical-storm-force wind gusts for about 16 h on that day.

As Leslie moved steadily away from Bermuda and the region of cold upwelled waters, the cyclone began to slowly strengthen by early 10 September. Leslie regained hurricane status around 1200 UTC that day when it was located about 700 n mi southwest of Cape Race, Newfoundland, and maintained an intensity of 65 kt until the cyclone made landfall along the southeast coast of Newfoundland about 24 h later. As the slow-moving mid-tropospheric trough amplified along the U.S. east coast, the increasing deep-layer steering flow forced Leslie to rapidly accelerate to the north-northeast and then the northeast at speeds of 35-40 kt. Increasing baroclinic effects also caused the central pressure of the cyclone to decrease by 20 mb – from 988 mb to 968 mb – during that same period. However, the drop in central pressure did not result in a corresponding increase in the maximum winds since the same baroclinic forcing caused the outer pressure field to expand, resulting in no increase in the inner core surface pressure gradient. By early on 11 September when Leslie was located about 75 n mi southwest of St. Lawrence, Newfoundland, the combination of strong vertical wind shear in excess of 40 kt, SSTs less than 20^{o} C, and a merger with a cold front caused the large category 1 hurricane to transition into a powerful extratropical cyclone around 0900 UTC. Leslie made landfall as a post-tropical cyclone

with hurricane-force winds around 1045 UTC along the southern portion of the Burin Peninsula of Newfoundland near the towns of St. Lawrence and Lawn. The large extratropical low pressure system continued to move rapidly northeastward across eastern Newfoundland at a forward speed of near 45 kt, and merged with a much larger extratropical low over the Labrador Sea by 0600 UTC 12 September.

b. Meteorological Statistics

Observations in Leslie (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. Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from flights by the National Oceanic and Atmospheric Administration (NOAA) Aircraft Operations Center WP-3D and Gulfstream-IV (G-IV) aircraft. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Tropical Rainfall Measuring Mission (TRMM), 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 Leslie.

NOAA conducted three reconnaissance missions into the cyclone by WP-3D aircraft on 7 and 8 September, which resulted in six eye penetrations and center fixes. One synoptic surveillance mission around the cyclone was conducted by the NOAA G-IV jet aircraft on 8 September. Each of these NOAA missions occurred when Leslie was located south-southeast of Bermuda and posed a threat to the island. A maximum flight-level wind of 83 kt at 8000 ft was measured in the northwest quadrant at 2335 UTC 7 September; this would normally correspond to a peak cyclone intensity of about 70 kt. However, peak SFMR surface wind speed estimates were only 54-57 kt, which were supported by dropwindsonde data obtained from the inner-core of the cyclone, and this was the justification for not making a Leslie a hurricane at that time.

The estimated peak intensity of 70 kt at 1200 UTC and 1800 UTC on 5 September was based on a blend of subjective and objective Dvorak intensity estimates (ADT) of T4.0/65 kt and T4.5/77 kt. The 65-kt estimated intensity of Post-tropical cyclone Leslie when it made landfall on the Burin Peninsula of Newfoundland at 1045 UTC 11 September was based on AMSU intensity estimates of 61-70 kt just before extratropical transition occurred.

Selected ship and buoy reports of tropical-storm-force winds associated with Leslie are given in Tables 2 and 3, respectively. Observed wind gusts associated with Post-tropical cyclone Leslie's passage over Newfoundland are listed in Table 4. At around 0700 UTC 11 September, the eye of Hurricane Leslie passed over Canadian buoy 44139, which reported a minimum pressure of 970.9 mb (Fig. 6).

The strongest winds that occurred on Bermuda were observed on 9 September when a sustained wind of 35 kt with a gust to 48 kt was reported around 1531 UTC at the Bermuda International Airport. Commissioner's Point at Dockyard recorded a wind gust to near hurricane

strength. The outer rain bands of Leslie produced a total of 5.17 inches (131 mm) of rainfall during the period 8-10 September.

Leslie's rapid forward motion across Newfoundland on 11 September contributed to several reports of hurricane-force wind gusts across the eastern and southern portions of the province, especially on the Avalon Peninsula.

As a hurricane, Leslie produced rainfall totals of 2-4 inches (50-100 mm) across much of Nova Scotia, with a maximum amount of 6.50 inches (165 mm) measured at Shubenacadie. As a post-tropical cyclone, Leslie produced similar rainfall totals of 2-4 inches (50-100 mm) across Newfoundland, especially over the central and western portions of the province. However, there was a large disparity in rainfall totals from west-to-east – a maximum rainfall amount of 4.25 inches (108 mm) was observed at Cow Head, which is located along the northwest coast Newfoundland, whereas only 0.28 inch (7 mm) was observed along the southeast coast at St. John's Airport.

The highest storm surge measured on Newfoundland was 3.61 ft (1.10 m) at Argentia and St. Lawrence, which are located just east of where the center of Leslie made landfall. However, no significant coastal inundation was observed since the storm surge occurred at low tide.

Post-tropical cyclone Leslie's pressure at landfall near St. Lawrence, Newfoundland is estimated to be 969 mb; that estimate is based on a pressure of 973.1 mb observed at Sagona Island (CWZN) at 1100 UTC 11 September, and which was accompanied by a sustained wind of 35 kt.

c. Casualty and Damage Statistics

Bermuda

Scattered power outages affected hundreds of Bermuda residents, and there were numerous reports of large tree branches broken off and other debris that covered some roadways.

Canada

The Avalon Peninsula of Newfoundland received the brunt of Post-tropical cyclone Leslie when it made landfall during the morning of 11 September. The large extratropical low ripped off roofs from home, caused widespread tree damage, and left 45,000 homes without power for about 6 h. A partially built house was destroyed in Pouch Cove and several unfinished homes were damaged in St. John's. Localized flooding was caused by the heavy rainfall, which made some roads and bridges impassable; the Port au Port Peninsula was temporarily isolated from the western Newfoundland mainland.

There were no reports of casualties associated with Leslie, either while it was a tropical cyclone or during its post-tropical phase. No damage estimates were available from either Bermuda or Canada.

d. Forecast and Warning Critique

The genesis of Leslie was predicted with modest success. The system was first mentioned in the Atlantic Tropical Weather Outlook (TWO) with a low (<30%) probability of formation 66 h before genesis occurred. However, the probabilities were increased to the medium (30-50%) and high (≥60%) categories only 24 h and 6 h, respectively, before Leslie formed due to moderate to strong east-northeasterly vertical wind shear that was expected to continue and inhibit development. However, the shear relaxed sooner than forecast by the global models, allowing deep convection to become organized and more concentrated near the system center.

A verification of NHC official track forecasts for Leslie is given in Table 5a. Official forecast track errors (OFCL) were lower than the mean official errors for the previous 5-yr period at all forecast times, and averaged about 23% better through 120 h. However, OCD5 track errors also averaged better by 24% throughout the 120-h forecast period, suggesting that Leslie may have been easier than average to forecast. A homogeneous comparison of the official track errors with selected guidance models is given in Table 5b. Models that notably outperformed OFCL were the EMXI at 48 h, the FSSE at 48h and 72 h, the GFSI and AEMI at 96 h and 120 h, and the medium and shallow Beta and Advection Models (BAMM/BAMS) at 120 h. The EMXI model handled the north-northeastward recurvature of Leslie better than any of the other models.

A verification of NHC official intensity forecasts for Leslie is given in Table 6a. Official forecast intensity errors were noticeably lower than the mean official errors for the previous 5-yr period through 36 h and near average at 48-120 h. In contrast, OCD5 errors were considerably lower than the previous 5-yr period at all forecast times, an averaged 43% better in the 12–48-h period and 60% better from 72-120 h. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 6b. The OFCL intensity forecasts were significantly outperformed by nearly all of available models, except for HWFI, at almost every forecast period. The main reason for the lack of OFCL forecast skill at 48 h and beyond is due to the lack of anticipation that Leslie would generate as much cold upwelling as it did on 5-7 September and weaken as a result.

Watches and warnings associated with Leslie are given in Table 7.

Acknowledgements

NHC extends special thanks to the staffs of the Bermuda Weather Service and the Canadian Hurricane Centre for their inputs on Leslie, and to John Cangialosi from the National Hurricane Center for his preparation of the Hurricane Leslie track map.

Table 1. Best track for Hurricane Leslie, 30 August – 11 September 2012.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
28 / 1200	12.9	27.4	1010	20	low
28 / 1800	13.0	29.6	1010	20	"
29 / 0000	13.1	31.7	1009	25	"
29 / 0600	13.2	33.7	1009	25	"
29 / 1200	13.3	35.6	1009	25	"
29 / 1800	13.4	37.5	1008	25	"
30 / 0000	13.5	39.2	1007	30	tropical depression
30 / 0600	13.6	40.9	1006	30	"
30 / 1200	13.8	42.6	1005	35	tropical storm
30 / 1800	14.2	44.2	1004	40	"
31 / 0000	14.7	45.8	1002	45	"
31 / 0600	15.3	47.4	1001	50	"
31 / 1200	16.0	49.0	999	55	"
31 / 1800	16.5	50.6	999	55	"
01 / 0000	17.1	52.2	998	60	"
01 / 0600	17.6	53.8	996	60	"
01 / 1200	18.1	55.3	995	60	"
01 / 1800	18.8	56.8	994	60	"
02 / 0000	19.6	58.1	994	60	"
02 / 0600	20.4	59.4	995	55	"
02 / 1200	21.2	60.7	997	50	"
02 / 1800	22.1	61.4	997	50	"
03 / 0000	22.9	61.7	997	50	"
03 / 0600	23.4	62.2	996	50	"
03 / 1200	23.5	62.6	993	50	"
03 / 1800	23.8	62.8	990	55	"
04 / 0000	24.2	62.6	989	60	"
04 / 0600	24.5	62.5	988	60	"
04 / 1200	24.8	62.5	988	60	"
04 / 1800	25.0	62.6	988	60	"
05 / 0000	25.2	62.8	988	60	"
05 / 0600	25.4	62.8	985	65	hurricane
05 / 1200	25.6	62.8	982	70	"
05 / 1800	25.8	62.7	982	70	"
06 / 0000	26.0	62.6	984	65	"
06 / 0600	26.2	62.5	984	65	"
06 / 1200	26.3	62.4	983	65	"
06 / 1800	26.4	62.3	982	65	"
07 / 0000	26.5	62.2	982	65	"
07 / 0600	26.6	62.2	982	65	"
07 / 1200	26.8	62.2	981	60	tropical storm
07 / 1800	27.1	62.2	981	60	"
08 / 0000	27.4	62.3	983	60	"
08 / 0600	27.8	62.4	985	55	"
08 / 1200	28.3	62.5	987	55	"
08 / 1800	29.0	62.5	988	55	"
09 / 0000	29.7	62.6	988	55	"
09 / 0600	30.5	62.6	988	55	"

09 / 1200	31.5	62.5	988	55	"
09 / 1800	32.6	62.3	988	55	"
10 / 0000	33.8	62.0	988	55	"
10 / 0600	35.1	61.6	985	60	"
10 / 1200	36.4	60.8	980	65	hurricane
10 / 1800	38.5	59.8	975	65	"
11 / 0000	41.1	58.6	970	65	"
11 / 0600	44.0	57.3	968	65	"
11 / 0900	45.8	56.1	968	65	extratropical
11 / 1200	47.7	54.9	970	65	"
11 / 1800	51.6	51.9	972	60	"
12 / 0000	55.5	48.5	975	55	"
12 / 0600					absorbed by larger extratropical low
05 / 1200	25.5	62.8	982	70	maximum intensity
11 / 0600	44.0	57.3	968	65	minimum pressure

Table 2. Selected ship reports with sustained winds of at least 34 kt for Hurricane Leslie, 30 August - 11 September 2012.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
03 / 0800	C6SE4	20.6	63.9	270 / 37	1009.0
04 / 0600	DPJK	21.6	61.6	250 / 37	1012.0
06 / 1800	SKWI	23.2	59.5	200 / 35	1010.7
07 / 0000	WWMZ	22.4	62.4	250 / 37	1014.0
10 / 1800	HPHV	37.1	57.7	160 / 57	1000.0
10 / 2100	PHOS	46.7	59.5	180 / 52	
11 / 0000	PCPR	33.9	55.8	230 / 41	1018.2
11 / 0000	WKPY	39.6	66.6	330 / 35	1009.5
11 / 0500	C6VG8	45.4	60.0	350 / 50	991.0
11 / 0600	3FPS9	43.6	66.5	300 / 38	1008.0
11 / 0600	YJUF7	46.7	48.0	150 / 39	1015.0
11 / 0700	C6VG8	45.7	59.5	330 / 53	989.0
11 / 0900	PHOS	44.4	62.6	320 / 35	1003.0
11 / 0900	VOXS	46.7	48.0	150 / 35	1012.0
11 / 0900	YJUF7	46.7	48.0	150 / 44	1011.3
11 / 0900	CGCX	47.5	55.2	070 / 37	979.9
11 / 0900	SHIP	47.5	55.2	070 / 37	979.9
11 / 1000	CGCX	47.6	55.1	140 / 43	976.2
11 / 1000	SHIP	47.6	55.1	140 / 43	976.2
11 / 1100	CGAH	47.7	56.1	010 / 36	977.2
11 / 1100	SHIP	47.7	56.1	010 / 36	977.2
11 / 1500	VOXS	46.7	48.0	170 / 35	1007.5
11 / 1500	YJUF7	46.7	48.0	170 / 53	1007.1
11 / 1800	VOXS	46.7	48.0	180 / 36	1006.5
11 / 1800	YJUF7	46.7	48.0	180 / 45	1005.9

Table 3. Selected buoy reports with sustained winds of at least 34 kt for Hurricane Leslie, 30 August - 11 September 2012.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
02 / 0550	41044	21.6	58.6	120 / 37	1004.8
02 / 0950	41044	21.6	58.6	160 / 41	1007.1
02 / 1050	41044	21.6	58.6	170 / 43	1007.9
06 / 0550	41049	27.5	63.0	070 / 43	1001.9
06 / 0650	41049	27.5	63.0	070 / 43	1001.7
06 / 1150	41049	27.5	63.0	060 / 45	1000.8
06 / 2050	41049	27.5	63.0	060 / 45	998.6
06 / 2150	41049	27.5	63.0	050 / 45	998.7
07 / 0550	41049	27.5	63.0	030 / 45	996.6
07 / 0650	41049	27.5	63.0	030 / 45	995.7
07 / 0750	41049	27.5	63.0	030 / 45	995.3
07 / 0950	41049	27.5	63.0	020 / 45	994.9
07 / 2150	41049	27.5	63.0	350 / 43	985.6
07 / 2350	41049	27.5	63.0	010 / 35	986.4
08 / 0050	41049	27.5	63.0	350 / 37	986.5
11 / 0400	44139	44.2	57.1	080 / 41	
11 / 0500	44139	44.2	57.1	100 / 47	973.1
11 / 0500	44139	44.2	57.1		970.9
11 / 0800	44139	44.2	57.1	280 / 47	981.5

Table 4. Measured wind gusts in Newfoundland associated with Post-tropical cyclone Leslie.

Location	Gust (kt)
Cape Pine	74
Bell Island	71
St. John’s Airport	71
Bonavista	67
Long Pond	67
Argentia	65
Paradise	64

Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Leslie. Mean errors for the 5-yr period 2007-11 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 (Leslie)	**23.6**	**33.8**	**49.9**	**69.4**	**96.6**	**127.4**	**165.8**
OCD5 (Leslie)	37.7	72.1	115.6	156.8	240.6	294.0	346.3
Forecasts	46	44	42	40	36	32	28
OFCL (2007-11)	30.4	48.4	65.9	83.1	124.4	166.5	213.4
OCD5 (2007-11)	46.9	95.2	151.7	211.6	316.8	404.3	485.2

Table 5b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Leslie. 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 5a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	26.4	36.9	54.3	74.2	99.2	128.9	168.9
OCD5	35.9	69.9	115.8	166.7	254.7	313.5	350.4
GFSI	27.0	42.2	58.8	80.7	**97.2**	**106.3**	**121.4**
AEMI	29.1	43.4	59.1	80.7	105.0	**127.5**	**153.2**
EMXI	**24.8**	37.4	**53.4**	**66.2**	101.9	161.9	227.9
TVCA	26.8	40.9	57.6	78.5	110.8	147.5	196.9
FSSE	**24.0**	**34.7**	**49.3**	**63.4**	**80.6**	**127.9**	180.6
GHMI	32.8	44.6	60.3	80.2	104.8	133.5	208.9
HWFI	30.5	52.5	75.2	106.8	141.6	168.9	226.1
UKMI	32.2	48.8	66.1	92.3	159.1	233.5	318.0
EGRI	32.2	48.8	66.1	92.3	159.1	233.5	295.9
CMCI	29.1	43.6	56.4	75.1	141.4	240.2	383.6
LBAR	31.6	45.1	65.4	89.5	119.3	140.3	169.5
BAMD	41.5	71.5	97.5	115.8	143.0	192.6	268.8
BAMM	35.5	55.7	75.4	88.9	113.4	140.4	**146.2**
BAMS	53.1	93.7	126.4	156.4	193.5	190.7	**147.3**
Forecasts	37	37	36	35	31	28	26

Table 6a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Leslie. Mean errors for the 5-yr period 2007-11 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 (Leslie)	**4.0**	**6.7**	**10.7**	15.1	18.9	18.1	18.9
OCD5 (Leslie)	5.2	7.2	8.4	9.2	9.8	7.1	8.5
Forecasts	46	44	42	40	36	32	28
OFCL (2007-11)	7.1	10.8	13.0	15.0	16.9	17.1	18.1
OCD5 (2007-11)	8.4	12.4	15.4	17.7	20.5	21.5	21.2

Table 6b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Leslie. 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 6a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	4.0	6.6	10.9	15.4	18.6	17.7	18.9
OCD5	5.0	6.9	**8.1**	**9.1**	**9.9**	**6.8**	**8.2**
DSHP	5.2	8.4	11.4	**14.0**	**18.3**	18.2	**17.7**
LGEM	5.3	7.7	**10.1**	**12.4**	**13.5**	**14.1**	**14.3**
GHMI	5.8	7.0	**8.5**	**10.4**	**13.1**	**15.3**	**17.0**
HWFI	5.8	8.3	11.2	**14.8**	20.7	25.7	29.9
ICON	4.8	**6.4**	**8.5**	**11.5**	**15.4**	**17.5**	**18.8**
FSSE	4.8	6.8	**9.1**	**11.9**	**14.3**	**13.1**	**12.0**
Forecasts	45	43	41	39	35	31	27

Table 7. Watch and warning summary for Hurricane Leslie, 30 August - 11 September 2012.

Date/Time (UTC)	Action	Location
6 / 2100	Tropical Storm Watch issued	Bermuda
8 / 0900	Tropical Storm Watch changed to Tropical Storm Warning	Bermuda
10 / 0300	Tropical Storm Warning discontinued	All
10 / 0600	Tropical Storm Watch issued	Indian Harbour to Stones Cove
10 / 0600	Tropical Storm Watch issued	Fogo Island to Charlottetown
10 / 0600	Hurricane Watch issued	Stones Cove to Charlottetown
10 / 1500	Tropical Storm Watch discontinued	All
10 / 1500	Tropical Storm Warning issued	Indian Harbour to Triton
11 / 1500	Hurricane Watch discontinued	All
11 / 1900	Tropical Storm Warning discontinued	All

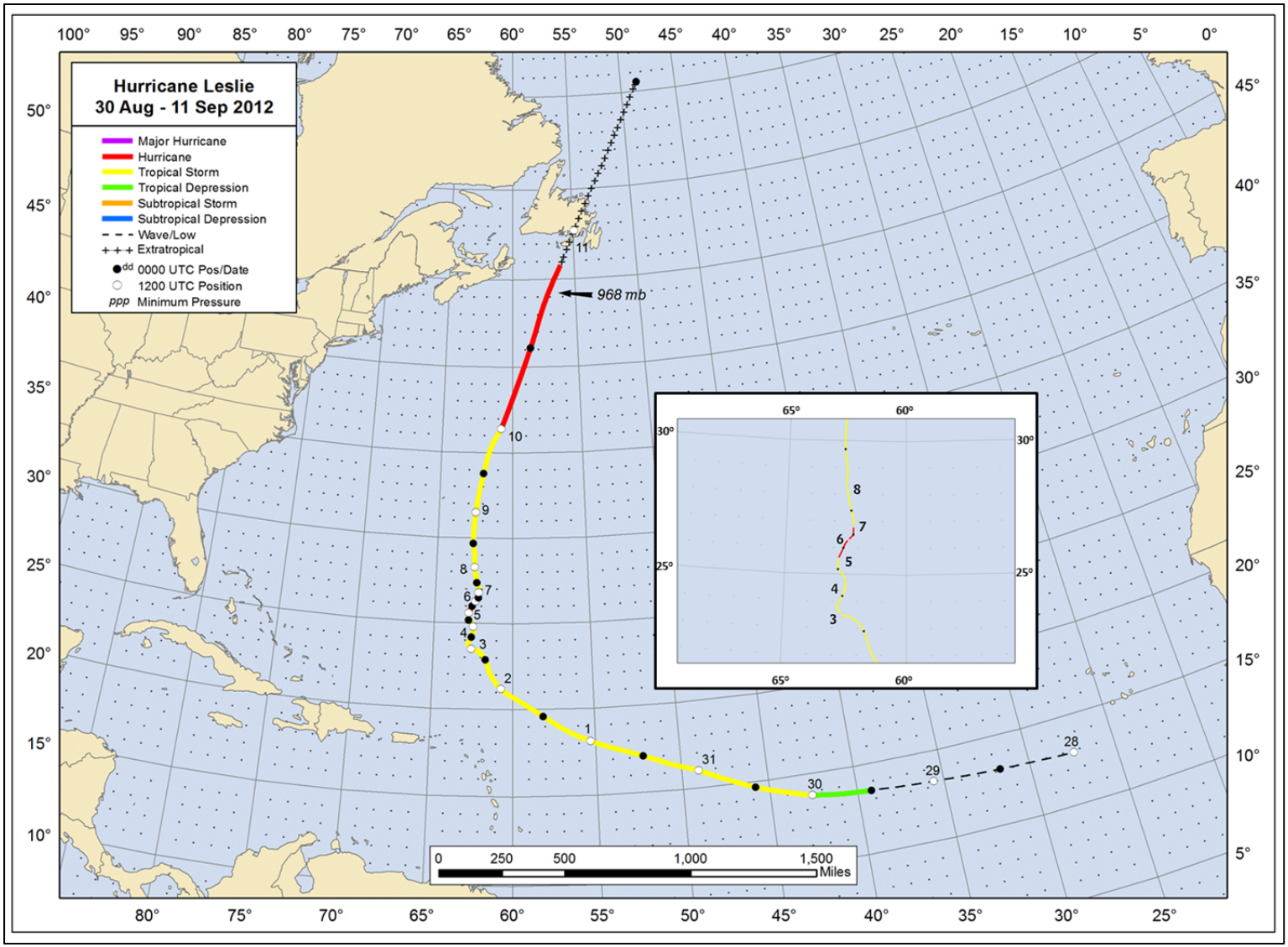

Figure 1. Best track positions for Hurricane Leslie, 30 August – 11 September 2012. Inset image shows best track during hurricane stage on 5-7 September. Track during the extratropical stage is partly based on analyses from the NOAA Ocean Prediction Center and the Canadian Hurricane Centre.

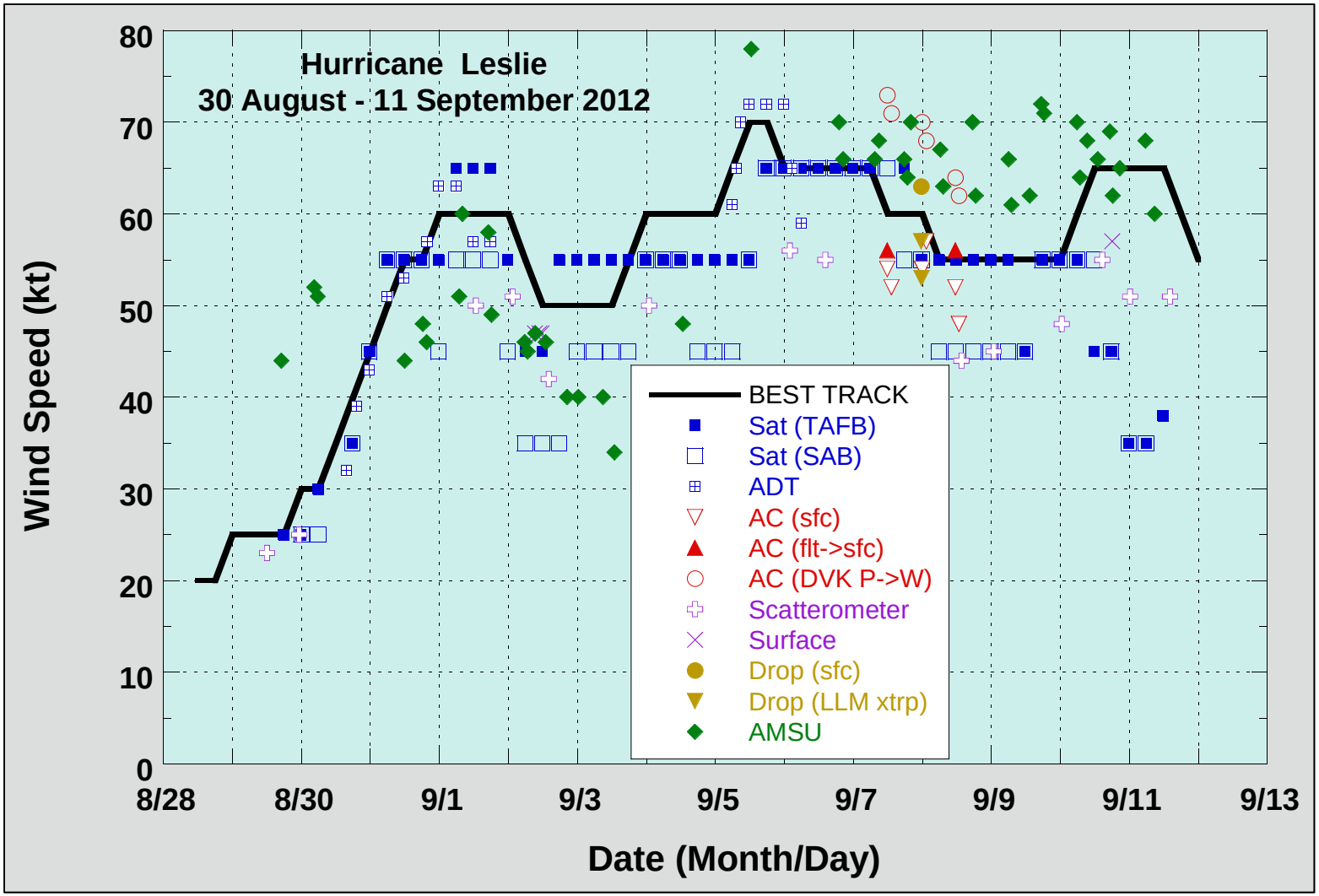

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Leslie, 30 August – 11 September 2012. Advanced Dvorak Technique estimates represent CI numbers. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Estimates during the extratropical stage are partly based on analyses from the NOAA Ocean Prediction Center and the Canadian Hurricane Centre. Dashed vertical lines correspond to 0000 UTC.

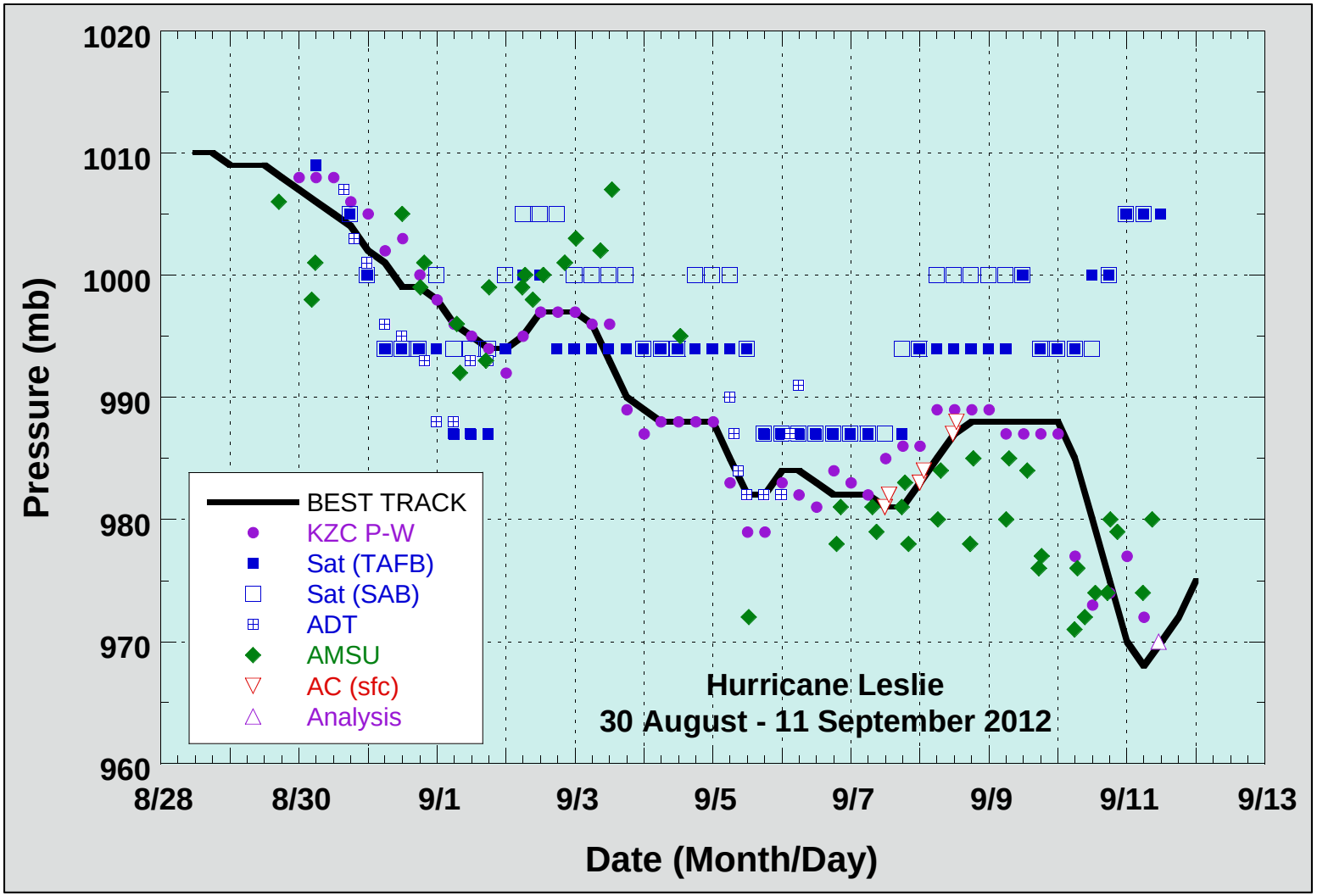

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Leslie, 30 August – 11 September 2012. Advanced Dvorak Technique estimates represent CI numbers. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. The KZC P-W values are obtained by applying the Knaff-Zehr-Courtney pressure-wind relationship to the best track wind data. Estimates during the extratropical stage are partly based on analyses from the NOAA Ocean Prediction Center and the Canadian Hurricane Centre. Dashed vertical lines correspond to 0000 UTC.

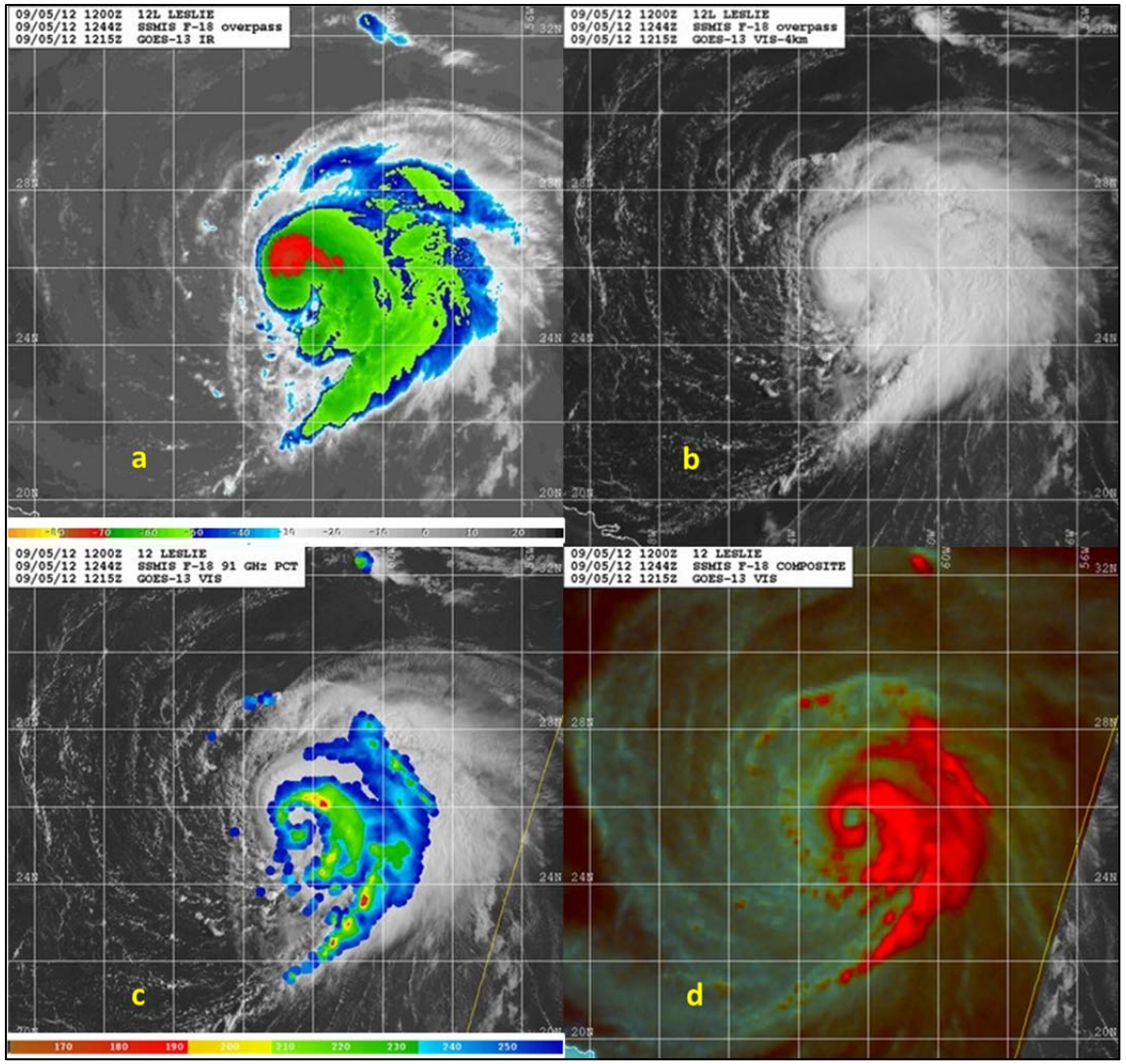

Figure 4. Multispectral satellite imagery at the time of Hurricane Leslie's peak intensity of 70 kt – (a) 1215 UTC 5 Sep GOES-13 infrared; (b) 1215 UTC 5 Sep GOES-13 visible; (c) 1244 UTC 5 Sep SSMI/S 91 GHz PCT; (d) 1244 UTC 5 Sep SSMI/S 91 GHz. A 20 n mi diameter eye is evident near 25.7^{o} N 62.7^{o} W in the SSMI/S microwave images. (images courtesy of U.S. Navy Fleet Numerical Meteorology and Oceanography Center, Monterey, CA)

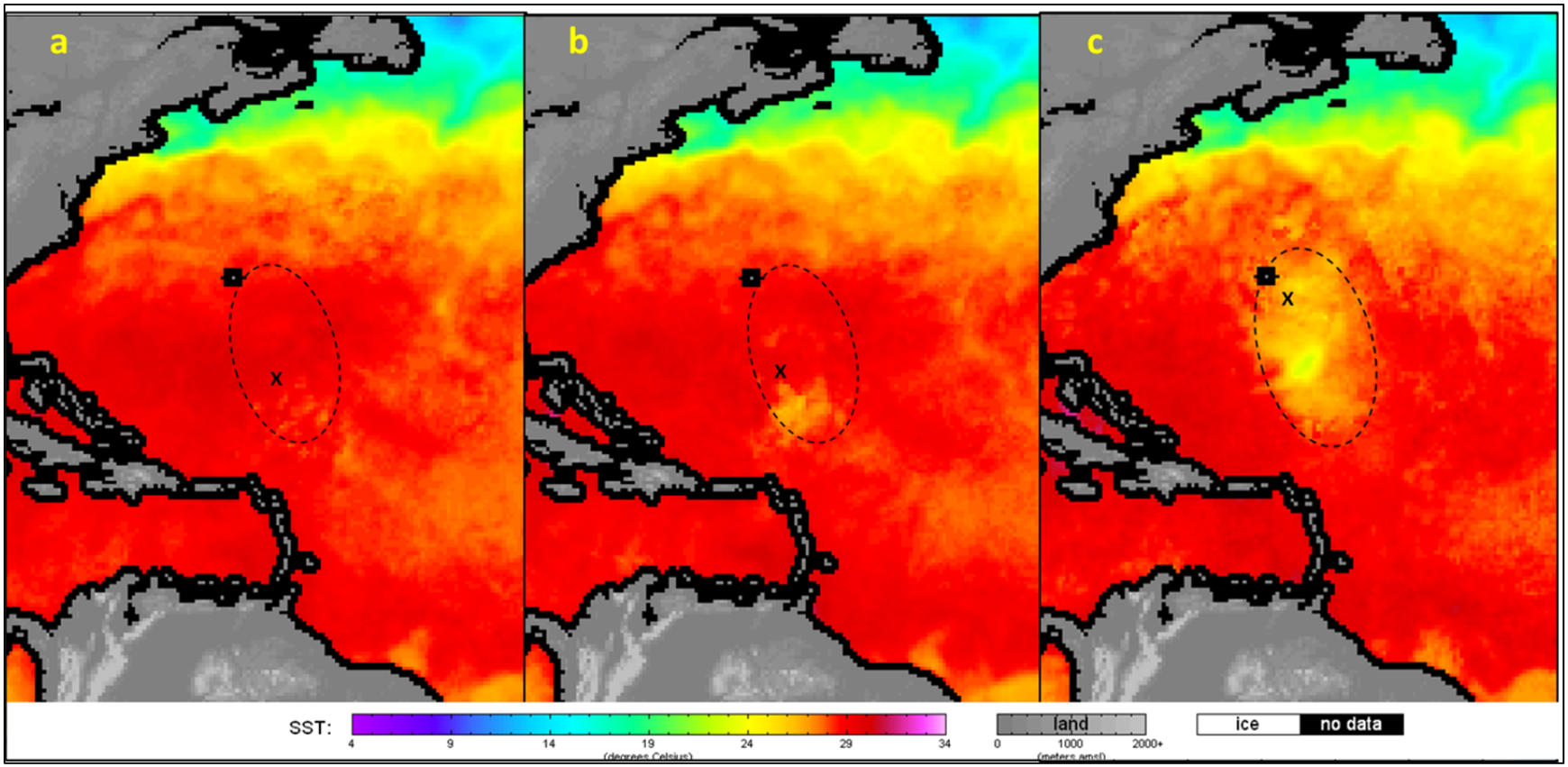

Figure 5. Atlantic microwave sea-surface temperature analyses -- (a) 1200 UTC 3 September 2012 before Hurricane Leslie slowed down to the southeast of Bermuda and began to generate cold upwelling; SST values greater than 29^{o} C were present inside the dashed lined area; (b) 1200 UTC 4 September 2012 when slow-moving Hurricane Leslie began to produce cold upwelling along the storm track; (c) 1200 UTC 9 September 2012 after slow northward-moving Hurricane Leslie had generated significant cold upwelling with minimum SST values less than 23^{o} C. Black "X" marks the location of Leslie at the time of the SST analysis. (images courtesy of Remote Sensing Systems, Santa Rosa, CA)

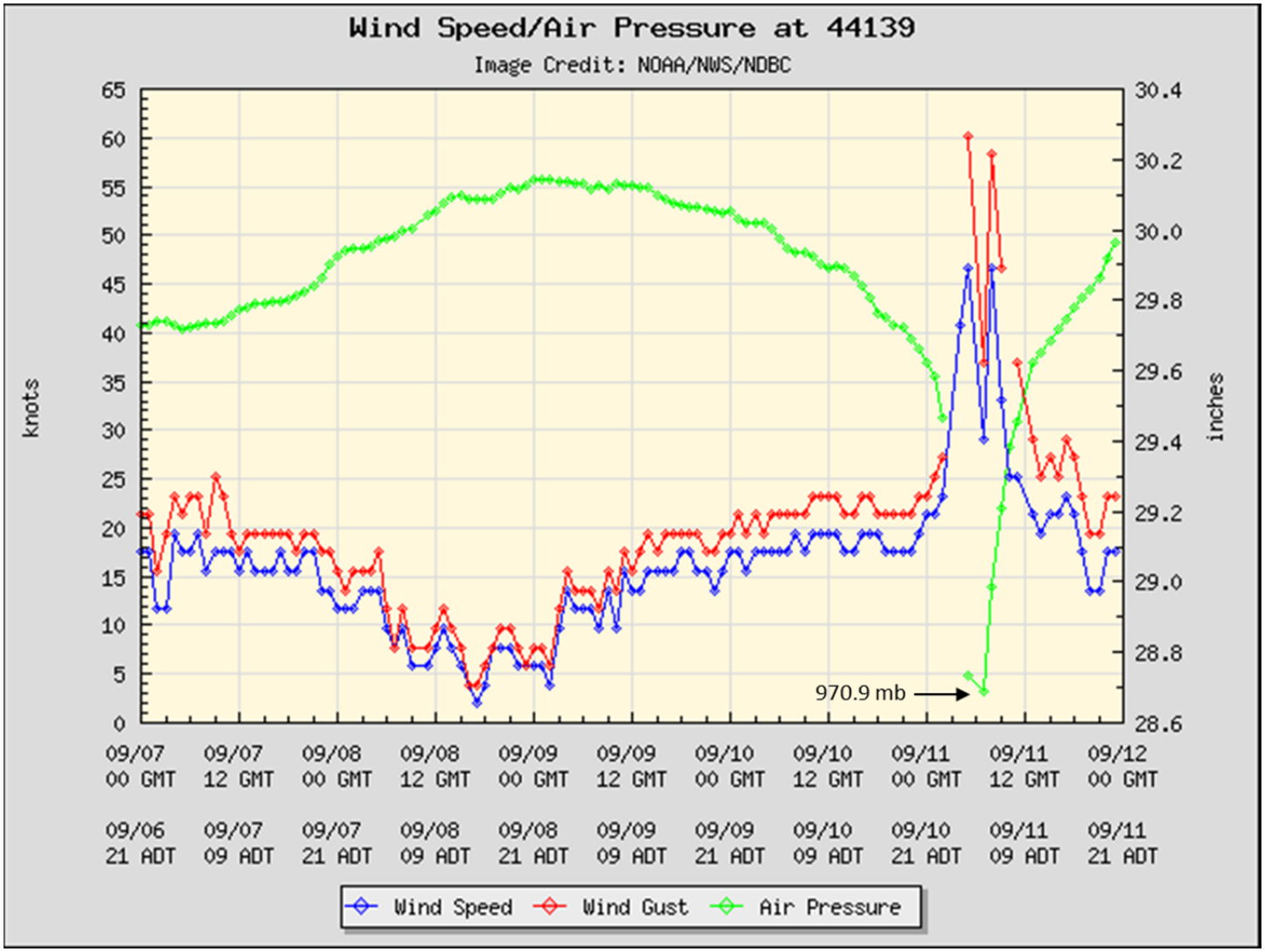

Figure 6. Plot of surface pressure (green), 8-min average wind speed (blue), and 3-second wind gusts (red) from Canadian NOMAD buoy 44139 (location: 44.24° N 57.10° W) from 7-12 September 2012. The center of Hurricane Leslie passed approximately 10 n mi west of the buoy at around 0700 UTC 11 September when the buoy measured a minimum pressure of 970.9 mb/28.67 in Hg. (graphic courtesy of NOAA-National Data Buoy Center)