Tropical Cyclone Report
Hurricane Miriam
(EP132012)
22-27 September 2012

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Miriam was a category 3 hurricane (on the Saffir-Simpson Hurricane Wind Scale) when it neared Clarion Island well to the southwestern coast of mainland Mexico.

a. Synoptic History

The tropical wave that left the west coast of Africa on7 September and spawned Atlantic Hurricane Nadine continued westward across the Caribbean Sea with little shower activity for several days. Once the wave crossed Central America on 16 September, there was a gradual increase in cloudiness and thunderstorms. The disorganized disturbance continued westward for a few days along the southern coast of Mexico and the adjacent Pacific. The cloud pattern began to show evidence of organization, with developing upper-level outflow and cyclonically curved convective bands wrapping around an area of low pressure. It is estimated that a tropical depression formed from this disturbance at 0000 UTC 22 September about 360 n mi south-southwest of Manzanillo, Mexico. 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].

The depression moved toward the west-northwest and northwest around the southwestern periphery of a subtropical high centered over Mexico and became a tropical storm at 1200 UTC 22 September. An environment of low shear and a warm ocean favored steady intensification, and Miriam became a hurricane at 0000 UTC 24 September well south of the Baja California peninsula. A period of rapid intensification then began, and Miriam reached an estimated peak intensity of 105 knots and a minimum pressure of 959 mb 12 h later, as it was approaching Clarion Island, Mexico. By then, the hurricane had developed a very compact and symmetric central dense overcast (CDO) and a pinhole eye (Fig 4). The rapid intensification occurred just before Miriam's circulation began to move over relatively cool waters. Once the hurricane moved over cooler waters the convection began to wane and the cyclone gradually weakened. The cyclone lost all its convection, and Miriam became a remnant low at 1800 UTC 27 September. The remnant low began to meander and then to drift southward with the low-level flow until dissipation occurred a few days later.

[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.

b. Meteorological Statistics

Observations in Miriam (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), and objective Advanced Dvorak Technique (ADT) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA 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 Miriam.

The estimated peak intensity at 1200 UTC 24 September was based on the blend of subjective and objective Dvorak T-numbers. There were no reports from ships of winds of tropical storm force associated with Miriam. A Mexican Navy automatic weather station at Clarion Island reported sustained winds of 58 kt with a gust of 90 kt at 0430 UTC 25 September when the western eyewall moved near the island. The minimum pressure reported at that site was 973 mb at 0945 UTC 25 September.

c. Casualty and Damage Statistics

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

d. Forecast and Warning Critique

The genesis of Miriam was well anticipated. The disturbance from which Miriam developed was introduced in the Tropical Weather Outlook and given a "low" (less than 30%) chance of formation during the following 48 h at 1200 UTC 19 September. This was about 60 hours before genesis occurred. The probability was increased to medium (30 to 50%) 12 h later, but to high (greater than 50%) only 12 h before formation.

A verification of NHC official track forecasts for Miriam is given in Table 2a. At all time periods, the official forecast track errors were lower than the mean official errors for the previous 5-yr period. The climatology-persistence model (OCD5) errors were also lower than the previous 5-yr average errors. A homogeneous comparison of the official track errors with selected guidance models is given in Table 2b. The consensus model (TVCE) appears to have been the best performer during the first 48 h. The official forecast had, in general, lower errors than the rest of the models.

A verification of NHC official intensity forecasts for Miriam is given in Table 3a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period at the 12-, 96-, and 120-h periods. The climatology-persistence model errors were also lower than its previous 5-yr mean errors at 96-, and 120-h periods. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 3b. The LGEM model performed the best from 72 h and beyond.

Table 1. Best track for Hurricane Miriam, 22-27 September 2012.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
22 / 0000	13.5	106.4	1005	30	tropical depression
22 / 0600	13.7	106.6	1005	30	"
22 / 1200	13.9	106.9	1003	35	tropical storm
22 / 1800	14.2	107.4	1003	35	"
23 / 0000	14.6	108.0	1002	40	"
23 / 0600	15.0	108.6	1000	45	"
23 / 1200	15.4	109.3	995	55	"
23 / 1800	15.9	110.0	991	60	"
24 / 0000	16.4	110.8	981	75	hurricane
24 / 0600	17.0	111.7	971	90	"
24 / 1200	17.5	112.5	959	105	"
24 / 1800	17.9	113.1	960	100	"
25 / 0000	18.2	113.7	962	100	"
25 / 0600	18.4	114.0	965	95	"
25 / 1200	18.6	114.4	969	85	"
25 / 1800	18.8	114.8	976	75	"
26 / 0000	19.0	115.0	985	65	"
26 / 0600	19.3	115.2	990	60	tropical storm
26 / 1200	19.8	115.3	992	55	"
26 / 1800	20.4	115.2	994	50	"
27 / 0000	21.1	115.5	997	45	"
27 / 0600	21.5	115.7	997	40	"
27 / 1200	22.0	116.1	998	35	"
27 / 1800	22.1	116.7	998	30	low
28 / 0000	22.0	116.6	999	30	"
28 / 0600	21.8	116.6	999	30	"
28 / 1200	21.6	116.1	1000	30	"
28 / 1800	21.5	115.6	1000	30	"
29 / 0000	21.4	115.2	1001	30	"
29 / 0600	21.3	114.8	1001	30	"
29 / 1200	21.3	114.5	1002	30	"
29 / 1800	21.2	114.2	1003	25	"
30 / 0000	20.9	114.1	1004	25	"
30 / 0600	20.4	114.0	1005	20	"
30 / 1200	19.7	114.2	1006	20	"
30 / 1800	19.2	114.6	1007	20	"
01 / 0000	18.5	114.7	1008	20	"
01 / 0600	17.9	114.7	1009	20	"
01 / 1200	17.4	114.7	1010	20	"
01 / 1800	16.9	114.7	1010	20	"
02 / 0000	16.7	115.2	1010	20	"
02 / 0600	16.7	115.7	1010	20	"
02 / 1200	16.7	116.2	1010	20	"
02 / 1800	16.7	116.7	1010	20	"
03 / 0000					dissipated
24 / 1200	17.5	112.5	959	105	minimum pressure

Table 2a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Miriam. 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	**24.5**	**34.2**	**42.8**	**51.3**	**60.3**	**88.4**	**167.1**
OCD5	36.8	71.7	103.4	124.6	133.6	137.5	299.4
Forecasts	21	19	17	15	11	7	3
OFCL (2007-11)	28.6	46.3	62.7	78.1	108.0	145.3	181.1
OCD5 (2007-11)	38.5	74.8	116.0	159.8	246.1	324.2	392.8

Table 2b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Miriam. 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	19.1	28.1	40.4	50.9	53.8	96.7	98.5
OCD5	32.4	67.0	100.2	132.4	181.8	108.1	204.2
GHMI	20.3	31.8	**38.8**	**41.6**	69.8	107.6	**55.6**
HWFI	22.2	32.8	41.6	58.0	161.3	**84.7**	**86.5**
UKMI	30.1	57.0	86.7	117.2	157.4	183.4	263.4
EGRI	30.1	57.0	86.7	117.2	157.4	183.4	263.4
EMXI	22.9	31.8	48.0	59.8	70.7	**8.2**	133.1
GFSI	**18.3**	33.3	54.2	67.9	100.4	136.7	157.1
CMCI	23.5	49.4	70.0	92.4	159.3	**92.0**	119.2
AEMI	**18.9**	**27.5**	45.2	67.6	110.9	199.9	264.1
TVCE	**17.9**	**22.7**	**25.0**	**26.2**	60.5	102.4	130.9
LBAR	29.4	60.7	103.3	144.4	193.6	197.7	366.3
BAMD	40.8	73.5	113.9	147.5	250.2	218.8	254.4
BAMM	37.5	56.5	71.9	85.5	113.6	212.0	267.0
BAMS	55.9	97.1	132.2	157.3	152.1	295.3	378.5
Forecasts	15	13	11	9	5	1	1

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Miriam. 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	**5.2**	11.1	14.7	18.7	16.8	**12.9**	**16.7**
OCD5	6.9	14.5	21.5	25.9	20.5	9.6	17.0
Forecasts	21	19	17	15	11	7	3
OFCL (2007-11)	6.4	10.6	13.7	15.1	17.0	18.5	17.8
OCD5 (2007-11)	7.5	12.4	16.1	18.4	20.1	20.1	20.8

Table 3b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Miriam. 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	5.2	11.1	14.7	18.7	16.8	12.9	16.7
OCD5	6.9	14.5	21.5	25.9	20.5	**9.6**	17.0
GHMI	7.6	15.2	18.6	20.2	19.5	20.9	35.3
HWFI	5.6	**10.1**	15.6	20.1	22.8	19.1	31.0
ICON	6.0	11.2	15.2	19.0	**16.4**	**12.0**	25.7
LGEM	5.5	11.1	15.9	19.0	**15.2**	**5.4**	**8.0**
DSHP	5.8	**11.0**	15.1	**17.7**	**13.6**	15.4	27.0
Forecasts	21	19	17	15	11	7	3

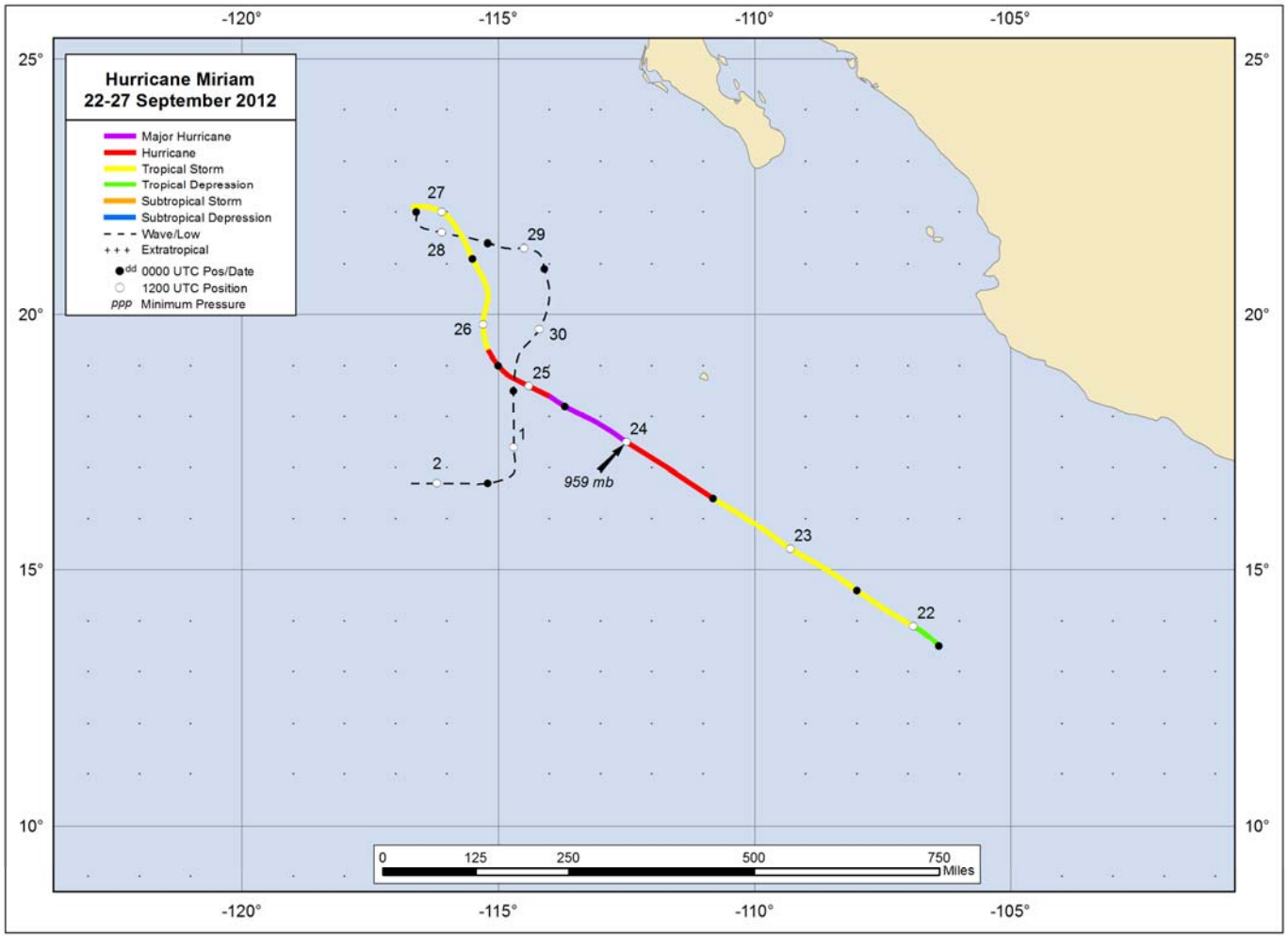

Figure 1. Best track positions for Hurricane Miriam, 22-27 September 2012.

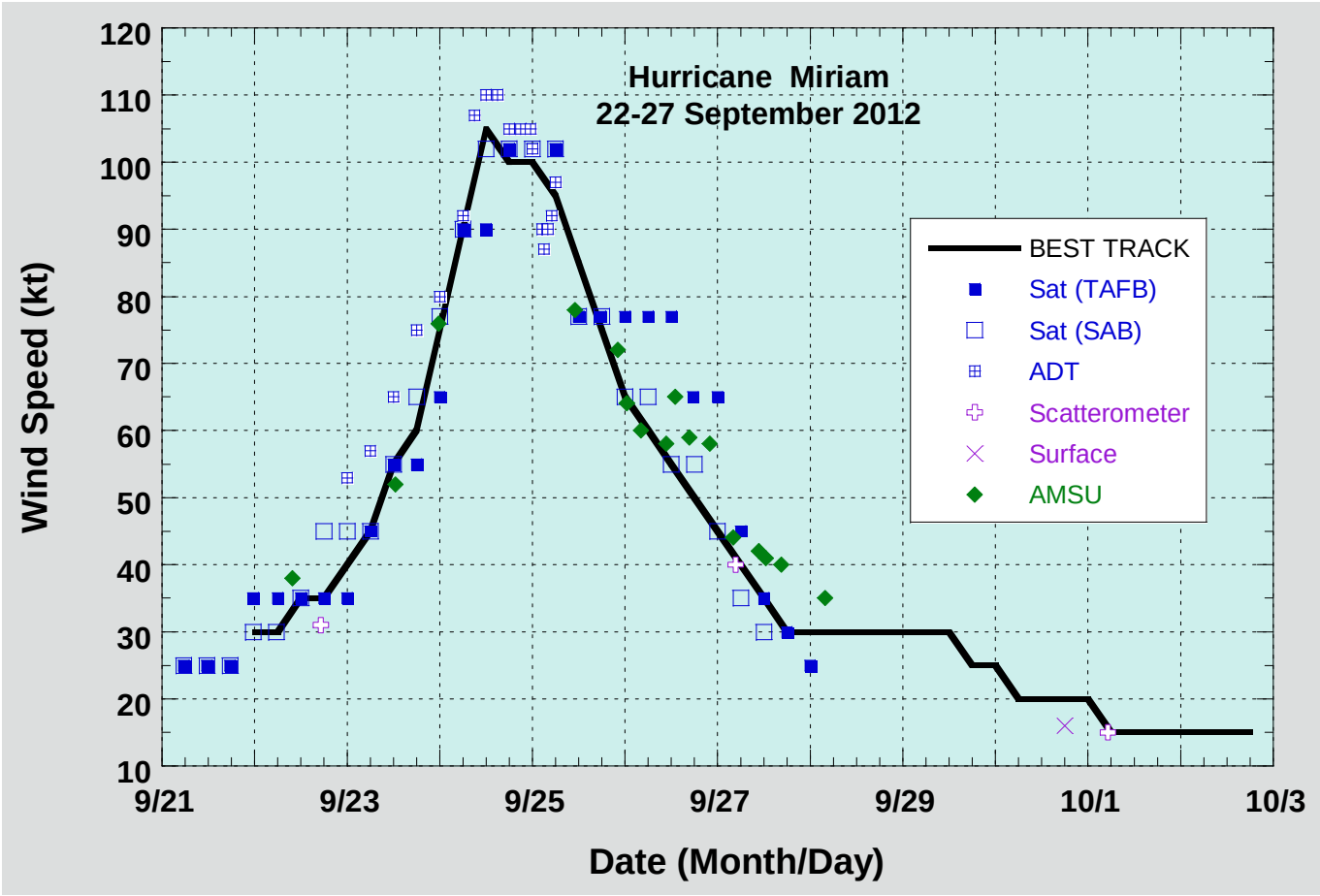

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Miriam, 22-27 September 2012. Advanced Dvorak Technique estimates represent CI numbers. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

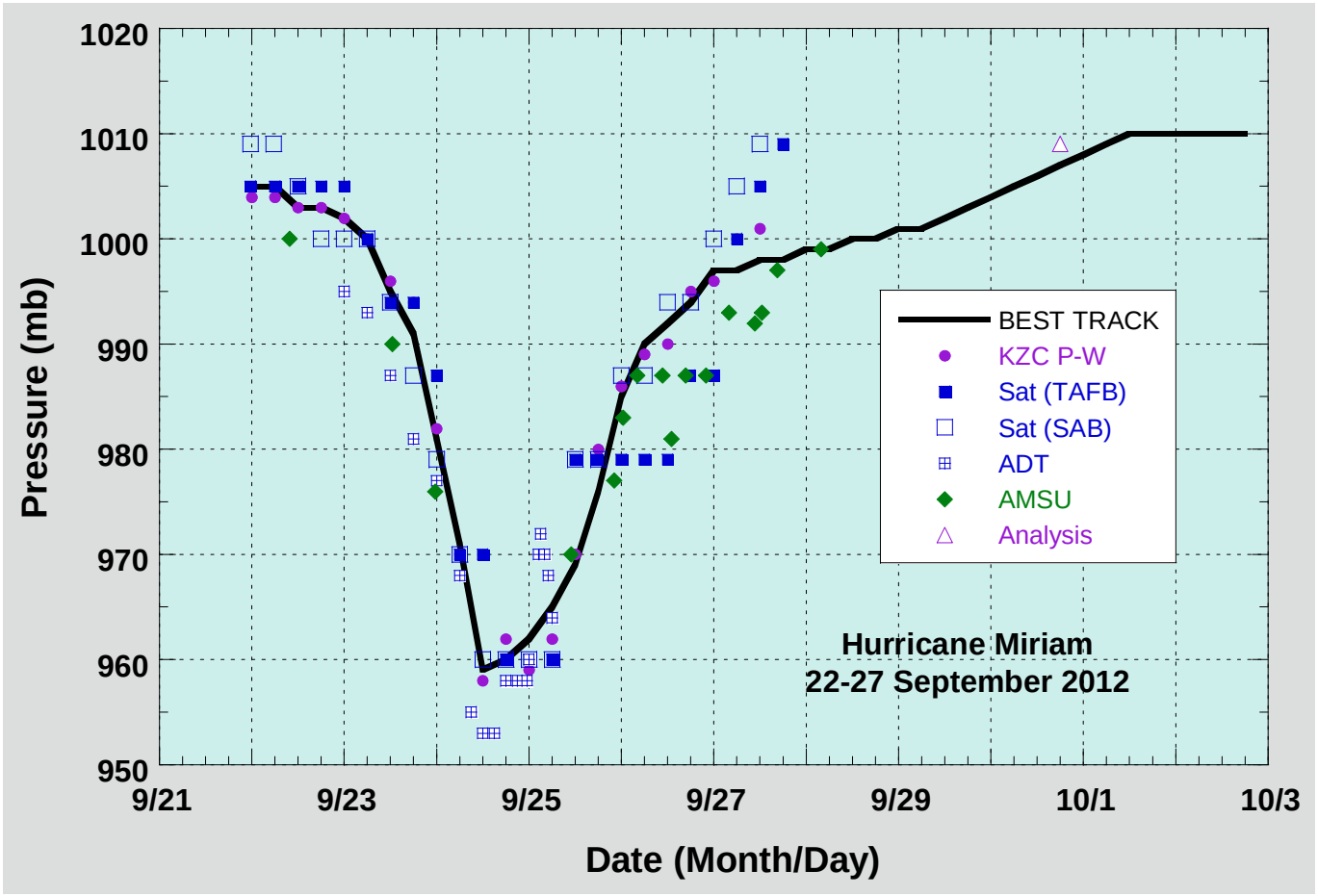

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Miriam, 22-27 September 2012. Advanced Dvorak Technique estimates represent Current Intensity (CI) numbers. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. The KZC P-W values are obtained by applying the Knaff-Zehr-Courtney pressure-wind relationship to the best track wind data. Dashed vertical lines correspond to 0000 UTC.

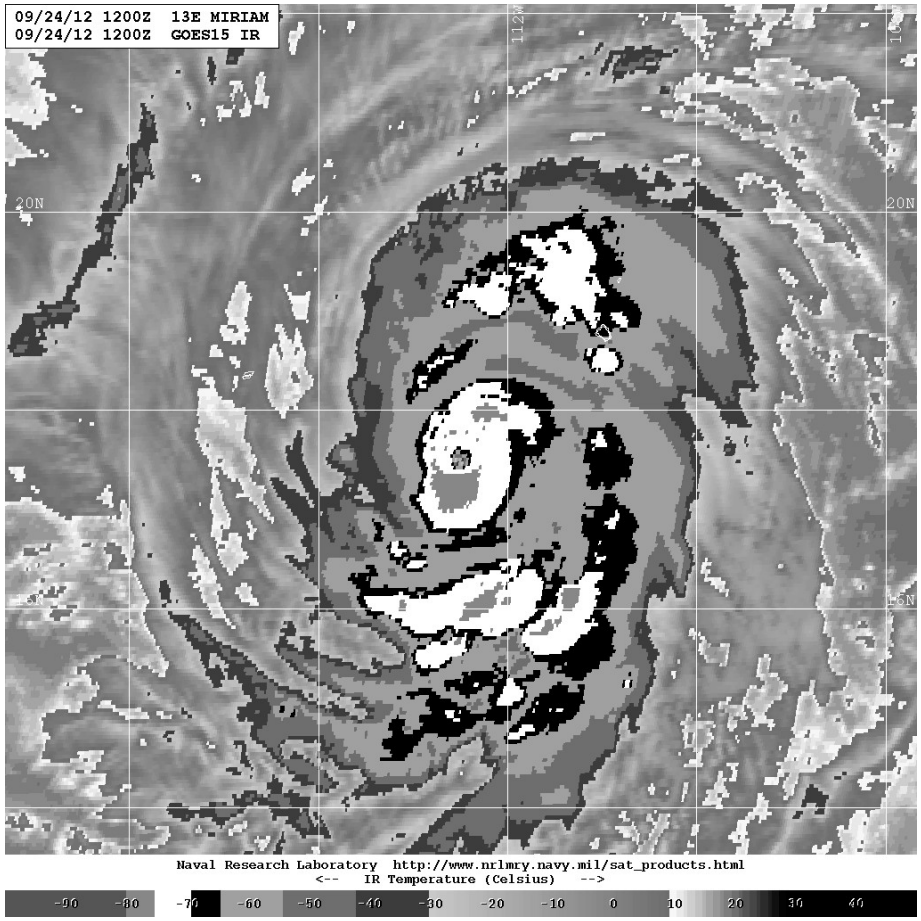

Figure 4. Infrared satellite image with the Dvorak BD enhancement of Hurricane Miriam near its estimated peak intensity of 105 kt at 1200 UTC 24 September 2012. Image courtesy of the Navy Research Laboratory.