

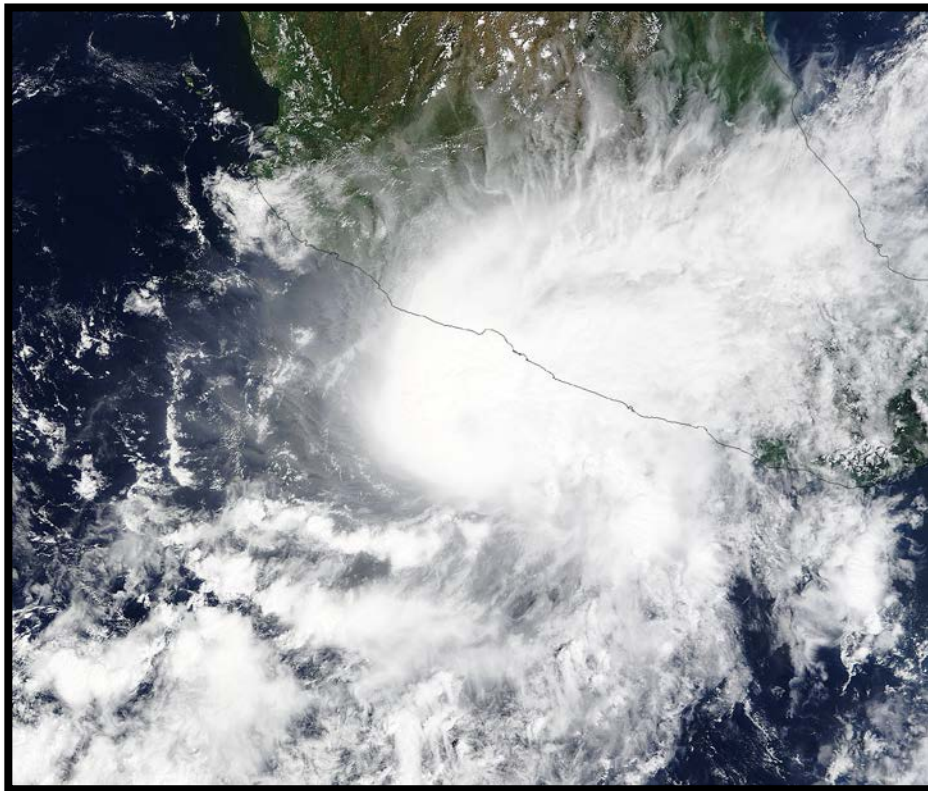


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE MARTY (EP172015)

26 – 30 September 2015

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NASA TERRA/MODIS VISIBLE SATELLITE IMAGE OF HURRICANE MARTY AT 1735 UTC 28 SEPTEMBER 2015, NEAR THE TIME OF ITS PEAK INTENSITY WHILE CENTERED OFF THE COAST OF SOUTHWESTERN MEXICO

Marty was a category 1 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that meandered off the southwestern coast of Mexico for a few days. Marty caused heavy rainfall and flooding across portions of the Mexican state of Guerrero.

Hurricane Marty

26 – 30 SEPTEMBER 2015

SYNOPTIC HISTORY

A tropical wave that moved across the west coast of Africa on 10 September contributed to Marty's formation off of the southern coast of Mexico. While moving westward across the tropical Atlantic the wave split, with the slower-moving northern portion initiating the development of Tropical Depression Nine on 16 September over the central Atlantic. The faster-moving southern portion of the wave reached the northern coast of South America on the same day and moved across Venezuela and Colombia through 21 September. The wave continued westward, and deep convection increased over a large area south of the coasts of Mexico and Central America during the next few days. Satellite images indicated that a well-defined low pressure system developed by 1200 UTC 26 September, and the associated convection became sufficiently organized and persistent for the system to be designated as a tropical depression at 1800 UTC that day while centered about 290 n mi southwest of Acapulco, Mexico. The depression strengthened into a tropical storm by 0000 UTC 27 September. 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.

Marty initially moved slowly northward toward a large mid- to upper-level trough that covered the southern United States, Mexico, and the western Gulf of Mexico, and the cyclone steadily strengthened within an environment of low tropospheric vertical shear and over very warm sea surface temperatures around 30°C. But, as Marty got closer to the base of the trough on 27 September, westerly 850-200 mb vertical shear increased to about 20 kt, and the associated deep convection became more focused to the east of the low-level center. Despite the shear, a mid-level eye became apparent in microwave satellite imagery on the morning of 28 September, and it is estimated that Marty became a hurricane by 1200 UTC while centered about 190 n mi west of Acapulco. Marty turned northeastward and eastward while under the influence of the trough and reached a peak intensity of 70 kt around 1800 UTC that same day.

Marty's tenure as a hurricane was short lived. As shown in the microwave images of [Fig. 4](#), strong vertical shear scoured the deep convection eastward, leaving the low-level center completely exposed in a span of about three hours late on 28 September. Marty weakened to a tropical storm by 0600 UTC 29 September, and continued strong shear caused the intensity to steadily decrease. The last burst of deep convection occurred late on 29 September, and Marty degenerated into a post-tropical low by 0600 UTC 30 September about 120 n mi west-southwest of Acapulco after permanently losing organized deep convection near its center. As a shallower system, the post-tropical low turned sharply westward in the low-level flow and weakened further,

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*k directory, while previous years' data are located in the *archive* directory.

opening up into a trough after 1800 UTC 30 September about 170 n mi west of Acapulco. The trough moved westward and again became a closed low on 1 October, but the low never attained sufficient organized deep convection for it to be re-classified as a tropical cyclone. The low turned northward and north-northeastward toward the southern Gulf of California and dissipated on 4 October before reaching the coast of western Mexico.

METEOROLOGICAL STATISTICS

Observations in Marty (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 one flight of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command. 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 Marty. Selected surface observations from land stations are given in [Table 2](#).

Winds and Pressure

Marty's estimated peak intensity of 70 kt at 1800 UTC 28 September is based on data from the Air Force Reserve reconnaissance flight that day. On its second pass through the eye, the plane measured a peak 700-mb flight-level wind of 71 kt at 1923 UTC and a peak SFMR wind of 70 kt at 1929 UTC. Also, a dropsonde released into the eyewall at 1929 UTC measured an average wind of 81 kt in the lowest 150 m of the sounding, which equates to a surface estimate of 65-70 kt.

There were no reports of sustained tropical-storm-force winds over land, and it is likely that winds of that intensity remained just offshore of the southwestern coast of Mexico. A station at Puerto Vicente in the state of Guerrero reported a wind gust to 35 kt on 28 September.

Marty's analyzed minimum central pressure of 987 mb is based on data from two dropsondes released into the eye during the reconnaissance flight. A sonde released at 1816 UTC during the first passage through the eye measured a surface pressure of 989 mb with 22 kt of wind. The second center drop, released at 1927 UTC, measured a surface pressure of 988 mb without a corresponding wind, but the instrument did report 16-kt winds 1 mb higher in the atmosphere. These data support a minimum central pressure of 987 mb.

There was one ship report of winds of tropical storm force. A container ship, the *Zim Colombo* (A8UC5), reported sustained winds of 38 kt at 1200 UTC 28 September while located about 65 n mi north-northeast of Marty's center.

Rainfall and Flooding

Although Marty did not make landfall in Mexico, it produced several inches of rain near the coast of southwestern Mexico, mainly in the state of Guerrero. A majority of reporting stations across the state received at least 2 inches of rain, and areas along the coast near and to the west of Acapulco received 5 to 6 inches between 26 September and 1 October ([Table 2](#) and [Fig. 5](#)). The National Water Commission of Mexico (CONAGUA) reported that the highest rainfall total during that period was 6.15 inches (156.25 mm) in the El Coloso section of Acapulco. The heavy rainfall caused some flooding of rivers and coastal lagoons, especially to the west of Acapulco.

CASUALTY AND DAMAGE STATISTICS

There were no reported deaths associated with Marty. However, the Department of Civil Protection of Guerrero did report some damage in the state due to heavy rainfall caused by the cyclone. Media reports indicate that the heavy rains caused flooding on six rivers, and several roads were blocked due to eleven separate landslides. Three hundred homes were flooded west of Acapulco along the Laguna de Coyuca and Río Coyuca. Two people were reportedly injured in Acapulco and Coyuca de Benítez.

The remnants of Marty caused damage in the state of Sonora in northwestern Mexico. CONAGUA reported that over 4 inches of rain occurred in some parts of the state, affecting 35,000 people in 9 municipalities. The city of Guaymas was hit hardest, and flooding forced the closure of the Mexico-Nogales Highway between Guaymas and Ciudad Obregón. Damage in Guaymas was estimated to be 500 million pesos (30 million USD).

FORECAST AND WARNING CRITIQUE

The genesis of Marty was generally well forecast. A low (< 40%) chance of genesis during the next five days was introduced into the Tropical Weather Outlook (TWO) 114 h before Marty formed, and the probability was raised to a high (> 60%) chance 72 h before genesis. The precursor disturbance was given a low chance of formation during the next 48 h three days before genesis, but the 48-h probabilities were only raised to the medium and high categories at 24 and 18 h before formation, respectively. [Table 3](#) provides the number of hours in advance of formation associated with the first NHC TWO forecast in each likelihood category.

A verification of NHC official track forecasts for Marty is given in [Table 4a](#). Official forecast track errors were greater than the mean official errors for the previous 5-yr period for 12 and 24 h and were lower from 36 to 72 h. A homogeneous comparison of the official track errors with selected guidance models is given in [Table 4b](#). Since Marty was a relatively short-lived cyclone, homogeneous forecast verification statistics are only available through 48 h. The United Kingdom Met Office model (EGRI) and the Florida State Superensemble (FSSE) were the only two models to have lower mean errors than the NHC official track forecasts at every forecast period. However, the TVCX multi-model ensemble and the NWS Global Ensemble Forecast System mean (AEMI)

also performed respectably, having lower errors than the NHC official forecasts for three out of four forecast periods. Models such as the NWS Global Forecast System (GFSI) and the Navy Global Environmental Model (NVGI) tended to have higher errors than the NHC official forecasts and other models (not shown) because they erroneously moved Marty inland over southern Mexico.

A verification of NHC official intensity forecasts for Marty is given in [Table 5a](#). Official forecast intensity errors were greater than the mean official errors for the previous 5-yr period at 12 h but were lower from 24 to 72 h. A homogeneous comparison of the official intensity errors with selected guidance models is given in [Table 5b](#). The NHC official intensity forecasts had lower errors than every model at the 36- and 48-h forecast periods. While some of the models had lower errors than the official forecasts at the other forecast times, no one model stood out as dominant in predicting Marty's intensity.

Watches and warnings associated with Marty are given in [Table 6](#).

ACKNOWLEDGMENTS

Rainfall data in [Table 2](#) and the rainfall accumulation map in [Fig. 5](#) was provided by the National Water Commission of Mexico (CONAGUA).



Table 1. Best track for Hurricane Marty, 26-30 September 2015.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
26 / 1200	12.7	102.8	1006	25	low
26 / 1800	13.1	103.0	1005	30	tropical depression
27 / 0000	13.6	103.1	1003	40	tropical storm
27 / 0600	14.1	103.1	1000	45	"
27 / 1200	14.6	103.1	997	50	"
27 / 1800	15.0	103.1	997	50	"
28 / 0000	15.4	103.2	994	55	"
28 / 0600	15.8	103.2	991	60	"
28 / 1200	16.3	103.0	989	65	hurricane
28 / 1800	16.6	102.4	987	70	"
29 / 0000	16.5	102.1	988	65	"
29 / 0600	16.3	101.9	991	60	tropical storm
29 / 1200	16.2	101.6	994	55	"
29 / 1800	16.2	101.2	1000	45	"
30 / 0000	16.1	101.3	1002	40	"
30 / 0600	16.1	101.7	1003	35	low
30 / 1200	16.2	102.2	1004	30	"
30 / 1800	16.4	102.7	1005	30	"
1 / 0000					dissipated
28 / 1800	16.6	102.4	987	70	maximum winds and minimum pressure

Table 2. Selected surface observations for Hurricane Marty, 26-30 September 2015.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC)	Sustained (kt)	Gust (kt)	
Guerrero						
Coloso (U.H. El Coloso)						6.15
Aeropuerto de Chilpancingo						5.40
Observatorio Acapulco						5.18
Acapulco						5.13
San Jerónimo						5.08
Chilpancingo						4.87
Petacalco						4.79
Chilpancingo						4.36
Acapulco						4.25
Xochihuehuetlán						3.86
Iguala						3.81
Laguna de Tuxpan						3.81
Puerto Vicente			28 Sep		35	3.43
Tlacotepec						3.28
Olinalá						3.14
Zihuatanejo						2.45
Copala						2.42
Ometepec						1.40
Michoacán						
Lázaro Cárdenas						5.36
Lázaro Cárdenas (Col. Industrial)						5.29

Table 3. 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%)	72	114
Medium (40%-60%)	24	78
High (>60%)	18	72

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Marty, 26-30 September 2015. 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	29.7	39.5	42.2	42.4	37.0		
OCD5	40.0	78.0	123.6	189.9	327.7		
Forecasts	12	10	8	6	2		
OFCL (2010-14)	23.4	36.4	47.2	59.4	89.0	123.6	159.5
OCD5 (2010-14)	36.6	74.2	116.5	159.7	245.6	331.1	427.4



Table 4b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Marty, 26-30 September 2015. 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	32.0	41.4	40.1	42.1			
OCD5	41.3	83.1	136.0	198.2			
GFSI	38.9	48.0	49.7	77.1			
EMXI	30.6	61.9	69.4	38.2			
EGRI	23.6	33.7	36.4	41.9			
NVGI	42.9	58.9	54.1	64.8			
CMCI	37.0	55.8	54.3	89.7			
GHMI	50.2	71.0	91.8	144.6			
HWFI	39.0	42.9	37.3	34.6			
GFNI	49.9	89.9	107.6	126.5			
TCON	35.4	38.5	32.7	49.6			
TVCE	32.8	39.5	34.2	42.1			
TVCX	32.4	39.7	36.0	38.3			
GFEX	34.5	48.8	46.4	43.0			
FSSE	30.5	40.6	38.3	37.2			
AEMI	31.3	39.4	41.2	24.7			
BAMS	40.5	94.5	158.3	183.9			
BAMM	44.9	69.7	92.3	117.5			
BAMD	81.4	173.4	273.9	458.9			
Forecasts	10	8	6	4			



Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Marty, 26-30 September 2015. 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	6.3	7.0	5.0	5.0	7.5		
OCD5	7.6	5.4	11.8	13.3	22.5		
Forecasts	12	10	8	6	2		
OFCL (2010-14)	5.9	9.8	12.5	14.0	15.5	16.3	14.9
OCD5 (2010-14)	7.7	12.8	16.4	18.8	21.1	20.9	19.7

Table 5b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Marty, 26-30 September 2015. 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	6.4	7.8	5.0	3.0	5.0		
OCD5	7.6	5.7	12.7	14.2	28.0		
DSHP	5.5	11.3	13.7	12.4	0.0		
LGEM	6.8	12.8	14.0	8.8	4.0		
GHMI	4.1	8.1	18.3	27.2	18.0		
HWFI	6.3	6.7	10.6	7.2	2.0		
GFNI	7.0	6.8	16.7	28.2	3.0		
ICON	4.8	8.7	12.0	13.8	4.0		
IVCN	4.8	8.7	12.0	13.8	4.0		
FSSE	5.3	6.4	8.3	7.6	5.0		
GFSI	8.5	8.0	9.7	13.8	23.0		
EMXI	8.6	12.4	10.0	12.4	0.0		
Forecasts	11	9	7	5	1		



Table 6. Watch and warning summary for Hurricane Marty, 26 – 30 September 2015.

Date/Time (UTC)	Action	Location
27 / 0900	Tropical Storm Watch issued	Acapulco to Lázaro Cárdenas
28 / 1500	Tropical Storm Watch changed to Tropical Storm Warning	Tecpán de Galeana to Lázaro Cárdenas
28 / 1500	Tropical Storm Watch issued	West of Lázaro Cárdenas to Punta San Telmo
28 / 2100	Tropical Storm Warning changed to Hurricane Warning	Tecpán de Galeana to Lázaro Cárdenas
28 / 2100	Tropical Storm Watch changed to Tropical Storm Warning	Acapulco to east of Tecpán de Galeana
29 / 0600	Hurricane Warning changed to a Tropical Storm Warning	Tecpán de Galeana to Lázaro Cárdenas
30 / 0900	Tropical Storm Warning and Watch discontinued	All

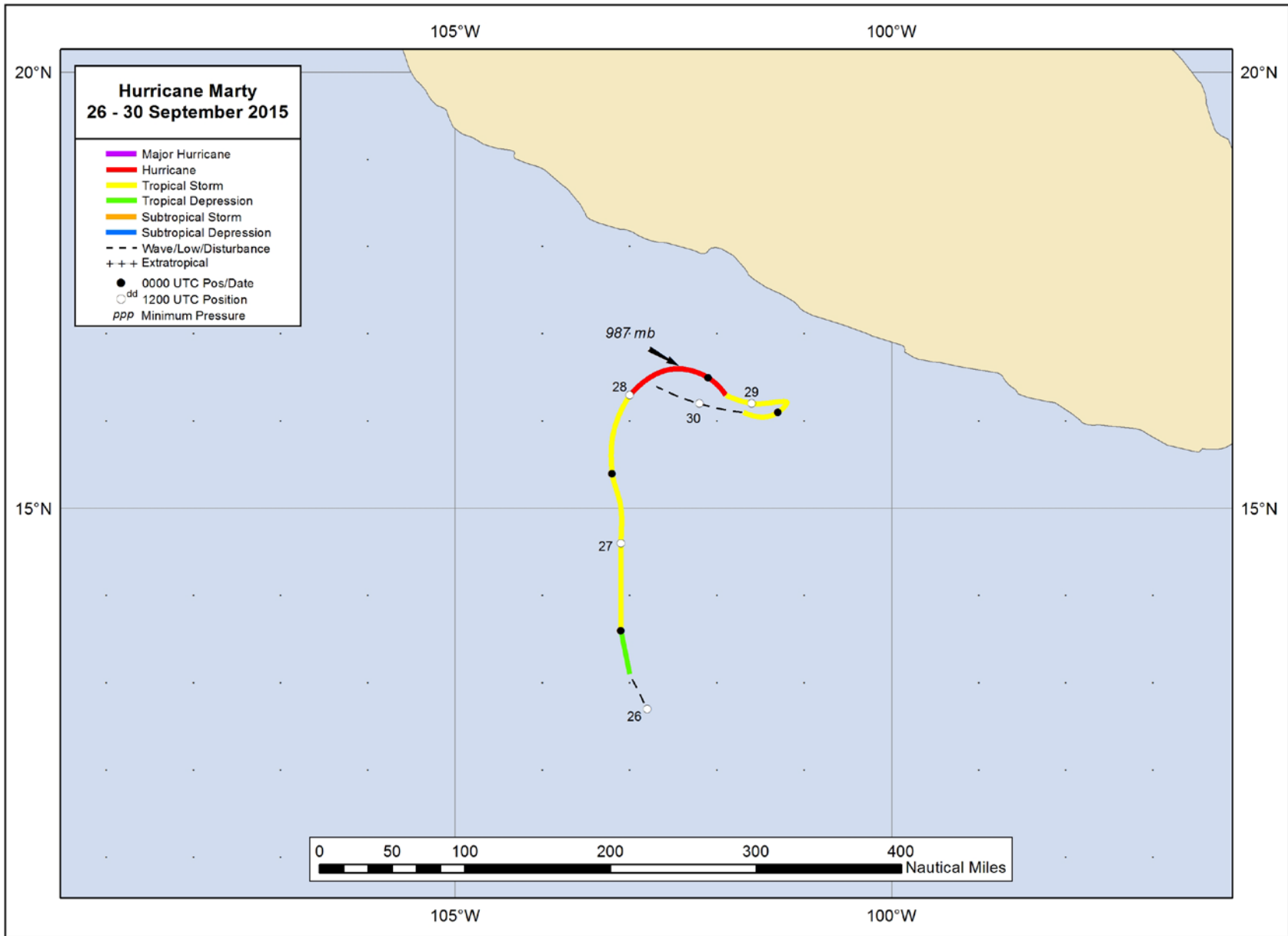


Figure 1. Best track positions for Hurricane Marty, 26-30 September 2015.

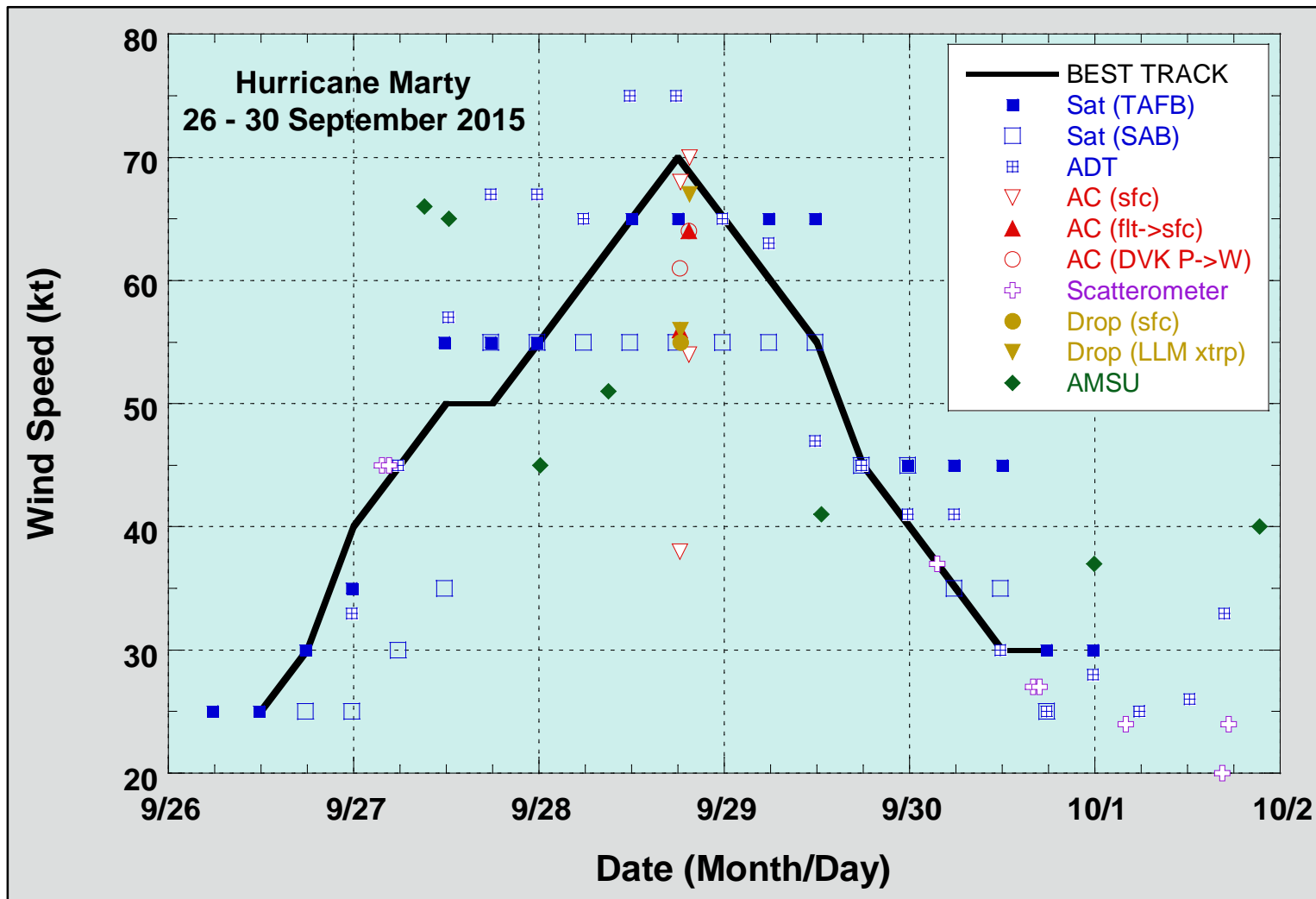


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Marty, 26-30 September 2015. Aircraft observations have been adjusted for elevation using a 90% adjustment factor for observations from 700 mb. Dropwindsonde observations include actual 10 m winds (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.

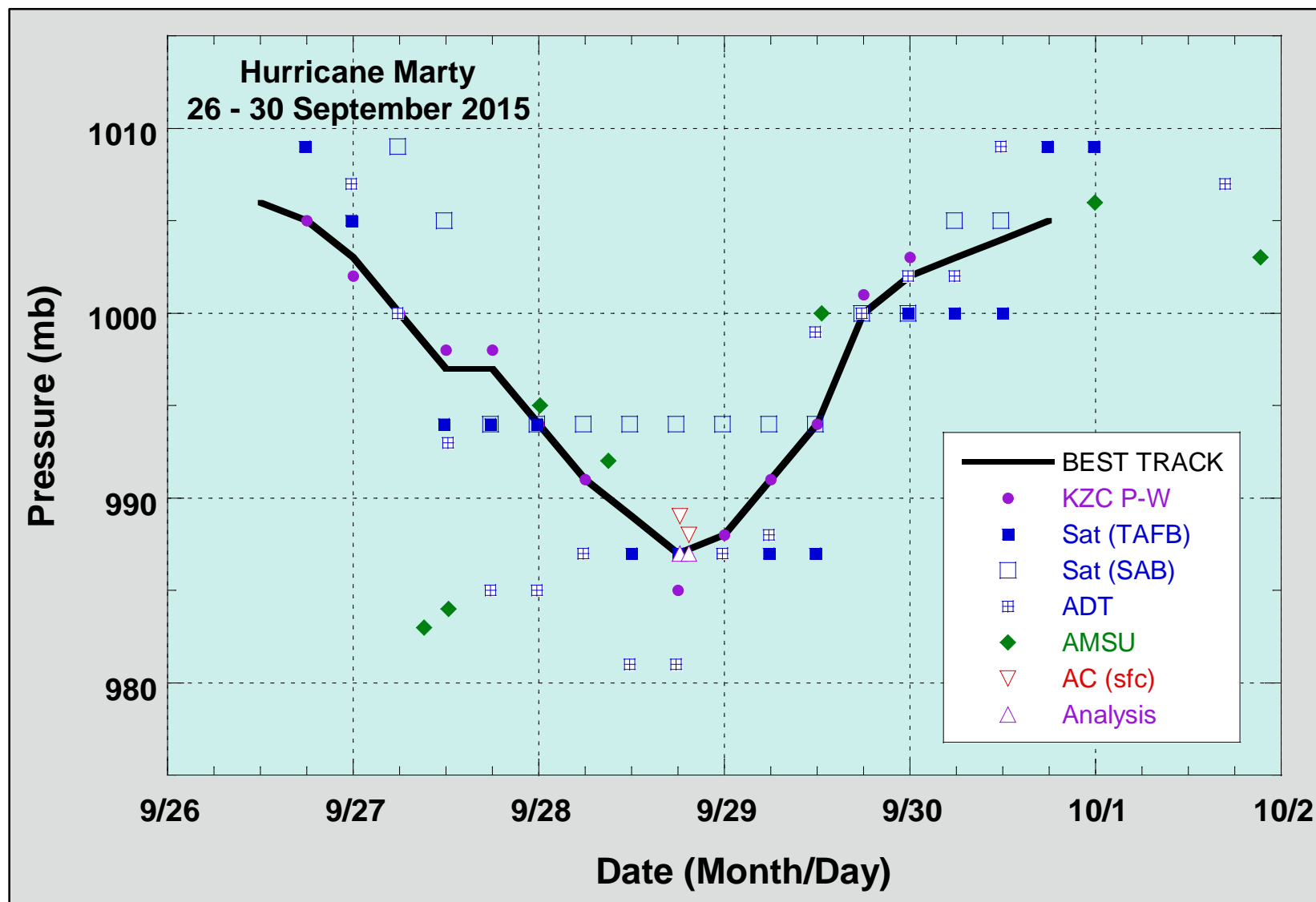


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Marty, 26-30 September 2015. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological 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.

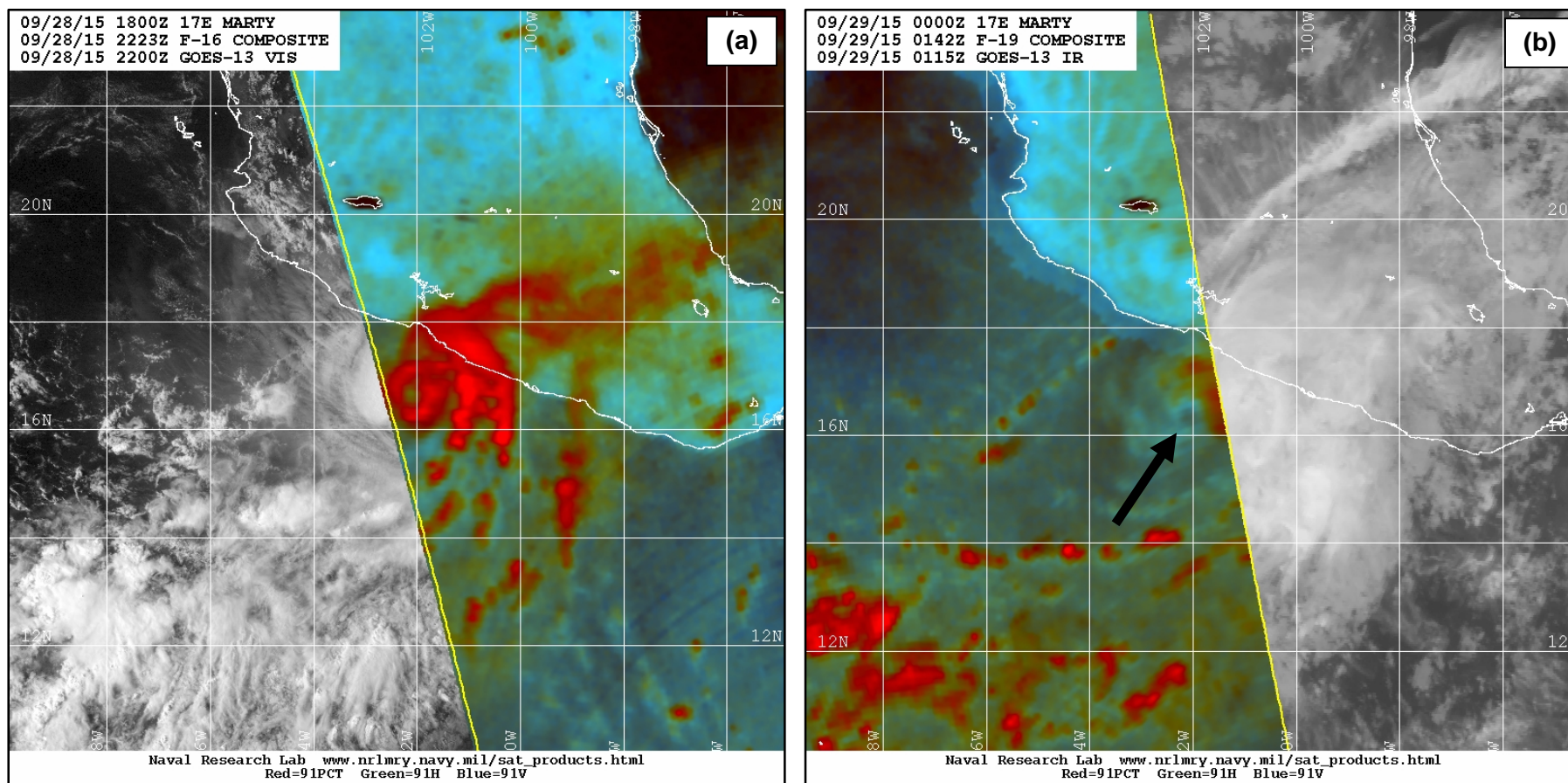


Figure 4. SSMIS 91-GHz microwave images of Hurricane Marty at (a) 2223 UTC 28 September 2015 and (b) 0142 UTC 29 September. The images show that within a span of about three hours, deep convection was sheared off to the east, leaving the low-level center exposed [marked by the arrow in (b)]. Images courtesy of the Naval Research Laboratory.

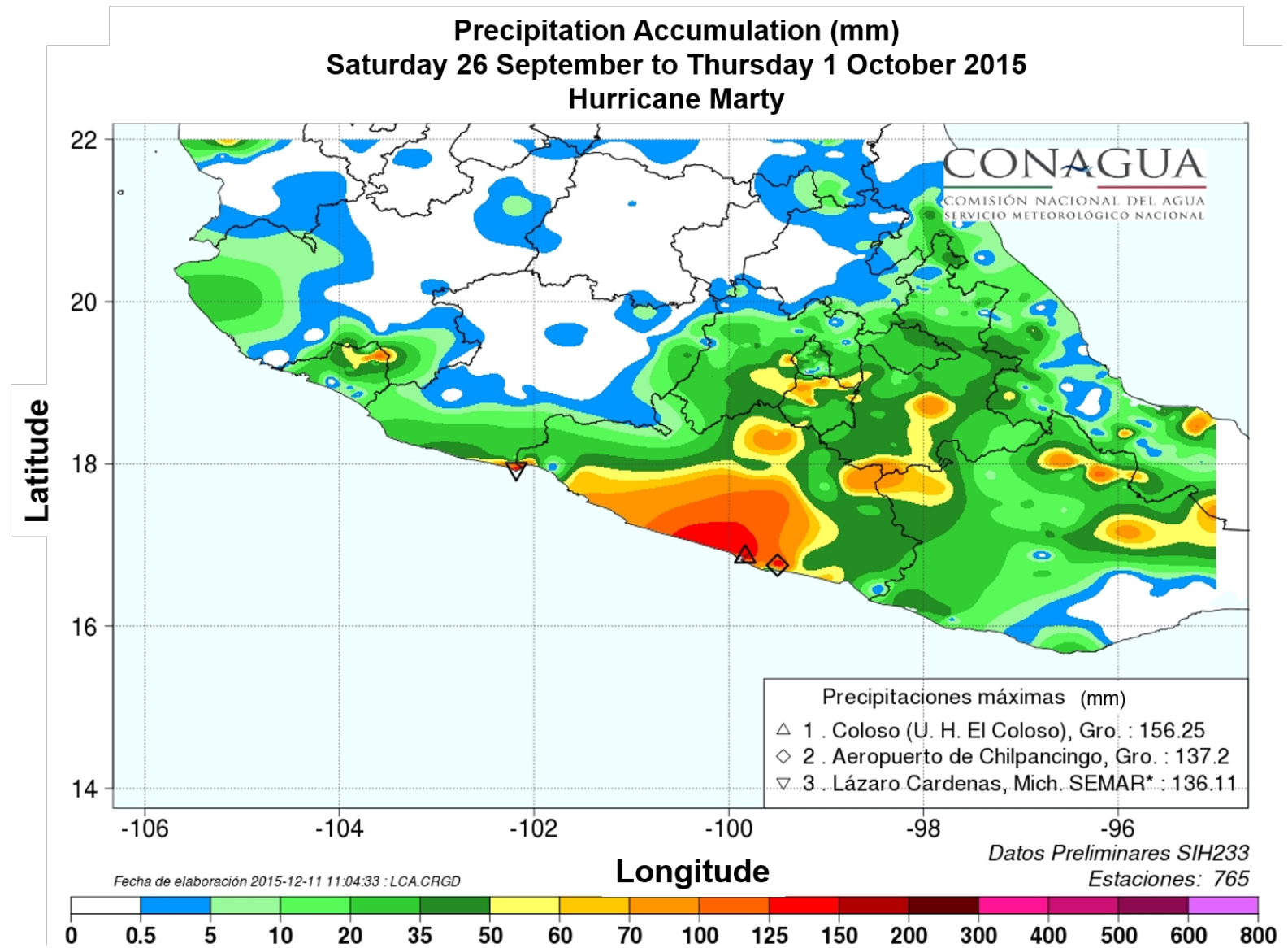


Figure 5. Analysis of rainfall produced by Hurricane Marty along the coast of southwestern Mexico between 26 September and 1 October 2015. Rainfall amounts are in millimeters (mm). Image courtesy of the National Water Commission of Mexico (CONAGUA).