

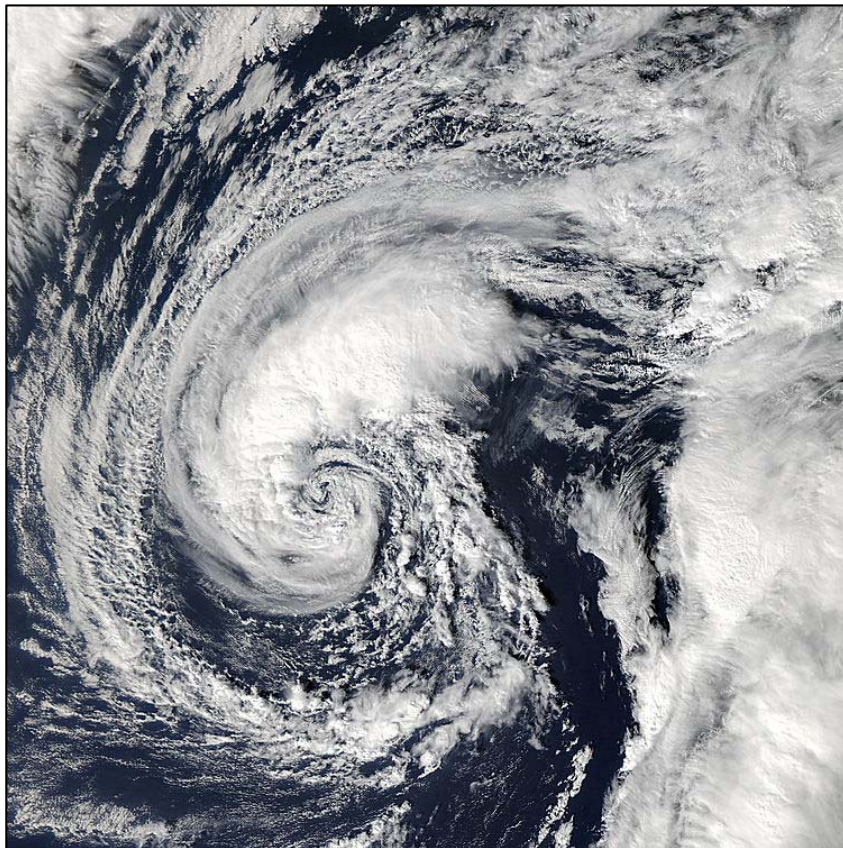


# NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

## TROPICAL STORM MELISSA (AL142013)

18 – 21 November 2013

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22 January 2014



MODIS SATELLITE IMAGE OF MELISSA AT 1630 UTC 19 NOVEMBER 2013. IMAGE COURTESY OF NASA.

Melissa was a subtropical storm that transitioned to a tropical cyclone over the central Atlantic Ocean. The storm brought large swells to Bermuda and northern portions of the Caribbean Islands, and produced strong winds over the western Azores Islands.

# Tropical Storm Melissa

18 – 21 NOVEMBER 2013

## SYNOPTIC HISTORY

The origin of Melissa was non-tropical. An area of low pressure developed along a stalled front over the central subtropical Atlantic around 0000 UTC 17 November. This extratropical low intensified over the next day or so while it moved erratically northward when it was co-located with an upper-level low. By early on 18 November when the fronts dissipated, the low was producing deep convection near and to the west of the center and in a disorganized band well east of the center. The system became a subtropical storm near 1200 UTC 18 November, when it was located about 625 n mi east-southeast of Bermuda; this classification is based primarily on the system's co-location with the upper-level low and its relatively large radius of maximum winds (roughly 80 n mi). The "best track" chart of Melissa'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<sup>1</sup>.

Melissa moved north-northwestward to northward over the next 24 h while strengthening slightly, and the storm reached its first peak intensity of 55 kt around 0600 UTC 19 November. Later that day, the thunderstorm activity diminished and scatterometer data indicated that Melissa weakened to an intensity of 45 kt by 0000 UTC 20 November, at which time the cyclone turned northeastward on the east side of an approaching deep-layer trough. Thunderstorm activity re-developed over the center of Melissa a few hours later, and Florida State phase space diagrams from early 20 November suggest that the cyclone became warm core. Based on the convective distribution and the phase-space analyses, Melissa is estimated to have become a tropical storm around 0600 UTC 20 November, while the cyclone was centered about 675 n mi east-northeast of Bermuda. The tropical storm accelerated toward the east-northeast later that day, and reached its second peak intensity of 55 kt at 1200 UTC 21 November, when it was located about 250 n mi west of Flores Island in the Azores. Melissa lost all of its deep convection over cold water and became a post-tropical cyclone by 0000 UTC 22 November about 120 n mi north-northeast of Flores Island.

The post-tropical storm merged with another weather system and became extratropical by 1200 UTC 22 November. The frontal system turned eastward and then east-southeastward and weakened, degenerating into a trough over the far northeastern Atlantic about 350 n mi west of the coast of Portugal shortly after 0600 UTC 23 November.

A sequence of infrared satellite images (Fig. 4) shows the evolution of Melissa.

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<sup>1</sup> 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.

## METEOROLOGICAL STATISTICS

Observations in Melissa (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), Herbert-Poteat satellite intensity estimates from TAFB, 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 Melissa.

The first estimated peak intensity of 55 kt as a subtropical storm from 0600 to 1200 UTC 19 November is based on satellite estimates from TAFB. The second estimated peak intensity of 55 kt as a tropical storm from 1200 to 1800 UTC 21 November is based primarily on an ASCAT pass at 1302 UTC that day.

Ship reports of winds of tropical storm force associated with Melissa are given in Table 2.

## CASUALTY AND DAMAGE STATISTICS

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

## FORECAST AND WARNING CRITIQUE

The genesis lead times (the number of hours between genesis and the first official forecast in the specified category) for Melissa are given below. The formation of Melissa was not particularly well anticipated, as it was unclear if the cyclone would lose its frontal characteristics.

	Hours Before Genesis	
	48-Hour Outlook	120-Hour Outlook
Low (<30%)	54	84
Medium (30%-50%)	24	54
High (>50%)	6	24

A verification of NHC official track forecasts for Melissa is given in Table 3a. Official forecast track errors were higher than the mean official errors for the previous 5-yr period. A



homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The best-performing models for Melissa were the United Kingdom Meteorological Office model (EGRI) and the Environment Canada global model (CMCI), which consistently beat the official forecast.

A verification of NHC official intensity forecasts for Melissa is given in Table 4a. Official forecast intensity errors were lower than the mean errors for the previous 5-yr period at all times, since the official forecasts correctly predicted that Melissa would not strengthen significantly. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The official forecast errors were close to those of the better-performing guidance, which includes the Hurricane Weather Research and Forecasting Model (HWFI) and the Florida State Super Ensemble (FSSE). The statistical-dynamical guidance had the largest errors and suffered from a high bias.



Table 1. Best track for Tropical Storm Melissa, 18-21 November 2013.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
17 / 0000	23.9	52.4	1006	35	extratropical
17 / 0600	24.3	52.7	1005	35	"
17 / 1200	25.0	52.9	1005	35	"
17 / 1800	26.0	52.9	1002	40	"
18 / 0000	27.1	52.7	997	45	"
18 / 0600	28.3	52.7	992	45	"
18 / 1200	29.1	53.4	987	50	subtropical storm
18 / 1800	29.7	54.0	987	50	"
19 / 0000	30.2	54.5	985	50	"
19 / 0600	30.8	54.7	982	55	"
19 / 1200	31.6	54.7	982	55	"
19 / 1800	32.5	54.4	982	50	"
20 / 0000	33.3	53.2	985	45	"
20 / 0600	34.1	51.4	988	45	tropical storm
20 / 1200	35.1	49.0	988	45	"
20 / 1800	36.3	46.4	988	45	"
21 / 0000	37.5	43.5	984	45	"
21 / 0600	38.8	40.0	984	50	"
21 / 1200	39.9	36.6	980	55	"
21 / 1800	40.7	33.3	980	55	"
22 / 0000	41.3	30.2	984	50	low
22 / 0600	41.6	27.5	988	45	"
22 / 1200	41.6	24.7	992	40	extratropical
22 / 1800	41.3	22.0	996	40	"
23 / 0000	40.8	19.5	1000	35	"
23 / 0600	40.0	17.1	1004	35	"
23 / 1200					dissipated
21 / 1200	39.9	36.6	980	55	maximum wind and minimum pressure



Table 2. Selected ship reports with winds of at least 34 kt for Tropical Storm Melissa, 18 – 21 November 2013.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
17 / 2200	C6FU4	28.4	46.8	160 / 37	1009.0
20 / 0000	A8UF9	33.6	56.5	350 / 37	1002.0
20 / 1200	V7PR8	39.0	56.8	330 / 44	1021.0
20 / 2300	VRGT8	31.7	47.4	270 / 37	1015.0
21 / 1000	V7QH5	36.6	30.6	240 / 41	1012.9
21 / 1900	V7QH5	36.0	26.9	260 / 35	1012.6
22 / 0800	V7QH5	35.9	21.4	260 / 43	1013.3
22 / 0900	WDE826	41.3	26.0	310 / 37	
22 / 1200	MYNJ6	46.3	21.2	110 / 38	
22 / 1800	V7QH5	35.9	17.3	260 / 37	1012.4
22 / 2000	BATFR1	42.4	16.0	100 / 35	1009.1
22 / 2100	BATFR1	42.6	15.6	100 / 35	1010.4
23 / 0000	MYNJ6	46.9	18.9	110 / 37	

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Melissa. 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	29.3	50.9	83.2	128.5	236.1		
OCD5	53.9	159.6	320.3	495.2	742.3		
Forecasts	12	10	8	6	2		
OFCL (2008-12)	28.6	45.8	62.2	78.6	116.6		
OCD5 (2008-12)	47.5	99.7	161.4	224.0	329.7		



Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Melissa. 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	31.4	53.5	88.1	136.2	257.3		
OCD5	58.7	168.2	356.2	573.4	960.7		
GFSI	<b>26.9</b>	<b>44.3</b>	<b>65.3</b>	<b>119.3</b>	344.2		
GHMI	41.7	100.3	202.8	346.8	529.7		
HWFI	<b>29.1</b>	54.3	<b>84.8</b>	<b>119.1</b>	<b>208.2</b>		
EGRI	<b>22.1</b>	<b>41.1</b>	<b>57.4</b>	<b>75.8</b>	<b>189.4</b>		
EMXI	<b>30.0</b>	58.7	98.2	136.4	<b>165.6</b>		
CMCI	<b>27.1</b>	<b>41.4</b>	<b>69.4</b>	<b>101.5</b>	<b>169.3</b>		
AEMI	<b>24.5</b>	<b>43.5</b>	<b>70.9</b>	<b>125.5</b>	259.0		
FSSE	<b>28.2</b>	<b>52.3</b>	91.9	141.4	<b>243.3</b>		
TVCA	<b>28.1</b>	54.7	95.4	151.8	266.9		
LBAR	39.7	102.5	191.5	303.1	398.4		
BAMD	72.5	165.1	276.2	406.7	630.1		
BAMM	<b>30.1</b>	66.8	127.8	205.9	283.0		
BAMS	37.4	66.8	<b>81.0</b>	<b>92.2</b>	<b>149.7</b>		
Forecasts	10	9	7	5	1		

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Melissa. 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	<b>6.3</b>	<b>8.0</b>	<b>10.6</b>	<b>9.2</b>	<b>0.0</b>		
OCD5	6.5	8.2	9.9	4.8	2.0		
Forecasts	12	10	8	6	2		
OFCL (2008-12)	6.6	10.1	12.2	14.1	15.4		
OCD5 (2008-12)	7.8	11.6	14.0	15.6	17.9		

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Melissa. 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	6.8	8.9	10.0	8.0	0.0		
OCD5	6.9	<b>8.4</b>	10.6	<b>4.6</b>	0.0		
GHMI	7.4	<b>7.4</b>	<b>6.0</b>	<b>5.8</b>	7.0		
HWFI	7.4	<b>6.3</b>	<b>8.0</b>	<b>3.4</b>	7.0		
FSSE	<b>6.2</b>	<b>6.9</b>	<b>8.4</b>	<b>3.6</b>	9.0		
DSHP	<b>5.1</b>	9.2	13.9	16.8	15.0		
LGEM	<b>6.0</b>	9.0	14.0	12.6	6.0		
ICON	<b>5.7</b>	<b>6.9</b>	<b>9.9</b>	<b>7.6</b>	2.0		
Forecasts	11	9	7	5	1		



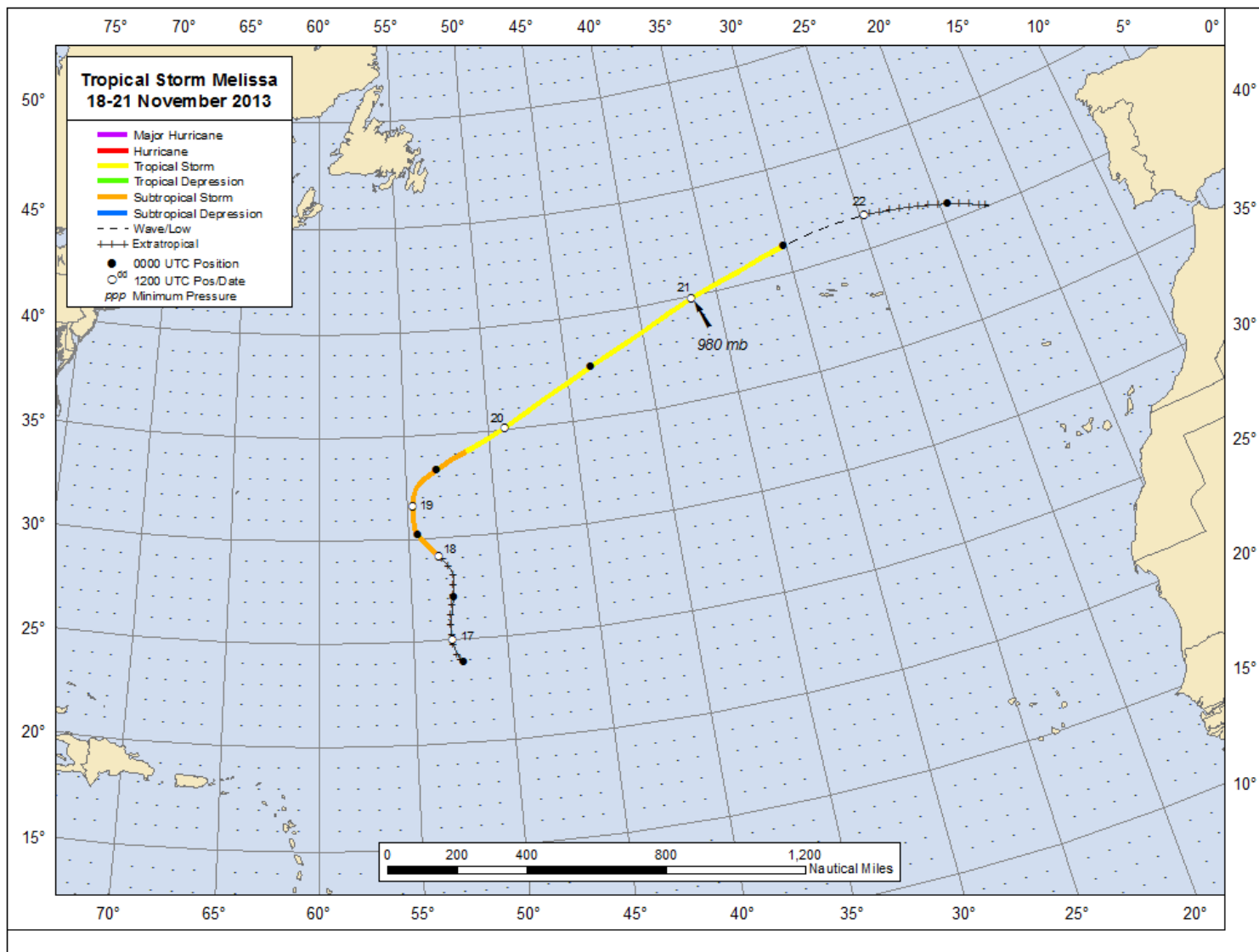


Figure 1. Best track positions for Tropical Storm Melissa, 18-21 November 2013. Track during the second extratropical phase is partially based on analyses from the NOAA Ocean Prediction Center.

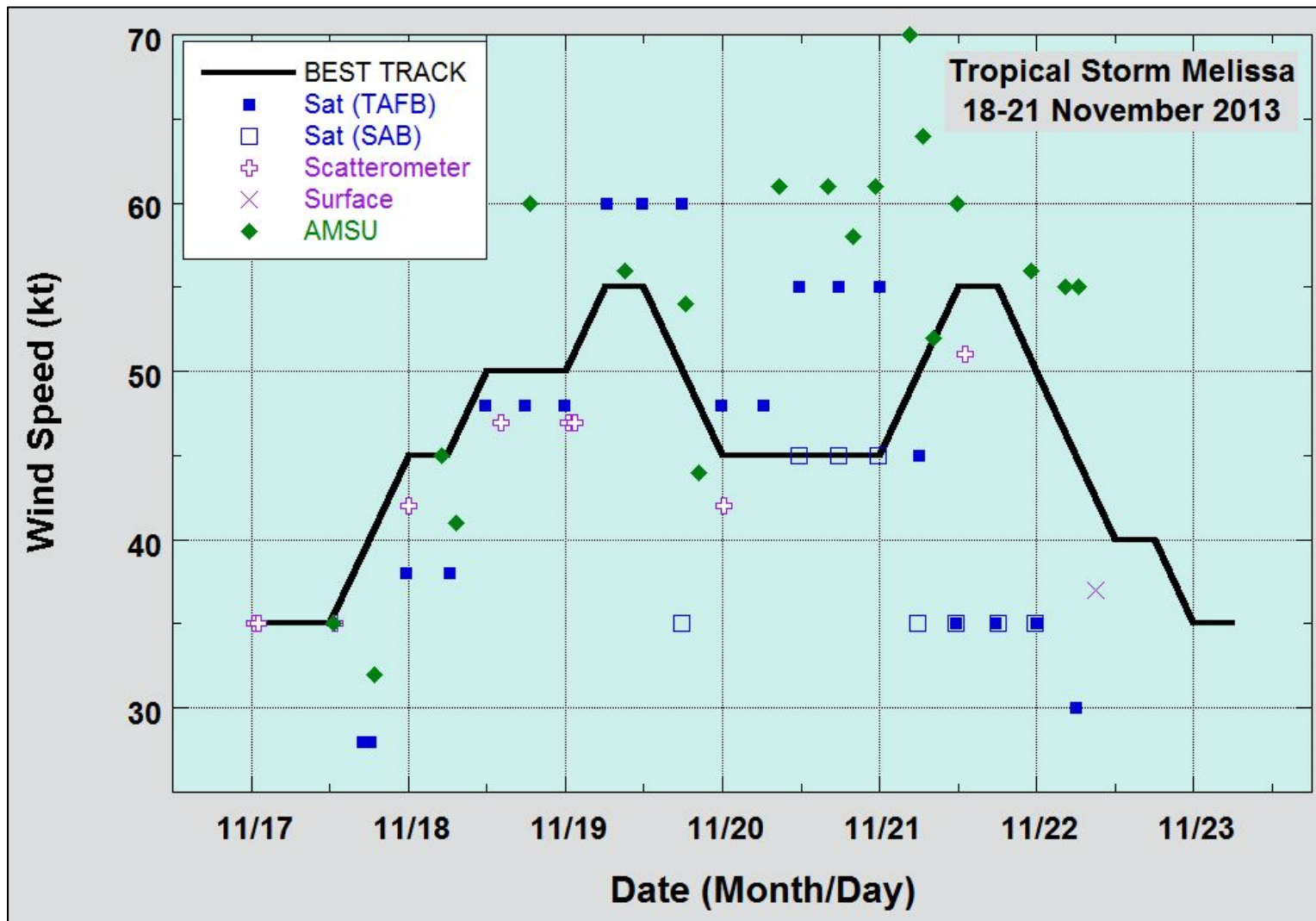


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Melissa, 18-21 November 2013. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

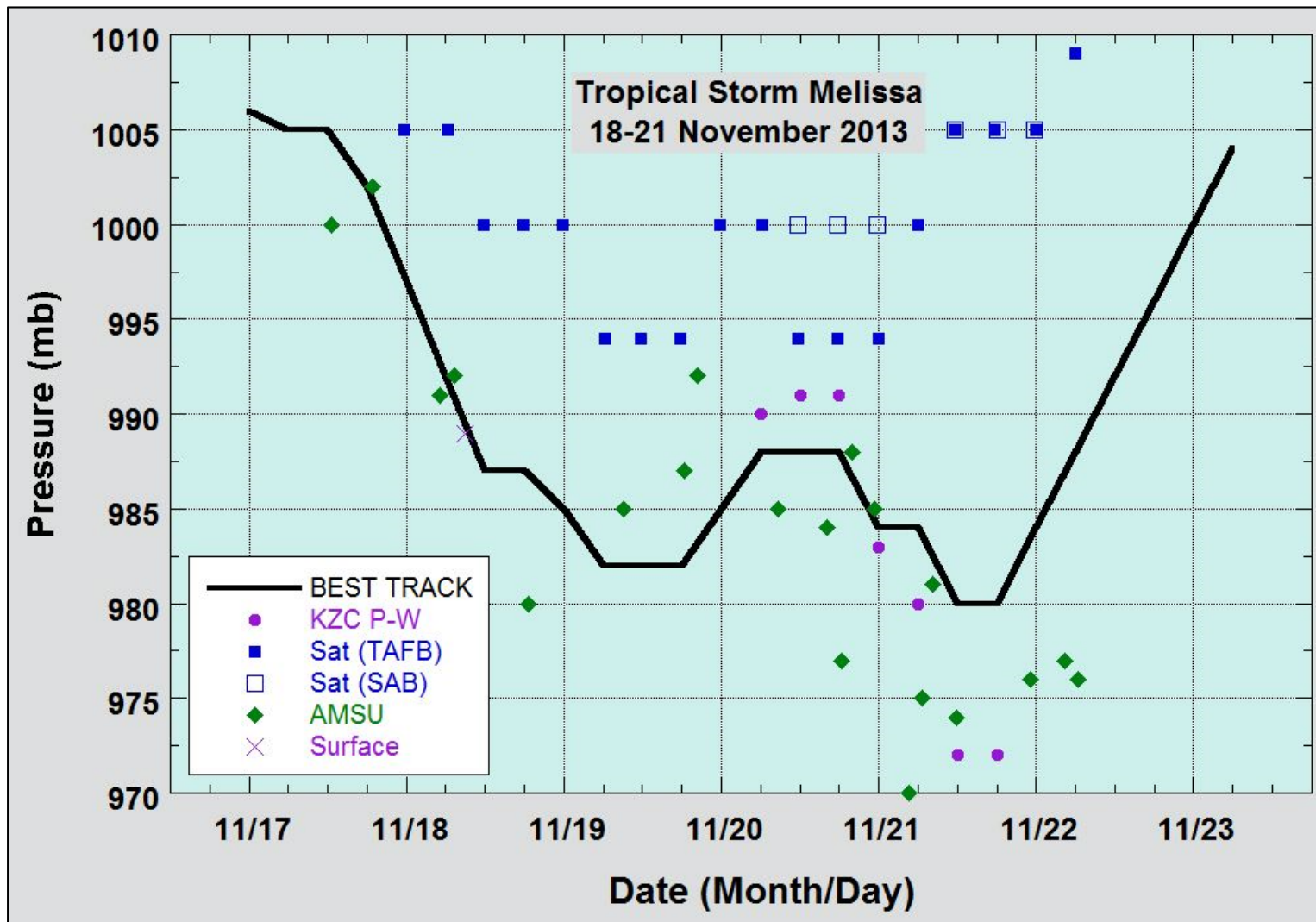


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Melissa, 18-21 November 2013. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.

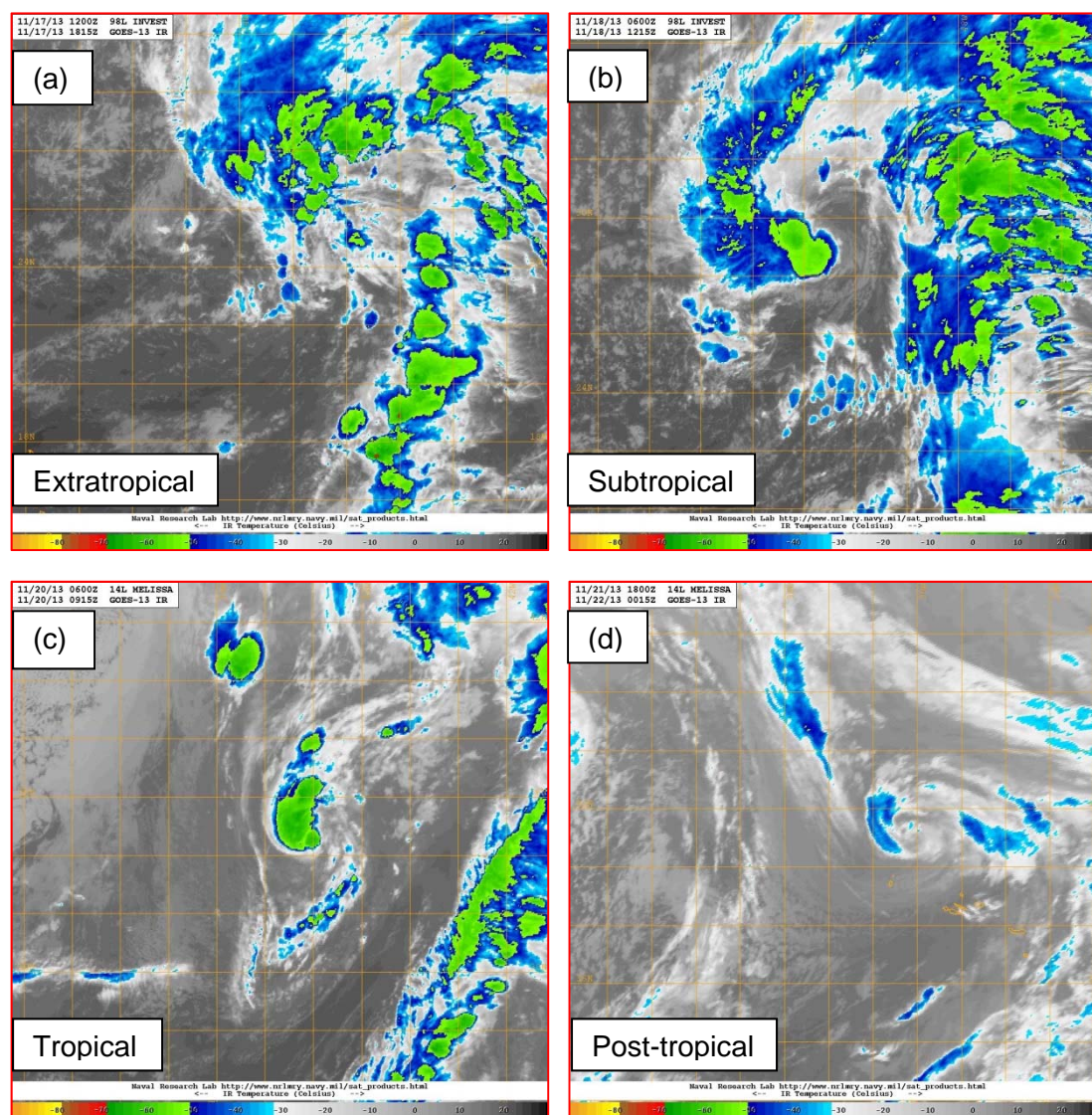


Figure 4. Infrared satellite images of Melissa as (a) an extratropical storm at 1815 UTC 17 November, (b) a subtropical storm at 1215 UTC 18 November, (c) a tropical storm at 0915 UTC 20 November, and (d) an post-tropical storm at 0015 UTC 22 November. Images courtesy of the United States Naval Research Laboratory.