NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

HURRICANE AMANDA

(EP012014)

22 – 29 MAY 2014

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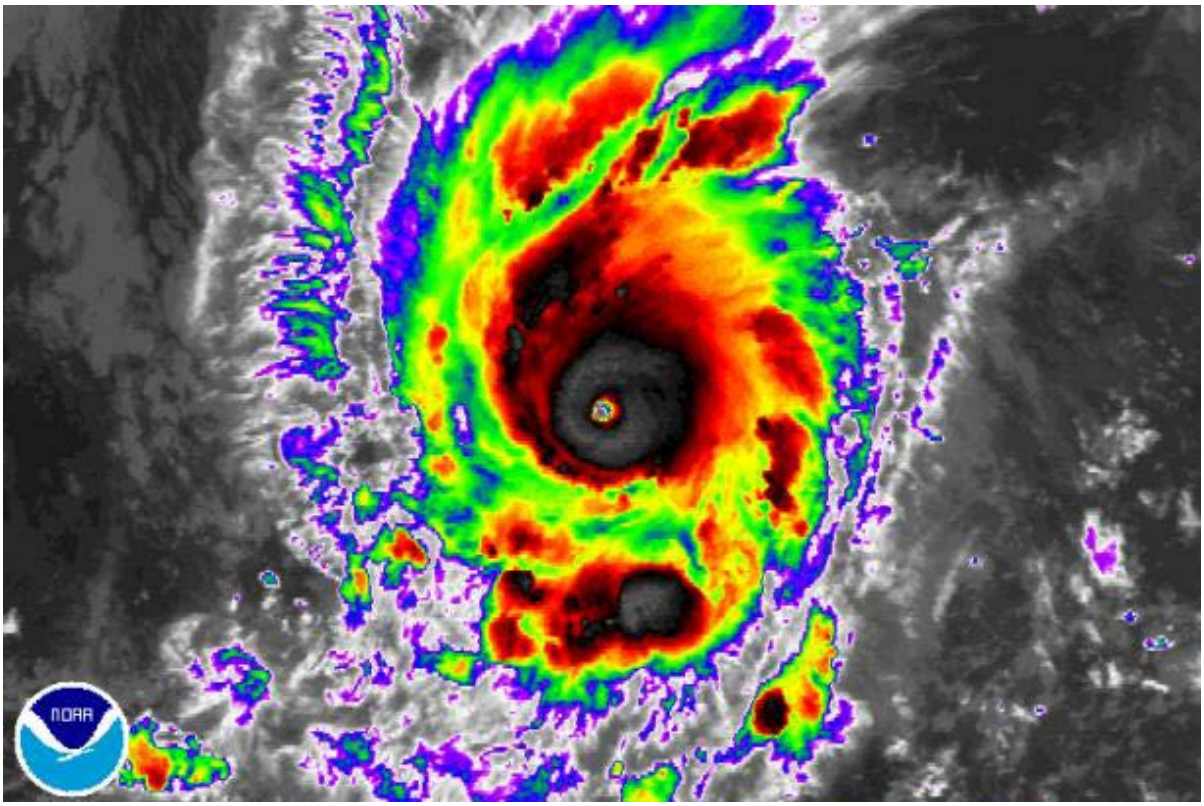

1130 UTC 25 MAY 2014 GOES-15 INFRARED SATELLITE IMAGE AT THE TIME OF AMANDA'S PEAK INTENSITY OF 135 KT (IMAGE COURTESY OF NOAA)

Amanda was a high-end, early-season category 4 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that remained over the open Pacific ocean well offshore of the coast of southwestern Mexico during its entire lifetime. Amanda is the strongest eastern North Pacific basin hurricane ever to occur in the month of May during the satellite era.

Hurricane Amanda

22 – 29 MAY 2014

SYNOPTIC HISTORY

Amanda formed from a tropical wave that moved into the eastern North Pacific Ocean on 16 May. The wave moved steadily westward over the next few days and a broad surface low developed along the wave axis by 19 May about 500 n mi south of Acapulco, Mexico. Over the next 48 h, convection waxed and waned and the disturbance turned west-northwestward. By early on 22 May, satellite scatterometer data indicated that the low pressure system's wind field had contracted and that a well-defined center had formed. Deep convection near the center of the low continued to increase and become better organized, and it is estimated that a tropical depression formed around 1800 UTC that day when the cyclone was located about 550 n mi south-southwest of Manzanillo, Mexico. The small cyclone continued its slow west-northwestward motion along the southern periphery of a subtropical ridge centered over central Mexico and gradually strengthened, becoming a tropical storm by 1800 UTC 23 May. The "best track" chart of Amanda'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 combination of weak vertical wind shear, high moisture content in the middle troposphere, and very warm sea-surface temperatures near 30^{O}C, plus the development of an eye and a small inner-core wind field (Fig. 4), resulted in a 42-h period of rapid intensification on 23-25 May. Amanda strengthened by 90 kt and reached its peak intensity of 135 kt around 1200 UTC 25 May when the cyclone was located about 670 n mi south of the southern tip of Baja California Sur, Mexico (cover page image). Although environmental conditions were still fairly conducive, sea-surface temperatures beneath the category 4 hurricane cooled by more than 6^{O}C due to cold upwelling (Fig. 5) created by the intense inner-core wind field and the hurricane's slow north-northwestward motion of only 2-3 kt. Amanda was able to maintain its peak intensity for only 6 h before gradual weakening began. By 1200 UTC 27 May, however, a more significant weakening trend ensued due to a combination of southerly vertical wind shear in excess of 20 kt and sea-surface temperatures less than 24^{O}C. These adverse conditions resulted in erosion of the inner-core convection, causing Amanda to rapidly weaken between 1200 UTC 27 May and 1200 UTC 28 May – a decrease of 40 kt during that 24-h period.

As Tropical Storm Amanda moved slowly northeastward around the western periphery of the subtropical ridge, drier and more stable air to its north began to be ingested into the cyclone's circulation, which further enhanced the weakening process. Amanda became a tropical depression by 1200 UTC 29 May when the cyclone was located about 400 n mi south of

[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.

the southern tip of Baja California, and dissipated shortly thereafter when the circulation became elongated and ill-defined.

METEOROLOGICAL STATISTICS

Observations in Amanda (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) and Aqua satellites, 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 Amanda.

There were no ship reports of tropical-storm-force winds associated with Amanda.

The 135-kt analyzed peak intensity of Amanda at 1200 UTC and 1800 UTC 25 May is based on a blend of satellite current intensity estimates of 7.0/140 kt from TAFB, 6.5/127 kt from SAB, and 6.6/130 kt and 6.9/137 kt from UW-CIMSS, respectively. The estimated minimum pressure of 932 mb, which was coincident with the peak intensity, is based on the Knaff-Zehr-Courtney (KZC) pressure-wind relationship estimate.

Amanda surpassed Hurricane Adolph of 2001 as the strongest hurricane ever in the month of May during the satellite era.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Amanda was not forecast particularly well (Table 2). An area of disturbed weather was introduced into the Tropical Weather Outlook (TWO) with a 20% (low) chance of formation in 5 days at 1800 UTC 19 May, 72 h prior to genesis. The 48-h genesis probability was increased to the medium chance category (30-50%) only 6 h before the system was designated as a tropical cyclone, and a high probability of development for both the 120-h and 48-h outlook periods was never officially designated. Despite the low vertical wind shear

conditions and very warm sea-surface temperatures, the global models struggled with forecasting the initial development of Amanda, possibly due to the cyclone's proximity to dry air in the mid-levels of the troposphere.

A verification of NHC official track forecasts for Amanda is given in Table 3a. Official forecast track errors were much lower 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. NHC official track forecast (OFCL) errors were significantly lower than the 5-yr average, ranging from 40% better at 24 h and 36 h to as much as 56% and 53% better at 96 h and 120 h, respectively. OFCL track forecasts outperformed most available model guidance at all times except for the Florida State University Superensemble (FSSE) model and the consensus model TVCE.

A verification of NHC official intensity forecasts for Amanda is given in Table 4a. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. In contrast to the exceptional track forecast errors, NHC official intensity forecast errors were considerably worse than the 5-yr average except at 120 h. The cause of the large OFCL intensity forecast errors was due to failure to capture the rapid intensification phase (fig. 6). However, NHC official intensity forecasts handled the rapid weakening period quite well. Despite the larger than average errors, OFCL intensity forecasts still showed skill over all of the available intensity models through 48 h and also at 96 h. The official intensity forecasts were bested only by the GHMI, HWFI models, and LGEM models at 72 h, and by a larger group of aids at 120 h.

No coastal watches or warnings were required with Amanda.

Table 1. Best track for Hurricane Amanda, 22-29 May 2014.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage*
22 / 0600	10.1	106.4	1007	25	low
22 / 1200	10.2	106.8	1007	25	"
22 / 1800	10.3	107.2	1007	25	tropical depression
23 / 0000	10.5	107.6	1007	25	"
23 / 0600	10.7	108.0	1006	30	"
23 / 1200	10.8	108.3	1006	30	"
23 / 1800	10.9	108.6	1005	35	tropical storm
24 / 0000	11.0	109.0	1002	45	"
24 / 0600	11.1	109.4	996	55	"
24 / 1200	11.2	109.8	989	65	hurricane
24 / 1800	11.3	110.1	983	75	"
25 / 0000	11.5	110.5	973	90	"
25 / 0600	11.6	110.8	946	120	"
25 / 1200	11.7	111.1	932	135	"
25 / 1800	12.0	111.2	933	135	"
26 / 0000	12.3	111.3	941	125	"
26 / 0600	12.7	111.5	945	120	"
26 / 1200	12.9	111.6	949	115	"
26 / 1800	13.2	111.8	953	110	"
27 / 0000	13.5	111.9	958	105	"
27 / 0600	14.0	112.1	962	100	"
27 / 1200	14.2	112.4	966	95	"
27 / 1800	14.5	112.7	972	85	"
28 / 0000	14.5	112.6	983	75	"
28 / 0600	14.6	112.5	989	65	"

28 / 1200	14.9	112.2	996	55	tropical storm
28 / 1800	15.7	111.8	999	50	"
29 / 0000	16.1	111.5	1001	45	"
29 / 0600	16.3	110.9	1003	35	"
29 / 1200	16.2	110.2	1004	30	tropical depression
29 / 1800					dissipated
25 / 1200	11.7	111.1	932	135	minimum pressure

* NHC is conducting an in-house experiment in which track, intensity, and size forecasts are prepared for disturbances that are assessed to have a 60% or higher chance of genesis within 48 h. To support the verification of these forecasts, NHC is currently extending the best track back to the point where the first experimental forecast was made.

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 (<30%)	66	72
Medium (30%-50%)	6	54
High (>50%)	0	0

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Amanda. 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	**20.0**	**24.9**	**33.2**	**39.4**	**61.1**	**58.9**	**79.0**
OCD5	33.7	70.3	121.3	164.4	296.1	425.1	550.4
Forecasts	26	24	22	20	16	12	8
OFCL (2009-13)	25.7	41.4	55.0	68.6	97.8	134.2	167.1
OCD5 (2009-13)	37.2	74.8	118.0	162.5	249.4	332.6	413.3

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Amanda. 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	18.9	27.3	33.6	43.5	59.1	48.8	70.4
OCD5	27.7	62.4	119.4	176.3	304.6	474.3	628.5
GFSI	25.3	45.9	65.4	84.7	98.5	120.9	121.2
AEMI	20.7	33.5	42.6	60.2	95.8	138.7	163.0
HWFI	36.4	62.7	76.4	92.5	102.7	199.1	298.8
GHMI	24.0	37.6	51.3	74.9	102.0	141.5	202.4
EMXI	21.9	27.7	**32.8**	46.5	65.2	64.6	**69.1**
UKMI	20.8	37.2	46.8	57.4	66.3	53.0	**63.4**
EGRI	20.8	37.2	46.8	57.4	66.3	53.0	81.2
CMCI	31.7	64.9	105.0	150.8	140.0	151.2	165.1
FSSE	**18.7**	**27.2**	**30.0**	**41.6**	66.4	50.3	78.2
TVCE	**18.3**	**27.0**	**31.3**	**39.1**	**51.2**	53.9	**70.3**
TCON	19.4	30.4	36.5	47.0	**58.2**	64.9	76.0
BAMD	50.3	95.4	142.1	189.0	299.1	467.8	705.5
BAMM	34.5	60.0	77.1	91.1	100.5	111.6	109.8
BAMD	50.3	95.4	142.1	189.0	299.1	467.8	705.5
LBAR	37.7	96.7	162.7	230.1	351.1	527.8	692.7
Forecasts	17	17	17	16	10	8	4

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Amanda. Mean errors for the 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	8.7	14.8	20.0	25.0	27.2	20.0	**11.3**
OCD5	12.3	21.0	27.0	32.7	39.1	29.8	15.0
Forecasts	26	24	22	20	16	12	8
OFCL (2009-13)	6.1	10.4	13.4	14.5	15.0	16.4	16.1
OCD5 (2009-13)	7.7	12.7	16.4	18.8	20.5	20.3	20.8

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Amanda. 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	11.2	17.1	19.7	17.8	15.5	8.8	7.5
OCD5	15.9	24.8	28.3	27.1	28.9	20.1	14.0
GHMI	14.6	22.7	28.5	19.7	**12.6**	14.6	8.0
HWFI	11.4	**16.1**	21.0	26.0	35.0	30.5	13.0
GFSI	17.0	25.2	33.4	37.1	39.6	33.0	**5.3**
EMXI	19.4	34.0	45.5	50.3	48.3	40.1	19.5
FSSE	11.6	17.6	19.9	19.5	20.0	9.4	**4.0**
DSHP	13.9	20.4	23.4	20.8	**14.7**	8.9	**2.3**
LGEM	13.2	19.6	21.9	19.7	**15.2**	9.9	**7.3**
IVCN	12.5	18.3	21.2	19.6	17.0	11.0	**2.5**
ICON	12.5	18.3	21.2	19.6	17.0	11.0	**2.5**
Forecasts	17	17	17	16	10	8	4

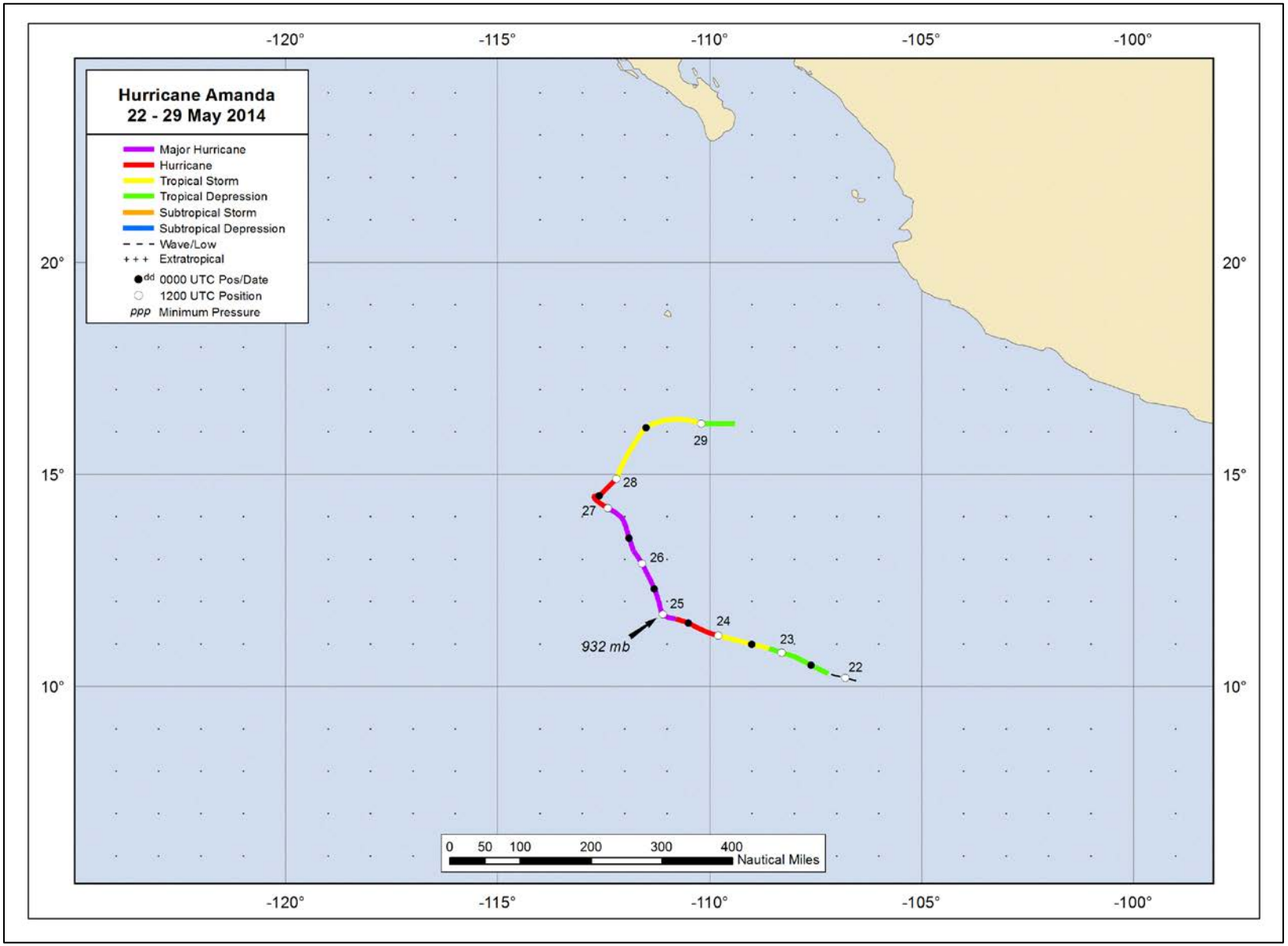

Figure 1. Best track positions for Hurricane Amanda, 22-29 May 2014.

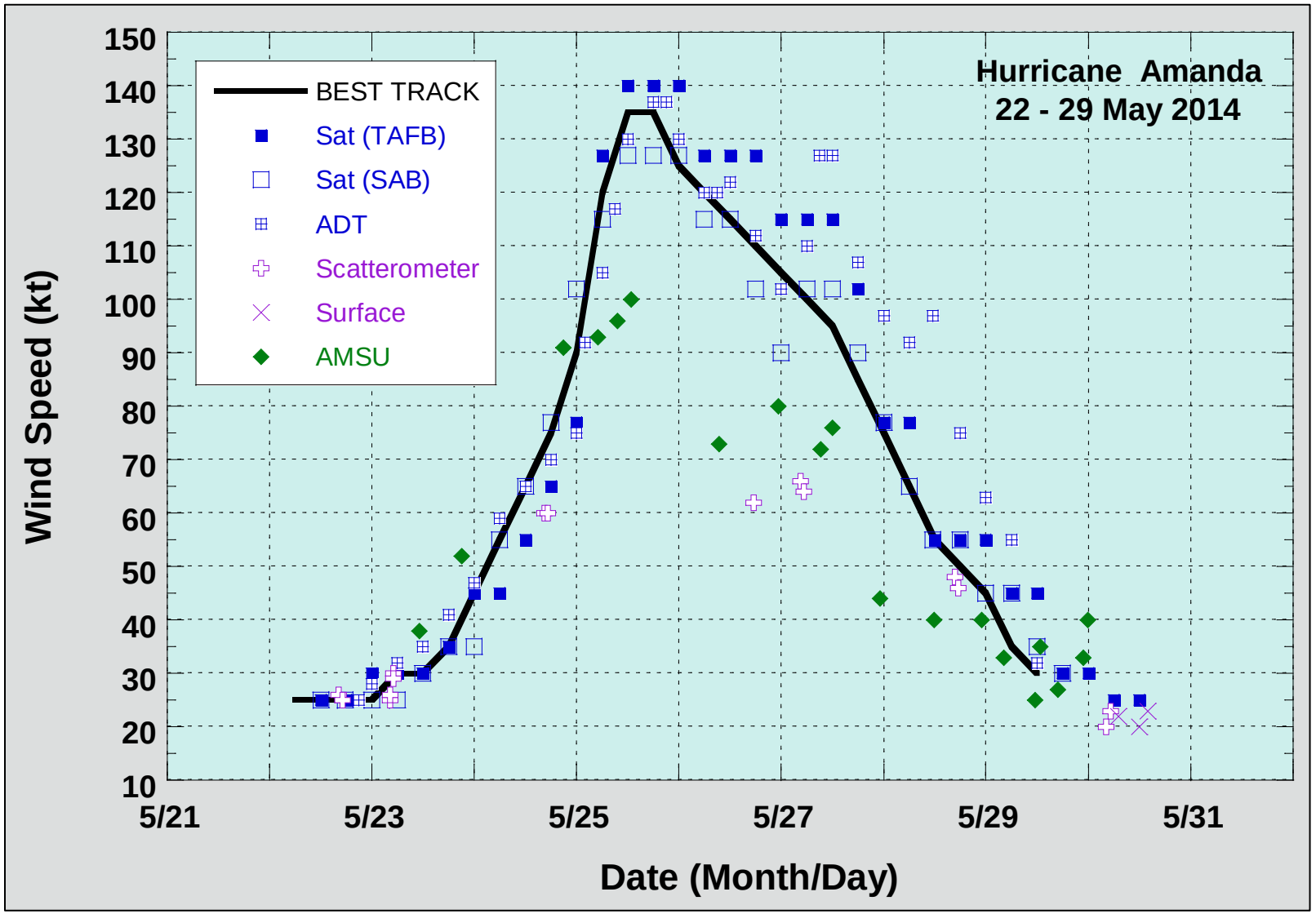

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Amanda, 22-29 May 2014. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

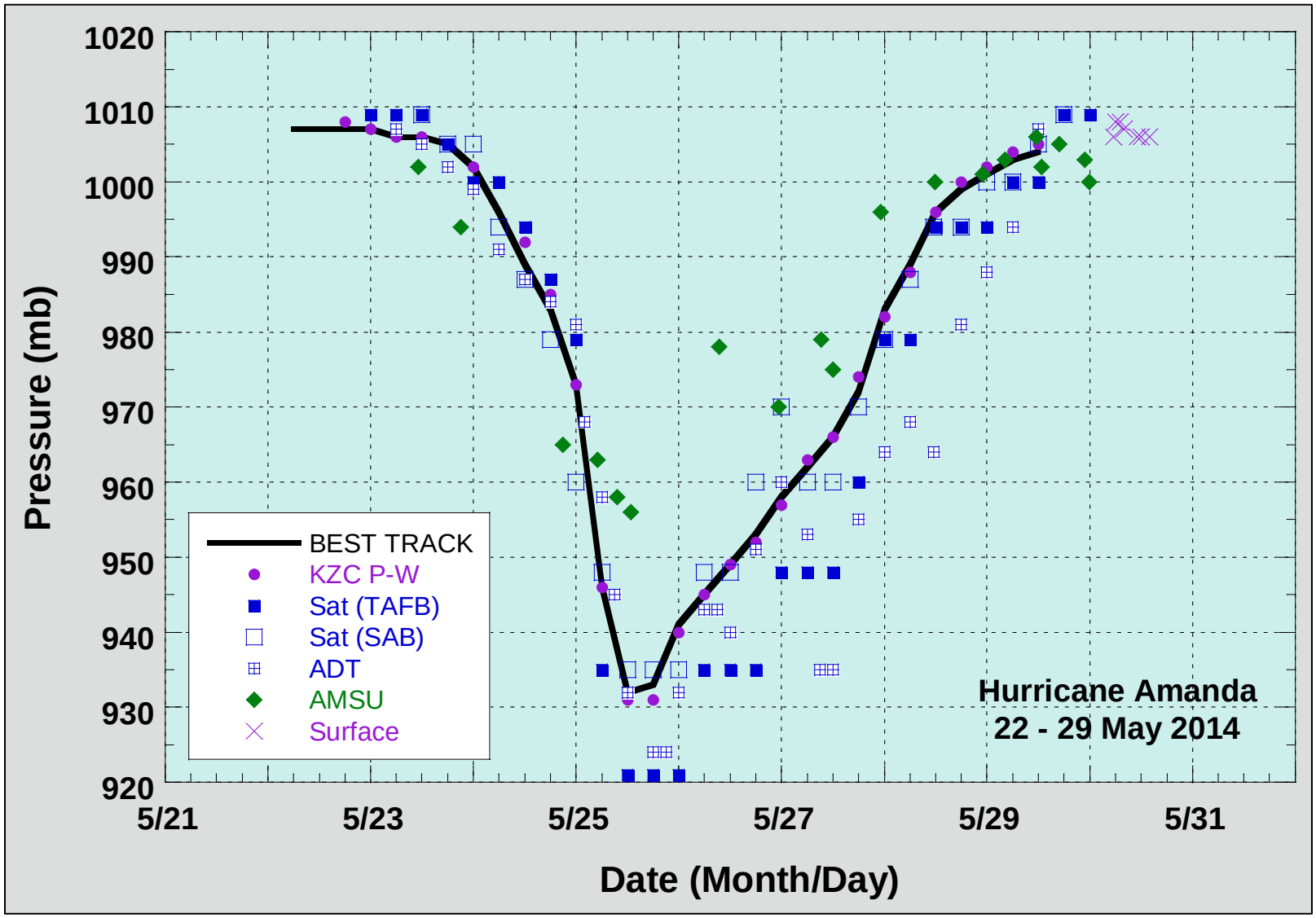

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Amanda, 22-29 May 2014. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological 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.

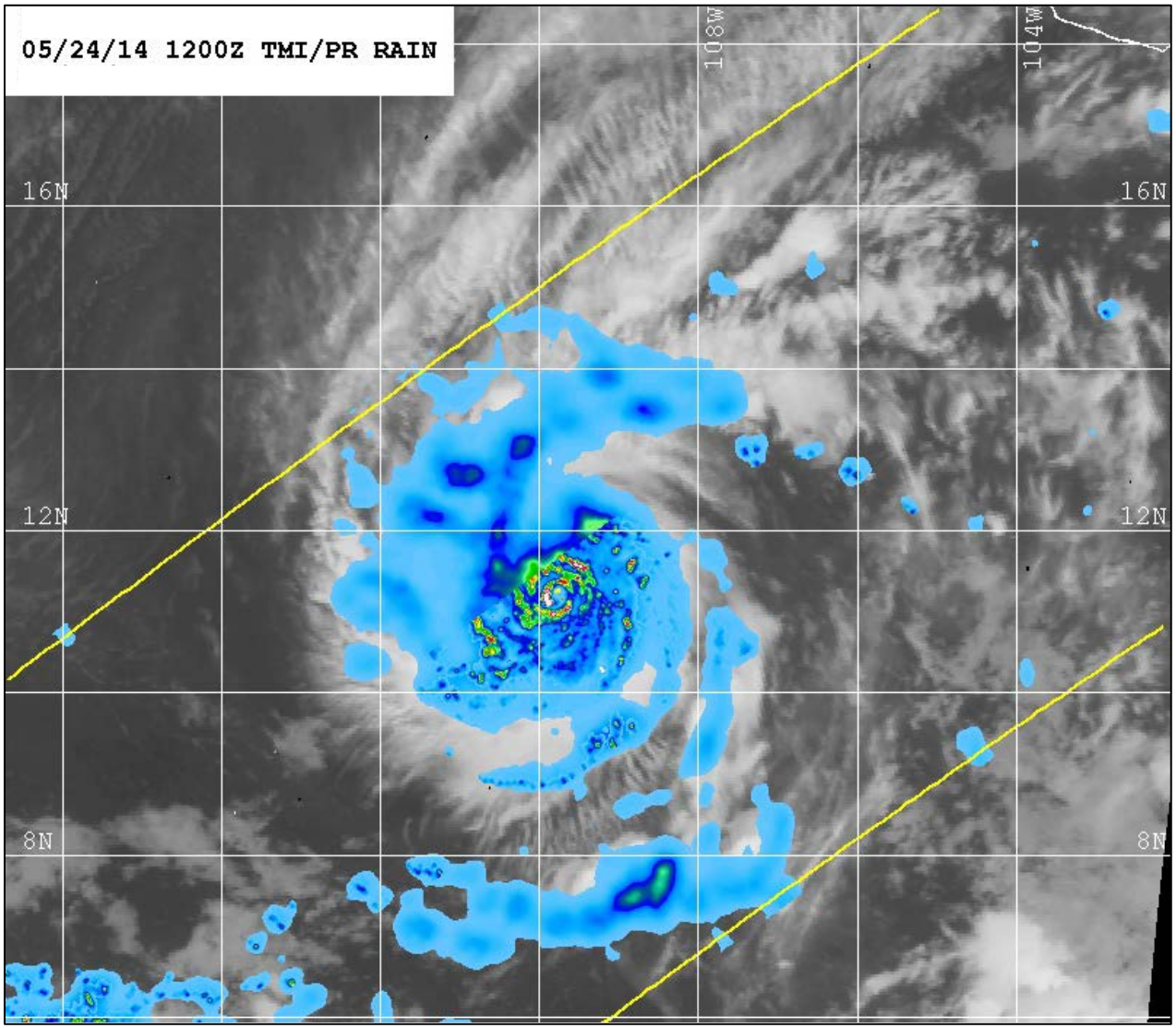

Figure 4. 1200 UTC 24 May 2014 NASA TRMM Precipitation Radar (PR) image of Amanda when it reached hurricane status and possessed a symmetrical 10 n mi diameter eye. Amanda was also nearing the midpoint of its rapid intensification phase. (Image courtesy of the U.S. Navy Fleet Numerical Meteorology and Oceanography Command, Monterey, CA)

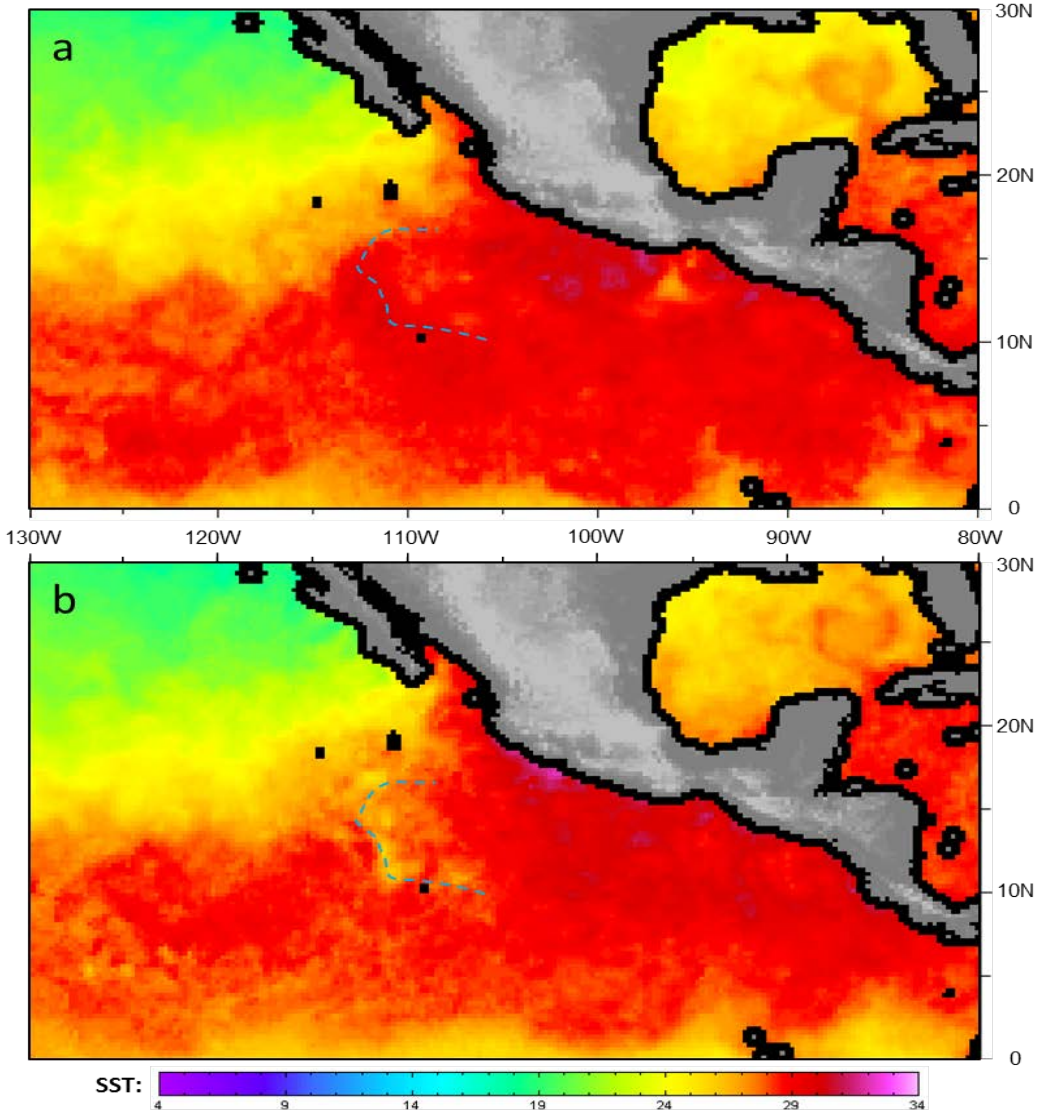

Figure 5. Sea-surface temperatures at (a) 1200 UTC 21 May 2014 and (b) 1200 UTC 27 May 2014. Cold upwelling of at least 6^{O}C occurred along the path (dashed blue line) of Amanda. (Data courtesy of Remote Sensing Systems, Santa Rosa, CA)

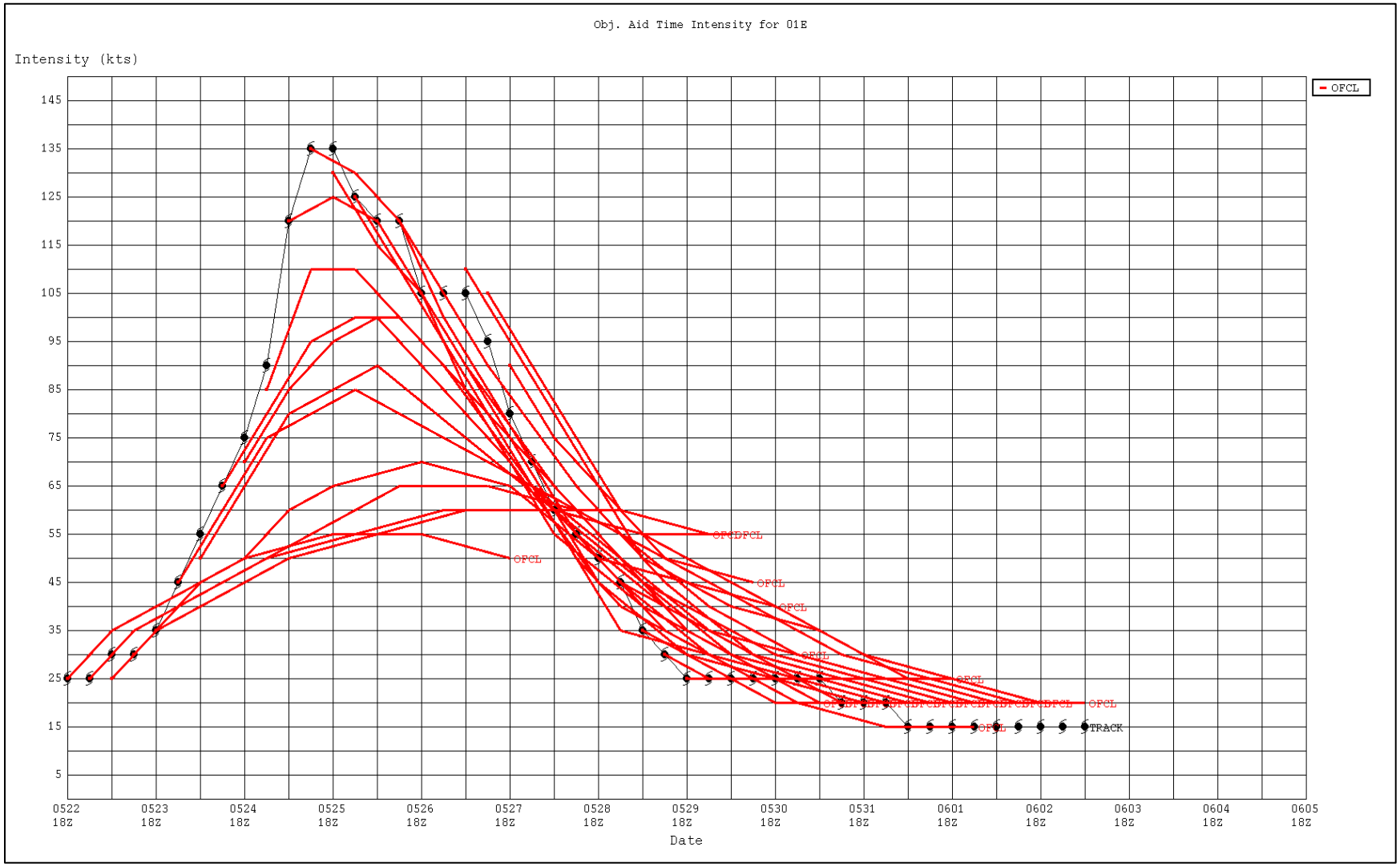

Figure 6. NHC official intensity forecasts (OFCL) for the period 1800 UTC 22 May 2014 to 1200 UTC 29 May 2014. The black line with hurricane symbols is the final 'best track' intensity for Hurricane Amanda.