

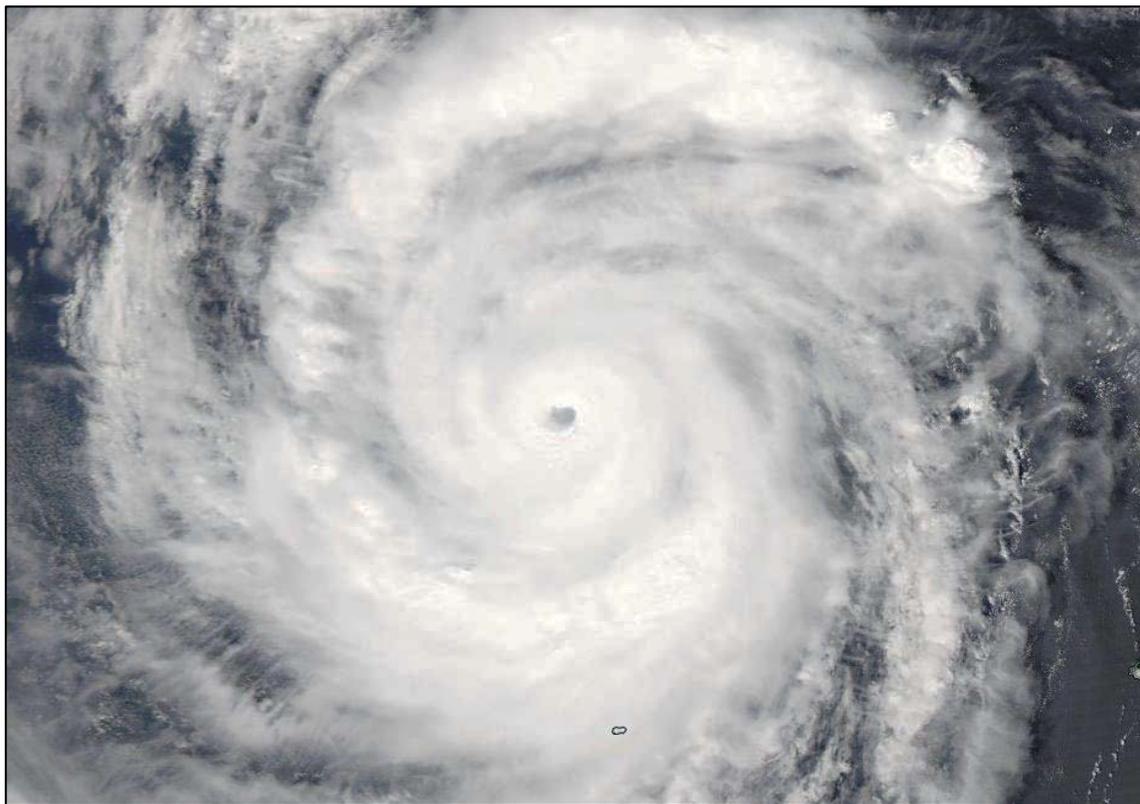


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE SIMON (EP192014)

1 – 7 October 2014

Stacy R. Stewart
National Hurricane Center
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NASA-MODIS VISIBLE SATELLITE IMAGE SHOWING HURRICANE SIMON NEAR ITS PEAK INTENSITY LATE ON 4 OCT 2014.

Simon was the eighth major hurricane to develop during the 2014 season. The category 4 hurricane (on the Saffir-Simpson Hurricane Wind Scale) remained over the eastern North Pacific Ocean during its entire lifetime, passing over Socorro Island and briefly threatening west-central Baja California Sur as a tropical storm.

Hurricane Simon

1 – 7 OCTOBER 2014

SYNOPTIC HISTORY

Simon developed from a tropical wave that interacted with the eastern North Pacific intertropical convergence zone (ITCZ). A tropical wave exited the west coast of Africa early on 14 September, and moved westward across the tropical Atlantic Ocean at about 15 kt for the next 10 days. The wave produced little in the way of deep convection outside of a few brief flare ups of activity when the system interacted with a series of low-latitude upper-level troughs. The wave crossed Central America and moved into the eastern North Pacific basin on 24 September, where interaction with the ITCZ resulted in the generation of an extensive area of disorganized convection. By 30 September, however, a low pressure system developed along the wave axis about 125 n mi south of Acapulco, Mexico, and deep convection began to increase and steadily become better organized. The low moved west-northwestward parallel to and just offshore of the coast of Mexico over sea-surface temperatures of near 30^o C and within an environment of light to moderate vertical wind shear. These favorable conditions allowed thunderstorm activity to further increase, and organized convective bands formed near and to the north and east of the center by 1800 UTC 1 October, marking the formation of a tropical depression about 120 n mi south of Manzanillo, Mexico. Additional convective organization followed and the depression strengthened into a tropical storm 12 h later. 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 1¹

Simon strengthened slowly during the next 30 h, during which time the inner-core wind field and radius of maximum winds (RMW) steadily contracted. Atmospheric and oceanic conditions became quite conducive for strengthening to occur, with an 850-200 mb vertical wind shear of 5 kt or less, mid-level relative humidity of at least 70%, and sea-surface temperatures (SSTs) around 28^o C. Around 1800 UTC, the compact 55-kt cyclone began a 30-h period of rapid intensification, with Simon becoming a hurricane around 0000 UTC 4 October. The center of Simon’s small eye passed less than 8 n mi north of Socorro Island (Fig. 4) around 2200 UTC 3 October, producing a 1.5-h period of tropical-storm-force winds from 2115 UTC to 2245 UTC. After passing Socorro Island, Simon reached its peak intensity of 115 kt around 0000 UTC 5 October, when the category 4 hurricane was located about 340 n mi west-southwest of the southern tip of Baja California Sur, Mexico (cover image). However, Simon’s peak intensity was short-lived.

A period of rapid weakening ensued almost immediately. Simon turned northwestward around the southwestern periphery of a deep-layer subtropical ridge, which brought the cyclone

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.

over cooler waters with SSTs of about 26.5° C and over upper-ocean heat content values of near zero. The strong inner-core winds of Simon induced cold upwelling/mixing beneath the hurricane, which resulted in SSTs decreasing to 22° C or less (Fig. 5) along the storm's track. Despite the low vertical wind shear and favorable upper-level outflow regime, the category 4 hurricane rapidly weakened to a 60-kt tropical storm just 24 h later when Simon was located about 260 n mi south-southwest of Punta Eugenia, Baja California Sur, Mexico. After weakening to a tropical storm early on 6 October, Simon moved northward and continued to weaken due to cooler waters and entrainment of drier mid-level air to the north and west of the cyclone. Simon turned northeastward on 7 October and weakened to a 30-kt remnant low early on 8 October after southwesterly vertical wind shear in excess of 40 kt stripped away all of the cyclone's deep convection. The remnant low, now located about 45 n mi west of Punta Eugenia, turned eastward and made landfall along the northwestern coast of Baja California Sur just north of Guerrero Negro at around 1700 UTC 8 October. The remnant circulation of Simon then moved southeastward and dissipated over the rugged terrain of central Baja California Sur by early on 9 October.

METEOROLOGICAL STATISTICS

Observations in Simon (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 of the NOAA WP-3D "Hurricane Hunters" research aircraft. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Tropical Rainfall Measuring Mission (TRMM) and Global Precipitation Measurement (GPM) mission, 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 Simon.

NOAA Hurricane Hunter aircraft conducted two reconnaissance missions into Hurricane Simon on 4 and 5 October, which resulted in four center fixes. However, these flights occurred several hours before and after Simon is estimated to have achieved its peak intensity.

Winds and Pressure

Simon's estimated peak intensity of 115 kt at 0000 UTC 5 October is based on a satellite intensity estimate of T6.0/115 kt from TAFB and a coincident satellite intensity estimate of T6.1/117 kt from UW-CIMSS ADT. The estimated minimum pressure of 946 mb at 0000 UTC 5 October is based on a blend of pressure estimates obtained from the Knaff-Zehr-Courtney (KZC) pressure-wind relationship and the Dvorak pressure-wind relationship associated with a satellite estimate of T6.1/117 kt from the UW-CIMSS ADT.

As Simon made its closest approach to Socorro Island, a Mexican Navy automated surface observing site (elevation 35 m) measured a west-northwesterly 15-minute average wind

of 43 kt and a gust to 60 kt at 2200 UTC 3 October. A concurrent minimum pressure of 987.8 mb was also measured at the site.

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

Rainfall and Flooding

Due to the rapid erosion of Simon's convection before the cyclone made landfall along the northwestern coast of Baja California Sur, rainfall amounts were generally less than 2 inches, which significantly reduced the threat for flash flooding.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Simon was well forecast, especially in the medium range (Table 3). The precursor disturbance was introduced into the Tropical Weather Outlook (TWO) with a 20% (low) chance of formation in five days 138 h prior to genesis. The system was assessed as having a medium chance (30%-50%) of development nearly five days before genesis occurred, with a high chance ($\geq 60\%$) of development indicated four days in advance. The system was assessed as having a 48-h genesis probability of $<30\%$ at least 96 h in advance of formation. The TWO probabilities were increased to the medium chance and high chance categories 42 h and 24 h, respectively, before tropical cyclone formation occurred.

A verification of NHC official track forecasts (OFCL) for Simon is given in Table 4a. Official forecast track errors at 12-48 h and at 120 h were lower than the mean official errors for the previous 5-yr period. OFCL errors at 72 and 96 h were slightly higher than the 5-yr means, which was due to Simon taking a more westward track than some of the earlier forecasts had indicated. A homogeneous comparison of the official track errors with selected guidance models is given in Table 4b. OFCL forecasts outperformed all of the available model guidance at 24 h. In general, however, the OFCL forecast were comparable to or slightly worse than most of the model guidance at the other forecast time periods.

A verification of NHC official intensity forecasts (OFCL) for Simon is given in Table 5a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period at 96 and 120 h. However, OFCL forecast were higher than the 5-yr means at 12-72 h, and especially at the 72-h period where errors were almost 40% higher than average. As is often the case, the greater-than-average intensity errors were the result of (a) underforecasting the peak intensity by not anticipating the rapid intensification period and (b) not anticipating the rapid weakening trend that immediately followed after the peak intensity was achieved. Although NHC forecasts missed the magnitude of the peak intensity that occurred at 0000 UTC 5 October, the



timing of the peak intensity (approximately 0300-0600 UTC 5 October), was forecast quite well (Fig. 6). A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 5b. In general, OFCL intensity forecasts were comparable to or outperformed all available forecast guidance at all times with only a few minor exceptions.

Watches and warnings associated with Simon are given in Table 6.

Table 1. Best track for Hurricane Simon, 1-7 October 2014.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
30 / 1200	14.7	100.1	1008	25	low
30 / 1800	15.2	100.9	1007	25	"
01 / 0000	15.7	101.6	1005	25	"
01 / 0600	16.2	102.4	1005	25	"
01 / 1200	16.7	103.2	1005	25	"
01 / 1800	17.1	104.0	1004	25	tropical depression
02 / 0000	17.5	104.8	1003	30	"
02 / 0600	17.9	105.7	1002	35	tropical storm
02 / 1200	18.1	106.6	1002	35	"
02 / 1800	18.2	107.4	1000	40	"
03 / 0000	18.2	108.0	999	45	"
03 / 0600	18.3	108.6	999	45	"
03 / 1200	18.4	109.3	998	50	"
03 / 1800	18.7	110.2	995	55	"
04 / 0000	19.0	111.2	985	65	hurricane
04 / 0600	19.3	112.2	978	75	"
04 / 1200	19.8	113.4	969	90	"
04 / 1800	20.3	114.6	950	105	"
05 / 0000	21.0	115.6	946	115	"
05 / 0600	21.8	116.4	957	100	"
05 / 1200	22.4	117.0	968	90	"
05 / 1800	23.1	117.5	978	70	"
06 / 0000	23.6	117.6	986	60	tropical storm
06 / 0600	24.2	117.6	992	55	"
06 / 1200	24.8	117.6	996	50	"
06 / 1800	25.4	117.6	997	45	"
07 / 0000	26.0	117.6	1000	40	"
07 / 0600	26.6	117.3	1001	40	"
07 / 1200	27.1	116.8	1002	35	"



07 / 1800	27.6	116.4	1002	35	"
08 / 0000	27.9	115.9	1003	30	low
08 / 0600	28.1	115.3	1004	30	"
08 / 1200	28.3	114.6	1005	25	"
08 / 1800	28.2	114.0	1006	25	"
09 / 0000	27.7	113.4	1007	20	"
09 / 0600					dissipated
05 / 0000	21.0	115.6	946	115	minimum pressure and maximum intensity

Table 2. Selected ship reports with winds of at least 34 kt for Hurricane Simon, 1-7 October 2014.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
06 / 0500	C6RN3	25.8	113.7	090 / 44	1011.0
06 / 0600	C6RN3	25.6	113.5	090 / 38	1011.0

Table 3. Number of hours in advance of formation of Simon 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%)	96	138
Medium (30%-50%)	42	114
High (>50%)	24	96

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Simon. 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	17.2	23.7	38.0	54.7	112.8	141.5	155.5
OCD5	32.2	67.1	111.8	164.9	246.5	251.3	207.9
Forecasts	23	21	19	17	13	9	5
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 4b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Simon. 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	14.4	16.3	37.7	60.9	132.2	173.4	
OCD5	34.1	79.7	137.2	194.2	282.7	319.8	
GFSI	21.7	28.3	41.7	74.2	136.1	215.2	
GHMI	22.4	38.9	66.6	86.6	123.3	269.7	
HWFI	21.2	26.1	47.5	74.3	139.2	209.1	
EGRI	12.3	17.6	35.7	62.6	143.6	146.5	
EMXI	14.5	24.6	47.8	74.9	195.6	363.7	
CMCI	20.8	36.2	63.2	103.7	177.4	161.3	
TCON	15.4	20.0	37.5	56.6	110.6	175.5	
TVCE	12.9	17.4	38.0	56.5	114.5	151.7	
FSSE	13.6	16.3	33.7	51.6	118.6	144.9	
AEMI	20.5	22.9	33.2	58.0	136.0	204.7	
BAMS	25.8	52.7	73.3	84.9	107.9	214.4	
BAMM	21.7	33.5	50.7	82.1	150.1	178.1	
BAMD	34.3	46.8	77.8	123.8	228.5	341.9	
Forecasts	15	13	12	11	7	3	

Table 5a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Simon. 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	7.0	11.4	14.5	16.8	20.8	13.3	4.0
OCD5	11.2	19.0	23.3	27.3	25.2	13.0	3.0
Forecasts	23	21	19	17	13	9	5
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 5b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Simon. 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	7.8	13.1	16.7	17.7	16.5	12.5	5.0
OCD5	12.6	21.6	25.6	26.5	16.4	10.5	2.5
HWFI	9.2	14.6	17.7	20.7	17.7	18.8	25.0
GHMI	12.2	20.4	23.6	23.7	17.1	11.3	17.0
DSHP	10.8	17.6	19.9	21.8	24.0	22.2	17.0
LGEM	10.3	16.7	21.3	25.2	19.9	9.8	4.5
ICON	9.7	16.0	19.5	20.9	18.9	13.3	7.5
IVCN	9.7	16.0	19.5	20.9	18.9	13.3	7.5
FSSE	9.5	13.8	16.3	18.6	16.4	13.0	8.5
GFSI	12.1	22.3	28.1	32.6	27.7	23.3	14.0
EMXI	13.9	26.4	35.5	40.8	30.2	13.5	2.5
Forecasts	18	16	15	13	10	6	2



Table 6. Watch and warning summary for Hurricane Simon, 1-7 October 2014.

Date/Time (UTC)	Action	Location
6 / 2100	Tropical Storm Watch issued	Punta Abreojos to Punta Eugenia
7 / 2100	Tropical Storm Watch discontinued	Punta Abreojos to Punta Eugenia

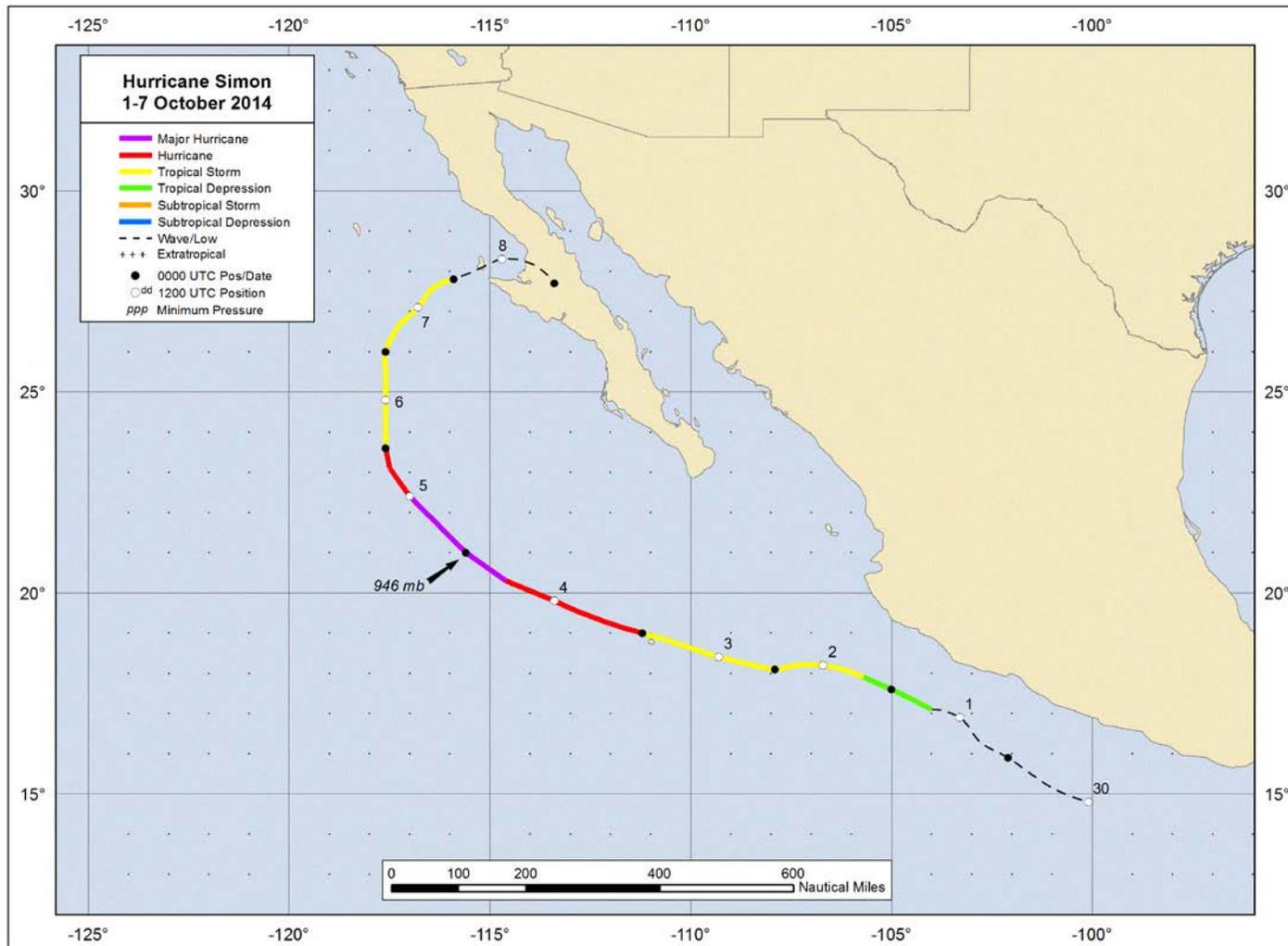


Figure 1. Best track positions for Hurricane Simon, 1-7 October 2014. Tracks during the post-tropical stage are partially based on analyses from the NOAA Tropical Analysis and Forecast Branch.

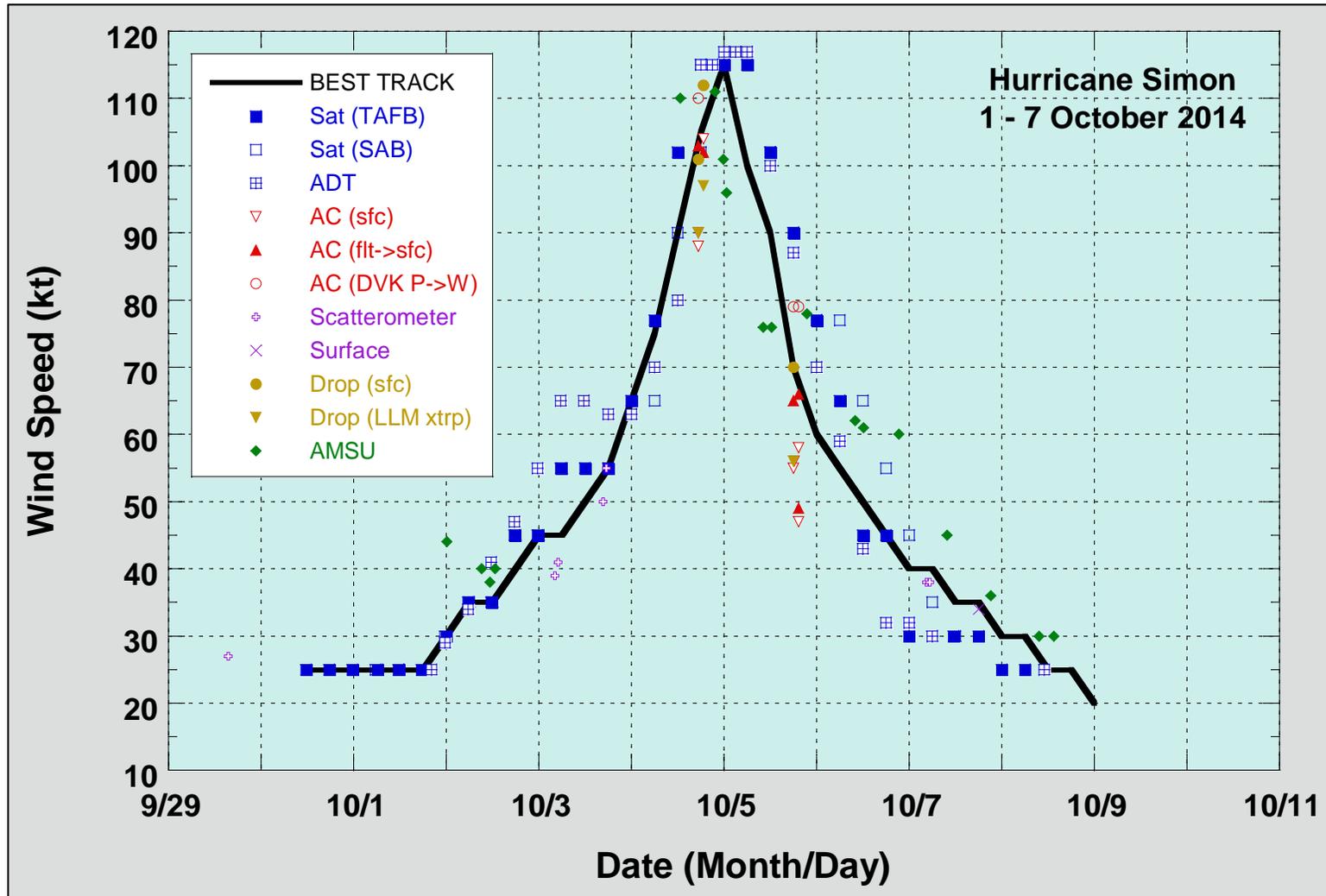


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Simon, 1-7 October 2014. Aircraft observations have been adjusted for elevation using a 90% adjustment factor for observations from 700 mb. Dropwindsonde observations include actual 10 m winds (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.

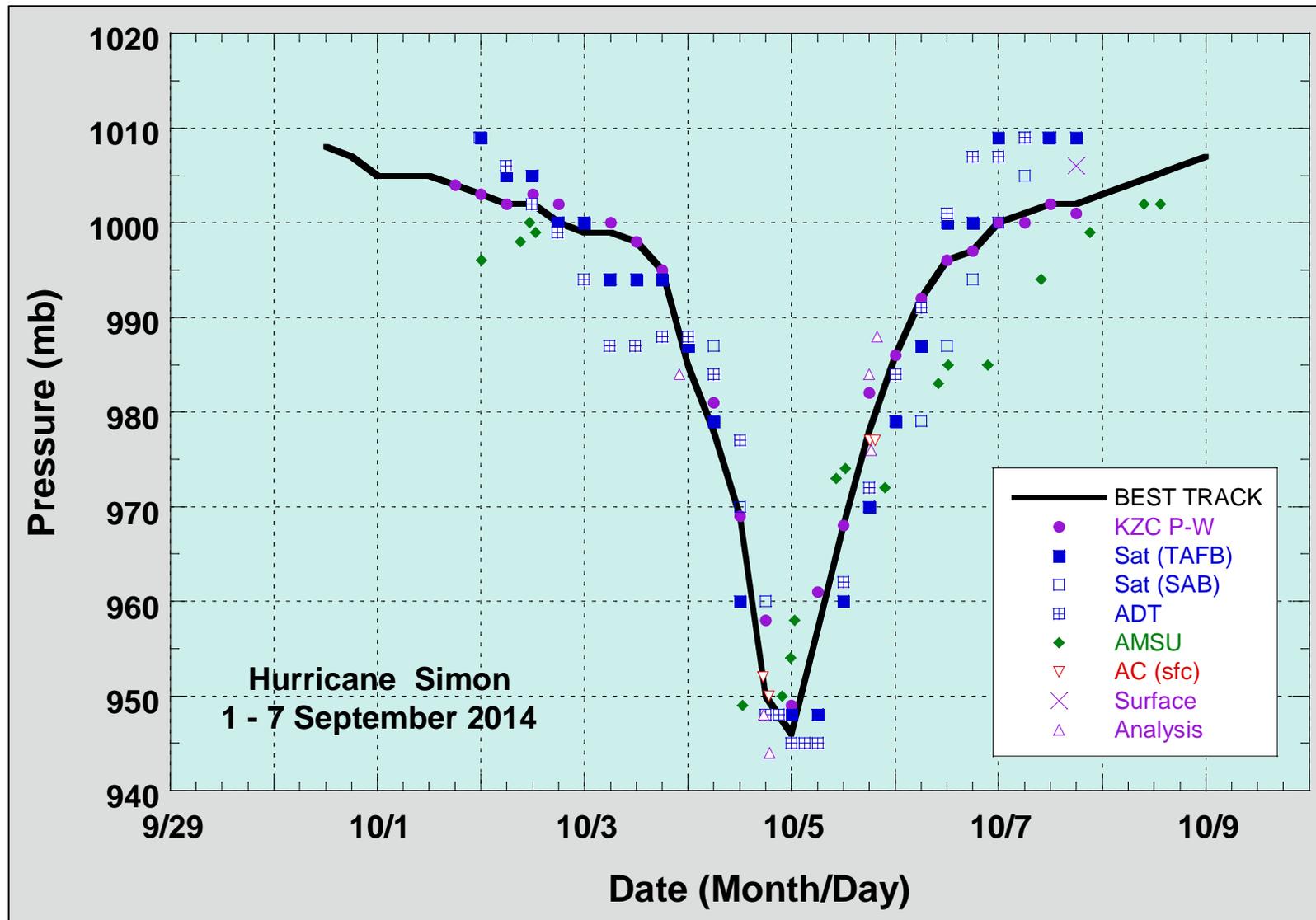


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Simon, 1-7 October 2014. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological 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.

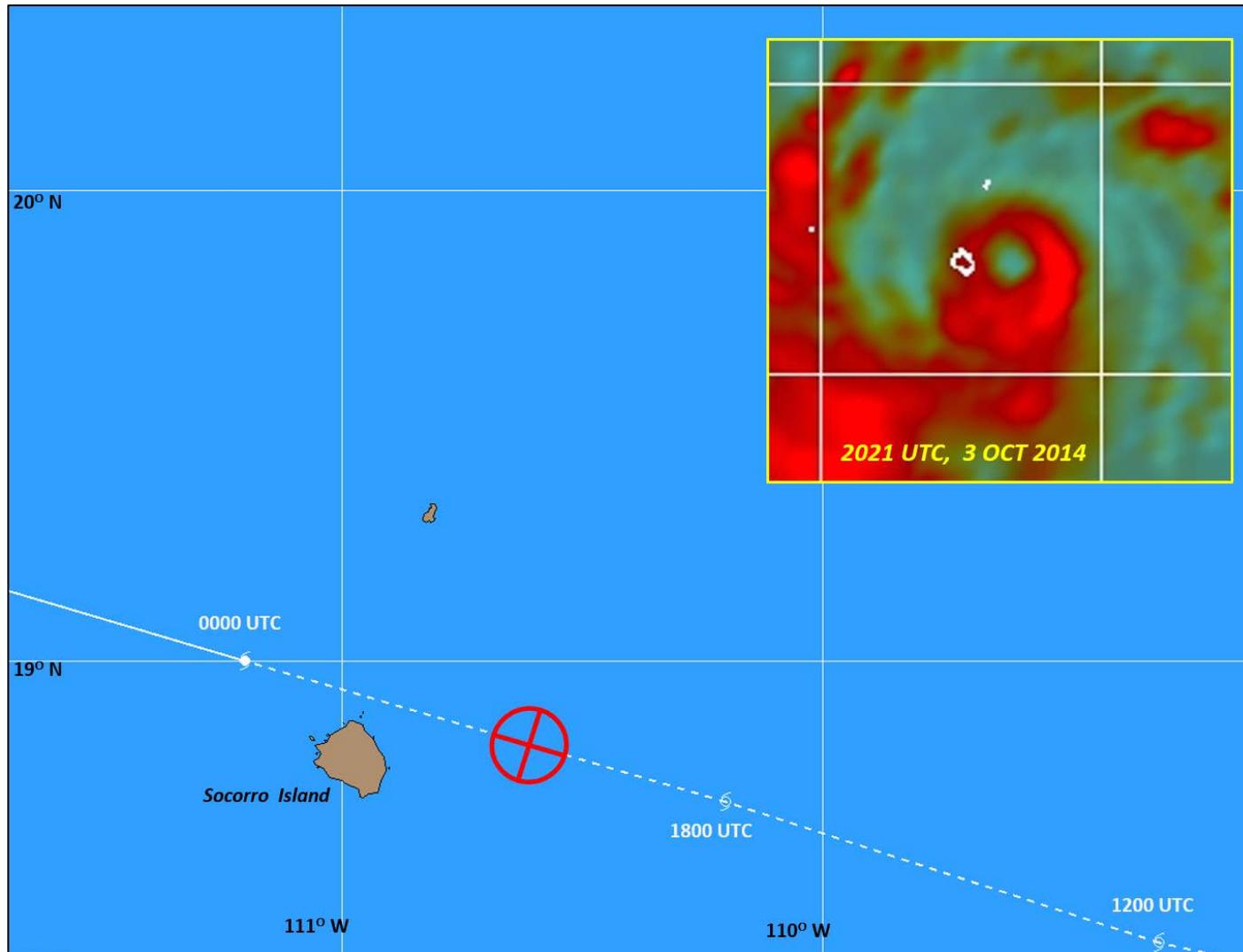


Figure 4. Track of Hurricane Simon during its passage just to the north of Socorro Island on 3 October. NASA Global Precipitation Measurement (GPM) microwave satellite image at 2021 UTC 3 October (inset) shows the small eye of the compact tropical cyclone when Simon was located about 20 n mi east of Socorro Island (red circled-X). Simon made its closest approach to the island a couple of hours later at around 2230 UTC, producing a sustained wind of 43 kt with a gust to 60 kt. (inset microwave image courtesy of U.S. Naval Research Laboratory)

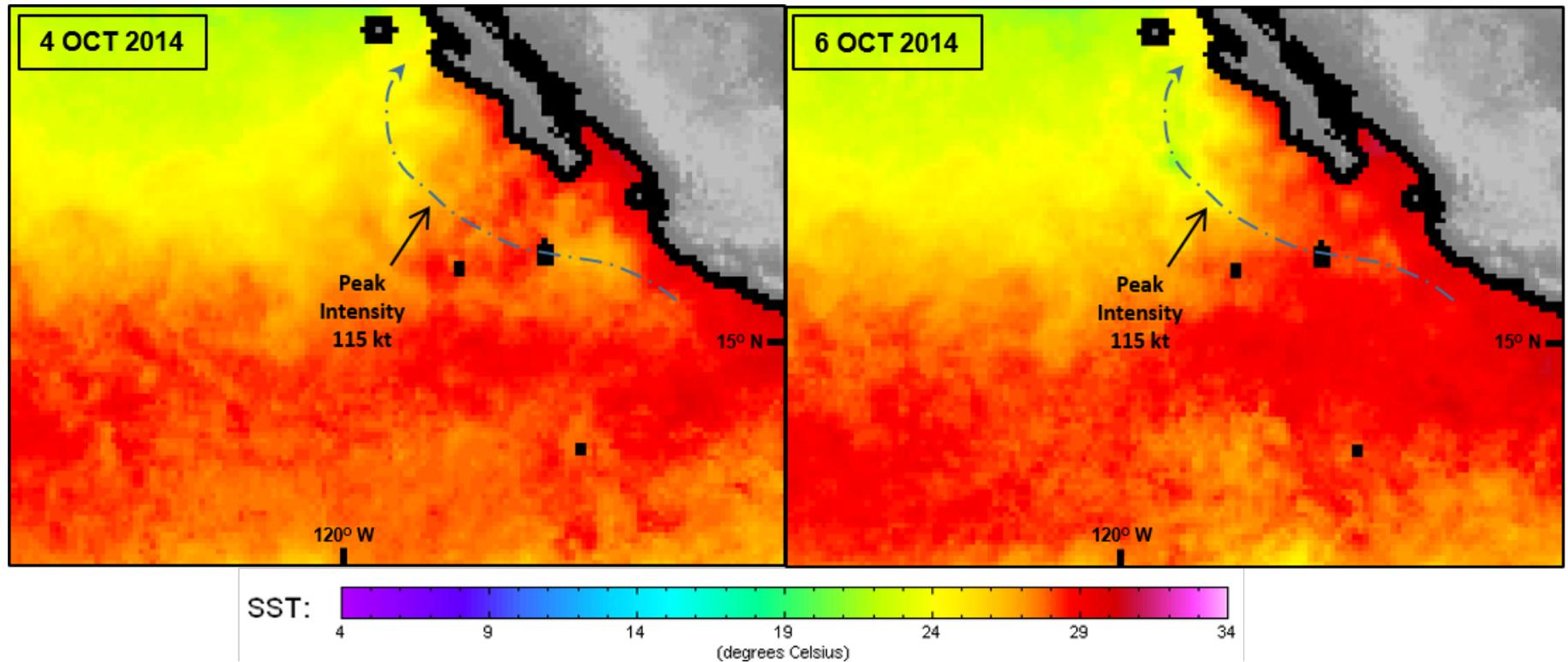


Figure 5. Sea-Surface temperature (SST) analyses valid at 1200 UTC on 4 October (left panel) and 6 October (right panel), respectively. Cold upwelling/mixing of at least 4°C (yellow and green shaded areas) induced by Hurricane Simon's wind field can be seen along the storm track, especially just to the northwest of the location where the peak intensity of 115 kt occurred at 0000 UTC 5 October 2014. (Images courtesy of REMSS, Santa Rosa, CA)

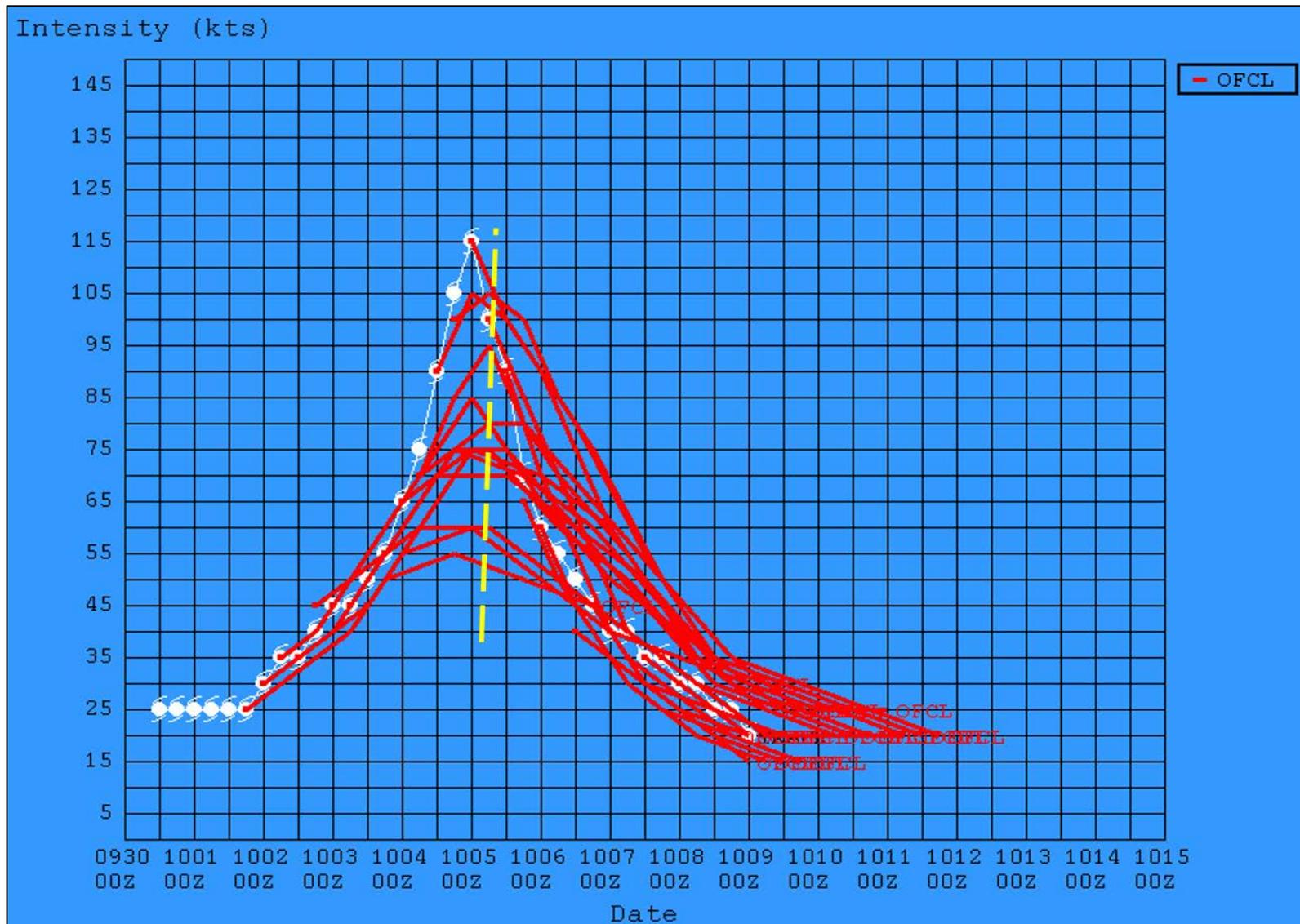


Figure 6. Plot of NHC official intensity forecasts (OFCL) for Hurricane Simon from 1800 UTC 1 October to 1800 UTC 7 October 2014. Although NHC underforecast the peak intensity of 115 kt, the timing of the peak intensity (dashed yellow line) was forecast quite well.