

Tropical Cyclone Report
Hurricane Calvin
(EP032011)
7-10 July 2011

Stacy R. Stewart
National Hurricane Center
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Calvin was a short-lived category 1 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that remained over the open waters of the eastern North Pacific Ocean throughout its lifetime.

a. Synoptic History

The tropical wave that spawned Hurricane Calvin emerged from Africa on 24 June. Thunderstorm activity was limited as the wave moved westward over the tropical Atlantic and northern South America for the next nine days, and only began to slowly increase after the system reached Central America on 3 July. A weak low pressure system embedded within the eastern North Pacific inter-tropical convergence zone produced minimal shower activity over the Gulf of Tehuantepec until the wave merged with the low on 5 July and added energy to the disturbance. On 6 July, thunderstorm activity began to increase and Dvorak satellite classifications were initiated on the system by the NOAA Tropical Analysis and Forecast Branch. Over the next 24 h, the low gradually became better defined and convection continued to increase near the low-level circulation center. By 1200 UTC 7 July, thunderstorm activity had become sufficiently organized for the system to be designated as a tropical depression centered about 150 n mi southwest of Acapulco, 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 1¹.

The depression moved west-northwestward on a path parallel to the southwestern coast of Mexico, which kept the center of the cyclone well offshore. Despite moderate easterly vertical wind shear of 15-20 kt, the depression steadily intensified and reached tropical storm status by 0000 UTC 8 July, when it was located about 150 n mi west-southwest of Zihuatanejo, Mexico. Over the course of the next 24 h, the vertical shear gradually decreased, which allowed Calvin to rapidly strengthen. The cyclone became a hurricane just 18 h later at 1800 UTC 8 July, and possessed a well-defined mid-level eye in passive microwave imagery (Fig. 4). Calvin reached its peak intensity of 70 kt shortly after that at 0000 UTC 9 July (Fig. 5), when the hurricane was located about 300 n mi southwest of Manzanillo, Mexico.

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

Almost as quickly as Calvin strengthened, however, the cyclone weakened. After reaching its peak intensity, the hurricane began a rapid weakening phase for the next 24 h as it moved over lower sea-surface temperatures, despite the very favorable upper-level shear conditions. Calvin became a tropical storm around 1200 UTC 9 July – just 12 h after reaching its peak intensity. By 0600 UTC 10 July, when Calvin was located about 355 n mi south-southwest of Cabo San Lucas, Mexico -- or about 130 n mi southeast of Clarion Island -- the cyclone had degenerated into a 35-kt non-convective remnant low pressure system. The remnant low moved slowly west-northwestward for the next two days over the open ocean before turning abruptly southwestward early on 13 July. The low finally dissipated by 0600 UTC 14 July about 675 n mi west-southwest of Cabo San Lucas.

b. Meteorological Statistics

Observations in Calvin (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 Dvorak estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Data and imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM) and Aqua, 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 Calvin.

No ship reports of tropical-storm-force winds associated with Calvin were received. However, the center of the remnant low pressure system passed over Clarion Island, Mexico (WMO 76639; 19.34°N 114.74°W) at around 1830 UTC 10 July. Prior to the low's passage over the island, a wind gust to 39 kt was observed at 1415 UTC. After the remnant low had passed to the west of Clarion Island, it produced a 10-min average wind speed of 32 kt with a gust to 37 kt at 2215 UTC.

c. Casualty and Damage Statistics

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

d. Forecast and Warning Critique

The genesis of Hurricane Calvin was reasonably well anticipated. The low pressure system that eventually became Calvin was first introduced to the eastern North Pacific Tropical Weather Outlook (TWOEP) with a "low" (0 to 20%) chance of formation 84 h before genesis occurred. However, just 18 h later the system was dropped from the TWOEP product, which was the correct decision since Calvin did not develop for another three days. The disturbance was re-introduced with a "low" (0 to 20%) chance of formation 42 h before genesis occurred. The genesis predictions reached the "medium" category (between 30-50%) 30 h before formation, and the genesis probability reached the "high" (>50% percent) category 18 h before the cyclone developed.

A verification of NHC official track forecasts for Calvin is given in Table 2a. A homogeneous comparison of the official track errors with selected guidance models is given in Table 2b. Due to the rather small sample size of forecasts, a meaningful assessment and comparison between the NHC official forecasts (OFCL) and available model guidance is difficult. However, the official forecast track errors overall were comparable to the mean official errors for the previous 5-year period through 36 h, but were double the average errors at 48 h. In comparison to the available track guidance models, the European Center for Medium Weather Forecasting (EMXI), NOAA Global Forecast System (GFSI), NOAA GSF ensemble (AEMI) models significantly outperformed the OFCL track forecasts at all time periods.

A verification of NHC official intensity forecasts for Calvin is given in Table 3a. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 3b. The OCD5 climatological errors were larger than the previous 5-year average throughout the forecast period, especially at 24 and 36 h where the errors were more than double the 5-year average. This suggests that Calvin's intensity was more difficult than usual to forecast. Official forecast intensity errors were comparable to or better than the mean official errors for the previous 5-year average, especially at 48 h where the official intensity errors were more than 50% lower than average. In comparison to the available intensity guidance models, the OFCL significantly outperformed all of the available intensity model guidance at all time periods, except at 48 h where it was bested by the Florida State Superensemble (FSSE) model, and the consensus models IVCN and ICON.

There were no watches and warnings associated with Calvin.

Table 1. Best track for Hurricane Calvin, 7-10 July 2011.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
07 / 0000	13.6	99.1	1006	25	low
07 / 0600	14.3	100.2	1006	25	"
07 / 1200	14.8	101.4	1005	30	tropical depression
07 / 1800	15.3	102.6	1004	30	"
08 / 0000	15.7	103.9	1003	35	tropical storm
08 / 0600	16.0	105.4	1000	45	"
08 / 1200	16.3	106.9	997	55	"
08 / 1800	16.5	108.1	987	65	hurricane
09 / 0000	16.7	109.1	984	70	"
09 / 0600	16.9	110.0	987	65	"
09 / 1200	17.1	110.8	994	55	tropical storm
09 / 1800	17.3	111.6	1000	40	"
10 / 0000	17.5	112.4	1001	35	"
10 / 0600	17.8	113.1	1001	35	remnant low
10 / 1200	18.0	113.8	1001	35	"
10 / 1800	18.2	114.5	1002	35	"
11 / 0000	18.4	115.2	1002	35	"
11 / 0600	18.7	115.8	1003	35	"
11 / 1200	18.9	116.5	1004	30	"
11 / 1800	19.1	117.0	1005	25	"
12 / 0000	19.3	117.5	1005	25	"
12 / 0600	19.3	118.1	1006	20	"
12 / 1200	19.1	118.5	1006	20	"
12 / 1800	18.8	118.9	1006	20	"
13 / 0000	18.6	119.3	1006	20	"
13 / 0600	18.3	119.6	1006	20	"
13 / 1200	18.0	119.9	1007	20	"
13 / 1800	17.6	120.1	1008	15	"
14 / 0000	17.2	120.2	1008	15	"
14 / 0600					dissipated
09 / 0000	16.7	109.1	984	70	minimum pressure and maximum wind

Table 2a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Calvin. Mean errors for the 5-yr period 2006-10 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	26.0	51.3	72.8	115.3			
OCD5	38.8	75.6	89.4	62.5			
NF	9	7	5	3			
OFCL (2006-10)	29.7	49.9	69.0	86.6			
OCD5 (2006-10)	38.4	74.8	115.3	155.9			

Table 2b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Calvin. 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	23.2	43.2	59.0	128.9			
OCD5	32.5	67.4	103.0	85.2			
EMXI	17.9	21.7	29.7	45.4			
GFSI	23.6	39.8	38.7	33.8			
UKMI	30.6	56.8	85.3	180.0			
NGPI	29.9	57.6	76.4	142.4			
GHMI	37.2	83.2	141.3	308.1			
HWFI	52.4	93.3	130.2	242.1			
GFNI	25.8	57.0	125.7	257.9			
AEMI	23.0	36.7	40.0	29.2			
CMCI	40.5	63.1	63.3	155.4			
FSSE	19.7	43.4	68.9	159.7			
TVCA	18.8	41.4	68.6	170.7			
TVCE	18.8	41.6	65.1	162.3			
TVCC	21.3	42.8	68.8	154.3			
LBAR	29.5	83.9	137.4	141.0			
BAMD	34.4	54.5	63.3	54.2			
BAMM	34.4	59.1	61.2	66.2			
BAMS	40.2	77.1	100.3	186.1			
NAMI	40.7	73.9	84.5	145.7			
Forecasts	7	5	3	1			

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Calvin. Mean errors for the 5-yr period 2006-10 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	7.8	10.7	11.0	6.7			
OCD5	11.8	23.1	21.6	8.7			
Forecasts	9	7	5	3			
OFCL (2006-10)	6.3	10.5	13.7	15.1			
OCD5 (2006-10)	7.3	11.9	15.3	17.6			

Table 3b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Calvin. 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	8.6	11.0	8.3	10.0			
OCD5	13.7	25.4	22.3	12.0			
LGEM	13.4	23.8	21.0	14.0			
DSHP	13.3	23.4	25.7	25.0			
HWFI	10.1	13.0	11.3	13.0			
GHMI	10.9	18.6	14.3	10.0			
GFNI	11.4	16.0	10.7	11.0			
FSSE	10.1	15.0	14.3	8.0			
ICON	11.6	17.0	13.7	4.0			
IVCN	11.4	15.8	12.3	1.0			
Forecasts	7	5	3	1			

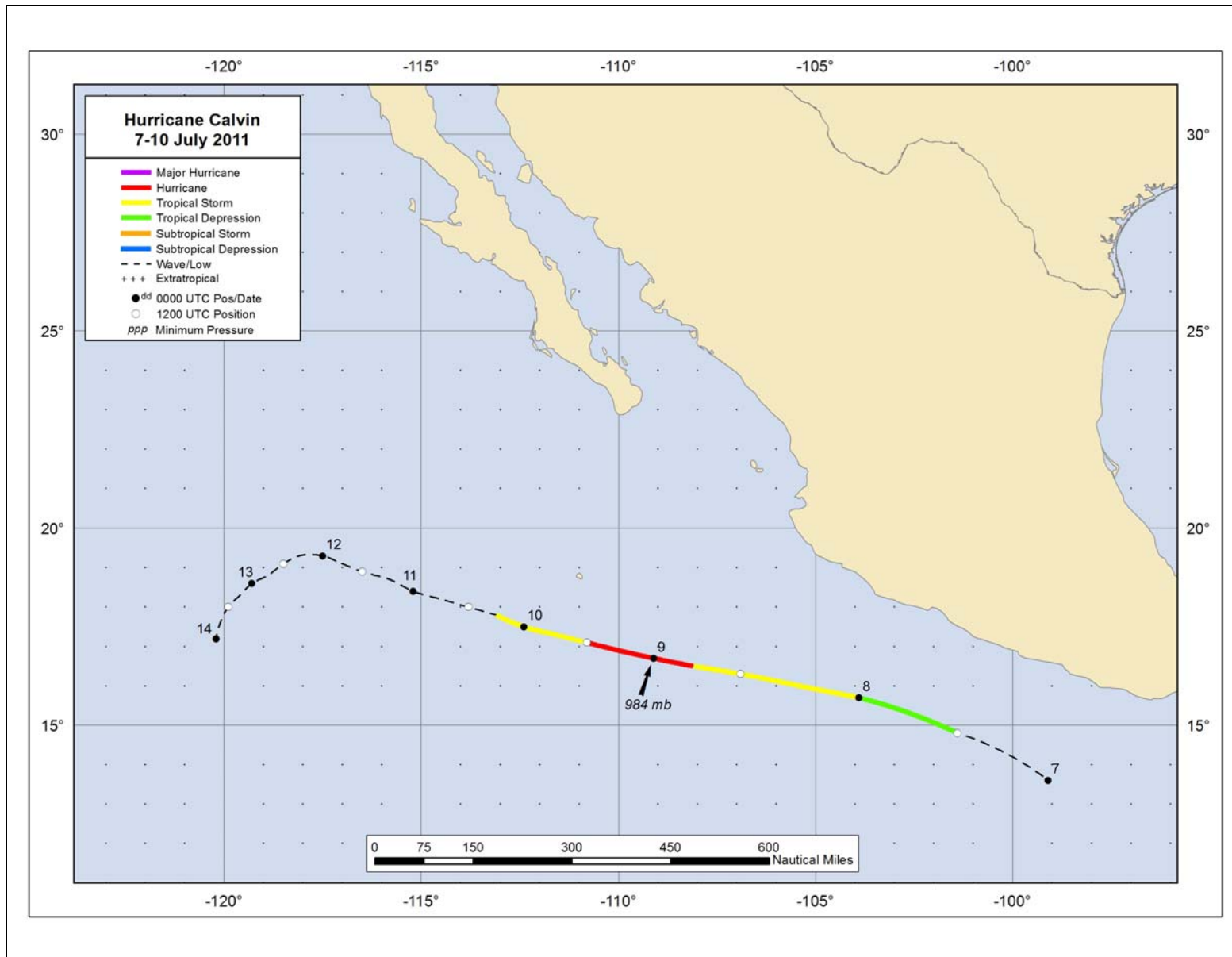


Figure 1. Best track positions for Hurricane Calvin, 7-10 July 2011.

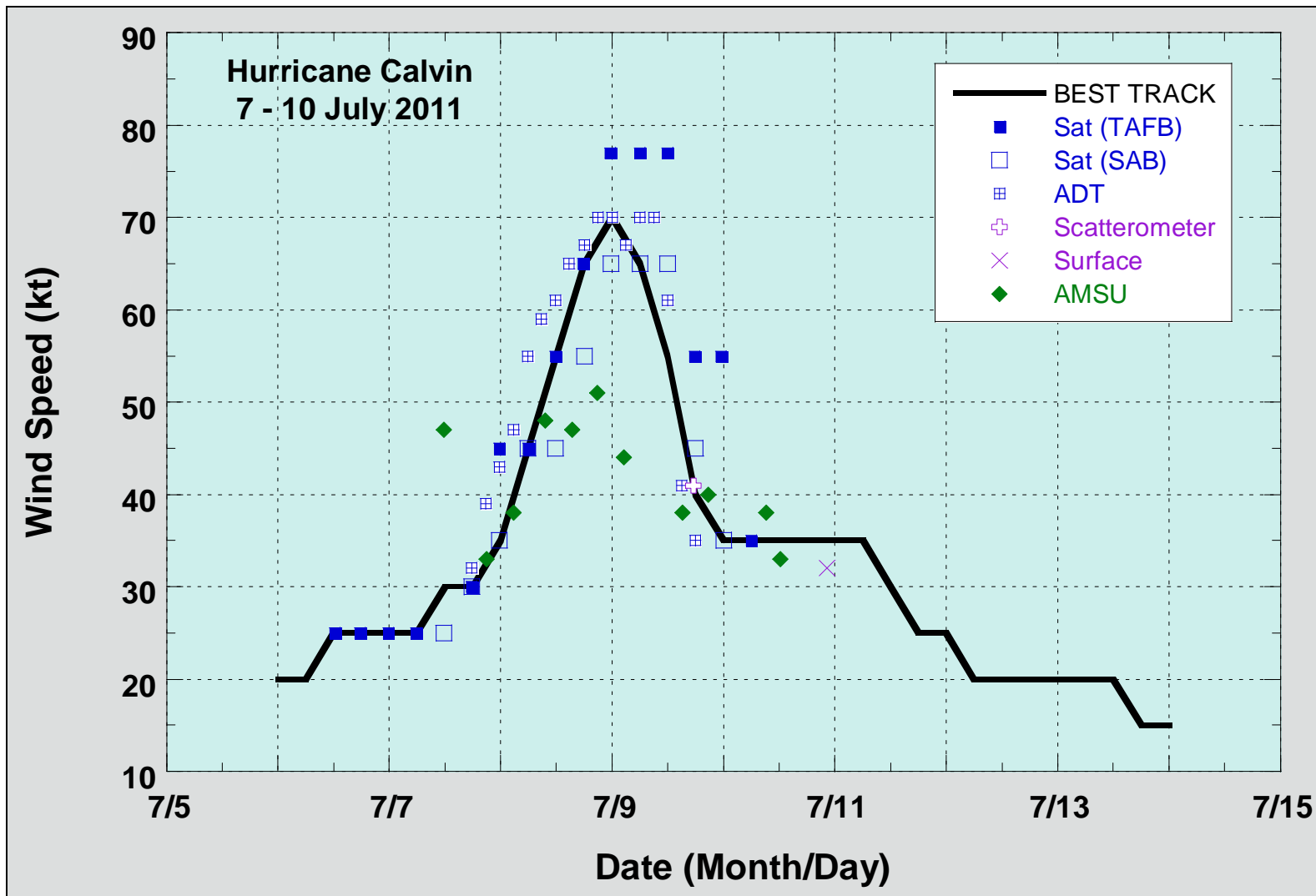


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Calvin, 7-10 July 2011. Advanced Dvorak Technique estimates represent linear averages over a three-hour period centered on the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

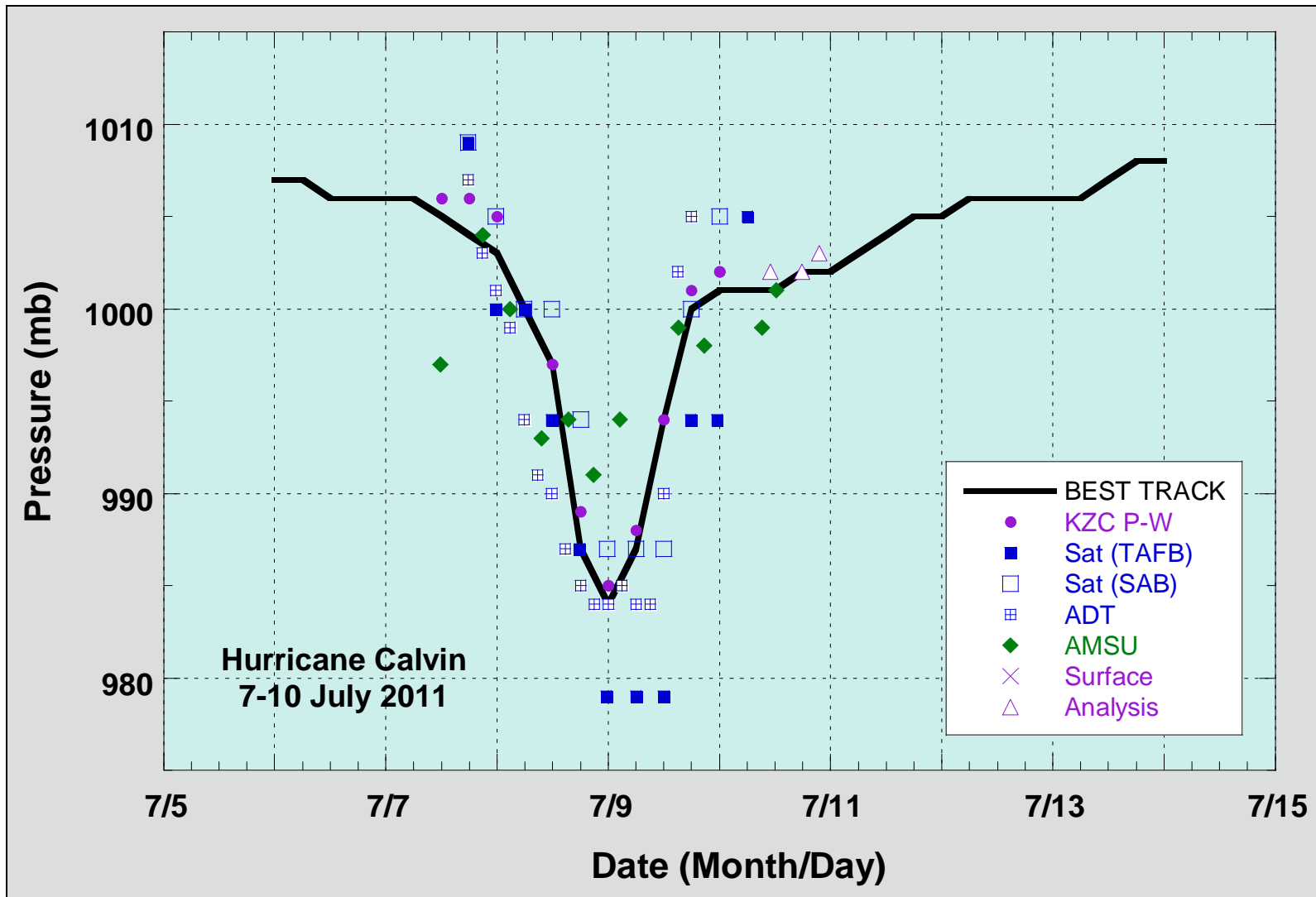


Figure 3. Selected pressure observations and best track minimum central pressure curve for Calvin, 7-10 July 2011. Advanced Dvorak Technique estimates represent linear averages over a three-hour period centered on the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W values are obtained by applying the Knaff-Zehr-Courtney pressure-wind relationship to the best track data. Dashed vertical lines correspond to 0000 UTC.

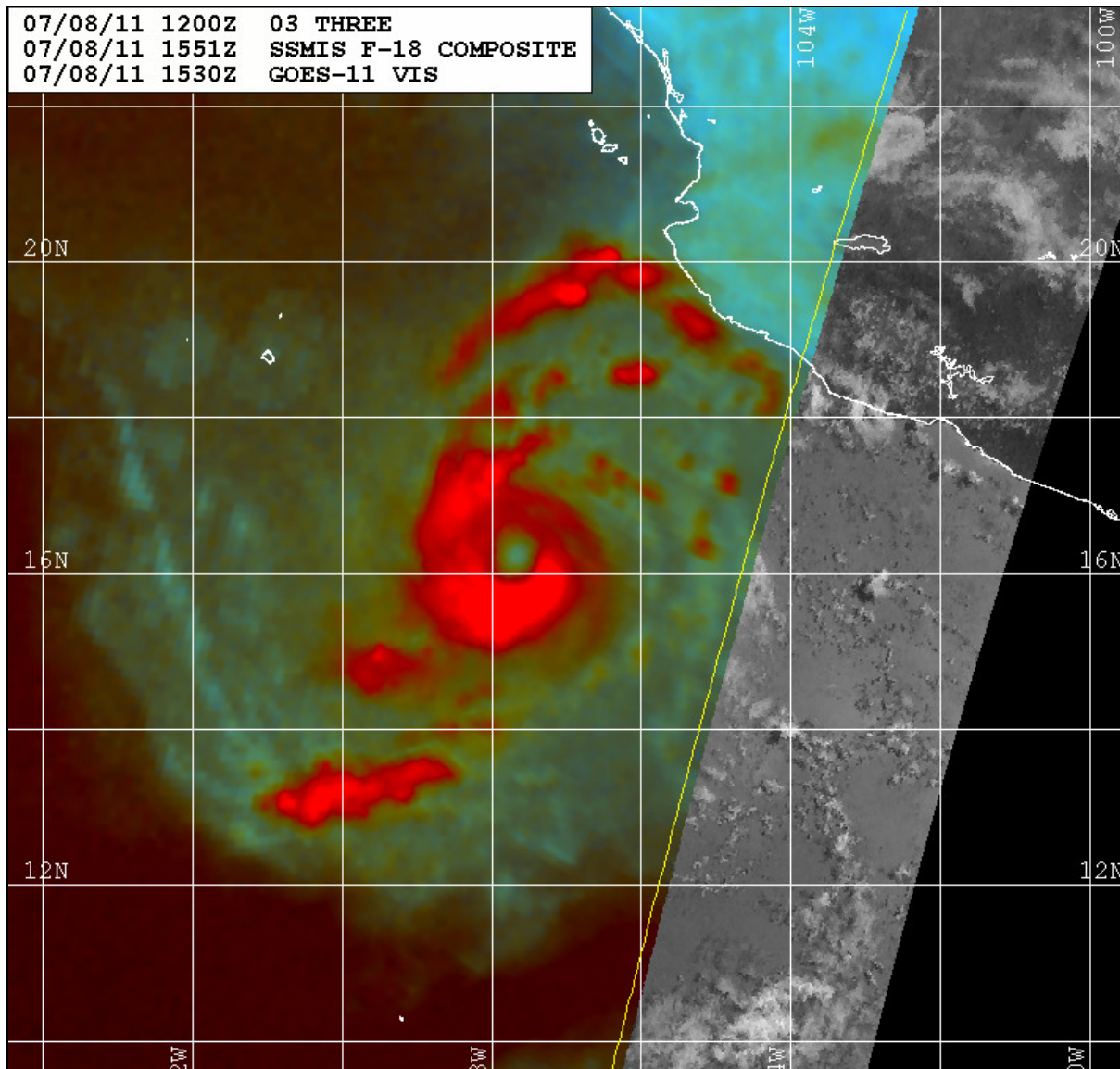


Figure 4. SSMIS/S 91GHz composite microwave satellite image at 1551 UTC 08 July 2011 depicting Calvin's well-defined mid-level eye feature. Image courtesy of the U.S. Navy Fleet Numerical Meteorology and Oceanography Center, Monterey, CA.

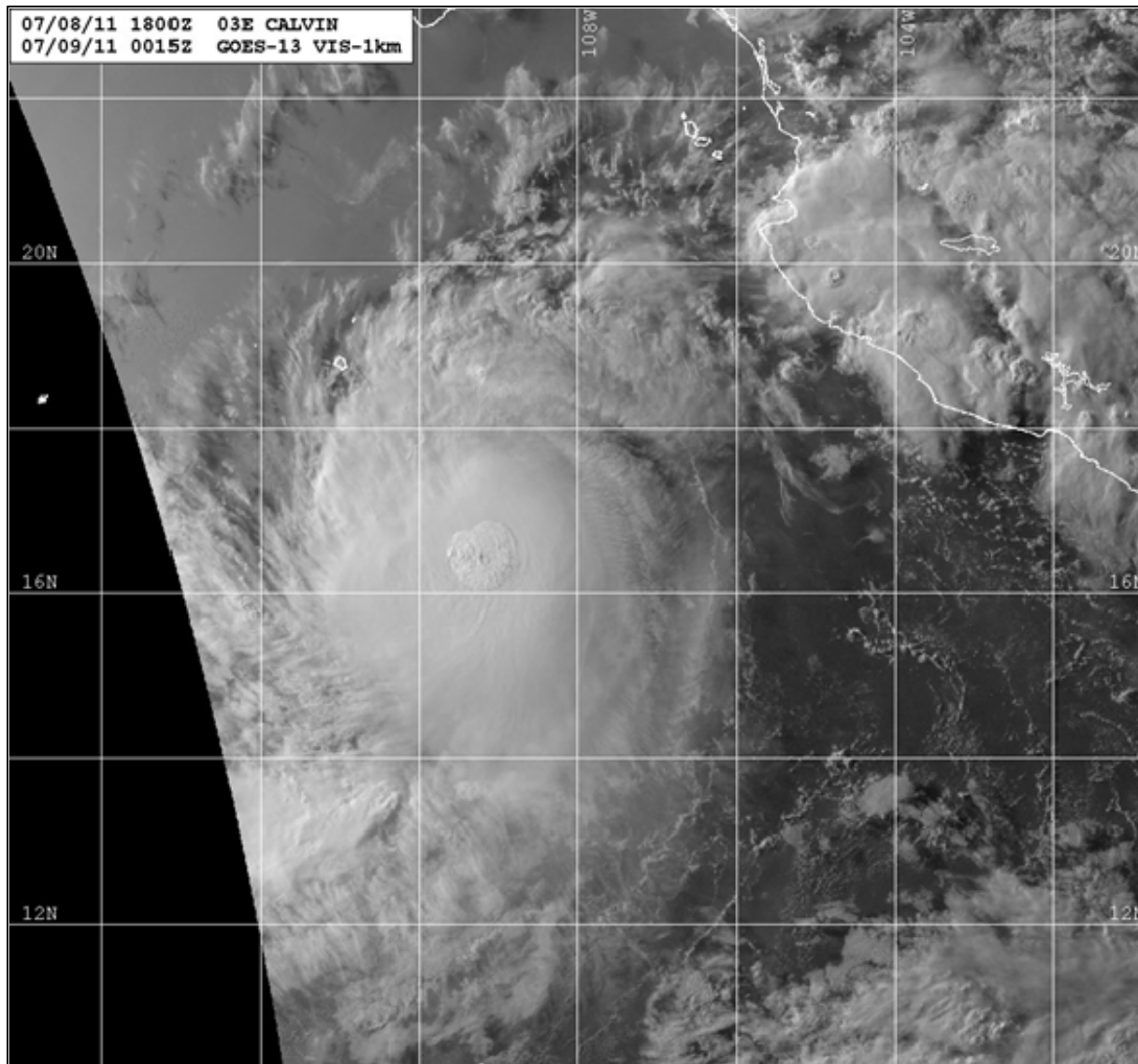


Figure 5. Hurricane Calvin near its peak intensity of 70 kt. Visible satellite image at 0015 UTC 09 July 2011 courtesy of the U.S. Navy Fleet Numerical Meteorology and Oceanography Center.