

Tropical Cyclone Report  
Hurricane Frank  
(EP092010)  
21-28 August 2010

Lixion A. Avila  
National Hurricane Center  
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Frank was a category one hurricane (on the Saffir-Simpson Hurricane Wind Scale) that moved very close and parallel to the southwestern coast of Mexico.

a. Synoptic History

The tropical wave that eventually became Frank was difficult to trace from the west coast of Africa. It was first identified on 15 August when a large area of showers, accompanied by a low-level cyclonic wind shift, was noted near the southern Windward Islands. Although the amount of convection fluctuated as the wave moved westward across the Caribbean Sea, satellite images showed that there were signs of a cyclonic circulation at the middle levels. Showers and thunderstorms increased a little as the wave crossed Central America on 19 August, but the activity did not become concentrated until the morning of 21 August over the Gulf of Tehuantepec as an area of low pressure gradually became better defined. The system developed curved convective bands while the thunderstorm activity increased near a circulation center, and it is estimated that a tropical depression formed from this system at 1800 UTC 21 August about 180 n mi southeast of Salina Cruz, 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 1<sup>1</sup>.

The depression drifted westward embedded within weak steering currents, with no significant change in structure for a day. The cloud pattern gradually became better organized, and satellite intensity estimates from the Tropical Analysis and Forecast Branch and the Satellite Analysis Branch indicated that the depression became a tropical storm at 1200 UTC 22 August. Frank began to move westward at about 6 knots on a track parallel to the coast of Mexico with some increase in intensity. However, strong northeasterly shear eroded the convection, and the cyclone weakened on 23 August. There was a resurgence of the thunderstorm activity during 24 August and gradual improvement in the cloud pattern. An AMSR-E 36 GHz image at 0834 UTC 25 August showed a closed ring of convection resembling an eyewall, and the ring was later observed on a TRMM pass at 1718 UTC. It is estimated that Frank became a hurricane at 1200 UTC 25 August. The eye was visible intermittently on conventional imagery during the next day or so, but additional microwave data showed that the eye persisted under the cirrus canopy. Frank reached its peak intensity of 80 knots at 1800 UTC 26 August when located about 300 n

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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.

mi south of the southern tip of Baja California. At that time, visible satellite images and microwave data clearly showed a small but distinct eye embedded within a circular area of deep convection (Fig. 4). A couple of hours later, the cloud pattern quickly deteriorated, and the eye observed earlier was no longer evident, indicating that the weakening process had begun. Frank moved toward the northwest and lost all its associated convection when it reached cooler waters and encountered high shear. It became a remnant low at 1800 UTC 28 August about 200 n mi southwest of the southern tip of Baja California.

b. Meteorological Statistics

Observations in Frank (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB). Data and imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the European Space Agency's Advance Scatterometer (ASCAT) and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also extremely useful in constructing the best track of Frank. The microwave data were even more useful in Frank since the cloud pattern observed on conventional imagery was shapeless at times, giving the impression of a weaker cyclone than was suggested by microwave data.

An automatic weather observing site maintained by the Mexican Navy at Socorro Island reported a wind gust of 44 knots and a minimum pressure of 997.4 mb at 0315 UTC 27 August as Frank passed nearby. There were no ship reports of tropical-storm-force winds associated with Frank.

c. Casualty and Damage Statistics

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

d. Forecast and Warning Critique

The genesis of Frank was not well anticipated. The area of disturbed weather was first mentioned in the Tropical Weather Outlook (TWO) 24 hours before formation with only a low (10%) chance of becoming a tropical cyclone. During this period the convection associated with the disturbance was poorly organized. The probability of formation was increased to medium (30%) at 1200 UTC 21 August about 6 hours before genesis when the convection became concentrated and showed signs of development. In fact, the probability of formation was increased to 60% at 1800 UTC on that day when the post-analysis showed that the depression had already formed.

A verification of NHC official track forecasts for Hurricane Frank is given in Table 2a. Official forecast track errors were lower than the mean official errors for the previous five-year period for the 12-72 h period but a little higher at the 96 and 120 h forecast times. The climatology persistence model (OCD5) errors were lower than the previous five-year OCD5

average suggesting that Frank's track was less difficult to forecast than an average storm in the area. A homogeneous comparison of the official track errors with selected guidance models is shown in Table 2b. The Florida State Super Ensemble (FSSE) model as well as the multi-model consensus (TVCN) were the best performers and had lower errors than the official forecast at all times. The Geophysical Fluid Dynamic Model (GHMI) also performed better than the official forecast at all times except for 12 h.

A verification of NHC official intensity forecasts for Frank is given in Table 3a. Official forecast intensity errors were lower than the mean official errors for all periods except for 120 h when the error was the same as the average. The official forecasts exhibited skill over the climatology and persistence benchmark at all time periods. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 3b.

Frank moved very close to the southwest coast of Mexico for a few days. This required the issuance of watches and warnings, which are listed in Table 4.

Table 1. Best track for Hurricane Frank, 21-28 August, 2010.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
21 / 1800	13.9	93.3	1007	25	tropical depression
22 / 0000	13.8	93.8	1006	30	"
22 / 0600	13.8	94.4	1005	30	"
22 / 1200	13.8	95.0	1002	40	tropical storm
22 / 1800	13.9	95.7	1000	50	"
23 / 0000	14.0	96.4	998	50	"
23 / 0600	14.2	97.1	999	50	"
23 / 1200	14.5	98.0	1000	45	"
23 / 1800	14.8	98.9	1000	45	"
24 / 0000	15.0	99.7	1000	45	"
24 / 0600	15.2	100.5	997	50	"
24 / 1200	15.4	101.1	994	55	"
24 / 1800	15.6	101.8	992	55	"
25 / 0000	15.9	102.7	991	60	"
25 / 0600	16.2	103.6	989	60	"
25 / 1200	16.5	104.6	987	65	hurricane
25 / 1800	16.8	105.7	987	65	"
26 / 0000	17.1	106.9	984	70	"
26 / 0600	17.2	108.1	984	70	"
26 / 1200	17.4	109.0	981	75	"
26 / 1800	17.9	109.9	978	80	"
27 / 0000	18.2	110.9	981	75	"
27 / 0600	18.5	111.4	984	70	"
27 / 1200	18.7	111.8	987	65	"
27 / 1800	19.1	112.1	994	55	tropical storm
28 / 0000	19.6	112.5	999	45	"
28 / 0600	20.0	112.4	1005	35	"
28 / 1200	20.6	112.3	1005	30	tropical depression
28 / 1800	20.9	111.8	1007	25	remnant low
29 / 0000	20.8	111.3	1007	25	"
29 / 0600					dissipated
26 / 1800	17.9	109.9	978	80	minimum pressure

Table 2a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Frank, 21-28 August, 2010. Mean errors for the five-year period 2005-9 are shown for comparison. Official errors that are smaller than the five-year means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL (Frank)	<b>23.9</b>	<b>38.9</b>	<b>51.8</b>	<b>65.5</b>	<b>104.1</b>	158.9	204.4
OCD5 (Frank)	35.8	70.8	105.4	131.9	172.5	227.6	314.0
Forecasts	26	24	22	20	16	12	8
OFCL (2005-9)	30.8	51.5	71.6	89.6	120.9	155.0	192.0
OCD5 (2005-9)	38.9	75.3	115.7	155.8	226.9	275.1	321.5

Table 2b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Frank, 21-28 August, 2010. 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 2a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	22.9	37.9	49.7	55.1	84.4	123.5	158.0
OCD5	36.5	71.9	110.0	130.1	143.8	184.5	262.5
GFSI	36.5	70.6	102.2	132.8	229.7	243.7	353.4
GHMI	24.7	<b>31.8</b>	<b>39.9</b>	<b>53.5</b>	<b>83.2</b>	<b>112.8</b>	<b>101.4</b>
HWFI	23.4	44.9	58.3	72.0	91.4	<b>116.2</b>	<b>95.5</b>
GFNI	40.6	89.0	131.0	164.0	149.6	<b>118.6</b>	<b>66.6</b>
NGPI	40.6	77.8	114.4	148.3	146.4	173.5	<b>127.0</b>
UKMI	36.0	59.0	72.5	74.5	105.4	265.4	335.2
EGRI	34.8	58.5	73.2	75.2	106.8	177.3	358.6
EMXI	24.1	40.5	61.1	83.5	133.0	182.2	187.5
AEMI	36.6	58.1	82.7	108.2	152.3	180.3	254.1
FSSE	<b>22.5</b>	<b>37.1</b>	<b>45.7</b>	<b>54.6</b>	<b>68.6</b>	<b>110.8</b>	<b>97.9</b>
TVCN	<b>22.5</b>	<b>35.8</b>	<b>43.3</b>	<b>52.7</b>	<b>69.8</b>	<b>90.2</b>	<b>135.2</b>
TVCC	25.9	41.8	52.0	63.4	<b>68.1</b>	<b>94.5</b>	170.7
LBAR	29.6	57.1	92.9	127.0	156.2	205.3	273.5
BAMD	30.3	52.4	67.7	80.0	132.7	195.0	362.4
BAMM	31.8	56.6	76.2	99.6	199.5	297.7	447.7
BAMS	42.4	80.8	117.1	154.3	296.6	460.2	603.6
Forecasts	14	14	13	12	9	5	2

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Frank, 21-28 August, 2010. Mean errors for the five-year period 2005-9 are shown for comparison. Official errors that are smaller than the five-year means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL (Frank)	<b>5.6</b>	<b>8.8</b>	<b>10.9</b>	<b>11.3</b>	<b>10.9</b>	<b>9.6</b>	18.8
OCD5 (Frank)	7.3	12.5	18.2	20.0	17.4	18.7	25.8
Forecasts	26	24	22	20	16	12	8
OFCL (2005-9)	6.3	10.5	13.8	15.5	17.5	19.0	18.8
OCD5 (2005-9)	7.1	11.6	15.0	17.4	18.7	19.8	19.4

Table 3b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Frank 21-28 August, 2010 . 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	5.4	9.0	11.6	11.2	11.9	11.7	24.0
OCD5	7.4	13.7	18.0	18.5	17.4	15.8	<b>20.6</b>
DSHP	6.0	9.6	11.6	12.9	13.0	13.6	<b>15.0</b>
LGEM	6.8	11.6	13.8	14.1	12.8	<b>7.9</b>	<b>22.6</b>
ICON	6.1	10.2	<b>11.5</b>	12.3	14.4	12.3	<b>14.6</b>
IVCN	6.3	10.3	11.8	12.8	15.0	13.3	<b>11.6</b>
FSSE	6.3	10.0	<b>10.4</b>	<b>10.9</b>	12.2	<b>10.1</b>	<b>8.2</b>
HWFI	5.8	11.7	17.8	18.9	24.2	22.1	<b>14.2</b>
GHMI	6.7	9.4	<b>8.3</b>	11.2	13.9	14.3	<b>11.6</b>
Forecasts	23	21	19	17	13	9	5



Table 4. Watch and warning summary for Hurricane Frank, 21-28 August, 2010.

Date/Time (UTC)	Action	Location
21 / 2100	Tropical Storm Watch issued	Salina Cruz to Lagunas de Chacahua
22 / 1500	Tropical Storm Watch modified to	Salina Cruz to Puerto Angel
22 / 1500	Tropical Storm Watch issued	Punto Maldonado to Tecpan de Galeana
22 / 1500	Tropical Storm Warning issued	Puerto Angel to Punto Maldonado
22 / 2100	Tropical Storm Watch discontinued	Salina Cruz to Puerto Angel
22 / 2100	Tropical Storm Watch modified to	Acapulco to Tecpan de Galeana
22 / 2100	Tropical Storm Warning modified to	Puerto Angel to Acapulco
23 / 0300	Tropical Storm Watch modified to	Tecpan de Galeana to Lazaro Cardenas
23 / 0300	Tropical Storm Warning modified to	Puerto Angel to Tecpan de Galeana
23 / 0900	Tropical Storm Watch discontinued	Tecpan de Galeana to Lazaro Cardenas
23 / 0900	Tropical Storm Watch issued	Zihuatanejo to Punta San Telmo
23 / 0900	Tropical Storm Warning discontinued	Puerto Angel to Tecpan de Galeana
23 / 0900	Tropical Storm Warning issued	Lagunas de Chacahua to Zihuatanejo
24 / 0000	Tropical Storm Warning modified to	Punta Maldonado to Zihuatanejo
24 / 0300	Tropical Storm Watch modified to	Acapulco to Punta San Telmo
24 / 0300	Tropical Storm Warning discontinued	All
24 / 1200	Tropical Storm Watch discontinued	All

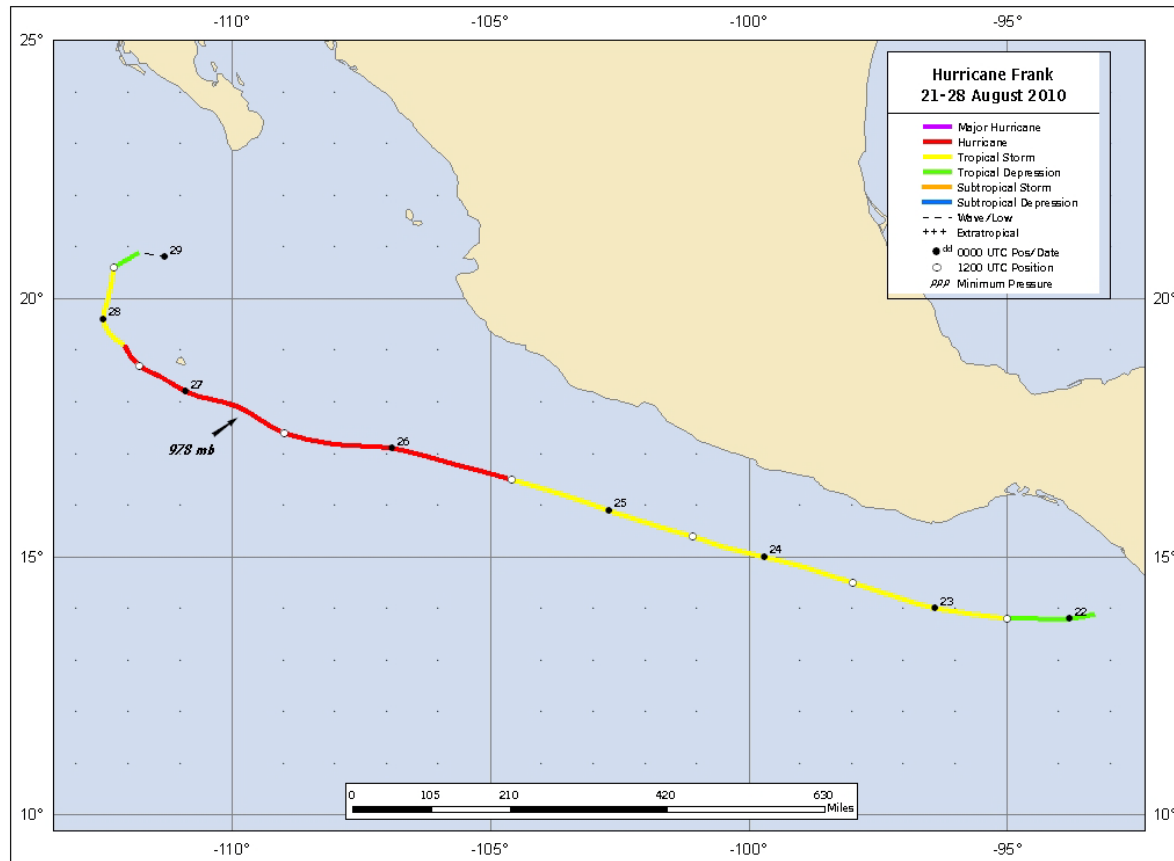


Figure 1. Best track positions for Hurricane Frank, 21-28 August 2010.

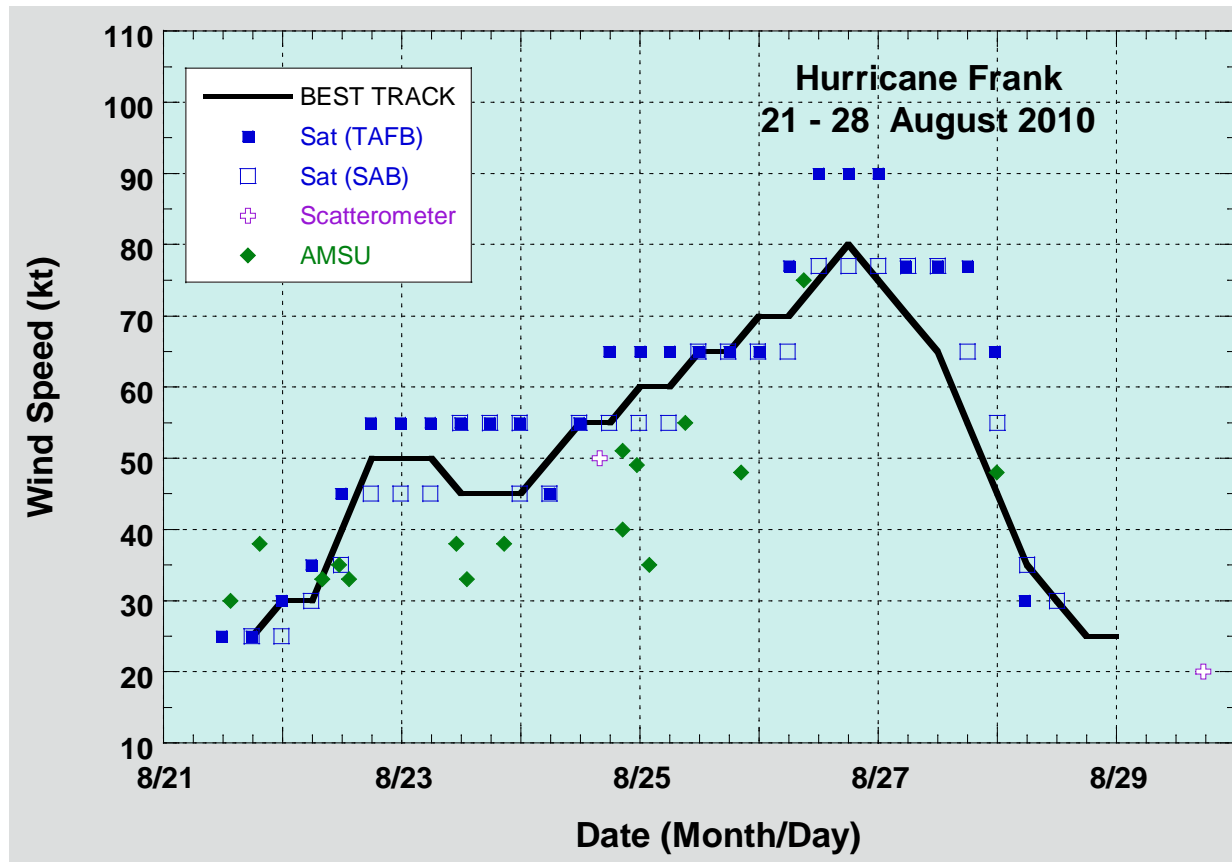


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Frank, 21-28 August 2010. Dashed vertical lines correspond to 0000 UTC.

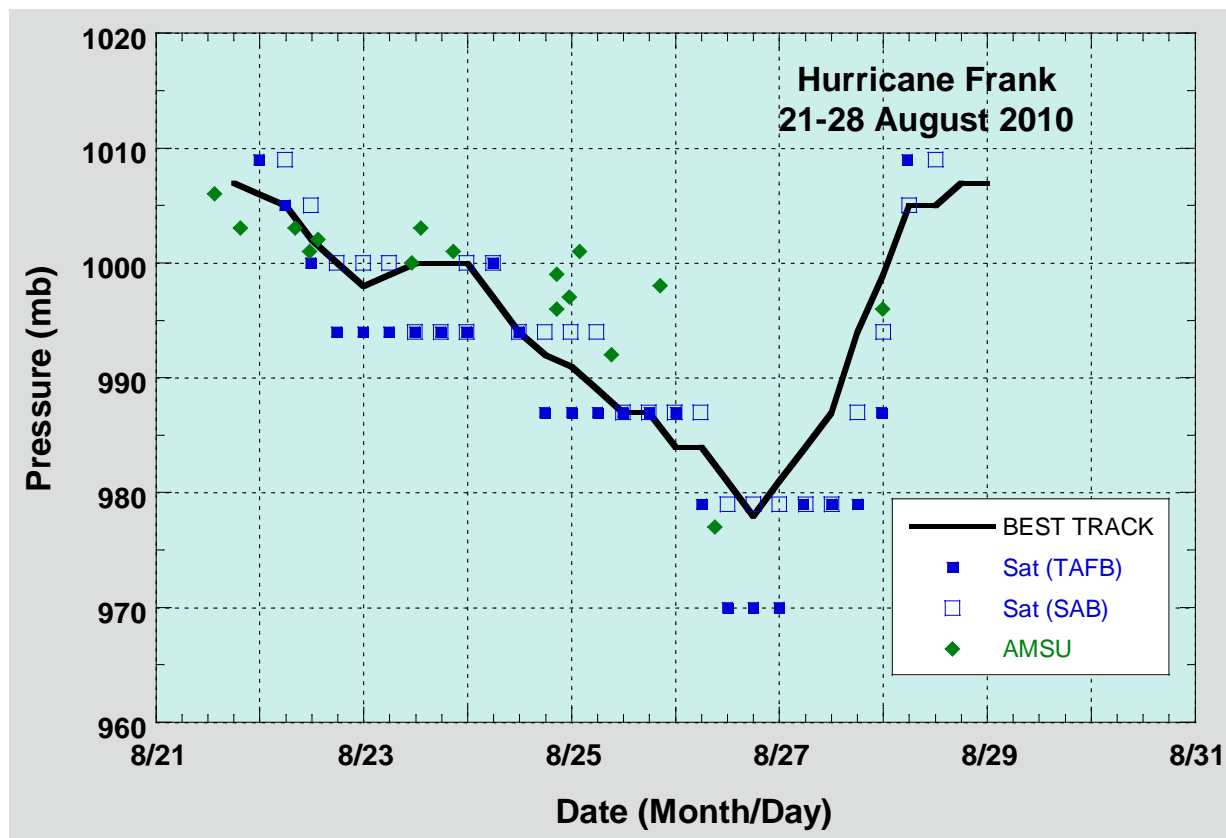


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Frank, 21-28 August 2010. Dashed vertical lines correspond to 0000 UTC.

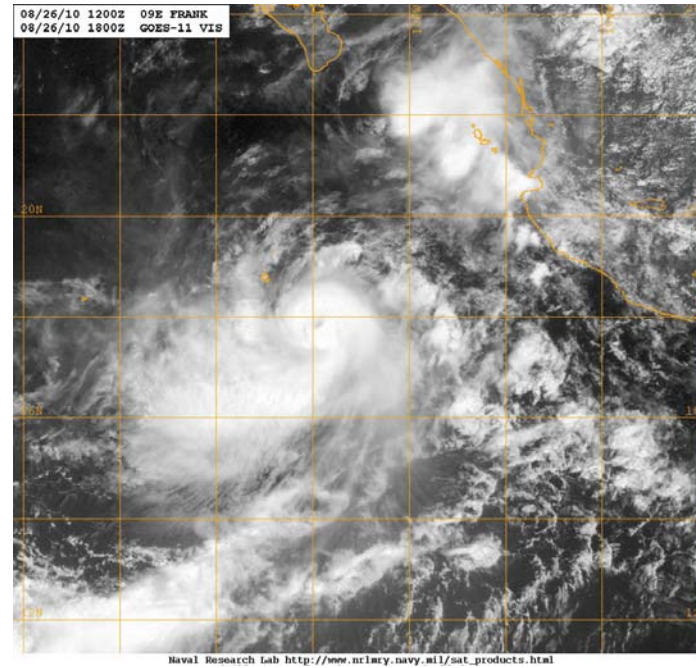
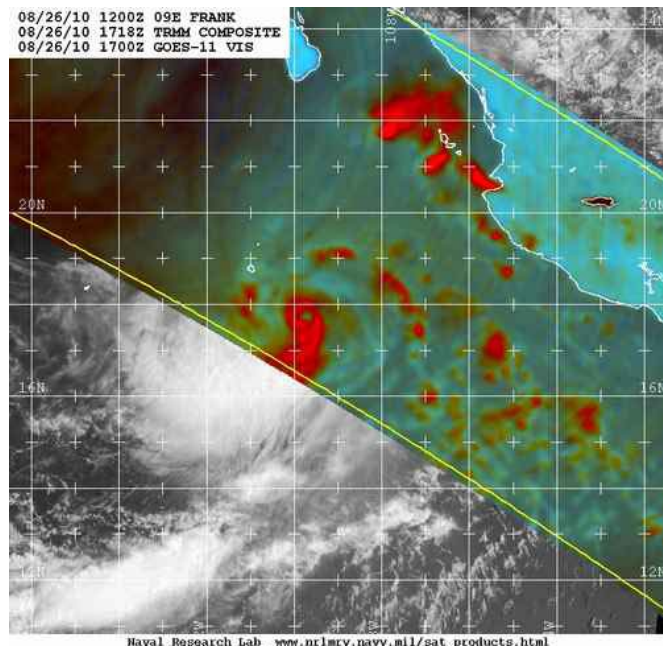


Figure 4. Microwave (1718 UTC 26 August) and Visible (1800 UTC 26 August) images at the approximate time that Frank reached peak intensity. Note the small eye in both images. Images courtesy of the Naval Research Laboratory (NRL).