

Tropical Cyclone Report
Tropical Storm Emilia
(EP062006)
21-28 July 2006

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Emilia produced localized heavy rainfall and tropical storm force winds over portions of the southern Baja California Peninsula of Mexico without making landfall.

a. Synoptic History

A tropical wave moved across northern South America into the eastern North Pacific Ocean on 16 July, and continued steadily westward for the next several days with little change in organization. By early on 20 July, a surface low pressure system developed along the wave axis about 370 n mi south of Acapulco, Mexico, and deep convection began to increase. The low pressure area turned northwestward early on 21 July and thunderstorm activity increased and became organized enough for the system to be classified as a tropical depression at 1200 UTC, about 350 n mi south-southwest of Acapulco. 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.

After turning northwestward, convective banding features gradually developed and became better defined, and the cyclone strengthened into a tropical storm by 0600 UTC 22 July about 350 n mi south of Manzanillo, Mexico. For the next five days, Tropical Storm Emilia alternated back and forth between a west-northwestward and north-northwestward direction around the southwestern periphery of a large subtropical ridge centered over the southwestern United States and northern Mexico. Around 0600 UTC 22 July, Emilia passed about 150 n mi southwest of Manzanillo and likely produced wind gusts to tropical storm force along the southwestern coast of mainland Mexico. Emilia reached its first peak intensity of 55 kt at 1800 UTC 23 July about 190 n mi west-southwest of Manzanillo. A sharp increase in vertical wind shear caused the cyclone to weaken for the next 24 hours.

Emilia began to re-intensify early on 25 July as the shear relaxed, and the cyclone reached its second peak intensity of 55 kt early on 26 July. Later that day, the center of Emilia passed about 50 n mi southwest of Cabo San Lazaro, located on the southwestern coast of the Baja California Peninsula of Mexico. Outer rain bands affected southern portions of Baja California with locally heavy rainfall and tropical storm force winds. By early on 27 July, Emilia turned toward the west-northwest moved over much cooler water off the west coast of Baja California, and began to rapidly weaken. Emilia became a tropical depression by 1200 UTC 27 July and degenerated into a non-convective remnant low pressure system at 0600 UTC on 28 July about 280 n mi west of Punta Eugenia. The low moved slowly westward for the next 2 days

before turning sharply northward early on 30 July. It dissipated at 1200 UTC 31 July about 430 n mi west-southwest of San Diego, California.

b. Meteorological Statistics

Observations in Emilia (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB) and the U. S. Air Force Weather Agency (AFWA). Microwave satellite imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA QuikSCAT, and Defense Meteorological Satellite Program (DMSP) satellites were also useful in tracking Emilia.

Peak intensity estimates of 55 kt at 1800 UTC 23 July and between 0000 UTC and 1200 UTC 26 July are based on a blend of subjective Dvorak satellite intensity estimates from TAFB, SAB, and AFWA, University of Wisconsin-CIMSS advance objective Dvorak T-numbers (ODT), and QuikSCAT wind values. Although a small mid-level eye feature briefly appeared in microwave satellite imagery between 0600-1000 UTC 26 July 2006 (Fig. 4), subsequent images just a few hours later indicated the eye feature had eroded. The lack of a persistent and well-defined eye is the basis for not designating Emilia as a hurricane operationally and in post-storm analysis. Tropical storm force winds were reported along the southern tip of Baja California and southwestern coast of Baja California. Between 2200-2300 UTC 25 July, Cabo San Lucas, Mexico (elevation 731 ft/223 m ASL) reported a 10-minute average wind of 37 kt, and a 37-kt wind with a gust to 48 kt was reported at Puerto Cortes, Mexico (elevation 137 ft/42m ASL) at 0730 UTC 26 July. Ship **H9UY** (Table 2) at 1500 UTC 24 July, located about 65 n mi northwest of Cabo Corrientes, Mexico, reported a sustained wind of 35 kt. The trajectory of the wind direction suggests that at least tropical storm force wind gusts possibly occurred along the southwestern coast of mainland Mexico between Manzanillo and Cabo Corrientes.

News reports indicate rainfall totals of 3 to 5 in were measured at a few locations across the southern Baja California peninsula with 5 in being reported in Cabo San Lucas. Higher amounts likely occurred in the higher elevations of southern Baja.

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

c. Casualty and Damage Statistics

News media reports indicate there were a few occurrences of minor flooding in and around the Cabo San Lucas area. Although some minor damage occurred to buildings and above-ground utility lines, no significant damage was reported in the main tourist regions of the city. However, several marinas along the southern tip of Baja California received minor damage from waves and were closed for about two days. There were no reports of casualties associated with Emilia.

d. Forecast and Warning Critique

Tropical Weather Outlooks from the National Hurricane Center began describing the area of disturbed weather from which Emilia originated several days prior to tropical cyclogenesis. However, the outlooks did not indicate the possible formation of a tropical depression in the area until 13 h before genesis actually occurred.

A verification of official and guidance model track forecasts is given in Table 3. Average official track errors for Emilia were 40, 75, 103, 117, 126, 144, and 157 n mi for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. The number of forecasts ranged from 25 at 12 h to 7 at 120 h. These errors are greater than the average long-term official track errors through 72 h, and then much lower at 96 and 120 h. There was generally a west bias in the official track forecasts in anticipation of the development of a stronger mid-level ridge that was expected to steer the cyclone more westward than west-northwestward. After about 48 hours of official forecasts, the subtropical ridge to the north of Emilia was assessed as being weaker than originally expected. Subsequent forecasts were shifted northward, which resulted in an improvement in the track forecast errors at all times.

Average official intensity errors (Table 4) for Emilia were 6.6, 11.3, 14.3, 12.6., 6.7, 4.1, and 7.9 kt for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. For comparison, the average long-term official intensity errors are 6, 11, 14, 17, 18, 18, and 19 kt. The hindering effects of vertical wind shear were well assessed from the beginning, and this resulted in the mean intensity forecast errors for Emilia being smaller than the long-term average errors, especially at 72-120 h.

Watches and warnings issued for Emilia are listed in Table 5.

Table 1. Best track for Tropical Storm Emilia, 21-28 July 2006.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
21 / 1200	11.9	103.0	1007	25	tropical depression
21 / 1800	12.5	103.1	1006	25	"
22 / 0000	13.1	103.4	1005	30	"
22 / 0600	13.8	103.7	1004	35	tropical storm
22 / 1200	14.9	104.3	1004	35	"
22 / 1800	15.9	104.6	1003	35	"
23 / 0000	16.8	105.3	1001	40	"
23 / 0600	17.3	106.3	999	45	"
23 / 1200	17.9	107.0	995	50	"
23 / 1800	18.0	107.7	991	55	"
24 / 0000	18.1	108.4	993	50	"
24 / 0600	18.3	109.2	995	45	"
24 / 1200	18.6	109.6	995	45	"
24 / 1800	19.0	110.1	995	45	"
25 / 0000	19.5	110.4	995	45	"
25 / 0600	19.9	110.7	993	50	"
25 / 1200	20.3	111.0	993	50	"
25 / 1800	21.4	111.3	993	50	"
26 / 0000	22.5	111.5	991	55	"
26 / 0600	23.6	112.2	990	55	"
26 / 1200	24.4	113.1	991	55	"
26 / 1800	25.1	114.1	993	50	"
27 / 0000	25.6	115.3	998	45	"
27 / 0600	26.3	116.5	1003	35	"
27 / 1200	26.9	117.8	1008	25	tropical depression
27 / 1800	27.2	118.7	1009	25	"
28 / 0000	27.9	119.5	1009	25	"
28 / 0600	28.0	120.3	1009	25	remnant low
28 / 1200	28.0	121.1	1010	20	"
28 / 1800	27.9	121.8	1010	20	"
29 / 0000	27.6	122.5	1011	20	"
29 / 0600	27.4	123.3	1011	20	"
29 / 1200	27.5	124.1	1011	20	"
29 / 1800	27.9	124.7	1011	20	"
30 / 0000	28.4	125.1	1011	20	"
30 / 0600	29.0	125.3	1011	20	"
30 / 1200	29.7	125.2	1011	20	"
30 / 1800	30.3	125.2	1012	15	"
31 / 0000	30.6	125.2	1012	15	"
31 / 0600	30.8	125.2	1012	15	"
31 / 1200	31.0	125.3	1013	15	"

31 / 1800					dissipated
26 / 0600	23.6	112.2	990	55	minimum pressure

Table 2. Selected ship and buoy reports with winds of at least 34 kt for Tropical Storm Emilia, 21-28 July 2006.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
24 / 1500	H9UY	21.2	106.6	140 / 35	1007.0
25 / 0600	DPCU	20.4	106.9	120 / 45	1009.5
25 / 0600	P3GY9	25.4	110.3	120 / 38	1009.0
25 / 0900	DGGV	21.4	108.5	130 / 40	1005.5

Table 3. Preliminary forecast evaluation (heterogeneous sample) for Tropical Storm Emilia, 21-28 July 2006. Forecast errors (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verification includes the depression stage.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	50 (25)	107 (23)	168 (21)	205 (19)	210 (15)	224 (11)	359 (7)
GFNI	40 (22)	65 (20)	92 (18)	125 (14)	178 (10)	237 (4)	370 (1)
GFDI	39 (25)	66 (23)	90 (21)	104 (19)	106 (15)	142 (11)	227 (7)
GFSI	49 (24)	86 (21)	125 (19)	156 (16)	210 (11)	248 (7)	587 (1)
AEMI	50 (25)	89 (20)	125 (20)	153 (18)	227 (14)	328 (10)	424 (6)
NGPI	35 (10)	66 (8)	90 (6)	87 (4)	91 (2)	60 (2)	
UKMI	45 (16)	88 (16)	132 (16)	161 (14)	272 (10)	397 (4)	1116 (2)
BAMD	49 (25)	84 (23)	113 (21)	139 (19)	205 (15)	235 (11)	258 (7)
BAMM	46 (25)	80 (23)	114 (21)	147 (19)	242 (15)	327 (11)	386 (7)
BAMS	48 (25)	84 (23)	116 (21)	149 (19)	253 (15)	383 (11)	476 (7)
CONU	37 (25)	66 (23)	89 (21)	110 (19)	118 (15)	142 (10)	315 (3)
GUNA	26 (4)	62 (4)	107 (4)	145 (2)			
FSSE	39 (21)	66 (20)	89 (18)	105 (16)	127 (12)	146 (8)	217 (4)
OFCL	40 (25)	75 (23)	103 (21)	117 (19)	126 (15)	144 (11)	157 (7)
NHC Official (2001-2005 mean)	35 (1300)	60 (1152)	83 (1009)	103 (877)	145 (652)	192 (465)	231 (313)

Table 4. Preliminary intensity forecast evaluation (heterogeneous sample) for Tropical Storm Emilia, 21-28 July 2006. Forecast errors (kt) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verification includes the depression stage.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
SHF5	7.2 (25)	8.9 (23)	8.2 (21)	7.4 (19)	12.7 (15)	11.1 (11)	9.1 (7)
GFDI	6.8 (25)	10.3 (23)	13.9 (21)	13.4 (19)	11.4 (15)	13.8 (11)	13.1 (7)
SHIP	7.8 (24)	10.8 (23)	12.9 (21)	14.1 (18)	16.9 (14)	18.0 (11)	20.6 (7)
DSHP	7.8 (24)	10.8 (23)	12.9 (21)	14.1 (18)	16.9 (14)	18.0 (11)	20.6 (7)
FSSE	8.1 (21)	12.1 (20)	15.3 (18)	14.9 (16)	9.8 (12)	10.4 (8)	1.8 (4)
ICON	7.1 (24)	10.2 (23)	12.7 (21)	11.8 (18)	5.6 (14)	4.1 (11)	9.1 (7)
OFCL	6.6 (25)	11.3 (23)	14.3 (21)	12.6 (19)	6.7 (15)	4.1 (11)	7.9 (7)
NHC Official (2001-2005 mean)	6.2 (1300)	10.8 (1152)	14.3 (1009)	16.5 (876)	18.7 (652)	18.3 (465)	19.3 (313)

Table 5. Watch and warning summary for Tropical Storm Emilia, 21-28 July 2006.

Date/Time (UTC)	Action	Location
22 / 2100	Tropical Storm Watch issued	Manzanillo to Cabo Corrientes
23 / 1500	Tropical Storm Watch discontinued	All
25 / 1500	Tropical Storm Watch issued	Buena Vista to Bahia Magdalena
25 / 2100	Tropical Storm Watch changed to Tropical Storm Warning	Buena Vista to Bahia Magdalena
26 / 0600	Tropical Storm Warning discontinued	Buena Vista to Bahia Magdalena
26 / 0600	Tropical Storm Warning issued	Cabo San Lucas to Punta Eugenia
26 / 1500	Tropical Storm Warning modified to	Santa Fe to Punta Eugenia
26 / 2100	Tropical Storm Warning modified to	Puerto San Andresito to Punta Eugenia
27 / 0300	Tropical Storm Warning discontinued	All

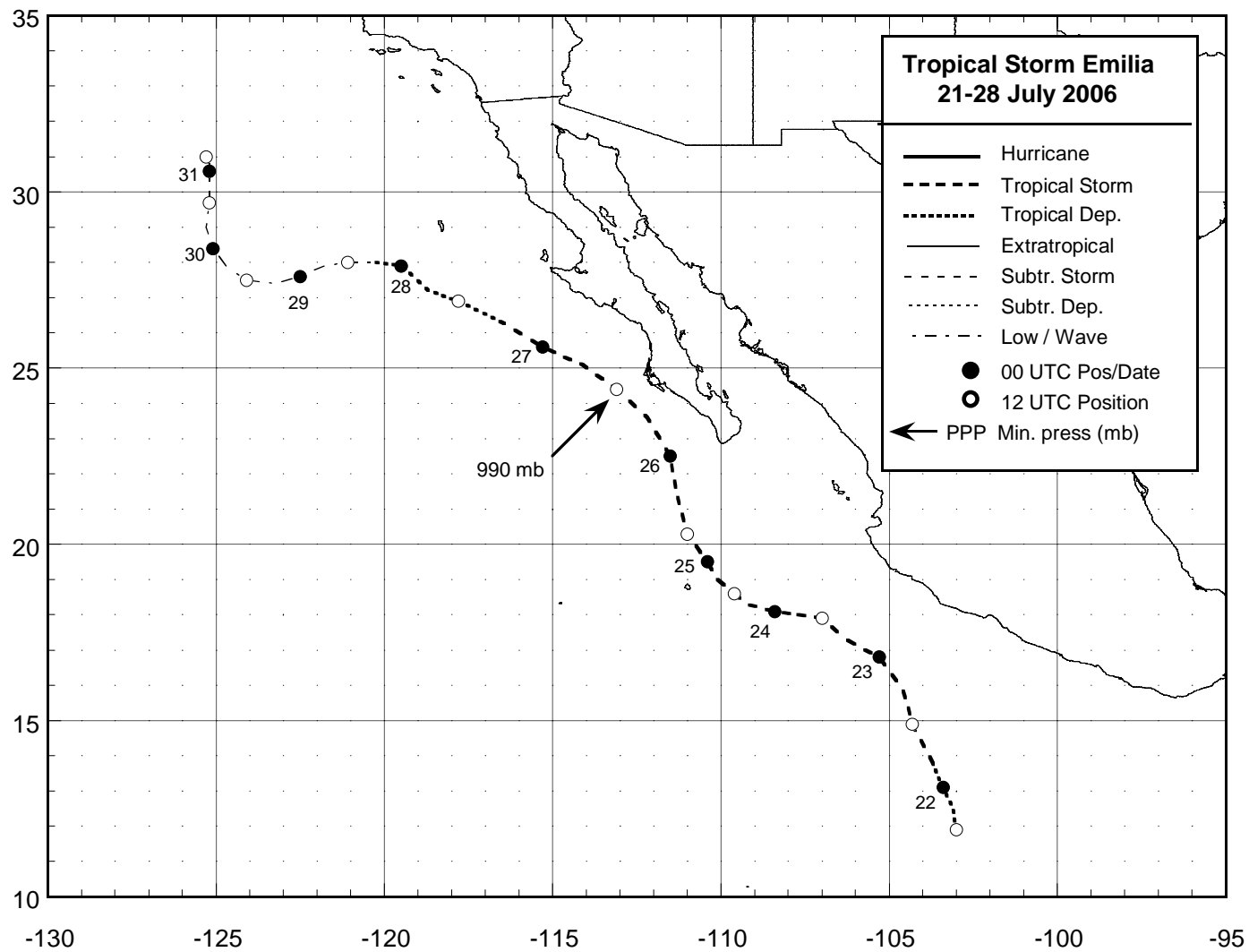


Figure 1. Best track positions for Tropical Storm Emilia, 21-28 July 2006.

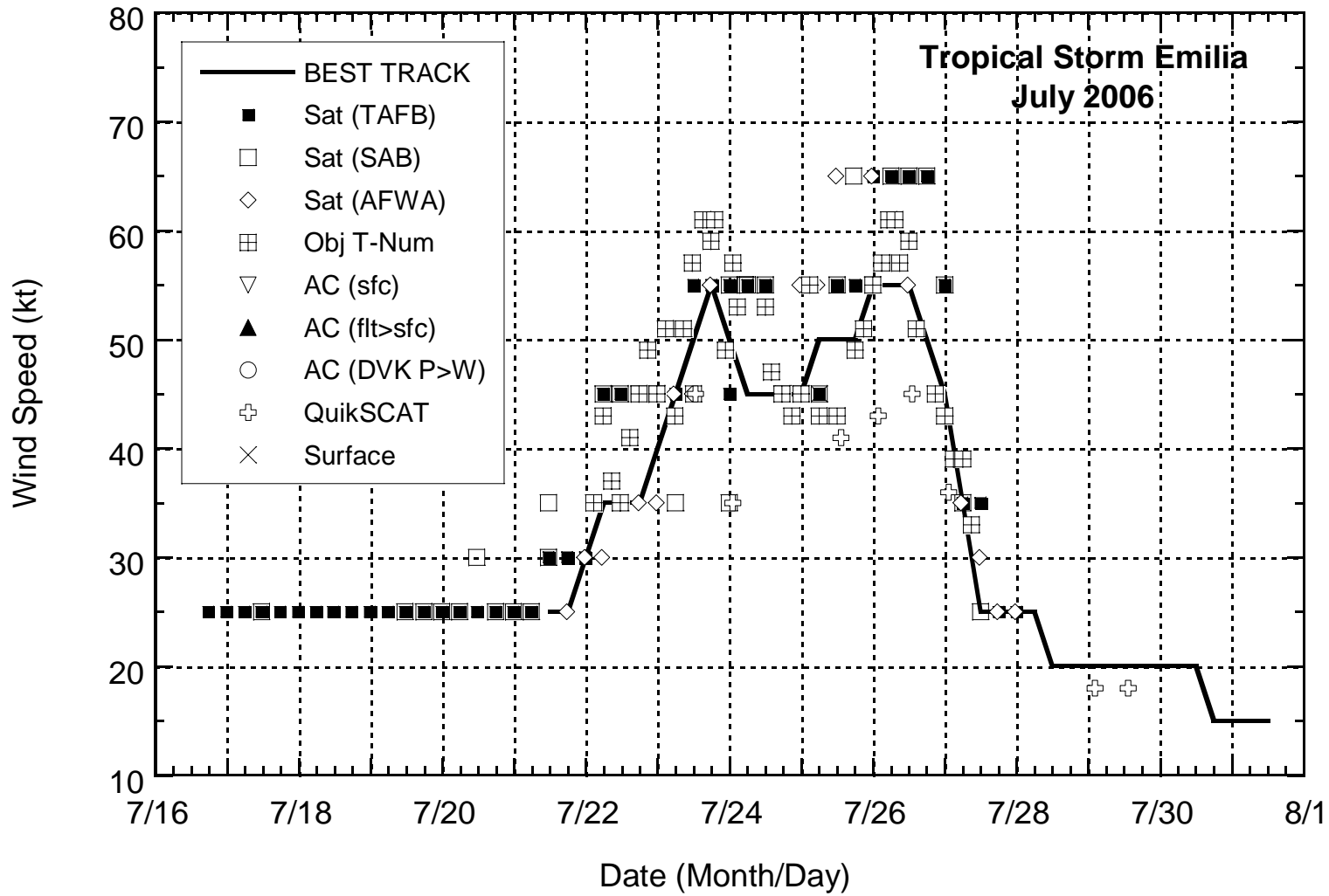


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Emilia, 21-28 July 2006. Objective Dvorak estimates represent linear averages over a three-hour period centered on the nominal observation time.

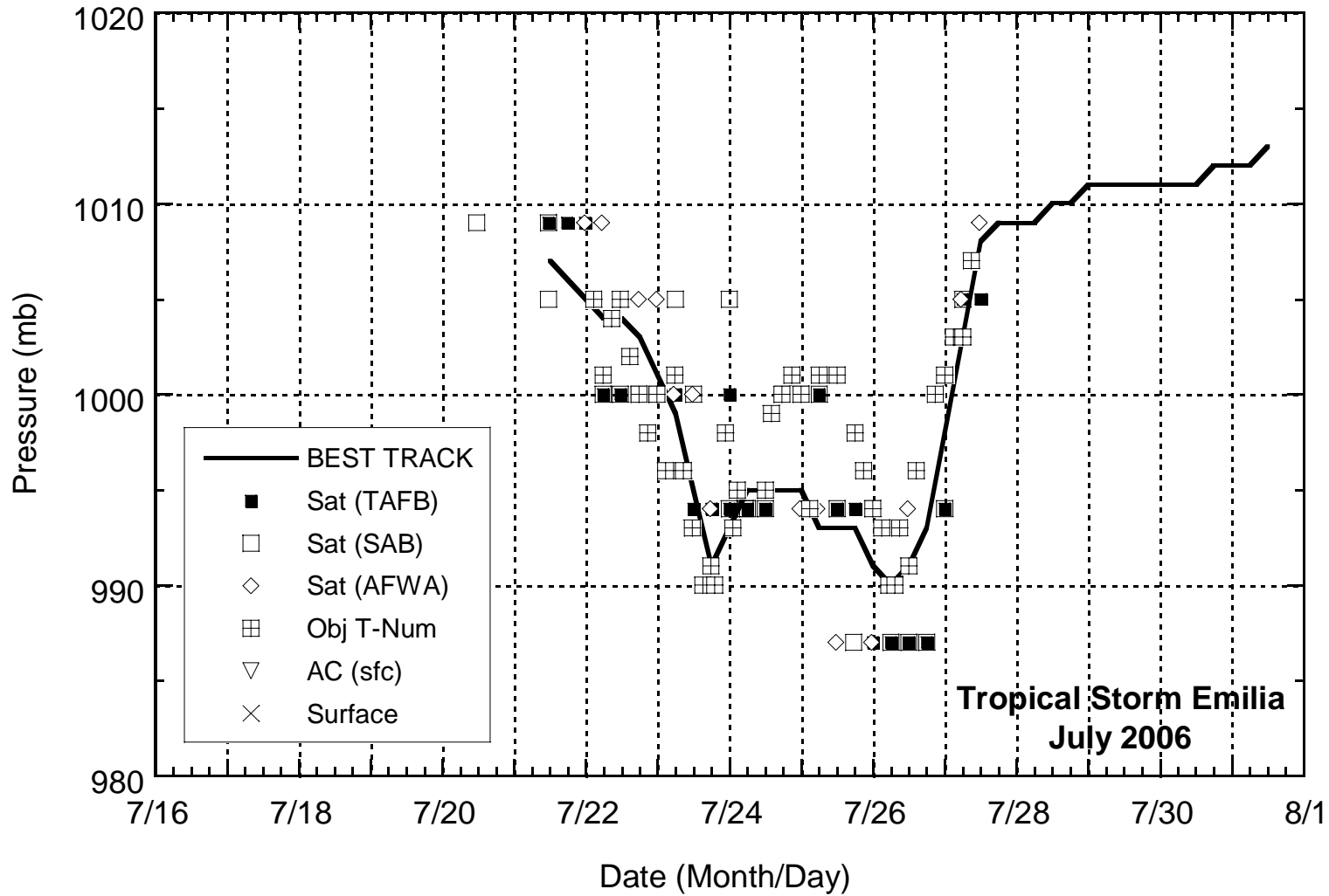


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Emilia, 21-28 July 2006. Objective Dvorak estimates represent linear averages over a three-hour period centered on the nominal observation time

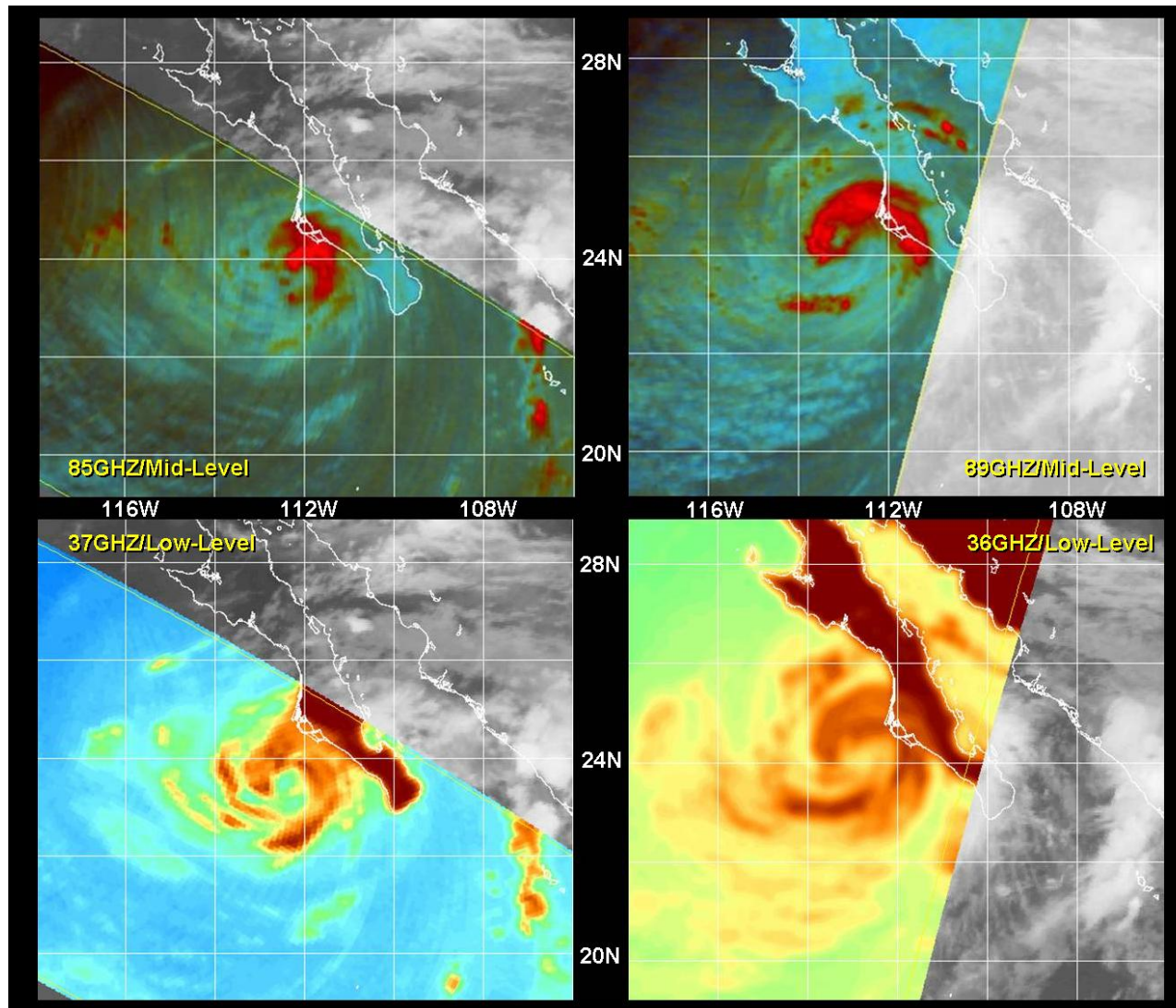


Figure 4. Satellite microwave overpasses near the time of peak intensity of Tropical Storm Emilia. A 0538 UTC 26 July 2006 TRMM image (left) revealed a nearly-closed mid- and low-level eye feature forming, while an AMSR-E overpass at 0939 UTC 26 July 2006 (right) showed a closed mid-level eye had developed 4 h later. (images courtesy of the U.S. Navy Fleet Numerical Meteorology and Oceanography Command, Monterey, CA).