

Tropical Cyclone Report  
Tropical Storm Bonnie  
3-13 August 2004

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Tropical Storm Bonnie made landfall in the vicinity of St. Vincent Island, Florida as a weak tropical storm.

a. Synoptic History

Bonnie developed from a tropical wave that crossed Dakar, Senegal on 29 July, and moved westward for several days accompanied by cloudiness, thunderstorms and a well-defined cyclonic rotation at the mid-levels. The shower activity became concentrated and the system developed a few convective bands as it moved westward. Data from QuikSCAT suggested that a small surface circulation had developed, and it is estimated that a tropical depression formed at 1200 UTC 3 August when the system was located about 360 n mi east of Barbados in the Lesser Antilles. The depression moved westward about 20 knots and lost its surface circulation when it entered the eastern Caribbean Sea. As a tropical wave, it continued moving rapidly to the west and the west-northwest producing intermittent convection. Once the system reached the western Caribbean Sea, it developed significant convection and regenerated a surface circulation. It is estimated that the tropical depression re-developed about 100 n mi southeast of the western tip of Cuba at 1200 UTC 8 August. The depression moved toward the west-northwest across the Yucatan Channel and became Tropical Storm Bonnie near the northeastern tip of the Yucatan Peninsula. Bonnie moved north and northeast, reaching its maximum intensity of 55 knots and a minimum pressure of 1001 mb at 1800 UTC 11 August. Strong southwesterly wind shear became established over Bonnie and the cyclone began to weaken. It made landfall near Saint Vincent and Saint George Islands just south of Apalachicola, Florida as a tropical storm. These winds were confined to coastal sections to the east of the center. As a depression, Bonnie continued to move northeastward, across the eastern United States. It finally became a weak remnant low just south of Cape Cod at 0000 UTC 14 August.

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.

b. Meteorological Statistics

Observations in Bonnie (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), as well as flight-level and dropwindsonde observations from flights of the 53<sup>rd</sup> Weather Reconnaissance Squadron of

the U. S. Air Force Reserve Command. 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 Bonnie. In addition, radar from Cancun, Mexico, and from the U.S. NWS network near the Gulf coast were used to analyze the cyclone when it was located near these sites. Selected ship and surface observations from land stations and data buoys are given in Tables 2 and 3. Bonnie had a very small circulation when it regenerated near the Yucatan Peninsula, and initial data from a reconnaissance plane indicate that it had a closed eyewall of 8 n mi in diameter. The small center was also observed from the Cancun radar shown in Fig. 4. A reconnaissance plane reported a minimum pressure of 995 mb at 0941 UTC 12 August when the cyclone was on a steady weakening trend. This minimum pressure was assumed to be associated with a meso-cyclone and this value is not representative of Bonnie's central pressure. A tornado outbreak over the southeastern United States was associated with Bonnie.

c. Casualty and Damage Statistics

There were three deaths in Pender County, NC, from a tornado spawned by Bonnie.

d. Forecast and Warning Critique

Average official track errors (with the number of cases in parentheses) for Bonnie were 43 (16), 75 (14), 87 (11), 78(9), 106(5), 595 (2), and 1038 (5) n mi for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. For the short range, these errors are lower than average official track errors for the 10-yr period 1994-2003<sup>1</sup> (44, 78, 112, 146, 217, 248, and 319 n mi, respectively). However, the 4 and 5 day errors are much large than the average. The model errors are displayed in Table 4. Note that dynamical models also had very large errors at the 120-h period. Models related to climatology produced the smallest errors.

Average official intensity errors were 8, 10, 12, 11, 8, 8, and 36 kt for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. For comparison, the average official intensity errors over the 10-yr period 1994-2003 are 6, 10, 12, 15, 19, 20, and 21 kt, respectively. Note that in general the intensity errors were similar to the average with the exception of the large error at 120 hours.

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<sup>1</sup> Errors given for the 96 and 120 h periods are averages over the three-year period 2001-3.

Table 1. Best track for Tropical Storm Bonnie, 3-13 August 2004. Positions given during the tropical wave stage represent the location of the mid-level circulation center observed on satellite.

Date/Time (UTC)	Latitude (EN)	Longitude (EW)	Pressure (mb)	Wind Speed (kt)	Stage
03 / 1200	12.9	53.6	1010	25	tropical depression
03 / 1800	13.2	55.4	1010	25	"
04 / 0000	13.5	57.4	1010	30	"
04 / 0600	13.6	59.5	1010	30	"
04 / 1200	13.6	61.6	1010	30	"
04 / 1800	13.7	63.7	1010	30	tropical wave
05 / 0000	14.0	65.7	1010	25	"
05 / 0600	14.9	67.7	1010	25	"
05 / 1200	16.0	69.7	1011	25	"
05 / 1800	16.5	71.5	1011	25	"
06 / 0000	17.0	73.0	1011	25	"
06 / 0600	17.1	74.6	1011	25	"
06 / 1200	17.2	76.2	1011	25	"
06 / 1800	17.0	77.2	1011	25	"
07 / 0000	17.1	78.2	1011	25	"
07 / 0600	17.4	79.2	1013	20	"
07 / 1200	17.8	80.2	1013	20	"
07 / 1800	18.4	81.1	1013	20	"
08 / 0000	19.0	81.9	1012	20	"
08 / 0600	19.7	82.7	1010	25	"
08 / 1200	20.3	83.5	1009	25	tropical depression
08 / 1800	20.9	84.3	1008	25	"
09 / 0000	21.5	85.5	1008	25	"
09 / 0600	22.0	86.6	1008	30	"
09 / 1200	22.5	87.6	1008	35	tropical storm
09 / 1800	22.9	88.3	1007	40	"
10 / 0000	23.1	89.0	1006	45	"
10 / 0600	23.4	89.8	1005	45	"
10 / 1200	24.0	90.6	1002	50	"
10 / 1800	24.4	90.6	1003	45	"
11 / 0000	24.7	90.6	1003	40	"
11 / 0600	25.2	90.6	1003	40	"
11 / 1200	25.7	90.4	1001	45	"
11 / 1800	26.4	89.6	1001	55	"
12 / 0000	27.0	88.8	1007	50	"
12 / 0600	27.7	88.1	1008	45	"
12 / 1200	29.0	86.1	1002	45	"
12 / 1800	30.2	84.0	1006	30	tropical depression
13 / 0000	31.9	81.3	1008	25	"
13 / 0600	33.5	79.0	1008	25	"
13 / 1200	35.5	76.5	1008	25	"
13 / 1800	37.1	74.9	1008	25	"
14 / 0000	39.0	73.5	1012	20	low
12 / 1400	29.6	85.1	1002	40	landfall St. Vincent/St. George Islands, FL.
11 / 1800	26.4	89.6	1001	55	minimum pressure

Table 2. Selected ship reports with winds of at least 34 kt for Bonnie, 3 -13 August, 2004.

Date/Time (UTC)	Ship call sign	Latitude (EN)	Longitude (EW)	Wind dir/speed (kt)	Pressure (mb)
10/0900	ZCIH7	26.3	88.6	160 / 37	1014.0
10/1800	H3GQ	23.8	91.0	230 / 40	1014.0

Table 3. Selected surface observations for Tropical Storm Bonnie 3-13 August 2004.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) <sup>c</sup>	Storm tide (ft) <sup>d</sup>	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) <sup>a</sup>	Sustained (kt) <sup>b</sup>	Gust (kt)			
<b>Florida</b>								
Apalachicola (NOS)						0.9	2.70	
Cedar Key (NOS)						1.9	5.21	
Cross City (KCTY)								3.22
Gainesville (KGNV)	12/1636	1010.2	12/1752	23	34			0.12
Perry (K40J)								3.11
<b>Buoy/CMAN</b>								
NOAA Buoy 42001			11/1440	51	66			
NOAA Buoy 42036	12/1450	1009.5	12/1520	31	35			
NOAA Buoy 42039	12/1250	1002.9	12/1030	37	47			
Tyndall AFB Tower C (SGOF1)	12/1600	1008.5	12/1300	32	40			
<b>Unofficial Observations:</b>								
<b>Florida</b>								
Alligator Point (Bald Point) 40 ft Level	12/1629	1005.6	12/1140	30	35			1.35
Mary Esther (Florosa Elementary School AWS)	12/1214	1010.2	12/0627		34			

<sup>a</sup> Date/time is for sustained wind when both sustained and gust are listed.

<sup>b</sup> Except as noted, sustained wind averaging periods for C-MAN and land-based ASOS reports are 2 min; buoy averaging periods are 8 min.

<sup>c</sup> Storm surge is water height above normal astronomical tide level.

<sup>d</sup> Storm tide is water height above National Geodetic Vertical Datum (1929 mean sea level).

Table 4. Preliminary forecast evaluation (heterogeneous sample) for Tropical Storm Bonnie, 3-13 August, 2004. 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, but does not include the extratropical stage, if any.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	44 (20)	115 (18)	230 (15)	335 (13)	544 ( 9)	<b>577 ( 6)</b>	<b>269 ( 6)</b>
GFNI	<b>40 (11)</b>	87 (11)	133 ( 9)	180 ( 7)	384 ( 3)		
GFDI	<b>38 (18)</b>	<b>62 (16)</b>	<b>86 (13)</b>	91 (11)	150 ( 7)	<b>417 ( 4)</b>	1248 ( 5)
GFDL	<b>30 (18)</b>	<b>46 (15)</b>	<b>74 (14)</b>	90 (12)	121 ( 8)	<b>134 ( 3)</b>	1273 ( 3)
GFDN	<b>42 (10)</b>	79 (10)	127 ( 9)	143 ( 7)	274 ( 3)		
LBAR	<b>34 (19)</b>	<b>73 (17)</b>	122 (15)	154 (13)	172 ( 9)	<b>247 ( 6)</b>	<b>597 ( 6)</b>
GFSI	48 (14)	103 (11)	134 ( 9)	138 ( 4)	163 ( 1)		1830 ( 1)
GFSO	<b>40 (14)</b>	92 (13)	139 ( 9)	166 ( 5)	193 ( 1)		1693 ( 1)
AEMI	51 (15)	95 (12)	138 ( 9)	159 ( 7)	214 ( 3)		<b>803 ( 1)</b>
BAMD	<b>40 (20)</b>	<b>73 (18)</b>	114 (15)	167 (13)	302 ( 9)	532 ( 6)	<b>767 ( 6)</b>
BAMM	<b>33 (19)</b>	<b>52 (17)</b>	90 (15)	126 (13)	277 ( 9)	490 ( 6)	<b>665 ( 6)</b>
BAMS	<b>42 (19)</b>	92 (17)	161 (15)	241 (13)	498 ( 9)	760 ( 6)	1149 ( 6)
NGPI	46 (14)	101 (11)	134 ( 9)	189 ( 7)	183 ( 3)		
NGPS	54 (12)	96 (10)	137 ( 9)	163 ( 7)	206 ( 4)		
UKMI	62 (10)	151 (10)	194 ( 8)	233 ( 6)	189 ( 3)	907 ( 1)	<b>1134 ( 2)</b>
UKM	<b>42 ( 7)</b>	136 ( 6)	172 ( 5)	255 ( 4)	142 ( 2)	1774 ( 1)	1094 ( 1)
A98E	<b>40 (20)</b>	<b>58 (18)</b>	105 (15)	129 (13)	231 ( 9)	<b>230 ( 6)</b>	<b>322 ( 6)</b>
A9UK	<b>39 (10)</b>	<b>73 ( 9)</b>	146 ( 7)	175 ( 6)	266 ( 4)		
GUNS	<b>39 (10)</b>	98 (10)	117 ( 8)	128 ( 6)	147 ( 3)		
GUNA	<b>42 (10)</b>	98 ( 9)	115 ( 7)	131 ( 3)	192 ( 1)		
OFCL	43 (16)	75 (14)	87 (11)	78 ( 9)	106 ( 5)	595 ( 2)	1038 ( 5)
NHC Official (1994-2003 mean)	44 (3172)	78 (2894)	112 (2636)	146 (2368)	217 (1929)	248 (421)	319 (341)

Table 5. Watch and warning summary for Tropical Storm Bonnie, 3-13 August, 2004.

Date/Time (UTC)	Action	Location
3/2100	Tropical Storm Warning Issued	St Lucia
3/2100	Tropical Storm Watch Issued	Guadeloupe, Martinique, Dominica, St. Maarten, Saba and St. Eustatius. Puerto Rico and U.S Virgin Islands.
4/1500	Tropical Storm Watch and Tropical Storm Warning Discontinued	All locations
11/0300	Tropical Storm Watch issued	Alabama/Florida border to mouth of Suwannee River
11/1500	Tropical Storm Warning and Hurricane Watch Issued	Alabama/Florida border to mouth of Suwannee River
11/2100	Hurricane Warning Issued	Florida from Destin to the mouth of Suwannee River
12/0900	Hurricane Warning and Watch Discontinued	All locations
12/1500	Tropical Storm Warning Discontinued	West of Destin
12/2100	Tropical Storm Warning Discontinued	All locations

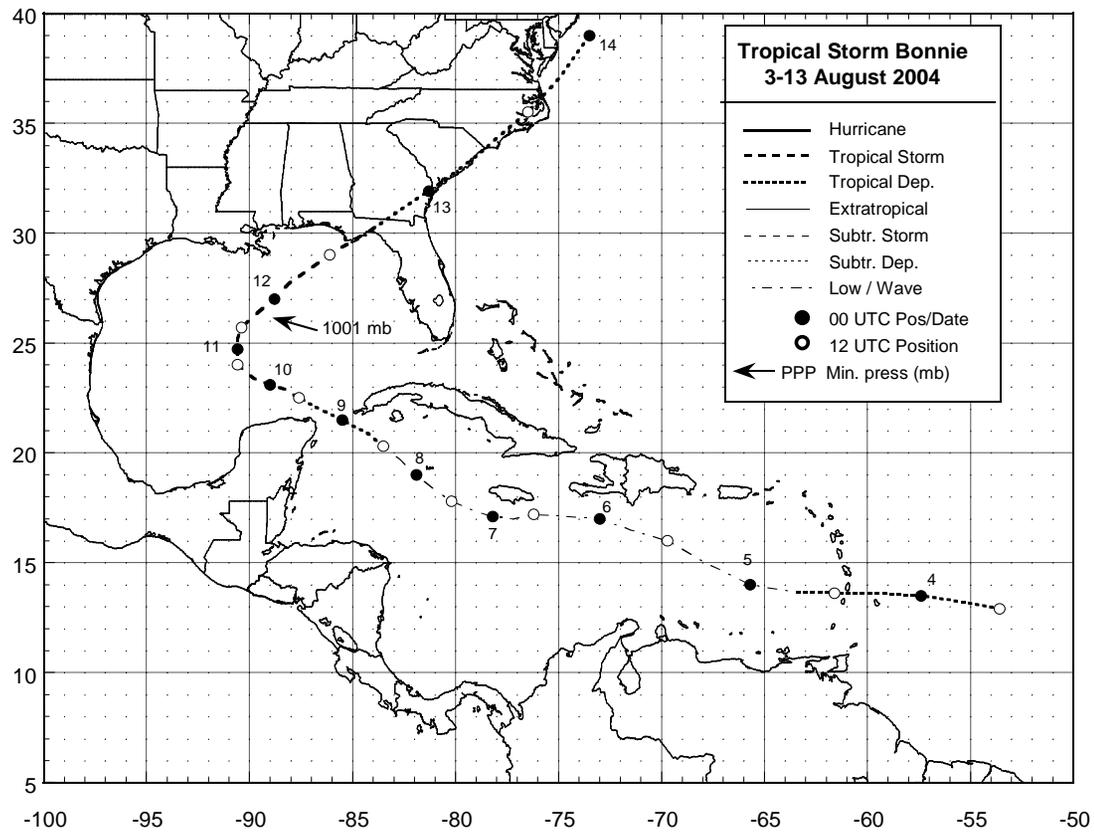


Figure 1. Best track positions for Bonnie, 3-13 August, 2004. Track after landfall stage is based on analyses from the NOAA Hydrometeorological Prediction Center (HPC).

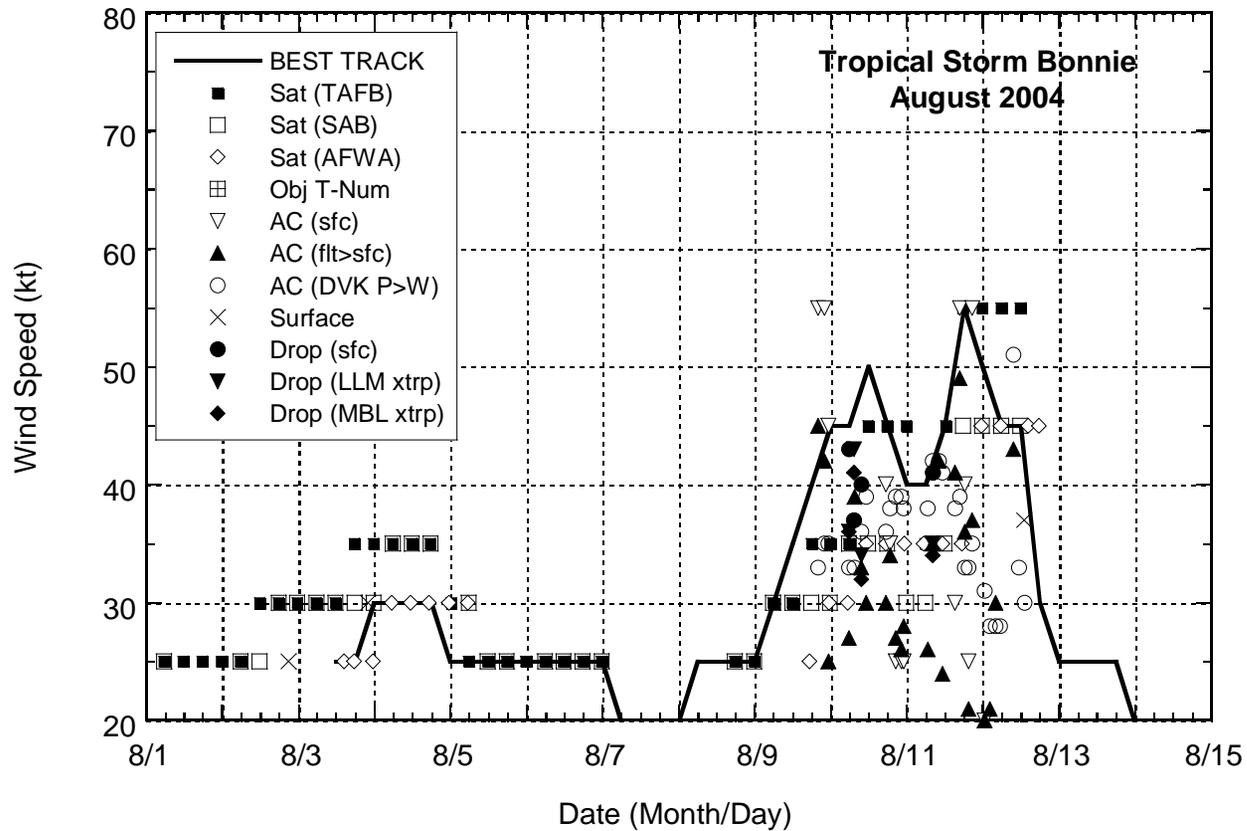


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Bonnie, 3-13 August 2004. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% reduction factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. 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), and from the sounding boundary layer mean (MBL). Objective Dvorak estimates represent linear averages over a three-hour period centered on the nominal observation time. Estimates after landfall are based on analyses from the NOAA Hydrometeorological Prediction Center.

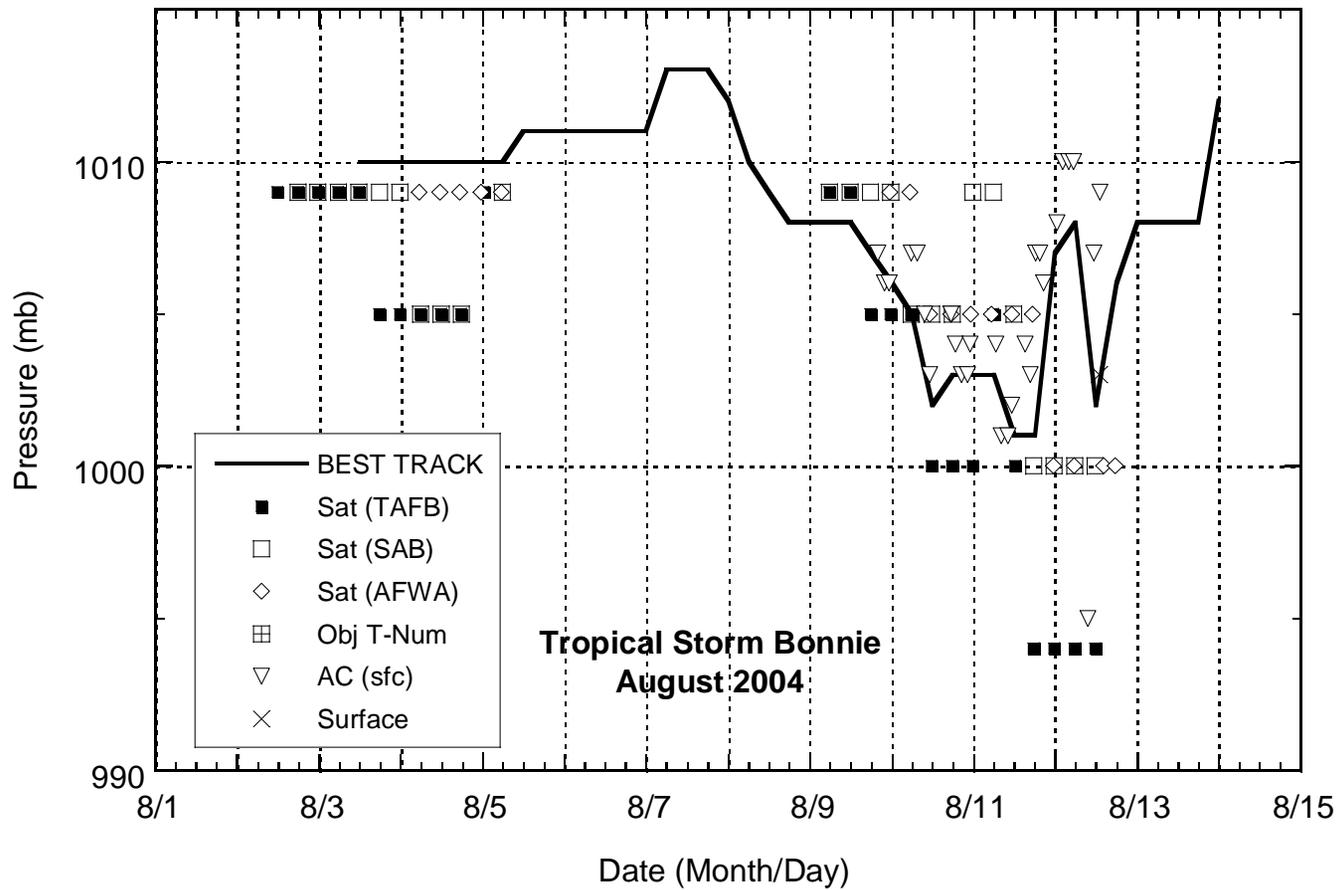


Figure 3. Selected pressure observations and best track minimum central pressure curve for Bonnie, 3-13 August, 2004. Estimates after landfall are based on analyses from the NOAA Hydrometeorological Prediction Center.



Figure 4. Radar image from Cancun, Mexico at 0516 UTC 9 August, showing the small center of the developing cyclone.