Tropical Cyclone Report
Hurricane Dennis
4 – 13 July 2005

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National Hurricane Center
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Updated for deaths, damages, forecast errors, and Jamaican data 17 March 2006

Hurricane Dennis was an unusually strong July major hurricane that left a trail of destruction from the Caribbean Sea to the northern coast of the Gulf of Mexico.

a. Synoptic History

Dennis formed from a tropical wave that moved westward from the coast of Africa on 29 June. The system began to organize on 2 July with the formation of a broad area of low pressure with two embedded swirls of low clouds. Convection increased near both low-level centers on 3 July. The western system moved through the southern Windward Islands on 4 July and lost organization over the southeastern Caribbean. The eastern system continued to develop, becoming a tropical depression over the southern Windward Islands near 1800 UTC 4 July. The "best track" chart of Dennis' 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.

The depression initially moved westward. It turned west-northwestward on 5 July as it became a tropical storm. Dennis reached hurricane strength early on 7 July, then rapidly intensified into a Category 4 hurricane with winds of 120 kt before making landfall near Punta del Ingles in southeastern Cuba near 0245 UTC 8 July. During this intensification, the central pressure fell 31 mb in 24 h.

Dennis weakened to a Category 3 hurricane while passing across southeastern Cuba. Once offshore in the Gulf of Guacanayabo, the hurricane moved west-northwestward parallel to the south coast of Cuba and again intensified to Category 4 status. Maximum sustained winds reached a peak of 130 kt at 1200 UTC 8 July, then decreased to 120 kt before Dennis made landfall near Punta Mangles Altos, Cuba near 1845 UTC that day. Dennis then traversed a long section of western Cuba before emerging into the Gulf of Mexico just east of Havana around 0900 UTC 9 July. Dennis weakened significantly over Cuba, with the maximum sustained winds decreasing to 75 kt by the time the center left the island.

Dennis gradually intensified for the next 6-12 h over the Gulf of Mexico, then began another cycle of rapid intensification near 1800 UTC 9 July, accompanied by a turn toward the north-northwest. During this intensification, the central pressure fell 37 mb in 24 h, including 20 mb in 6 h and 11 mb in 1 h 35 min. Maximum sustained winds reached a third peak of 125 kt near 1200 UTC 10 July. Thereafter, weakening occurred, likely due to mid/upper-level dry air from the western Gulf of Mexico entrained into the hurricane. The maximum sustained winds

decreased to 105 kt and the central pressure rose to 946 mb before Dennis made landfall on Santa Rosa Island, Florida, between Navarre Beach and Gulf Breeze, about 1930 UTC 10 July.

Dennis continued north-northwestward after landfall, with the center moving across the western Florida Panhandle into southwestern Alabama before it weakened into a tropical storm. It became a depression as it moved into east-central Mississippi on 11 July. The cyclone turned northward later that day and northeastward on 12 July as it moved into the Ohio Valley. On 13 July, Dennis weakened to a low pressure area, which meandered over the Ohio Valley through 15 July. The Dennis-low accelerated northeastward on 16 July and was absorbed into a larger low over northwestern Ontario on 18 July.

b. Meteorological Statistics

Observations in Dennis (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 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command and the NOAA Aircraft Operations Center. Microwave satellite imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA QuikSCAT, the NASA Aqua, and Defense Meteorological Satellite Program (DMSP) satellites were also useful in tracking Dennis.

The 53rd Weather Reconnaissance Squadron made 43 center fixes on Dennis, with the NOAA aircraft contributing an additional 10 fixes. The maximum flight-level winds measured by the aircraft at 700 mb were 150 kt at 1325 UTC 8 July. Additionally, the aircraft measured 700 mb flight-level winds of 134 kt at 2314 UTC 7 July and 140 kt at 0801 UTC 10 July. Dropsondes in the eyewall of Dennis reported 116-kt surface winds at 1515 UTC 10 July and 114 kt at 1705 UTC 8 July. The minimum aircraft-reported central pressure was 930 mb at 1143 UTC 10 July, with a 937 mb pressure measured at 1517 UTC 8 July. The last aircraft-reported pressure near landfall was 946 mb at 1930 UTC 10 July.

Ship reports of winds of tropical storm force associated with Dennis are given in Table 2, and selected surface observations from land stations and data buoys are given in Table 3.

Dennis brought hurricane conditions to portions of southeastern Cuba, and to a swath through central and western Cuba (Table 3). Cabo Cruz reported 116-kt sustained winds with a gust to 129 kt at 0200 UTC 8 July, with a minimum pressure of 956 mb at 0240 UTC just before the eye passed over the station. The anemometer was destroyed, and it is possible more extreme winds occurred. Unión de Reyes reported sustained winds of 96 kt with a gust to 107 kt at 2350 UTC 8 July, and there are numerous other reports of sustained hurricane-force winds.

Dennis also brought hurricane conditions to portions of the western Florida Panhandle and southwestern Alabama. An instrumented tower run by the Florida Coastal Monitoring Program (FCMP) at Navarre measured 1-min average winds (5-m elevation) of 86 kt and a gust to 105 kt at 1921 UTC 10 July. This tower was a few miles east of the radius of maximum

winds. Another FCMP tower at the Pensacola Airport measured 1-min average winds (10-m elevation) of 71 kt with a gust to 83 kt just west of the eye at 1946 UTC. A Florida Automated Weather Network station at Jay reported sustained winds of 62 kt at 1845 UTC.

While hurricane-force winds associated with Dennis covered only a small area near the eye, the hurricane had a large cyclonic envelope with tropical storm-force winds extending well to the east of the center over southern Florida and the Florida Panhandle. The Coastal Marine Automated Station (C-MAN) at Sand Key, Florida, reported 10-min average winds (13.1-m elevation) of 54 kt with a gust to 68 kt at 0820 UTC 9 July, while the C-MAN station at Sombrero Key, Florida, reported 2-min average winds (48.5-m elevation) of 64 kt with a gust of 76 kt at 0800 UTC 9 July. A National Ocean Service station at Panama City Beach, Florida, reported 6-min average winds (6.1-m elevation) of 51 kt with a gust to 63 kt at 1800 UTC 10 July. Tropical storm conditions also occurred over the metropolitan areas of southeastern Florida, elsewhere along the Florida west coast and the Florida Big Bend region, over portions of southwestern Alabama, and across Jamaica. Wind gusts to tropical-storm force occurred as far inland as eastern Mississippi and as far west as southeastern Louisiana.

Shipping avoided the intense core of Dennis. The highest marine wind was 56 kt at 2300 UTC 8 July from the **Caribbean Princess**.

The lowest official pressure from any land station was 956 mb at Cabo Cruz, Cuba, at 0240 UTC 8 July. The FCMP tower at the Pensacola Airport measured a pressure of 956.3 mb at 1943 UTC 10 July, while the FCMP tower in Navarre measure a pressure of 965.2 mb at 1909 UTC that day. A storm chaser in Pace, Florida, measured an unofficial pressure of 945 mb at 1910 UTC 10 July as the eye passed over.

Dennis produced a storm surge of 6-7 ft above normal tide levels on Santa Rosa Island near where the center made landfall. This surge overwashed Santa Rosa Island near and west of Navarre Beach. A storm surge of 6-9 ft above normal tide levels occurred in Apalachee Bay, Florida, which inundated parts of the town of St. Marks and other nearby areas (Figure 4). This surge was higher than currently known wind reports would support for that area, and roughly 3.5 ft higher that the surge forecast from the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model. This surge was likely triggered by an oceanic trapped shelf wave that propagated northward along the Florida west coast. Modeling results from the Center for Ocean-Atmospheric Prediction Studies at Florida State University suggest that although Dennis was roughly 150 n mi west of the area, this remotely generated sea-level rise added 3-4 ft to the surge in and around Apalachee Bay. (Reference: Personal communication with James O'Brien, Steve Morey, and Dimitri Dukhovskoy, COAPS, FSU.) A storm surge of 4-6 ft occurred elsewhere in the Florida Panhandle. Storm surges of 3-5 ft above normal tide levels occurred elsewhere along the Florida west coast, in the Florida Keys, and along the coast of Alabama. Tides of 2-4 ft above normal were reported along the coasts of Mississippi and southeastern Louisiana. Storm surge data from Cuba are currently not available.

Dennis produced widespread heavy rainfall over Cuba. Topes de Collantes reported a 24-h total of 27.67 in, while Las Piedra reported a 24-h total of 15.13 in. Storm totals for both places were likely higher. Rainfalls of 6-12 in were reported from other Cuban stations. Very

heavy rains also occurred in Jamaica, where Mavis Bank reported a storm total of 24.54 in and Shirley Castle reported a total of 23.27 in (Table 4). In the United States, Dennis produced widespread heavy rainfall along the track from the western Florida Panhandle to the Ohio Valley, and east of the track in Georgia and the remainder of Florida. A station 10 miles northwest of Camden, Alabama, reported a storm total rainfall of 12.80 in, while Monticello, Florida, reported 6.95 in (Table 4).

So far, Dennis is known to have caused nine tornadoes in Florida and one in Georgia. All were rated F0 except for an F1 near Bradenton, Florida. Additionally, numerous strong squalls occurred in the outer bands of Dennis over southern Florida. These produced a gust of 73 kt at the Fowey Rocks C-MAN station and a gust of 63 kt at Chekika in southern Miami-Dade County.

c. Casualty and Damage Statistics

Reports from Meteorological Service of Jamaica and the media indicate Dennis is directly responsible for 42 deaths – 22 in Haiti, 16 in Cuba, 3 in the United States, and 1 in Jamaica. The fatalities in the U. S. included a drowning on a sunken boat in the Florida Keys, a drowning in rough surf at Dania Beach, Florida, and a man crushed by a falling tree near Atlanta, Georgia. Dennis was also indirectly responsible for twelve deaths in Florida – two from electrocution, two from carbon monoxide poisoning, four from automobile accidents, two accidental falls during clean-up, and two cases of natural causes exacerbated by storm stress.

The American Insurance Services Group estimates the insured property damage in the United States at $1.115 billion. Based on a doubling of this figure to account for uninsured property damage, the total U. S. damage estimate for Dennis is $2.23 billion. The Meteorological Service of Jamaica estimates the damage from Dennis at 1.9 billion Jamaican dollars (approximately $31.7 million U. S. dollars).

d. Forecast and Warning Critique

Average official track errors (with the number of cases in parentheses) for Dennis were 25 (26), 36 (26), 51 (26), 61 (26), 65 (22), 74 (18), and 154 (14) n mi for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. These errors are significantly lower than the average official track errors for the 10-yr period 1995-2004[1] (42, 75, 107, 138, 202, 236, and 310 n mi, respectively), (Table 5). These errors were also lower than the corresponding track forecast errors for the vast majority of the guidance, as none of the models consistently outperformed the official forecasts.

Average official intensity errors were 11, 18, 16, 16, 23, 16, and 37 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 1995-2004 are 6, 10, 12, 15, 18, 20, and 22 kt, respectively. The

[1] Errors given for the 96 and 120 h periods are averages over the four-year period 2001-4.

relatively large intensity errors mainly resulted from underforecasting how quickly Dennis would intensify over both the Caribbean and the Gulf of Mexico.

Table 6 gives the watches and warnings associated with Dennis.

Acknowledgements

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Table 1. Best track for Hurricane Dennis, 4 – 13 July 2005.

Date/Time (UTC)	Latitude (EN)	Longitude (EW)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 1800	12.0	60.8	1010	25	tropical depression
05 / 0000	12.2	62.5	1009	30	“
05 / 0600	12.5	64.2	1008	30	“
05 / 1200	13.0	65.9	1007	35	tropical storm
05 / 1800	13.6	67.3	1005	40	“
06 / 0000	14.3	68.5	1000	45	“
06 / 0600	14.7	69.7	995	50	“
06 / 1200	15.1	70.9	991	55	“
06 / 1800	15.6	71.9	989	60	“
07 / 0000	16.2	73.0	982	70	hurricane
07 / 0600	16.7	74.1	972	80	“
07 / 1200	17.6	74.9	967	90	“
07 / 1800	18.5	76.1	957	100	“
08 / 0000	19.4	77.1	951	120	“
08 / 0600	20.3	78.4	953	110	“
08 / 1200	20.9	79.5	938	130	“
08 / 1800	22.0	80.6	941	120	“
09 / 0000	22.7	81.6	960	100	“
09 / 0600	23.4	82.5	973	75	“
09 / 1200	24.3	83.4	967	80	“
09 / 1800	25.2	84.2	962	90	“
10 / 0000	26.1	85.0	942	110	“
10 / 0600	27.2	85.8	935	125	“
10 / 1200	28.5	86.3	930	120	“
10 / 1800	29.9	86.9	942	110	“
11 / 0000	31.5	87.7	970	45	tropical storm
11 / 0600	32.6	88.5	991	30	tropical depression
11 / 1200	33.9	88.8	997	25	“
11 / 1800	35.3	89.1	1002	20	“
12 / 0000	36.4	89.2	1003	20	“
12 / 0600	37.1	89.0	1005	15	“
12 / 1200	37.7	88.7	1007	15	“
12 / 1800	38.1	88.3	1008	15	“
13 / 0000	38.5	87.8	1009	15	“
13 / 0600	38.9	87.2	1010	15	“
13 / 1200	39.2	86.5	1010	15	remnant low
13 / 1800	39.2	85.8	1010	15	“
14 / 0000	39.2	85.7	1009	10	“
14 / 0600	39.0	85.6	1009	10	“
14 / 1200	38.7	85.6	1010	10	“
14 / 1800	38.4	85.6	1010	10	“

15 / 0000	38.1	85.9	1009	10	“
15 / 0600	37.9	86.2	1010	10	“
15 / 1200	38.1	86.4	1012	10	“
15 / 1800	38.4	86.6	1012	10	“
16 / 0000	38.6	86.8	1011	10	“
16 / 0600	39.4	86.5	1013	10	“
16 / 1200	40.2	86.2	1014	10	“
16 / 1800	40.8	85.2	1014	10	“
17 / 0000	41.3	84.1	1013	10	“
17 / 0600	42.2	83.2	1013	10	“
17 / 1200	43.1	82.3	1013	10	“
17 / 1800	43.9	81.4	1012	10	“
18 / 0000	44.6	80.5	1010	10	“
18 / 0600	45.8	79.8	1009	10	“
18 / 1200					absorbed by larger low
04 / 2100	12.1	61.6	1009	30	landfall on Grenada
08 / 0245	19.9	77.6	956	120	landfall near Punta del Ingles, Cuba
08 / 1845	22.1	80.7	941	120	landfall just west of Punta Mangles Altos, Cuba
10 / 1930	30.4	87.1	946	105	landfall on Santa Rosa Island, Florida, 10 miles west of Navarre Beach
10 / 1200	28.5	86.3	930	120	minimum pressure
08 / 1200	20.9	79.5	938	130	maximum wind

Table 2. Selected ship reports with winds of at least 34 kt for Hurricane Dennis, 4 – 13 July 2005.

Date/Time (UTC)	Ship call sign	Latitude (EN)	Longitude (EW)	Wind dir/speed (kt)	Pressure (mb)
07 / 1800	**UBC Stavanger**	15.3	76.8	260 / 43	N/A
07 / 1800	**Lombok Strait**	18.3	74.9	160 / 41	1007.0
08 / 2300	**Caribbean Princess**	24.9	79.8	110 / 56	1008.1
09 / 0000	C6FM9	26.0	79.6	100 / 35	1012.0
09 / 1800	**Sealand Florida**	23.6	82.6	190 / 37	1003.8
09 / 2000	**Julius Hammer**	23.6	82.4	160 / 37	1007.0
09 / 2100	**Sealand Florida**	23.8	81.6	140 / 40	1006.6
10 / 0530	**Explorer of the Seas**	26.3	79.2	120 / 44	1012.5
10 / 0600	**Sea Horse**	25.3	80.0	140 / 35	1019.0
10 / 0600	KS049	25.9	83.3	160 / 39	999.9
10 / 0600	**Carnival Glory**	26.5	78.9	140 / 40	1015.0
10 / 0657	**Explorer of the Seas**	26.0	79.6	100 / 41	1012.0
10 / 1500	KS049	27.6	83.2	190 / 48	1001.8
13 / 2200	**Canadian Enterprise**	42.0	81.5	130 / 40	N/A

Table 3. Selected surface observations for Hurricane Dennis, 4 – 13 July 2005.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Jamaica								
Montego Bay			07/2049	60				
Cuba								
Aguada de Pasajeros	08/2100	977.9	08/2108	96	104			
Bainoa	09/0250	974.5	09/0230	62	67			9.34
Batabanó	09/0455	991.7	09/ N/A	38	48			5.26
Bauta	09/0410	988.9	09/ N/A	35	43			5.55
Cabo Cruz	08/0240	956.0	08/0200	116[h]	129[h]			
Caibarién	08/1800	1000.0	08/1600	31	46			
Camagüey	08/0600	1007.0	08/0500	38	51			
Camilo Cienfuegos	08/1000	1007.1	08/ N/A	36	41			
Casa Blanca	09/0445	975.0	09/0610	68	75			3.64
Cayo Coco	08/0900	1008.3	08/ N/A	30	49			
Cienfuegos	08/1800	982.1	08/1850	81	85			
Colón	08/2110	988.6	08/2110	58	73			10.76
El Jíbaro	08/1400	1002.0	08/1315	56	63			9.27
Esmeralda	08/0700	1005.9	08/0650	35	47			
Florida	08/0900	1005.2	08/0803	38	51			
Guantánamo	07/ N/A	1001.3	07/1850	37	41			
Güines	09/0210	981.1	09/0200	50	57			
Güira de Melena	09/0515	994.2	09/ N/A	29	36			4.23
Indio Hautey	08/2200	994.0	08/2000	62	67			
Jovellanos	08/2200	985.2	08/2350	58	73			12.26
Júcaro	08/1200	1004.5	08/ N/A	45	57			9.57
Jucarito	08/0200	1006.2	08/0440	35	46			
Las Piedra	08/1550	1000.9	08/1543	64	99			15.13
Las Tunas	08/0200	1008.0	08/0950	35	42			
Manzanillo	08/0215	1003.6	08/0135	38	51			
Melena del Sur	09/0230	990.8	09/ N/A	44	56			10.40

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	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Nuevitas	08/0700	1000.8	08/0600	43	51			
Palo Seco	08/0600	1007.5	08/0600	29	39			
Puerto Padre	08/0000	1008.4	07/1910	35	44			
Sagua la Grande	08/2100	1002.1	08/1700	43	59			
Sancti Spíritus	08/1500	1003.3	08/1750	46	60			9.25
Santa Cruz del Sur	08/0645	999.4	08/0600	71	89			
Santiago de las Vegas	09/0540	989.0	09/0610	68	75			5.54
Santo Domingo	08/1750	1000.9	08/1700	56	63			12.46
Tapaste	09/0230	977.0						11.28
Topes de Collantes			08/1555	81	89			27.67
Trinidad	08/1620	988.6	08/1600	94	103			14.11
Unión de Reyes	09/0000	972.5	08/2350	96	107			11.59
Varadero	09/0000	994.2	08/2330	54	67			6.62
Veguitas	08/0200	1002.8	08/0000	28	41			
Venezuela	08/1200	1005.6	08/ N/A	45	50			
Yabú	08/1800	1001.3	08/1300	31	51			8.06
Florida								
Apalachicola (KAAF)	10/1646	1000.7	11/0420	28	33			2.07
Apalachicola[f h]	10/1700	1001.5	10/1124	41	56	6.94	8.11	
Big Pine Key			09/1600	34	48			
Brooksville (KBKV)	09/2228	1009.1	10/1652	24	37			1.82
Cache[j]			09/0716		50			
Carysfort Reef Light			09/1500	51	59			
Chekika[j]			09/0337		63			4.08
Crestview (KCEW)	10/2009	989.5	10/2024	37	50			
Clearwater Beach[f]	10/1000	1006.4	09/2100	30	42	3.87	5.15	
Cross City (KCTY)	10.1754	1008.5	09/2318		39			4.32
Destin (KDTS)			10/1929	49	64			
Destin (FCMP tower)	10/1858	986.9	10/1921	55	70			
Eglin AFB A-5	10/1844	983.1	10/1544	73				

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Eglin AFB A-13B			10/1934	73	90			
Eglin AFB B-71	10/1958	982.1	10/1906	51	82			
Eglin AFB B-75	10/1940	977.7	10/1958	46	77			
Eglin AFB Valparaiso (KVPS)	10/1923	986.1	10/1923	48	72			
Eglin AFB Yellow River	10/1952	968.5						
Everglades City	09/1201	1007.2	09/1601	22	39			
Flamingo	09/0703	1005.5	09/0703	52	59			
Ft. Lauderdale (KFLL)	09/0841	1010.9	09/0857	26	41			
Ft. Lauderdale (KFXE)	09/0921	1011.2	09/1008	29	39			
Ft. Myers (KFMY)	09/2336	1007.8	09/2000	30	40			4.54
Ft. Myers (KRSW)	09/2336	1007.5	09/1929	29	37			
Ft. Myers[f]	09/2300	1008.7	09/2000		36	2.85	3.20	
Homestead ARB (KHST)	09/0555	1007.5	09/0102	24	38			
Jay[l]			10/1845	62				
Kendall Tamiami (KTMB)	09/0728	1007.5	09/0112	38	56			3.59
Key West (KEYW)	09/0853	1001.9	09/1017	53	64			5.81
Key West[f]	09/0848	1002.3	09/1524	27	44	1.67	2.97	
Marathon (KMTH)	09/0853	1006.5	09/0752	33	47			1.88
McKay Bay[f]			09/1706	28	47	3.38	4.84	
Miami Beach	09/0902	1005.8	09/0202	35	60			1.92
Miami Intl. (KMIA)	09/0622	1009.7	08/2222	36	44			2.39
Naples (KAPF)	09/2210	1005.8	09/1759	33	47			2.95
Naples[f]	09/2300	1009.4	09/0800		38	2.99	4.26	
Navarre (FCMP tower)	10/1909	965.2	10/1921	86	105			
New Pass Mote Lab[g]	10/0000	1005.0	09/1630		40			
Oasis[j]			00/0034		37			
Ochopee[j]			09/1536		37			3.29
Old Port Tampa[f]			09/1712		33	3.20	4.63	
Opa Locka (KOPF)	08/0140	1010.9	09/0315	44	58			2.45
Panama City (KPFN)	10/1707	1001.5	10/1757	33	48			3.46
Panama City Beach[f]	10/1800	994.1	10/1800	51	63	5.72	6.79	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Pembroke Pines (KHWO)	09/0706	1010.5	09/0753	33	50			3.09
Pensacola (KPNS)	10/1952	956.6	10/2002	66	81			4.11
Pensacola (FCMP tower)	10/1943	956.3	10/1946	71	83			
Pensacola[f]	10/1900	968.7	10/1900	35	51	4.16	5.52	
Pemsacola NAS (KNPA)	20/1956	976.6	10/1750	39	50			
Pompano Beach (KPMP)	09/0900	1011.6	09/1025	30	43			1.02
Port Manatee[f]			09/2242	28	41	2.87	4.09	
Punta Gorda (KPGD)	09/2359	1008.5	08/2038	35	44			4.39
St. Marks East[j]			10/2114		37			
St. Marks West[j]			10/1546		44			3.75
St. Petersburg (KPIE)	09/2353	1007.5	09/1044	38	50			2.40
St. Petersburg (KSPG)	09/2350	1007.1	09/1706	37	45			2.45
St. Petersburg[f]			10/1212	31	42	3.15	4.49	
Sarasota (KSRQ)	10/0009	1006.1	09/2057	31	38			1.83
Summerland Key			09/0800	36	50			
Tallahassee (KTLH)	10/2027	1005.4	10/1537	33	44			6.64
Tampa Bay C-CUT[f]	09/2252	1004.1	09/2222	39	48			
Tampa Intl. (KTPA)	09/2354	1008.5	09/1718	27	37			1.73
Tampa MacDill AFB (KMCF)			10/1155	33	43			1.63
Tenraw[j]			09/0723		48			
The Villages (KVVG)			09/2225		41			
Vaca Key[f]	09/0718	1005.8	09/0600		44		1.2	
Vandenburg (KVDF)			09/1757		35			
Virginia Key[f]	09/0700	1009.8	09/0300	31	51	0.6	2.6	
West Palm Beach (KPBI)	09/0709	1012.2	09/1053	27	38			2.04
Winter Haven (KGIF)	09/2226	1009.8	09/2314	26	35			2.40
Alabama								
Covington Cnty[j]			10/2220		43			
Dothan (KDHN)	10/2237	999.2	10/1839	33	44			3.07
Mobile (KMOB)	10/2228	990.5	10/1837	32	42			3.71

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Tuskegee[j]			10/2325		36			
Georgia								
Adel[j]			10/2000		34			
Albany	10/2310	1007.5	10/1853	25	37			4.59
Valdosta	10/2048	1009.8	10/1858	24	34			3.91
Mississippi								
Bienville[j]			11/0505		34			
Biloxi (KBIX)			10/1923	26	40			
Biloxi[f]						2.21	3.36	
Greene[j]			10/2310		34			
Gulfport (KGPT)	10/2254	997.6	10/1952	27	36			0.43
Lauderdale[j]			10.2310		48			
Neshoba[j]			11/0310		41			
Ocean Springs[f]	10/2242	995.9				2.50	2.97	
Pascagoula (KPQL)	10/2325	994.2	10/1931		34			1.06
Wausau[j]			11/0105		37			
Waveland	10/2254	1000.0				1.66	2.11	
Louisiana								
Lake Ponchartrain Mid-lake			10/2210	34	42			
New Orleans Lakefront (KNEW)	11/0030	1003.7	10/2120	31	41			0.08
SW Pass[f]	10/2306	1004.0	10/0636	33	38	1.29	2.54	
Buoys/C-MAN								
NOAA 42003 (26.0N 85.9W)	10/0000	991.5	09/2310	38[e]	49			
NOAA 42007 (30.1N 88.8W)	10/2150	995.1	10/1940	34	45			
COMPS 42013 (27.2N 82.9W)[g]	09/2210	1004.5	10/0210	45				

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
COMPS 42014 (25.3N 82.2W)[g h]	09/1129	1001.6						
COMPS 42021 (28.3N 83.3W)[g]	10/1100	1005.4						
NOAA 42036 (28.5N 84.5W)[h]	10/1150	996.4	10/0640	46[e]	58			
NOAA 42039 (28.8N 86.0W)[h]	10/1250	979.0	10/1050	47	58			
NOAA 42058 (15.0N 75.0W)	07/0750	1006.9	07/1350	27	35			
USM 42067 (30.0N 88.7W)[i]			10/2140	34	45			
Burrwood, LA (BURL1)	10/2300	1003.7	10/0640	33	39			
Cedar Key, FL (CDRF1)	10/1000	1009.7	10/0050	42[e]	51	4.81	7.79	
Dauphin Island, AL (DPIA1)	10/2100	990.6	10/1740	44[e]	57	2.76	3.51	
Fowey Rocks, FL (FWYF1)	09/0800	1009.7	09/0720	52[e]	73			
Grand Isle, LA (GDIL1)	11/0000	1004.7	10/2120	27	35	1.05	2.01	
Homosassa, FL (HSSF1)[g]	10/0948	1008.8	09/1948	36	52			
Keaton Beach, FL (KTNF1)	10/1500	1008.1	10/1918	34	48			
Long Key, FL (LONF1)	09/0700	1005.7	09/1250	41[e]	54			
Molasses Reef, FL (MLRF1)	09/0700	1007.6	09/0000	45	58			
NW Florida Bay (NFBF1)[g]	09/0724	1006.1	09/0600	41	54		1.2	
Sand Key, FL (SANF1)	09/0900	999.4	09/0920	54[e]	68			
Shell Point, FL (SHPF1)[g]	10/1430	1006.0	10/1700	32	41			
Sombrero Key, FL (SMKF1)	09/0800	1005.5	09/0800	64	76	1.3	2.6	
Tyndall Tower, FL (SGOF1)	10/1400	1000.4	10/1440	55[e]	68			
Venice, FL (VENF1)	10/0000	1006.0	10/1500	36	41			
Unofficial Observations								
Florida								
Boca Grande[k]	09/2300	1006.3	09/2225		34			
Cape Coral[k]	09/2340	1006.3	09/1924		40			
Cudjoe Key			09/0756		57			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Duck Key			09/1045		66			
Largo[k]	09/2330	1007.3	09/2130		40			
New Port Richey[k]	09/2230	1007.3	09/1745		37			
Niceville[k]	10/1750	988.4	10/1919	39	61			
Pace			10/1956		92		3.5	6.90
Pace	10/1910	945.0						
Pensacola			10/1943		69			
Pensacola (WEAR)	10/ N/A	968.5	10/ N/A		46			7.67
Perdido Key			10/1515	30	42			
St. Petersburg[k]	09/2320	1005.0	09/2200		38			
St. Petersburg[k]	09/2315	1007.3	09/2120		35			
St. Petersburg Beach[k]	09/2345	1002.6	09/2231		45			
Southwood (Florida High)	10/2015	1005.6	10/2350	24	34			6.96
Tallahassee (FSU)								6.64
Venice HS[k]	09/2310	1006.0	08/2115		36			
Alabama								
Foley[k]	10/1925	983.6	10/1600		37			
Lillian	10/2127	986.8	10/1829		38			
Loxley			10/1945		43			
Mobile[k]	10/2200	991.4	09/2000		35			
Mobile Bay (USS Alabama)	10/2137	987.8	10/1948		67			

[a] Date/time is for sustained wind when both sustained and gust are listed.
[b] Except as noted, sustained wind averaging periods for C-MAN and land-based ASOS reports are 2 min; buoy averaging periods are 8 min.
[c] Storm surge is water height above normal astronomical tide level.
[d] Storm tide is water height above National Geodetic Vertical Datum (1929 mean sea level).
[e] 10-min average.
[f] National Ocean Service station – sustained winds are 6-min averages.
[g] University of South Florida COMPS station.
[h] Incomplete record – more extreme values may have occurred.
[i] University of Southern Mississippi station.

[j] RAWS station.
[k] Weather Underground station.
[l] Florida Automated Weather Network station.

Table 4. Supplemental storm-total rainfall observations for Hurricane Dennis, 4 – 13 July 2005.

Location	Rainfall (in)		Location	Rainfall (in)
Jamaica			**Florida**	
Amity Hall	14.27		Andytown 2N	4.13
Beckford Kraal	9.61		Big Cypress	4.65
Bois Content	4.44		Coral Springs	3.27
Brandon Hill	13.28		Coral Springs 11W	3.06
Bybrook	7.85		Ft. Lauderdale WP	4.36
Castleton Gardens	12.60		Hillsboro Canal	3.05
Charm Hole	17.02		Hollywood	5.03
Constant Spring	15.51		Lakeland	3.02
Enfield	10.71		Marco Island	3.03
Ft. George Botanical Gardens	12.44		Mariana (MARF1)	3.75
Golden Spring	17.10		Miles City	4.13
Grass Piece	10.26		Miramar 17W	4.66
Hordley Estate	9.85		Monticello (MTCF1)	6.95
Industry	6.60		Moore Haven	3.05
Kingston Norman Manley Aprt.	12.28		Niceville	5.15
Lawrence Tavern	12.78		Oasis Ranger Station	3.05
Long Road	14.56		Ona	3.33
Mavis Bank	24.54		Ortona	4.88
Monn	14.20		Pennsuco	4.30
Moore Town	18.36		Perrine	6.89
Morant Bay	11.75		Plantation	4.49
New Hall	10.09		Quincy (QCYF1)	4.97
New Works	10.18		Racoon Point	4.09
Norbrook	15.03		South Bay	3.25
Norris	15.38		Steinhatchee (SHMF1)	3.75
Plantain Garden	9.96		Sweetwater 14N	4.07
Ramble	13.92			
Ritchies	13.94		**Georgia**	
Rock River	12.16		Ashburn (ASHG1)	4.70
Rose Hill	18.13		Bainbridge (BAIG1)	5.79
Shirley Castle	23.27		Camilla (CAMG1)	4.37
Spring Garden	8.02		Crisp Cnty Power Dam (WWCG1)	5.86
Swanson	12.14		Dawson (DAWG1)	5.78
Swift River	12.24		Leesburg (LEEG1)	6.14
Thompson Town	11.46		Moultrie (MOUG1)	6.00
Trout Hall	10.00		Tifton (TFTG1)	4.52
Wakefield	7.60			
Worthy Park Estate	7.87		**Alabama**	
			Bay Minette	4.65
			Brewton	3.50
			Camden 10 NW	12.80
			Evergreen	3.81
			Geneva (GVAA1)	3.48
			Jackson	4.24

Table 5. Preliminary forecast evaluation (heterogeneous sample) for Hurricane Dennis, 4 – 13 July 2005. 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	32 (27)	62 (27)	96 (27)	135 (27)	192 (23)	266 (19)	354 (15)
GFDI	36 (26)	64 (26)	84 (26)	100 (26)	113 (22)	122 (18)	162 (14)
GFDL*	34 (26)	69 (26)	87 (26)	103 (26)	118 (23)	109 (19)	**152** (15)
GFNI	31 (21)	58 (21)	79 (21)	102 (21)	152 (18)	217 (14)	253 (10)
GFDN*	27 (18)	60 (17)	81 (17)	95 (16)	140 (13)	231 (11)	289 (6)
FV4	53 (25)	89 (25)	112 (24)	113 (24)	89 (21)	121 (17)	230 (13)
AF1I	31 (21)	64 (21)	97 (21)	140 (21)	254 (17)		
AFW1*	36 (11)	60 (11)	83 (11)	118 (11)	195 (9)		
COAI	**23** (13)	45 (13)	75 (13)	106 (13)	213 (9)		
COAL*	32 (8)	50 (8)	83 (8)	104 (7)	193 (5)		
COEI	39 (20)	75 (20)	107 (20)	129 (18)			
COCE*	29 (10)	64 (10)	106 (10)	121 (9)			
ETAI	43 (23)	89 (23)	125 (23)	148 (22)	201 (17)		
ETA*	37 (25)	82 (25)	118 (25)	142 (23)	198 (18)		
GFSI	31 (25)	46 (25)	57 (25)	64 (25)	77 (21)	132 (17)	229 (13)
GFSO*	38 (25)	56 (25)	63 (25)	71 (25)	73 (22)	105 (18)	179 (14)
AEMI	33 (19)	54 (18)	68 (18)	76 (18)	92 (15)	104 (12)	**113** (9)
AEMN*	35 (22)	53 (21)	68 (20)	76 (19)	89 (16)	91 (13)	**102** (10)
NGPI	**21** (23)	42 (23)	61 (23)	82 (23)	101 (19)	122 (15)	**136** (11)
NGPS*	25 (25)	44 (24)	66 (24)	84 (23)	107 (19)	134 (15)	**134** (11)
UKMI	25 (25)	38 (25)	52 (25)	68 (25)	98 (21)	179 (17)	288 (13)
UKM*	26 (14)	36 (14)	**50** (14)	63 (13)	98 (11)	141 (9)	250 (7)
A98E	30 (27)	53 (27)	72 (27)	84 (27)	121 (23)	174 (19)	255 (15)
A9UK	26 (12)	44 (12)	56 (12)	62 (12)	87 (10)		
BAMD	26 (27)	40 (27)	56 (27)	74 (27)	106 (23)	175 (19)	278 (15)
BAMM	27 (27)	45 (27)	65 (27)	82 (27)	114 (23)	156 (19)	235 (15)
BAMS	39 (26)	63 (26)	84 (26)	101 (26)	136 (22)	190 (18)	275 (14)
LBAR	29 (27)	45 (27)	68 (27)	90 (27)	137 (23)	143 (19)	210 (15)
CONU	**23** (25)	41 (25)	55 (25)	70 (25)	84 (21)	124 (17)	173 (13)
GUNS	**22** (23)	40 (23)	56 (23)	70 (23)	82 (19)	114 (15)	**147** (11)
GUNA	**22** (23)	41 (23)	53 (23)	65 (23)	75 (19)	106 (15)	155 (11)
FSSE	**23** (22)	40 (22)	**48** (22)	62 (21)	78 (16)	148 (14)	273 (9)
OHPC	31 (25)	46 (25)	58 (25)	70 (25)	77 (21)	125 (17)	224 (13)
OFCI	26 (25)	39 (25)	54 (25)	62 (25)	68 (21)	90 (17)	192 (13)
OFCL	25 (26)	36 (26)	51 (26)	61 (26)	65 (22)	74 (18)	154 (14)
NHC Official (1995-2004 mean)	42 (3400)	75 (3116)	107 (2848)	138 (2575)	202 (2117)	236 (649)	310 (535)

* Output from these models was unavailable at forecast time.

Table 6. Watch and warning summary for Hurricane Dennis, 4 – 13 July 2005.

Date/Time (UTC)	Action	Location
5 / 1500	Tropical Storm Watch issued	Barahona Dominican Republic to Port au Prince Haiti
5 / 2100	Tropical Storm Warning issued	Barahona Dominican Republic to Port au Prince Haiti
5 / 2100	Hurricane Watch issued	Jamaica and the southwest peninsula of Haiti west of the Dominican Republic border
6 / 0300	Hurricane Watch issued	Cayman Is.
6 / 0600	Hurricane Watch issued	Eastern Cuba including Las Tunas, Granma, Santiego de Cuba, Guantanamo, and Holguin
6 / 0900	Hurricane Warning issued	Jamaica and the southwest peninsula of Haiti west of the Dominican Republic border
6 / 0900	Tropical Storm Warning issued	South coast of the Dominican Republic from Barahona westward to the Haiti border
6 / 1500	Hurricane Watch issued	Cuba including Sancti Spiritus, Ciego de Avila, and Camaguey
6 / 2100	Hurricane Warning issued	Eastern Cuba including Granma, Santiago de Cuba, and Guantanamo
7 / 0000	Tropical Storm Warning discontinued	Dominican Republic
7 / 0300	Hurricane Warning issued	Cayman Is.
7 / 1500	Tropical Storm Watch issued	Florida west coast from Bonita Beach southward and Florida east coast from Golden Beach to Ocean Reef
7 / 1500	Hurricane Warning issued	Cuba including Matanzas, Villa Clara, Cienfuegos, Sancti Spiritus, Camaguey, and Las Tunas
7 / 1500	Hurricane Watch issued	Cuba including Isle of Youth, Pinar del Rio, La Habana, Ciudad de la Habana, and Holguin
7 / 1500	Hurricane Watch issued	Florida Keys and Florida Bay
7 / 2100	Tropical Storm Warning issued	Florida Keys east of Seven Mile Bridge to Ocean Reef including Florida Bay
7 / 2100	Hurricane Warning issued	Florida Keys from Seven Mile Bridge westward

Date/Time (UTC)	Action	Location
8 / 0300	Tropical Storm Warning issued	Florida west coast from Bonita Beach southward and Florida east coast from Golden Beach to Ocean Reef
8 / 0300	Tropical Storm Watch issued	Florida west coast north of Bonita Beach to Longboat Key
8 / 0300	Hurricane Warning issued	Cuba including La Habana and Ciudad de la Habana
8 / 0300	Hurricane Warning discontinued	Southwest peninsula of Haiti
8 / 0900	Hurricane Warning discontinued	Jamaica
8 / 1200	Hurricane Warning changed to Tropical Storm Warning	Cayman Brac and Little Cayman
8 / 1200	All warnings discontinued	Grand Cayman Is.
8 / 1500	Tropical Storm Warning discontinued	Cayman Brac and Little Cayman
8 / 2100	Tropical Storm Watch discontinued	Long Boat Key to Bonita Beach
8 / 2100	Tropical Storm Warning issued	Florida west coast from Anclote Key to Longboat Key
8 / 2100	Tropical Storm Watch issued	Florida west coast north of Anclote Key to the Steinhatchee River
8 / 2100	Hurricane Watch issued	Steinhatchee River, Florida to the mouth of the Pearl River
9 / 0300	Tropical Storm Watch issued	Mouth of the Pearl River to Grand Isle, Louisiana including metropolitan New Orleans and Lake Ponchartrain
9 / 0900	Hurricane Warning issued	Steinhatchee River, Florida to the mouth of the Pearl River
9 / 0900	Tropical Storm Warning issued	Mouth of the Pearl River to Grand Isle, Louisiana including metropolitan New Orleans and Lake Ponchartrain
9 / 0900	Tropical Storm Warning issued	Florida west coast north of Anclote Key to the Steinhatchee River
9 / 0900	Hurricane Warning discontinued	Cuba including all provinces from Sancti Spiritus eastward
9 / 1500	Hurricane Watch discontinued	Florida Keys east of Seven Mile Bridge to Ocean Reef
9 / 1500	All watches and warnings discontinued	Cuba
9 / 2100	Hurricane Warning changed to Tropical Storm Warning	Florida Keys west of the Seven Mile Bridge

Date/Time (UTC)	Action	Location
9 / 2100	Tropical Storm Warning discontinued	Florida coast from Golden Beach to Flamingo and the Florida Keys from the Seven Mile Bridge eastward
10 / 0300	Tropical Storm Warning discontinued	Florida west coast south of Bonita Beach
10 / 0900	Tropical Storm Warning issued	Louisiana coast west of Grand Isle to Morgan City
10 / 0900	Tropical Storm Warning discontinued	Florida Keys
10 / 1300	Hurricane Warning changed to Tropical Storm Warning	Florida coast east of the Ochlockonee River to the Steinhatchee River
10 / 1500	Tropical Storm Warning discontinued	West of Grand Isle, Louisiana and south of Longboat Key, Florida
10 / 2100	Hurricane Warning modified to	AL/MS border to Destin, Florida
10 / 2100	Tropical Storm Warning modified to	Destin to Longboat Key, Florida
10 / 2100	Tropical Storm Warning modified to	Mouth of the Pearl River to AL/MS border
10 / 2300	Hurricane Warning changed to Tropical Storm Warning	AL/MS border to Destin, Florida
11 / 0300	All warnings discontinued	U. S. Gulf coast

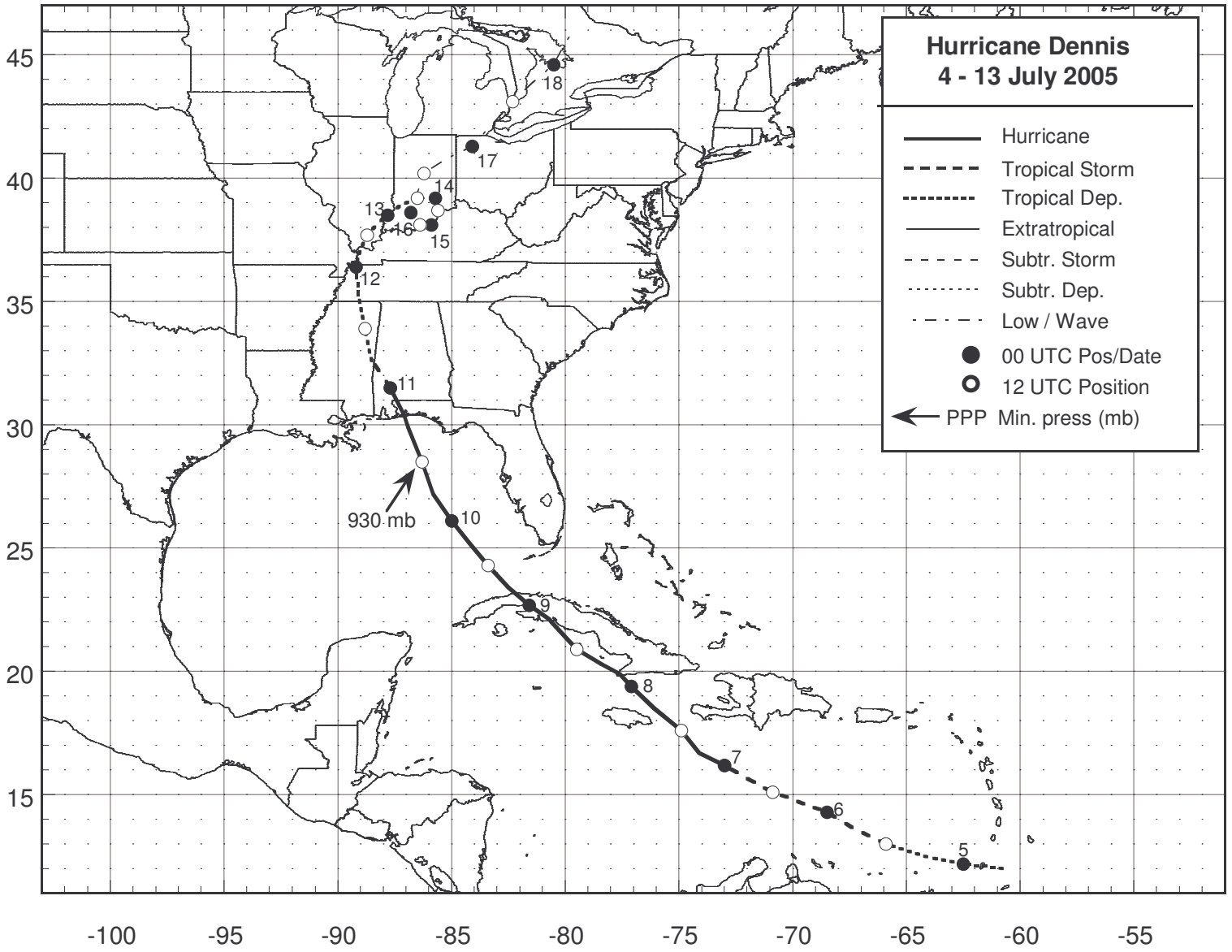

Figure 1. Best track positions for Hurricane Dennis, 4-13 July 2005.

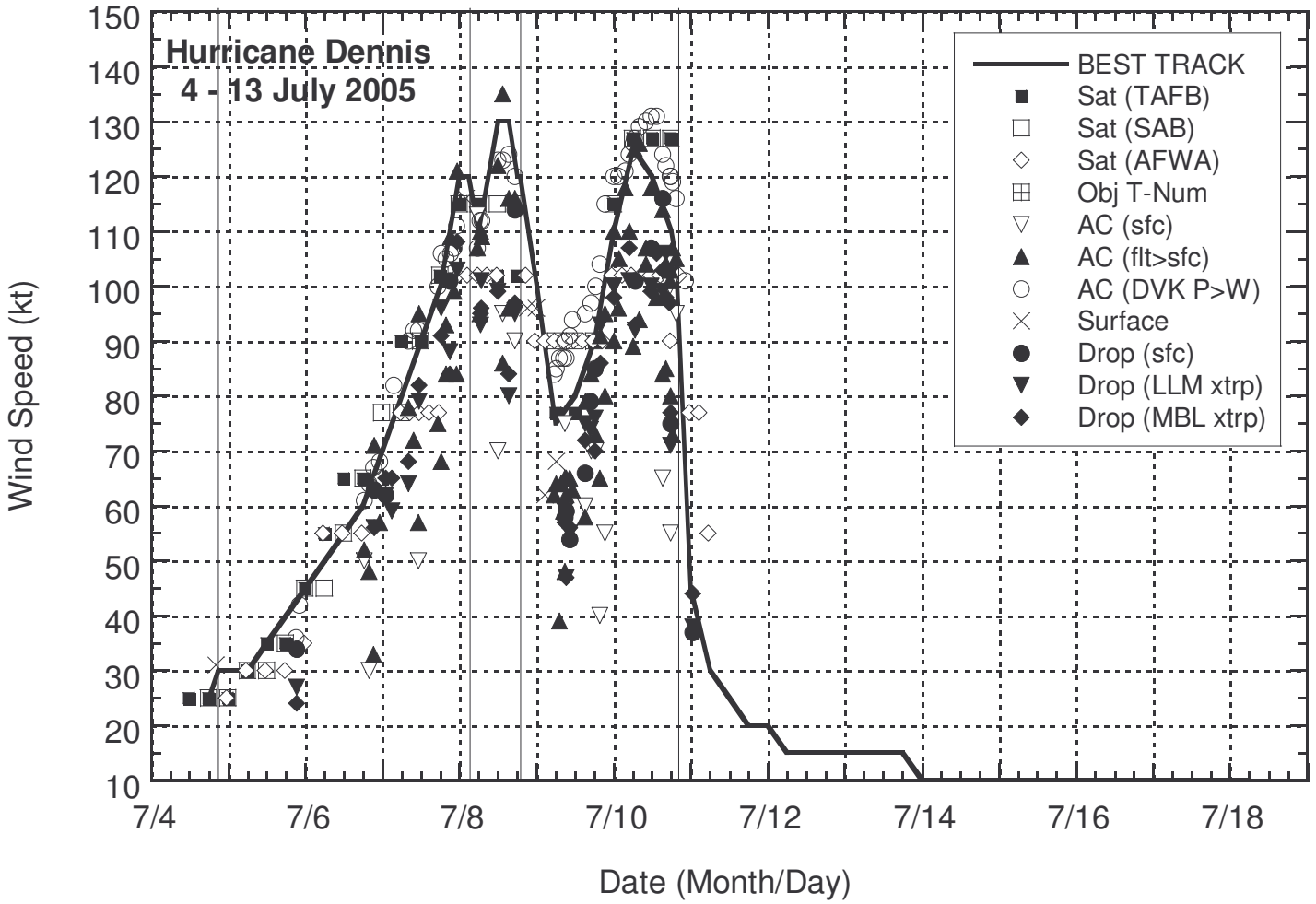

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Dennis, 4-13 July 2005. Aircraft observations have been adjusted for elevation using 90% and 80% reduction factors for observations from 700 mb and 850 mb, respectively. Dropwindsonde observations 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. Solid vertical lines indicate times of landfall.

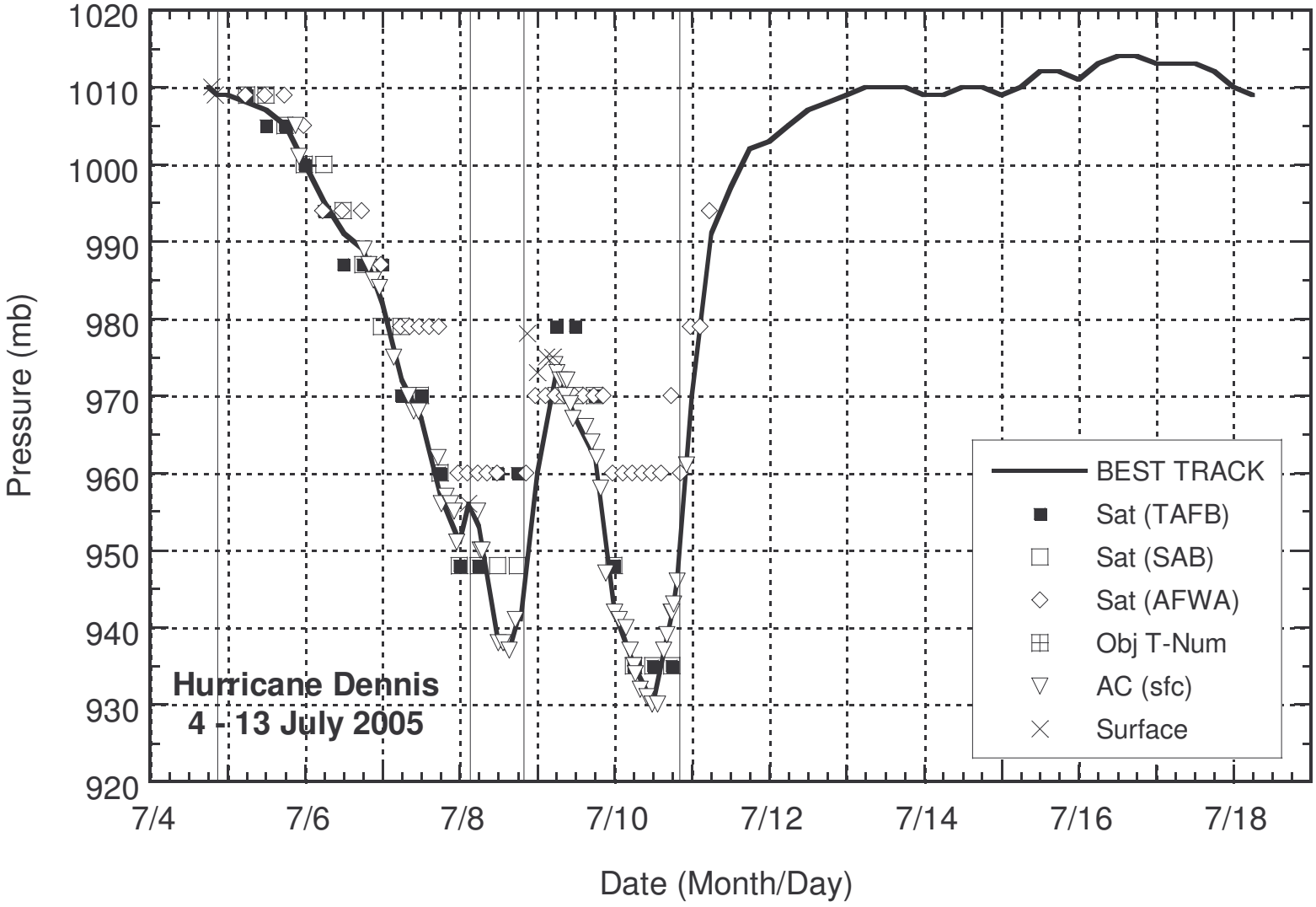

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Dennis, 4-13 July 2005. Objective Dvorak estimates represent linear averages over a three-hour period centered on the nominal observation time. Solid vertical lines indicate times of landfall.

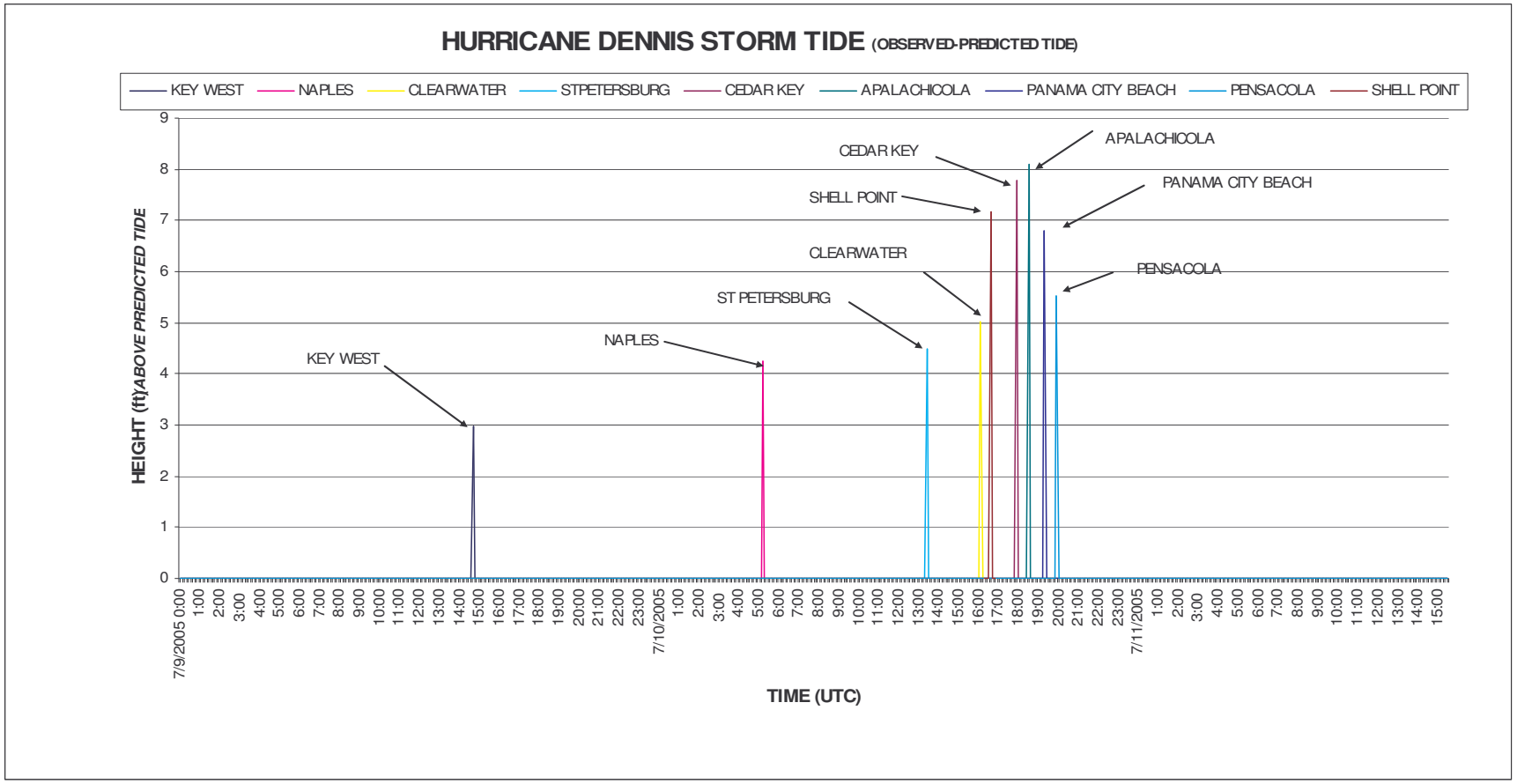

Figure 4. Storm-induced tides (surges) for Hurricane Dennis plotted versus time for the stations along the Florida west coast and Apalachee Bay. Image courtesy of the TPC Storm Surge unit.