

Preliminary Report  
Hurricane Erin  
31 July - 6 August 1995

Edward N. Rappaport  
National Hurricane Center  
26 November 1995

a. Synoptic History

Erin formed from a tropical wave that crossed from the coast of Africa to the tropical eastern Atlantic Ocean on 22 July 1995. A large area of disturbed weather and two distinct low-level circulation centers accompanied the wave. The circulation centers were oriented from northwest to southeast and moved in tandem toward the west-northwest over the following five days.

By the 27th, both circulations were generating deep convection a few hundred miles to the northeast of the Leeward Islands. A day later, meteorologists at the NHC Tropical Analysis and Forecast Branch (TAFB, formerly TSAF as in figures) and the NESDIS Synoptic Analysis Branch (SAB) assigned Dvorak technique T-numbers of 1.5 to the trailing cloud cluster. These numbers increased to T-2.5, potentially indicative of a tropical cyclone with 35 knot (tropical storm force) winds by midday on the 30th. In reality, although the cloud pattern was slowly consolidating and surface pressures were falling ahead of the system in the Bahamas, development was retarded by southwesterly vertical wind shear associated with an upper-level low that was moving southwestward at 10-15 knots across Florida. Reconnaissance aircraft data from the U.S. Air Force Reserves (Hurricane Hunters) on the 28th, 29th, and again during midday on the 30th indicated that the system did not have a closed circulation at low levels. Instead it was a very vigorous tropical wave--winds speeds around 40 knots were reported from ships in the northern part of the cloud pattern.

Because of the system's potential for development and its close proximity to the Bahamas and Florida, a special nighttime reconnaissance mission was requested by the NHC and flown by the Hurricane Hunters late on the 30th. The first "vortex message" was transmitted to the NHC shortly after 0100 UTC on the 31st. From that information it is estimated that the system became Tropical Storm Erin at 0000 UTC on the 31st (Fig. 1, Table 1).

The upper-level low near Florida affected Erin's movement and development. Associated steering currents accelerated Erin from 5 to 15 knots and diverted the cyclone around the northeast side of the low. The temporary and fairly subtle change of heading from west-northwest to northwest might have been insignificant if Erin had not been so close to land. Instead, the track of the center was deflected to a course that was over or near much of the Bahama Island chain and then toward a landfall over east-central (rather than southeast) Florida. As this occurred, enough shearing persisted to permit only slow strengthening. On the evening of the 31st, Erin became a hurricane while centered near Rum Cay in the Bahamas. A ragged-looking eye appeared on satellite pictures on

August 1st. Erin made landfall around 0600 UTC on the 2nd near Vero Beach, Florida as a Category 1 hurricane on the Saffir/Simpson Hurricane Scale, with estimated maximum one-minute wind speeds of 75 knots.

Erin's track bent back to west-northwest while the cyclone crossed the Florida peninsula during the morning and early afternoon of the 2nd. The cyclone weakened to a tropical storm with 50-knot winds during that period, but remained well-organized. Upon emerging into the eastern Gulf of Mexico, Erin reintensified on a track that gradually swung back to northwestward at about 10 knots. Final landfall occurred near Pensacola, Florida during the late morning of the 3rd. An eye had redeveloped but upper-level outflow was not particularly impressive on satellite images. Erin had around 85 knot winds (Category 2) in a small area of its northeastern eyewall when that part of the hurricane came ashore near Fort Walton Beach in the western Florida panhandle.

Erin weakened to a tropical storm in southeastern Mississippi overnight on the 3rd/4th. It was a tropical depression when its track shifted to the north on the 5th and the east on the 6th. The depression merged with a frontal system over West Virginia on the 6th.

#### b. Meteorological Statistics

Erin's intensity was estimated from the data presented in Figs. 2 and 3 and Table 2. Those figures show the curves of Erin's central pressure and maximum one-minute wind speed, respectively, versus time, along with the observations on which they were based. The figures contain relevant surface observations and intensity estimates derived from analyses of satellite images performed by the TAFB, SAB and the Air Force Global Weather Central (AFGWC). The aircraft data came from reconnaissance flights by the U.S. Air Force Reserve unit based at Keesler Air Force Base, Mississippi.

Table 2 lists a selection of surface observations. The highest wind at the surface was a gust to 128 knots reported in association with a tornado at Providenciales in the Turks and Caicos Islands.

Several reports of hurricane force winds (WMO-standard 10-minute average) were received from the Bahamas, including 68 and 70 knots during the passage of the northeast part of the eyewall over Cat Island at 0200 UTC and 0400 UTC, respectively, on August 1st. These 10-min winds are about 80 percent of the 86 knot maximum 10-second 850 mb flight-level winds encountered by the reconnaissance aircraft. Several amateur radio reports included gusts to around 90 knots in the Bahamas. The ship **Tampa** was in the northeastern eyewall at 1200 UTC on the 1st when it reported 70 knot winds.

The basis for the 75-knot wind speed estimate along the Florida east coast was a one-minute wind speed of 74.6 knots recorded by a Florida Institute of Technology anemometer which made one observation per hour at Sebastian Inlet. This wind appears to coincide with the passage of one of Erin's strongest convective

cells at that time (0500 UTC), which was located in the northwestern eyewall. While somewhat higher winds could have been expected to occur offshore in the (normally stronger) northeastern eyewall, Doppler radar data for that area suggests that the peak winds (inbound toward Melbourne) at the lowest tilt angle were only slightly stronger, around 85 knots. The maximum 850 mb flight-level wind speed then was around 85 knots.

A wind speed of 85 knots is estimated at 1330 UTC on 3 August near Fort Walton Beach. This took place in a small area within Erin's strongest sector, the northeastern eyewall, as it swept across the shoreline. That estimate is based largely on NWS Mobile office Doppler wind data which showed inbound wind speeds exceeding 100 knots in a few volume samples centered at about 9,800 feet above the coast from 1320 to 1400 UTC. The peak 850 mb flight-level wind speed leading up to this time was 92 knots in the northeastern eyewall near 1200 UTC, but subsequent excursions into that part of the hurricane were precluded by the hurricane's close proximity to land.

Doppler velocities decreased by about 15 knots over the following two hours and 75 knots is the estimated maximum surface wind speed when the center of the eye came ashore around 1600 UTC. Hence, the coastal region immediately west of Fort Walton Beach, including Pensacola, experienced Category 1 conditions, though gusts to near 100 knots likely occurred. The FAA system of six anemometers at Pensacola Regional Airport (PNS) registered a maximum 30-second wind speed of about 60 knots. The highest wind speed measured at an official reporting station in the Florida panhandle was an 88-knot gust at the Pensacola Naval Air Station (NPA). Amateur radio operators relayed unofficial observations of gusts near 95 knots to the NHC.

The hurricane's lowest pressure of 973 mb was reported by the Hurricane Hunters near 1330 UTC and again near 1600 UTC on the 3rd. The latter measurement placed the center of Erin near the coast and in the southern part of the eye as seen on surface radar.

The Melbourne National Weather Service Office estimated that Erin generated a 2 to 4 foot storm tide during the Florida east coast landfall. Storm tides averaged 1 to 2 feet along the west-central Florida peninsula. According to the Melbourne office, up to about 12 inches of rain fell southwest through northwest of their site. Several small, brief tornadoes occurred over east-central Florida well after Erin made landfall. One tornado caused minor damage in Titusville. Another occurred near Lake Lizzie, killing two horses. A couple of weak tornadoes were also reported over northeast Florida and in the panhandle near Hurlburt Air Force Base.

Storm tides were estimated at 6 to 7 feet just west of Navarre Beach and 3 to 4 feet along Pensacola Beach. Up to about 5 inches of rain was reported from the panhandle.

### c. Casualty and Damage Statistics

There were no deaths reported in the Bahamas or in Florida. A total of six deaths occurred in the Atlantic and Gulf of Mexico waters off Florida. All drowned. The 234-foot gambling and cruise ship **Club Royale** sank in the Atlantic 90 miles east of Cape Canaveral and three crew members are presumed dead. A 15-year old surfer drowned in a rip current off Palm Beach County. A man and daughter in an inflatable boat were swept from the Cape San Blas area into the Gulf of Mexico where they presumably drowned.

All Bahamas islands from Mayaguana to Grand Bahama suffered damage characterized by the Bahamas Department of Meteorology as mostly minor. Some structural damage, sunken boats, crop loss and flooding was reported. Losses known to date for Abaco, Grand Bahama, Mayaguana, and Exuma total \$400,000.

The American Insurance Services Group estimated \$375 million as the loss to insured property in the United States caused by Erin (\$350 million in Florida, \$20 million in Alabama, and \$5 million in Mississippi). Because the total loss is usually estimated by the NHC to be up to about double the insured loss, the total U.S. loss is tentatively estimated at \$700 million.

Wind damage occurred over east-central and northeast Florida. Thousands of homes and businesses suffered damage in Brevard county. Less significant damage occurred in other counties in the region. Freshwater flooding from rainfall occurred in the Melbourne and Palm Bay areas and westward in some spots to the Florida gulf coast. Beach erosion occurred along the central Florida east coast, with damage mainly to boardwalks, beach accessways and the dune system. Light to moderate beach erosion was also reported northward to the Georgia border. Minor erosion occurred along the west-central Florida coast.

The most significant structural damage for the final landfall occurred on Pensacola Beach, Navarre Beach, around Mary Esther and in northeast Pensacola. More than 2,000 homes were damaged there and crop losses were reported. Some beach erosion was reported west of Navarre Beach. Farther inland, about 100 homes were damaged in Alabama. Widespread tree, power line and crop damage extended inland.

### d. Forecast and Warning Critique

Prior to Erin becoming a tropical cyclone and the NHC initiating advisories, forecasts and warnings for the precursor tropical wave/gale system were issued in High Seas Forecasts of the NWS Tropical Prediction Center. During that period, NHC Tropical Weather Outlooks indicated that the wave could soon become a tropical depression or tropical storm. Nevertheless, no lead time (in the traditional sense of tropical storm or hurricane watches or warnings) was available to the Turks and Caicos Islands and the southeastern Bahamas. For the future, it might be worth considering whether and how to issue such watches/warnings (and,

perhaps, track forecasts) for systems near land that could rapidly become a threatening tropical cyclone.

Compared to the most recent 10-year averages, the NHC track forecast errors for Erin were of about normal magnitude at 12 and 24 hours and much smaller than normal at 48 and 72 hours (Table 3). The first few NHC forecasts and the corresponding numerical guidance did not accurately incorporate the effects of the upper-level low near Florida on the path of Erin, and generally showed the cyclone making landfall over southeast Florida. Intensity forecasts were generally quite good, although in the first two forecasts not enough strengthening was shown because the deleterious effects of strong vertical wind shear were incorrectly forecast to persist.

Some people in the Pensacola area indicated that they did not have sufficient notice of Erin's approach (see Table 4). Table 5 shows lead times for that area of about 37, 25, and 21 hours for the tropical storm watch, tropical storm warning, and hurricane warning, respectively. Although there was no hurricane watch, the other lead times are close to normal and, based on past experience, should have been sufficient to accomplish the necessary tasks to protect life and property. In fact, there were no lives lost in that area.

Rather than lack of lead time, it appears that the hurricane warning was not taken seriously. Comments suggest one reason was that the NHC forecasts did not show the cyclone center moving directly over Pensacola. This is a critical misuse of NHC's forecasts. The users of NHC advisory information are encouraged to be familiar with potential track errors (Table 3) and to understand that warning areas are designated with those uncertainties in mind. In addition, cyclones which move along a course roughly parallel to the coast pose an additional problem because even a slight sideways jog of the hurricane or nonuniformity of the coastline can result in landfall. In the limiting case, the center of the eye can remain just offshore, but the entire coast could experience the eyewall and its destructive hurricane conditions. In the future, to ameliorate this kind of situation, the NHC will further their efforts to deemphasize the precise forecast track in favor of the threat implied by a watch or warning.

Apparently, a second problem was that Erin was "only" a tropical storm when the hurricane warning was issued on the afternoon of August 2. Residents were "surprised" to find out that Erin had become a hurricane (as was forecast) when they awoke on the morning of the 3rd. Hence, the public did not give enough attention to the intensity forecast--but paid too close attention to details of the track forecast. In both instances, the hurricane warning should have been the overriding consideration driving public response.

#### **Acknowledgments**

Some information in this report was provided by the Forecast Office of the Bahamas Department of Meteorology and by NWS offices in the watch and warning areas.

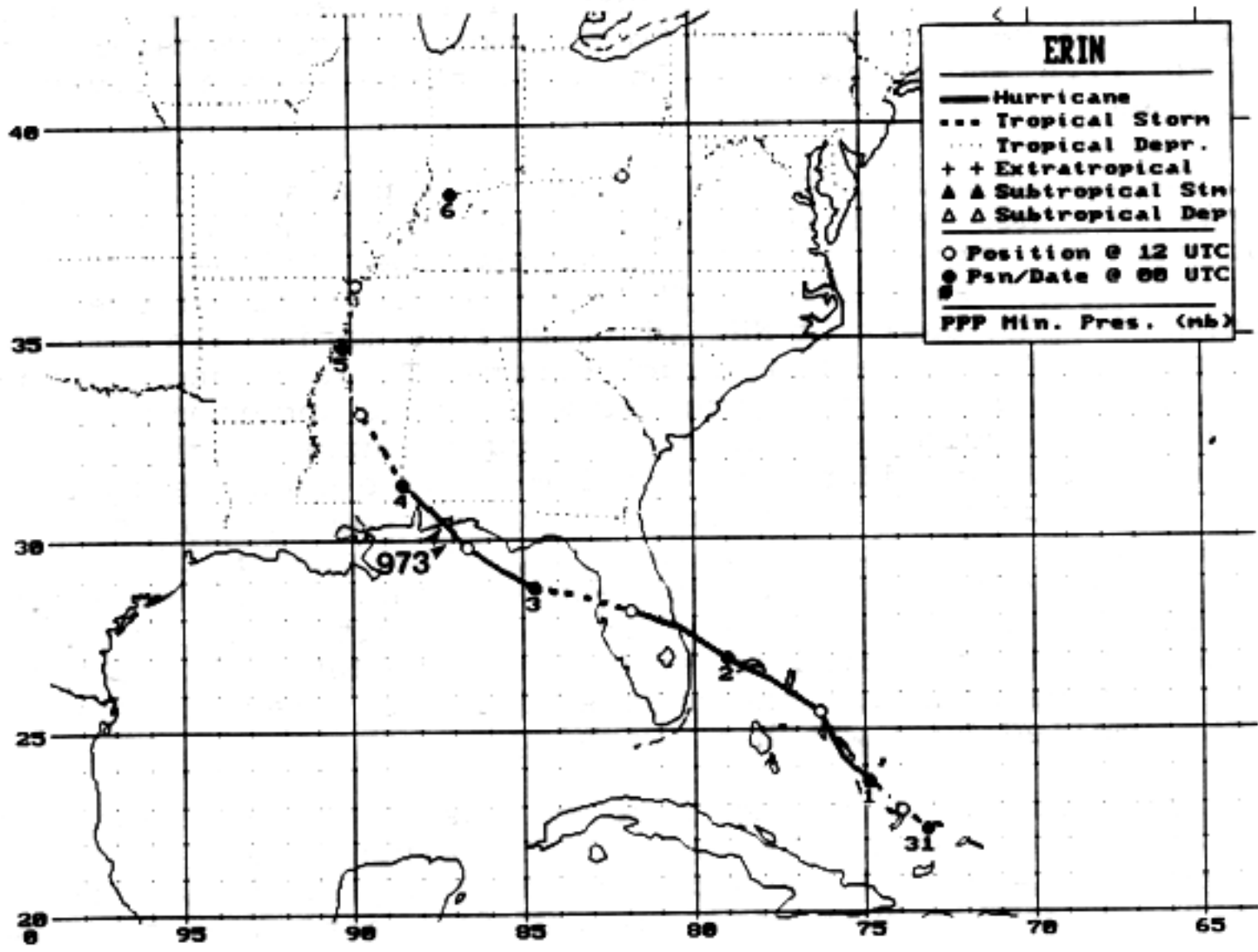


Figure 1. Track of Hurricane Erin.

Table 1

## Track of Hurricane Erin, 31 July-6 August 1995

Date/Time (UTC)	Position		Pressure (mb)	Wind Speed (kt)	Stage
	Lat. (°N)	Lon. (°W)			
31/0000	22.3	73.2	1004	45	Tropical Storm
0600	22.6	73.6	1003	50	" "
1200	22.8	73.9	999	55	" "
1800	23.2	74.3	997	60	" "
01/0000	23.6	74.9	992	70	Hurricane
0600	24.3	75.7	988	75	" "
1200	25.5	76.3	985	75	" "
1800	26.3	77.7	980	75	" "
02/0000	26.9	79.0	982	75	" "
0600	27.7	80.4	985	75	" "
1200	28.2	81.9	990	50	Tropical Storm
1800	28.6	83.4	988	60	" "
03/0000	28.8	84.7	985	65	Hurricane
0600	29.3	85.7	979	70	" "
1200	29.8	86.6	974	80	" "
1800	30.6	87.5	985	65	" "
04/0000	31.4	88.5	997	45	Tropical Storm
0600	32.3	89.1	1001	35	" "
1200	33.2	89.7	1003	20	Tropical Depression
1800	34.1	90.2	1003	20	" "
05/0000	34.8	90.2	1003	20	" "
0600	35.4	90.1	1003	20	" "
1200	36.3	89.8	1003	20	" "
1800	37.5	88.8	1003	20	" "
06/0000	38.4	86.8	1003	20	" "
0600	38.7	84.9	1005	20	" "
1200	38.8	82.0	1008	20	Merged with front

03/1330	30.0	86.8	973	85	Mx. Speed/Mn. Press.
03/1600	30.3	87.2	973	75	Minimum Pressure

## Landfall information:

Many islands in the Bahamas chain either had a landfall or received a "direct hit", defined as coming within one Radius of Maximum Wind (RMW) to the left of the cyclone center or two RMW to the right of center.

## near Vero Beach, Florida

02/0615	27.7	80.3	984	75	Hurricane
---------	------	------	-----	----	-----------

## near Fort Walton Beach, Florida (landfall of eyewall)

03/1330				85	Hurricane
---------	--	--	--	----	-----------

## Pensacola Beach, Florida

03/1600	30.3	87.2	973	75	Hurricane
---------	------	------	-----	----	-----------

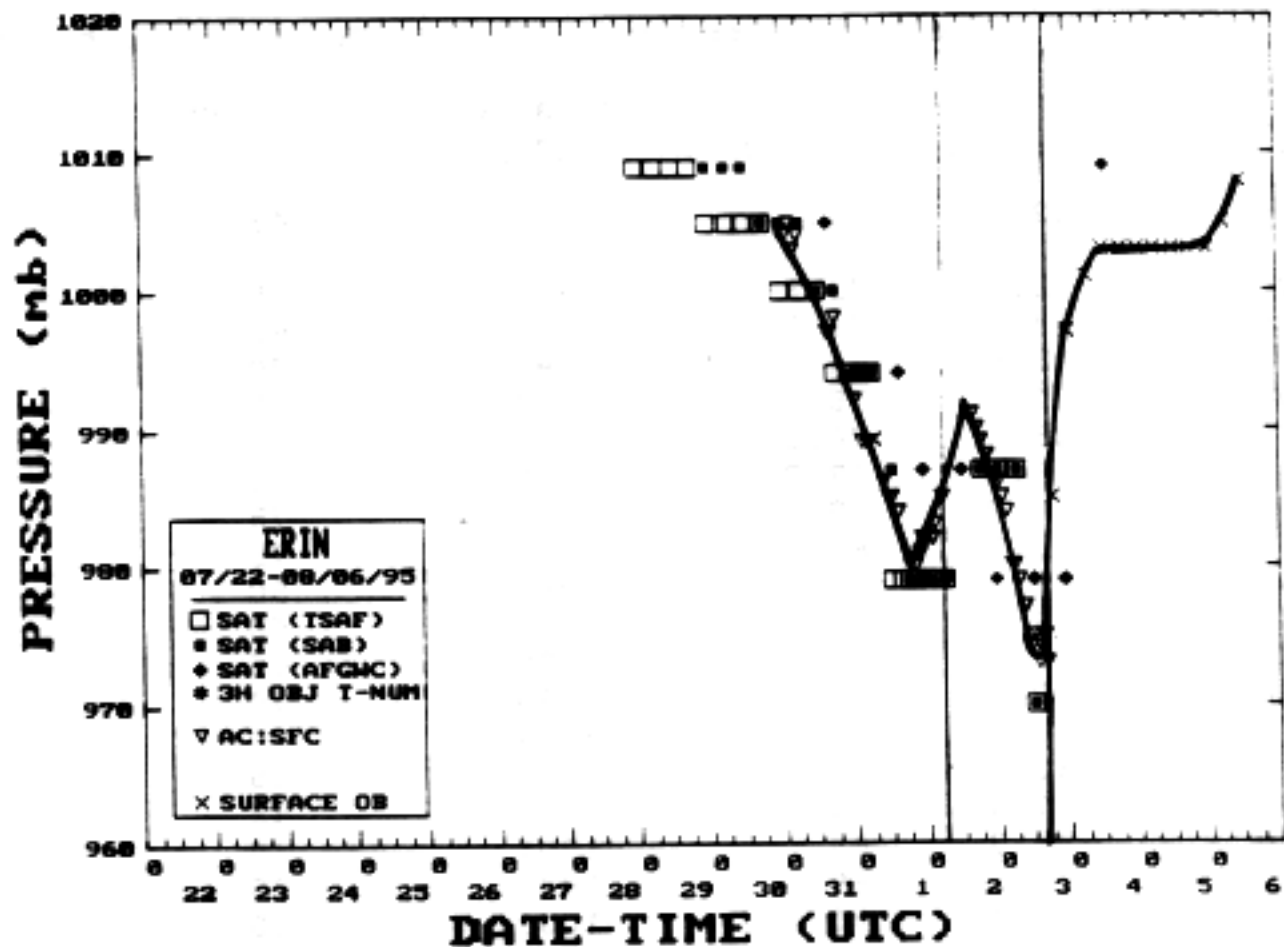


Figure 2. Central pressure curve for Hurricane Erin, July - August 1995. Vertical line denotes mainland landfall. X's indicate observations before final landfall and estimates from surface analyses thereafter.

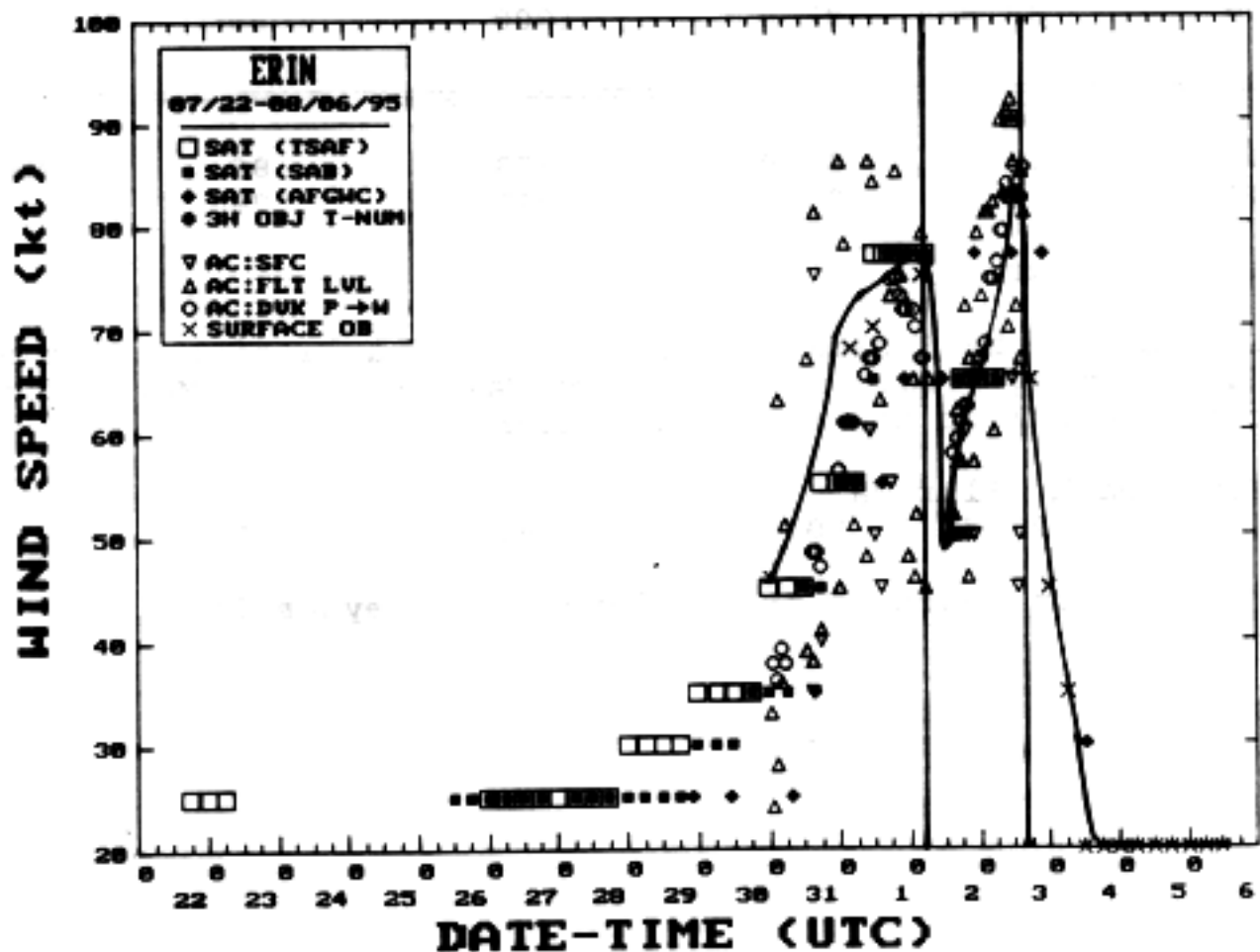


Figure 3. Maximum one-minute wind speed curve for Hurricane Erin, July-August 1995. Not all aircraft observations are a sampling of the maximum wind. Vertical line denotes mainland landfall. X's indicate observations before final landfall and estimates from surface analyses thereafter.

Table 2

## Hurricane Erin selected surface observations, July-August 1992

Location	Minimum sea-level pressure		Maximum surface wind speed (kt)		Storm surge <sup>c</sup> (ft)	Storm tide <sup>c</sup> (ft)	Rain (storm total) (in)
	Pressure (mb)	Date/time (UTC)	sustained wind <sup>a</sup>	Peak gust			
<b>Bahamas</b>							
Cat Island	989.2	01/0600	70		01/0400		
Grand Bahama	987.8	01/2250	68	89	01/2146		12.18
Church Grove, Crooked I.							
San Salvador	1000.0	01/0100, 0200	52		01/0100		
Exuma	1003.3	01/0600	45		01/0100		
Long Island	995.9	31/2100	40		31/1800, 1900		
<b>Florida</b>							
Sebastian Inlet	985.1	02/0600	75		02/0500		8.81
Melbourne (MLB)	985.8	02/0700		66	02/0803		2.46
Vero Beach (VRB)	986.1	02/0554		61	02/0449		
Orlando Int. (ORL)	994.8	02/0907		54	02/1003		0.59
Daytona Beach (DAB)	1004.7	02/0856		39	02/0816		
Port St. Lucie City Hall			45	52	02/0530-0630		
Cape Canaveral (USAF wind tower)				71 <sup>d</sup>	02/0710		10.14
Melbourne NWSO				E72	02/0555		8.29
Melbourne 5N							3.14
Vero Beach 4W							2.05
Sebastian 2S							
Melbourne 10S	980.8	02/0714					
Ft. Pierce Intracoastal Waterway	989.8	02/0415	30	48	02/0415		2.96
Orlando (MCO)							2.56
MIBF1			23	37	03/0000		2.07
Jacksonville (JAX)	1010.8	02/1150	22	37	02/1922		1.26
Jacksonville NAS	1008.1	02/1055		42	02/1042		
Mayport Navy Base	1008.0	02/1155		45	02/1255		
Mayport Montys Marina				50	02/1300		
Fernandina Harbor Marina				52	02/1300		
Jacksonville Bch Pier				60	02/1415		
Gainesville (GNV)	1006.8	02/1445		28	02/1145		1.80
Ocala unofficial	1002.0	02/1330		41			2.38
Crystal River				44	02/1630		
Brooksville ASOS				40	02/1113		
New Port Richey ASOS	993.3	02/1437	24	39	02/1755		
St. Petersburg ASOS			31	41	02/1250		
Tampa Int. Arpt. ASOS			29	38	02/1312		
Port Tampa			30	36	02/1159		

Table 2 continued

## Hurricane Erin selected surface observations, July-August 1992

Location	Minimum sea-level pressure		Maximum surface wind speed (kt)			Storm surge <sup>c</sup> (ft)	Storm tide <sup>c</sup> (ft)	Rain (storm total) (in)
	Pressure (mb)	Date/time (UTC)	sustained wind <sup>a</sup>	Peak gust	Date/time (UTC) <sup>b</sup>			
Ruskin NWSO TBW				37	02/1820			
Sunshine Skyway Bridge			28	43	02/1842			
Lake Wales				61	02/1815			
Lakeland (LAL)	993.6	02/1200	20	38	02/1100			
Winter Haven ASOS	987.5	02/1107	31	42	02/0944			
Sarasota (SRQ)	1002.4	02/1347	20	35	02/1952			
St. Augustine								0.75
Jacksonville Beach							E1-2	1.35
Flagler Beach							E3-5	
St. Augustine Beach							E2-3	
Marineland							E2-3	
Fernandina Beach							E1-2	
Near Defuniak Springs								20.00
Defuniak Springs FL Forestry tower								11.00
Homestead (HST)								3.87
West Palm Beach (PBI)	1000.9	02/0239	22	28	02/0405			3.80
Miami (MIA)	1005.2	01/2350						2.56
Fort Lauderdale	1004.2	02/0048						6.75
Hollywood								6.25
West Kendall (TMB)								4.19
Miami Beach (MIBF1)			23	37	03/0000			
Tallahassee (TLH)	1007.0	02/2130	27	34	02/2117			0.80
Apalachicola NWS	1001.6	02/2151		50	02/2159			
St. George Island				64				
Panama City Airport			30	45	03/1449			
Panama City Beach								5.40
CSBF1			37	43	02/1300			
Eglin AFB (VPS)	992	03/1355	43	58	03/1355			2.78
Destin (ASOS?)			36	44	03/1151			
Pensacola NAS (NPA)	976*	03/1600	55	88	03/1600			2.19
Whiting Field NAS (NSE)			44	51	03/1625			3.76
Hurlburt Field (HRT)	988	03/1409	E70	E85	03/1409			4.06
Pensacola Regional Airport FAA--6 anemometers			60		03/----			
Navarre Beach							E6-7	
Pensacola Beach							E3-4	
<b>Alabama</b>								
Mobile (MOB) (ASOS?)	997	03/2029	25	44	03/1950			2.56
Fairhope (ASOS?)			32	43	03/1834			3.92

Table 2 continued

## Hurricane Erin selected surface observations, July-August 1992

Location	Minimum sea-level pressure		Maximum surface wind speed (kt)			Storm surge <sup>c</sup> (ft)	Storm tide <sup>c</sup> (ft)	Rain (storm total) (in)
	Pressure (mb)	Date/time (UTC)	sustained wind <sup>a</sup>	Peak gust	Date/time (UTC) <sup>b</sup>			
<b>Ship reports</b>								
C6CM7	(23.4 N 72.9 W)	1005.0	31/0000	46	31/0000			
LAEB2	(20.1 N 71.0 W)	1010.3	01/0000	35	01/0000			
Tampa	(25.7 N 76.1 W)	995.7	01/1200	70	01/1200			
ELKI6	(26.7 N 76.0 W)	1007.0	01/1200	50	01/1200			
OYSN2	(26.2 N 74.5 W)	1007.5	01/1800	58	01/1800			
ELKI6	(26.9 N 74.9 W)	1011.0	01/1800	60	01/1800			
UUZU?	(27.0 N 79.5 W)	995.9	02/0000	54	02/0000			
9VUM	(27.6 N 75.9 W)	1009.5	02/0000	44	02/0000			
C6HH4	(30.3 N 81.1 W)	1014.0	02/0000	35	02/0000			
C6HH4	(29.7 N 80.3 W)	1009.0	02/0600	38	02/0000			
	(30.7 N 79.1 W)	1014.1	02/0600	34	02/0000			
NGTB	(31.0 N 79.5 W)	1013.5	02/0600	35	02/0600			
DQFT	(31.0 N 80.0 W)	1014.5	02/0600	39	02/0600			
DNGV	(28.0 N 76.9 W)	1015.5	02/1200	35	02/1200			
DQFT	(30.2 N 79.3 W)	1011.5	02/1200	41	02/1200			
	(30.5 N 78.9 W)	1012.7	02/1200	37	02/1200			
WGWA	(31.0 N 80.0 W)	1012.1	02/1200	38	02/1200			
WRYX	(31.2 N 78.5 W)	1014.0	02/1200	45	02/1200			
	(31.6 N 78.6 W)	1015.7	02/1200	38	02/1200			
DNGV	(27.5 N 78.0 W)	1017.2	02/1800	34	02/1800			
KRJP	(28.5 N 79.3 W)	1014.0	02/1800	35	02/1800			
VRUQ2	(28.7 N 79.3 W)	1012.8	02/1800	48	02/1800			
C6HH4	(29.2 N 79.8 W)	1011.0	02/1800	34	02/1800			
	(30.5 N 79.3 W)	1014.1	02/1800	34	02/1800			
	(30.7 N 78.4 W)	1016.9	02/1800	37	02/1800			
GOYE	(28.4 N 78.7 W)	1014.8	03/0000	35	03/0000			
C6HH4	(28.8 N 79.5 W)	1014.0	03/0000	40	03/0000			
WPPO	(29.2 N 80.1 W)	1017.0	03/0000	35	03/0000			
<b>NDBC Platforms</b>								
<b>Buoys</b>								
41009		999.9	02/0600, 0700	41	53	02/0500		
41010		1007.4	02/0200	35	46	02/0300		
42036		991.9	03/0000	34	45	03/0100		
42007				29	38	03/1930		

Table 2 continued

## Hurricane Erin selected surface observations, July-August 1992

Location	Minimum sea-level pressure		Maximum surface wind speed (kt)			Storm surge <sup>c</sup> (ft)	Storm tide <sup>c</sup> (ft)	Rain (storm total) (in)
	Pressure (mb)	Date/time (UTC)	sustained wind <sup>a</sup>	Peak gust	Date/time (UTC) <sup>b</sup>			
C-MAN								
SPGF1			35	55	02/0020			
LKWF1	1001.8	02/0300	32	40	01/2200			
SAUF1	1007.9	02/1100	37	42	02/0150			
CDRF1	1001.7	02/1600	40	50	02/1700			
CSBF1			38	54	03/1300			
DPIA1			36	44	03/1800			

<sup>a</sup> NWS standard is one-minute period, except for ASOS which is two minutes. WMO standard is 10 minutes. Ship reports are often Beaufort estimates with remainder of unknown averaging period and from anemometers at unknown height. NOAA buoys report hourly 8-min average wind and 10-min wind otherwise. C-MAN station reports are 2-min average winds at the top of the hour and 10-min averages at other times. FAA anemometers at PNS had 30-second averages. Contact National Data Buoy Center (NDBC) for additional details. In many cases, a more extreme value could have occurred.

<sup>b</sup> Time of sustained wind unless only gust is given.

<sup>c</sup> Storm surge is water height above normal tide level. Storm tide is water height relative to National Geodetic Vertical Datum (NGVD) which is defined as mean sea level in 1929.

<sup>d</sup> Non-standard elevation.

<sup>e</sup> Trace shows 979 mb minimum

E Estimated

Table 3

Hurricane Erin track forecast verification  
Heterogeneous sample

(Errors in nautical miles for tropical storm  
and hurricane stages with number  
of forecasts in parenthesis)

Forecast Technique	Period (hours)				
	12	24	36	48	72
GFDI	44 (15)	73 (13)	90 (11)	95 (9)	224 (5)
GFDL*	45 (8)	76 (7)	95 (6)	99 (5)	183 (3)
VBAR*	50 (15)	96 (13)	131 (11)	147 (9)	152 (6)
BAMD	47 (16)	78 (14)	95 (12)	89 (10)	97 (6)
BAMM	45 (16)	74 (14)	89 (12)	101 (10)	193 (6)
BAMS	49 (16)	84 (14)	118 (12)	160 (10)	305 (6)
A90E	56 (16)	100 (14)	119 (12)	118 (10)	120 (6)
AVNI	53 (14)	107 (13)	147 (11)	199 (9)	406 (5)
CLIP	56 (16)	121 (14)	193 (12)	277 (10)	381 (6)
NHC Official	53 (16)	96 (14)	103 (12)	89 (10)	138 (6)
NHC Official (1985-94 10-yr average)	50	98		194	296

\* Not available until after forecast was issued

Table 4

## Hurricane Erin watch and warning summary

Date/Time (UTC) /Action	Location
31/0330 Tropical Storm Warning issued	Central and Southeast Bahamas
31/0330 Tropical Storm Watch issued	Northwest Bahamas
31/0330 Tropical Storm Watch issued	Florida east coast Sebastian Inlet southward through Florida Keys including Dry Tortugas and Florida Bay and Florida west coast Venice southward
31/0900 Tropical Storm Warning issued	Northwest Bahamas
31/1500 Hurricane Warning issued	Sebastian Inlet southward through Florida Keys including Dry Tortugas and Florida Bay and all of the Bahamas
31/1500 Hurricane Watch issued	Florida west coast from Venice southward to Everglades City and for Lake Okeechobee
01/0200 Hurricane Warning discontinued	Southeastern Bahamas
01/0300 Tropical Storm Warning issued	North of Sebastian Inlet to New Smyrna Beach
01/0300 Hurricane Watch issued	Florida west coast Bayport southward and for Lake Okeechobee
01/0900 Hurricane Warning issued	Lake Okeechobee
01/1500 Hurricane Warning issued	Sebastian Inlet to New Smyrna Beach
01/1500 Tropical Storm Warning issued	New Smyrna Beach to St Augustine
01/1500 Hurricane Warning discontinued	Central Bahamas
01/1500 Hurricane Watch issued	North of Bayport to Cedar Key
01/1800 Hurricane Warning discontinued	Florida Keys from Key Largo southward
01/2100 Tropical Storm Warning issued	Florida west coast from Fort Myers to Suwanee River
01/2100 Tropical Storm Watch issued	Suwanee River to Apalachicola
01/2100 Hurricane Watch discontinued	Fort Myers southward
02/0000 Hurricane Warning discontinued	Florida east coast south of Hallandale
02/0100 Hurricane Warning discontinued	New Providence and Andros Islands
02/0300 Tropical Storm Warning issued	Suwanee River to Apalachicola
02/0300 Tropical Storm Watch issued	Apalachicola to Pensacola
02/0700 Hurricane Warning discontinued	Florida east coast southward from Deerfield Beach
02/0900 Hurricane Warning discontinued	Remaining areas
02/0900 Tropical Storm Warning issued	Florida east coast from Fernandina Beach southward to Jupiter Inlet including Lake Okeechobee
02/0900 Tropical Storm Warning issued	Florida Gulf Coast Longboat Key to Apalachicola
02/1000 Hurricane Warning discontinued	Remainder of Bahamas
02/1100 Tropical Storm Warning discontinued	Lake Okeechobee
02/1500 Tropical Storm Warning issued	Apalachicola to Pensacola
02/1500 Tropical Storm Watch issued	Pensacola to mouth of Pearl River
02/1900 Hurricane Warning issued	Suwannee River to mouth of Pearl River
02/1900 Hurricane Watch issued	South of mouth of Pearl River to mouth of Mississippi River including city of New Orleans

02/2300 Hurricane Warning issued	Mouth of Pearl River to mouth of Mississippi River including city of New Orleans
03/0100 Tropical Storm Warning discontinued	Long Boat Key to mouth of Suwannee River
03/0300 Hurricane Warning issued	Mouth of Mississippi River to Grand Isle Louisiana
03/0300 Hurricane Watch issued	Grand Isle to Morgan City Louisiana
03/0500 Hurricane Warning issued	Grand Isle to Morgan City
03/0900 Hurricane Warning discontinued	East of Apalachicola
03/1900 Hurricane Warning discontinued	West of mouth of Pearl River and for New Orleans
03/2100 Hurricane Warning discontinued	Remaining areas

---

**Table 5**

**Watch and warning lead times for U.S. sites during Hurricane Erin**

Lead time refers to time lapsed from issuance to landfall of circulation center.

<u>Location</u>	<u>Type</u>	<u>Lead Time (hours)</u>
Florida east coast (Vero Beach)	Tropical Storm Watch	51
	Hurricane Warning	39
Florida panhandle (Pensacola)	Tropical Storm Watch	37
	Tropical Storm Warning	25
	Hurricane Warning	21