

Tropical Cyclone Report
Hurricane Gordon
14-18 September 2000

Stacy R. Stewart
National Hurricane Center
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Gordon became a category one hurricane on the Saffir-Simpson Hurricane Scale over the eastern Gulf of Mexico, but eventually made landfall in the Florida Big Bend area as a weakening tropical storm.

a. Synoptic History

A tropical wave moved off the west coast of Africa on 4 September and tracked westward across the tropical Atlantic. Little or no deep convection was associated with the wave until 8 September when the wave was located about 600 n mi east of the Lesser Antilles. The tropical wave moved through those islands on 9-10 September bringing locally heavy rainfall and wind gusts of 25 to 30 kt. The wave tracked west-northwestward and developed centralized convection near the vorticity center over the central Caribbean Sea on the 12th.

Satellite classifications from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB) began around 0000 UTC 13 October. They indicated the convection was poorly organized. However, by 1800 UTC surface observations indicated a broad low pressure area had developed along the wave axis about 100 n mi southeast of Cozumel, Mexico. At 0000 UTC 14 October, Dvorak satellite intensity estimates from the TAFB, SAB, and the Air Force Weather Agency (AFWA) suggested the broad low pressure system was near tropical depression strength, but the overall convective pattern was still poorly organized.

Tropical Depression Eleven formed about midway between Cozumel and Chetumal, Mexico on the morning of 14 October based on a U. S. Air Force Reserve (USAFR) reconnaissance aircraft report of a broad closed circulation and 31 kt flight-level (1500 ft) winds. By 2100 UTC, the depression's low-level center had moved inland over the eastern Yucatan Peninsula, while the more pronounced mid-level circulation was located about 10 n mi to the northeast. This decoupled pattern persisted for more than 24 hours while the depression tracked slowly northwestward across the northern Yucatan Peninsula.

Late on 15 October, an Air Force Reserve reconnaissance aircraft indicated the depression had moved off the north coast of the Yucatan and over the warm waters of the Gulf of Mexico. Aircrew reported the low- and mid-level circulations had become vertically aligned, 59 kt flight-level (1500 ft) winds, and a minimum pressure of 1003 mb. At 0000 UTC 16 October, the depression had strengthened into Tropical Storm Gordon. Once over the warm Gulf waters, Gordon moved steadily northeastward toward the Florida Big Bend area and slowly intensified. A report of easterly winds of 64 kt from ship MYMX5 located about 30 n mi northeast of the center indicated that Gordon had become a hurricane by 0000 UTC 17 October. Only slight strengthening continued for another 6 hours and Gordon eventually peaked at 70 kt. Figure 1 is a NEXRAD/WSR-88D radar image at 0803 UTC 17 October, from Tampa Bay, Florida (KTBW) when Gordon was near its peak strength.

After peaking on the 17th about 165 n mi southwest of Tampa, Florida, slow weakening began as moderate southwesterly upper-level winds ahead of an approaching mid-tropospheric trough began to increase the vertical shear across the hurricane. Water vapor imagery and surrounding upper-air data indicated that mid-level dry air entrainment from the south also helped the weakening process. The dry air helped erode the outer cloud and precipitation shield and gradually wrapped into the inner core of the hurricane. This is depicted in Figure 1 by the large rain-free or “dry slot” area located in the eastern semicircle between the eye and the outer convective bands near the Florida west coast. Within a few hours, the dry slot had worked its way counter-clockwise completely around the eye and by 1328 UTC reconnaissance reports indicated the minimum surface pressure had risen sharply to 990 mb.

Gordon weakened to a tropical storm at 0000 UTC 18 October. It continued to track northeastward and eventually made landfall just northwest of Cedar Key, Florida, at 0300 UTC 18 October, as a tropical storm with 55 kt winds. After landfall, interaction with land and cool, stable air north of a weak frontal boundary hastened the weakening process. At 1200 UTC the same day, Gordon weakened into a tropical depression. By 1800 UTC, it merged with the front and extratropical transition occurred over southeast Georgia. Gordon’s remnant low-level circulation then moved northeastward up the east coast of the United States for the next 3 days before being absorbed by a large extratropical low pressure system over eastern Canada around 1200 UTC 21 October. Owing to the lack of any significant baroclinic effects, only modest rainfall totals and no significant flooding were observed over the mid-Atlantic and northeast regions of the United States.

b. Meteorological Statistics

Table 1 lists the best track positions and intensities of Gordon at six-hour intervals. Figure 2 is a display of this track. Observations in Gordon (Figs. 3 and 4) include satellite-based Dvorak technique intensity estimates from TAFB, SAB, and AFWA. In addition, flight-level observations were available from flights of the USAFR 53rd Weather Reconnaissance Squadron and the NOAA Aircraft Operations Center.

As a result of Gordon weakening well offshore the Florida west coast, only a few reports of tropical storm force winds were received. Tables 2 and 3 consist of all ship and buoy reports, respectively, of tropical storm force winds (≥ 34 kt) associated with Hurricane Gordon. Table 4 consists of selected surface reports from Automated Surface Observing System (ASOS) and Coastal-Marine Automated Network (C-MAN) observation stations from Florida for Hurricane Gordon.

During Gordon’s intensification stage, the maximum reconnaissance flight level (850 mb) wind measured was 89 kt (71 kt surface wind using an adjustment factor of 80%) at 0544 UTC 17 October, whereas the minimum surface pressure of 981 mb was observed at 0805 UTC -- 11 mb lower than the pressure when the maximum wind was observed.

Dry air entrainment further reduced the amount of rainfall that typically occurs with a land falling tropical cyclone moving at a forward speed of 10 to 12 kt. The largest rainfall amounts were reported in Florida and ranged from 4.83 in at Cedar Key on the west coast to 3.02 in at Vero Beach on the east coast. No significant flooding was reported.

Gordon’s weakened state also reduced the amount of storm surge flooding that otherwise

could have occurred. Maximum storm tides (i.e., water height above National Geodetic Vertical Datum [1929 mean sea level]) occurred along the Florida west coast and generally ranged from 3 to 5 ft from the Tampa Bay area northward to Cedar Key.

c. Forecast and Warning Critique

There are no error statistics available at 72 h due to the short time period that Gordon existed as a tropical storm or hurricane. Average official track errors for Gordon (with the number of cases in parentheses) were 32 (8), 37 (6), 40 (4), and 75 (2) n mi for the 12, 24, 36, and 48 h forecasts, respectively. These errors are significantly lower than the average official track errors for the 10-yr period 1990-1999 (46, 85, 122, and 158 n mi, respectively) at all times. The official forecast errors were better than all available forecast guidance at all times, except slightly worse than the CLIPER (CLImatological and PERsistence) model at 12 h and the GFDL model at 48 h.

Average official intensity errors for Gordon were 8, 9, 20, and 18 kt for the 12, 24, 36, and 48, respectively. Unlike the track errors, the intensity errors were greater than the average official errors for the 10-yr period 1990-1999 (7, 11, 13, and 16 kt, respectively), and were over-forecasts at all times, especially at 36 and 48 h. The SHIPS (Statistical Hurricane Intensity Prediction Scheme) intensity forecast model had similarly poor intensity forecasts.

Table 5 lists watches and warnings issued for Hurricane Gordon.

d. Casualty and Damage Statistics

There were 23 deaths reported in Guatemala due to heavy rainfall-induced flooding in mountainous areas. Many of the deaths may have occurred during the pre-depression stage while the system was moving slowly over the western Caribbean Sea and Yucatan Peninsula of Mexico. One death occurred in the United States when a surfer drowned in heavy seas near Pensacola, FL while Gordon made landfall in the Florida Big Bend area.

Most of the damage was due to downed tree and power lines. In addition, more than 20,000 Florida customers lost power for more than six hours during Gordon's passage. Also, numerous homes along the immediate Florida west coast from the Tampa Bay area northward to Cedar Key experienced some minor roof damage. Some coastal roads and highways experienced flooding from the storm surge and had to be temporarily closed. Damage estimate for the United States is \$10.8 million. No damage estimates have been received from Guatemala in association with the heavy rainfall and flooding.

There were also two confirmed tornadoes. The first tornado (intensity unknown) occurred around 1845 UTC 17 October, in Cape Coral along the Florida west coast. At least 1 home received major damage and 2 other homes received minor damage. A second tornado (F0) touched down later that day around 2030 UTC near the town of Ponce Inlet in Volusia County along the Florida east coast. Damage was minimal and mainly confined to downed trees and power lines, although a few homes received minor damage.

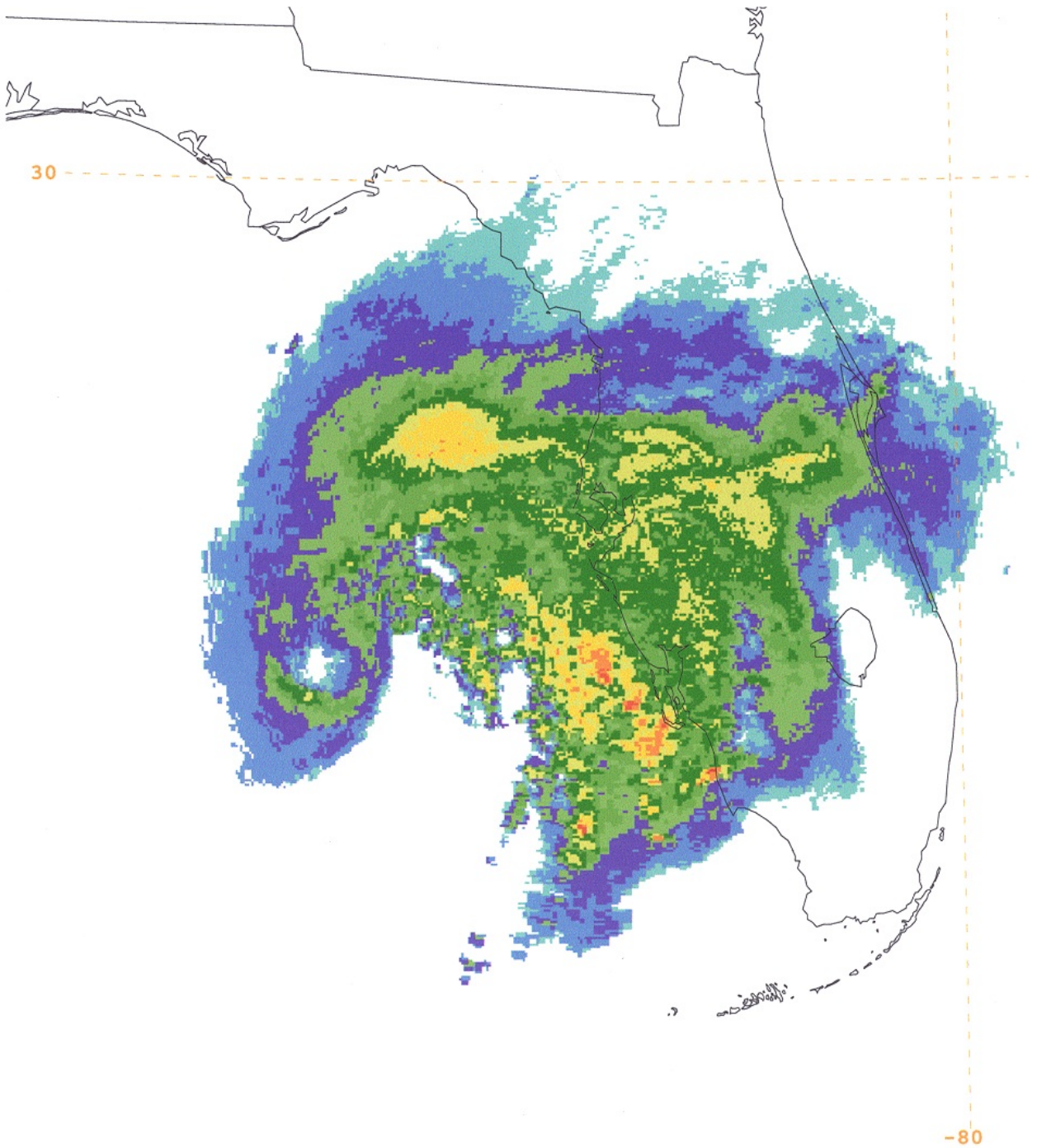


Figure 1. 0803 UTC, 17 October 2000, NEXRAD/WSR-88D Base Reflectivity (0.5° elev.) radar data from Tampa Bay (KTBW), Florida. Image is at approximately the same time the minimum pressure of 981 mb was observed. Eye is located about 140 n mi west-southwest of the radar site at an altitude of approximately 22,000 ft ASL.

Table 1. Best track for Hurricane Gordon, September 2000.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
14 / 1200	19.8	87.3	1008	25	tropical depression
14 / 1800	20.4	87.4	1007	25	"
15 / 0000	20.7	87.7	1007	25	"
15 / 0600	21.0	88.0	1006	25	"
15 / 1200	21.4	88.7	1004	25	"
15 / 1800	21.6	87.8	1004	30	"
16 / 0000	22.5	86.7	1000	40	tropical storm
16 / 0600	22.9	86.6	997	50	"
16 / 1200	23.5	86.3	992	55	"
16 / 1800	24.3	85.9	983	60	"
17 / 0000	25.2	85.4	985	65	hurricane
17 / 0600	26.1	84.9	981	70	"
17 / 1200	27.1	84.3	987	65	"
17 / 1800	28.0	83.8	985	65	"
18 / 0000	28.9	83.4	989	60	tropical storm
18 / 0600	29.8	83.0	1000	40	"
18 / 1200	31.0	82.3	1006	30	tropical depression
18 / 1800	32.3	81.5	1011	25	extratropical
19 / 0000	33.5	80.2	1011	25	"
19 / 0600	35.0	79.0	1011	20	"
19 / 1200	37.0	78.2	1010	20	"
19 / 1800	38.5	76.0	1008	25	"
20 / 0000	40.0	74.0	1007	25	"
20 / 0600	41.5	72.0	1005	25	"
20 / 1200	42.0	69.5	1005	30	"
20 / 1800	42.5	67.2	1005	30	"
21 / 0000	43.0	65.0	1004	30	"
21 / 0600	43.5	63.0	1003	30	"
21 / 1200					absorbed by extratropical low

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
17 / 0600	26.1	84.9	981	70	minimum pressure
18 / 0300	29.3	83.2	991	55	landfall near Cedar Key, Florida

Table 2. Ship reports with winds of at least 34 kt for Hurricane Gordon.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
16 / 1500	WPWH	25.8	86.9	120/35	1010.5
16 / 1800	MYMX5	25.5	85.9	110/45	1004.4
16 / 1800	VRWK5	25.6	87.0	110/42	1009.0
16 / 2100	MYMX5	25.1	85.0	090/64	999.9
17 / 0000	KGBE	24.9	83.8	150/52	1004.2
17 / 0000	MYMX5	24.7	84.5	170/60	1001.3
17 / 0300	MYMX5	24.6	83.5	170/54	1006.8
17 / 0600	WCOB	24.9	84.1	210/45	1006.8
17 / 0600	MYMX5	24.1	83.4	190/45	1008.3
18 / 1200	H3GQ	27.3	88.5	090/36	1011.0

Table 3. Buoy reports with winds of at least 34 kt for Hurricane Gordon.

Date/Time (UTC)	Buoy call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)*	Pressure (mb)
17 / 0020	42003	25.9	85.9	345/43(57 ^b)	999.6
17 / 0200	42003	25.9	85.9		998.5
17 / 1722 ^a	42036	28.5	84.5	340/51 ^b	1002.7
17 / 1800	42036	28.5	84.5	010/37	1005.5
17 / 2000	41009	28.5	80.2	130/35 ^b	1010.8
17 / 2100	42036	28.5	84.5	340/37(41 ^b)	1003.8
18 / 0900	41004	32.5	79.1	090/35 ^b	
18 / 1700 ^a	41008	31.4	80.9	200/37 ^b	

* 8-min average wind, moored buoys

^a last of several occurrences

^b peak gust

Table 4. Selected surface observation reports (ASOS and C-MAN stations) from Florida for Hurricane Gordon.

Date/Time (UTC)	Location (Identifier)	Sustained Wind dir/speed (kt) [*]	Peak Gust (kt)	Pressure (mb) [Date/Time, if different]
17 / 1529	St. Petersburg (KSPG)	130/38		
17 / 1552	Punta Gorda (KPGD)	160/32		
17 / 1650	Titusville (KTTS)	150/15	30	1011.8 [17/2250]
17 / 1800	St. Petersburg (KPIE)	180/39		
18 / 1855	Patrick AFB (KCOF)	120/27	39	
17 / 1908	Leesburg (KLEE)	130/35		
18 / 0015	Keaton Beach (KTNF1)		36	1003.7 [18/0500]
18 / 0110	Cedar Key (CDRF1)	110/45 ^a	59	999.3 [18/0300]
18 / 0229	Cross City (KCTY)	040/29	37	997.6 [18/0543]
18 / 0242	Perry-Foley (K40J)	360/24	34	1005.1 [18/0612]
18 / 0540	St. Augustine (SAUF1)	160/32 ^a	40	1008.2 [18/0900]
18 / 0604	Gainesville (KGNV)			1004.4
18 / 1302	Jacksonville (KCRG)		36	

* 2-min average wind

^a 10-min average wind

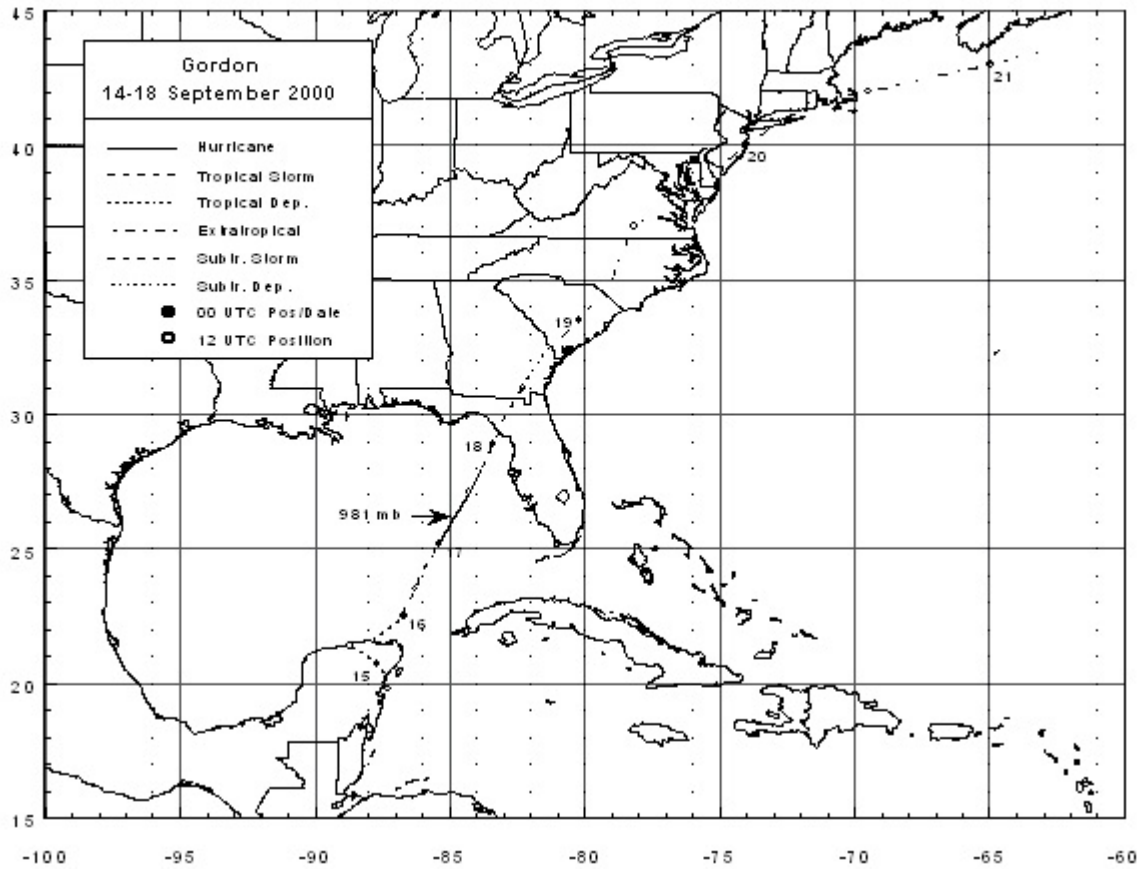


Figure 2. Best track positions for Hurricane Gordon. Track during the extratropical stage is based on analyses from the Tropical Analysis and Forecast Branch and the NOAA Hydrometeorological Prediction Center.

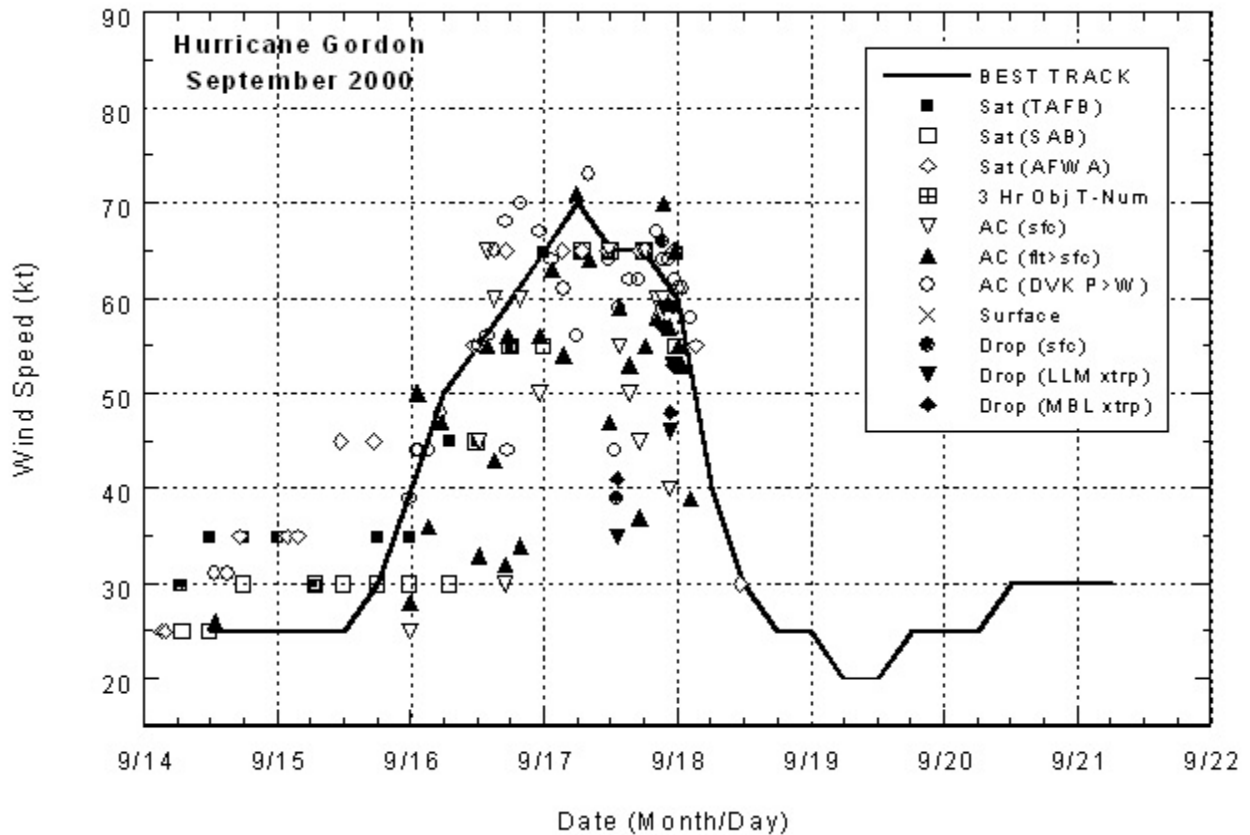


Figure 3. Best track maximum sustained surface wind speed curve for Hurricane Gordon, and the observations on which the best track curve is based. Aircraft observations have been adjusted for elevation using 90%, 80% and 85% reduction factors for observations from 700 mb, 850 mb and 1500 ft, respectively. Estimates during the extratropical stage are based on analyses from the Tropical Analysis and Forecast Branch and the NOAA Hydrometeorological Prediction Center.

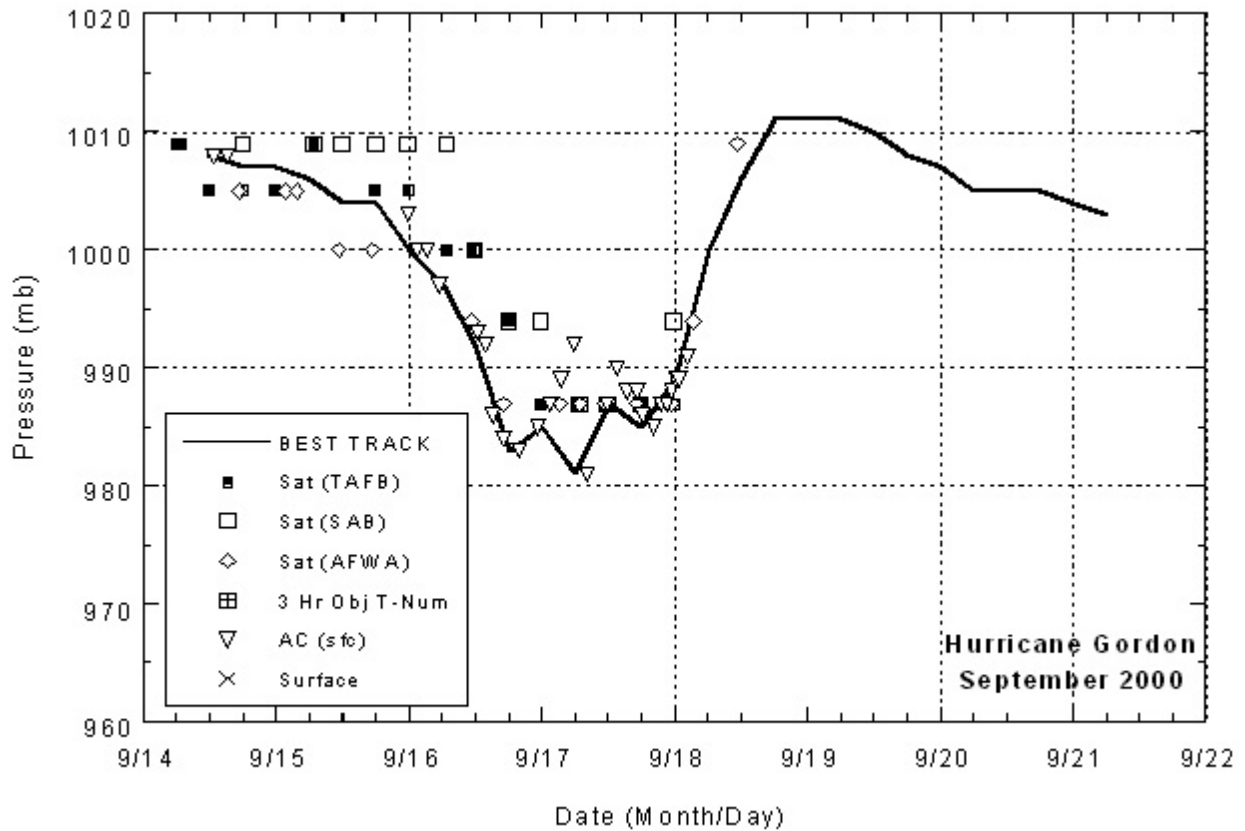


Figure 4. Best track minimum central pressure curve for Hurricane Gordon, and the observations or estimates on which the best track curve is based. Estimates during the extratropical stage are based on analyses from the Tropical Analysis and Forecast Branch and the NOAA Hydrometeorological Prediction Center.

Table 5. Watch and warning summary for Hurricane Gordon, September 2000.

Date/time (UTC)	Action	Location
16/0300	Hurricane Watch Issued	Florida west coast from Bonita Beach northward to the Suwanee River
16/1500	Tropical storm warning issued	Florida west coast from Bonita Beach northward to the Suwanee River
16/1500	Hurricane watch extended	Florida west coast from Suwanee River northward and westward to Apalachicola
17/0300	Hurricane warning issued	Florida west coast from Anna Maria Island to Ochlockonee River
17/0300	Tropical storm warning	Florida west coast from Bonita Beach northward to south of Anna Maria Island, and from west of Ochlockonee River westward to Indian Pass
17/0300	Tropical storm watch issued	Florida northeast coast and Georgia southeast coast from Flagler Beach, Florida northward to Brunswick, Georgia
17/0900	Tropical storm watch upgraded to tropical storm warning	Southeast U.S. coast from Flagler Beach, Florida northward to Brunswick, Georgia
17/0900	Tropical storm watch issued	Brunswick, Georgia northward to the South Santee River, South Carolina
17/1500	Tropical storm warning extended	Southeast U.S. coast from Flagler Beach, Florida northward to Little River Inlet, South Carolina
17/1500	Tropical storm watch extended	north of Little River Inlet, South Carolina to Cape Hatteras, North Carolina
17/1800	Tropical storm warning extended	Florida east coast from Flagler Beach south to Titusville
17/2100	Hurricane warning downgraded to tropical storm warning	Florida Gulf Coast from Anna Maria Island northward to Indian Pass
17/2100	Tropical storm warning discontinued	Florida west coast south of Anna Maria Island
17/2100	Hurricane watch discontinued	Florida Gulf Coast

Date/time (UTC)	Action	Location
18/0000	Tropical storm watch extended	Cape Hatteras, North Carolina northward to the North Carolina-Virginia Border, including Albemarle and Pamlico Sounds
18/0300	Tropical storm warning discontinued	Florida Gulf Coast west of Saint Marks and south of Anclote Keys
18/0300	Tropical storm warning discontinued	Florida east coast south of Flagler Beach
18/0900	Tropical storm warning discontinued	All of Florida Gulf Coast
18/0900	Tropical storm watch discontinued	All of North Carolina coast
18/1200	Tropical storm warning discontinued	All coasts of North Florida, Georgia, and South Carolina