Tropical Cyclone Report
Tropical Storm Helene
15 – 25 September 2000

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Helene made landfall as a minimal tropical storm near Fort Walton Beach, Florida and redeveloped into a strong tropical storm over the North Atlantic.

a. Synoptic History

Helene developed from a tropical wave that emerged from the African coast on 10 September. The wave lost all of its deep convection the next day as it continued moving westward. There was little sign of redevelopment until 14 September when convection formed near the center of the system. Showers and thunderstorms continued overnight and Dvorak satellite estimates indicate that Tropical Depression Twelve formed on the afternoon of the 15th about 500 n mi east of the Lesser Antilles. The depression appeared to weaken before aircraft reconnaissance first flew into the system the next day. The aircraft could not find a closed circulation, indicating that the depression had degenerated into a tropical wave. It is notable that, even without any center, the plane reported winds in excess of 55 knots at 1500 ft to the north and east of the wave.

The remnants of the depression moved over the Leeward Islands on the 17th, producing heavy rains and gusty winds to tropical storm force in squalls. Upper-level conditions seemed very favorable for regeneration, but the system was slow to redevelop. It was not until late on the 19th that a reconnaissance aircraft found a closed circulation northwest of Grand Cayman Island, while the system was moving more to the west-northwest. The depression was very weak with only a few thunderstorms near the center when it crossed the western tip of Cuba the next day. However, convection redeveloped near the center and it became Tropical Storm Helene early on the morning of the 21st in the southeast Gulf of Mexico. The center passed just west of the *Cherry Valley* which reported maximum winds of 54 knots at 2100 UTC 21 September. The storm moved northwestward, strengthening under marginally favorable conditions. However, the vertical wind shear increased, preventing Helene from attaining hurricane status. The system became very asymmetric as a result of the shear, with most of its deep convection, winds, and heavy rainfall displaced to the east of the center. It peaked at a maximum intensity of 60 knots about twelve hours before landfall. The shear increased further and weakened Helene to an intensity of 35 knots during landfall near Fort Walton Beach, Florida around 7 am CDT on the 22nd. Helene then moved toward the northeast over the southeastern states as a tropical depression.

Even with strong westerly shear, deep convection began to intensify over the coastal waters of North Carolina when the system approached the east coast. Tropical storm force

winds were measured at stations off the coast of North Carolina. A post-analysis of buoy data and satellite imagery indicates that Helene had developed enough tropical characteristics to be considered a tropical cyclone as it emerged from the coast of Virginia. The cyclone began to race northeastward away from the United States toward decreasing shear. Ship observations and satellite images indicate the system was very compact over the Atlantic, no more than 120 n mi wide with the strongest winds in the south and east quadrants. An intense burst of convection formed over the center on the 24th, and it is estimated that Helene reached a second peak intensity of 60 knots early on the 25th before merging with a cold front later that day. The best track is listed in Table 1 and is plotted in Figure 1.

b. Meteorological statistics

Figure 2 shows the best track curves for maximum sustained 1-min surface winds and minimum central pressure data, respectively, as functions of time. These plots include aircraft reconnaissance, Dvorak satellite classification estimates, and surface observations. Table 2 includes selected surface observations along the path of Helene. The intensity or redevelopment of Helene as it emerged off the Mid-Atlantic coast would likely never have been known if not for the hourly reports of the ship *Koeln Express*. The ship reported sustained winds of 56 knots at 0600 UTC on the 25th as the storm moved nearby. An intensity of 60 knots has been estimated from this ship report. The ship also recorded a lowest pressure of 988.2 mb with a westerly wind of 46 knots. However, it is likely that the ship did not report the minimum pressure as the winds indicate that the ship was displaced to the south of the center and a final estimate of 986 mb has been made. It is notable that *Koeln Express* had reports that were similar to another ship to its southeast, the *Global Mariner*, that reported sustained winds of 52 knots at the same time that the *Koeln Express* reported 56 knots. Figure 3 displays the hourly wind and pressure data reported by the *Koeln Express.*

c. Casualties and damages

The one casualty associated with Helene was a man killed in a F2 tornado in South Carolina as the tropical depression moved through the region on the 23rd. The storm caused extensive flooding in Tallahassee, Florida where it dumped near nine inches of rain. Total damage estimate was nearly 16 million dollars.

d. Forecast and warning critique

Despite the apparently favorable conditions for tropical cyclone development: low shear, enough convection, low pressure, warm ocean, and high ocean heat content, the depression did not strengthen until after it entered the Gulf of Mexico. The expected strengthening from the official forecast as well as the intensity guidance prompted tropical storm watches and warnings for some of the eastern Caribbean Sea islands and then for western Cuba. Once Helene formed in the Gulf of Mexico, watches and warnings were issued for a portion of the northeast Gulf coast. Table 3 includes a watch and warning summary. The final official forecast issued on Helene indicated the possibility of

restrengthening over water as an extratropical system and it was handled as such in the High Seas forecast products issued by the National Weather Service. However, the post-analysis indicates that system retained tropical characteristics.

Operationally, Helene was a tropical storm for 36 hours only. Therefore, no forecast verification statistics are presented. It is worth noting that, in general, track models correctly captured the westward motion of the system through the Caribbean and the gradual northward turn over the Gulf of Mexico.

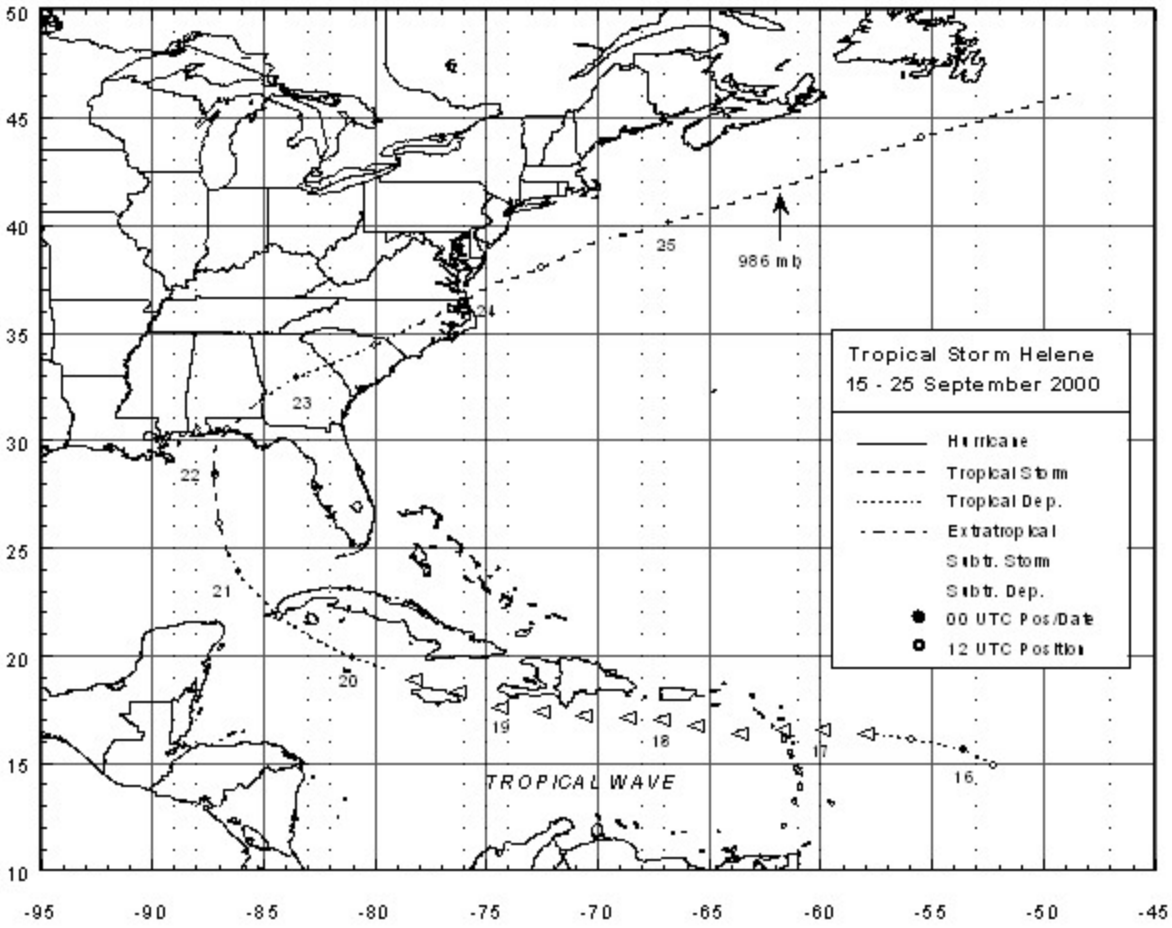
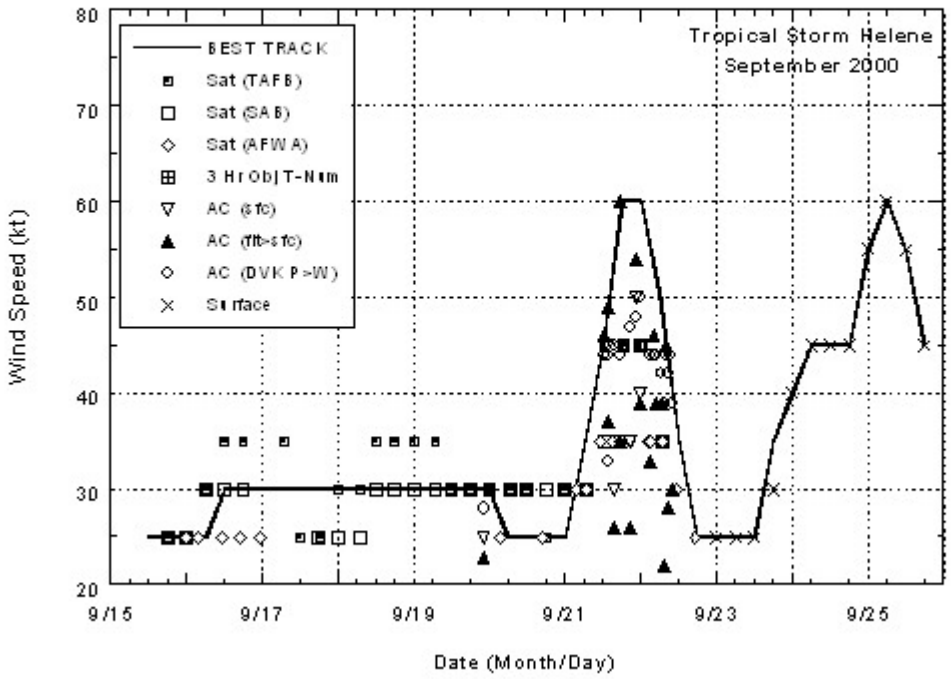


Fig. 1. Best track positions for Tropical Storm Helene, 15-25 September, 2000.



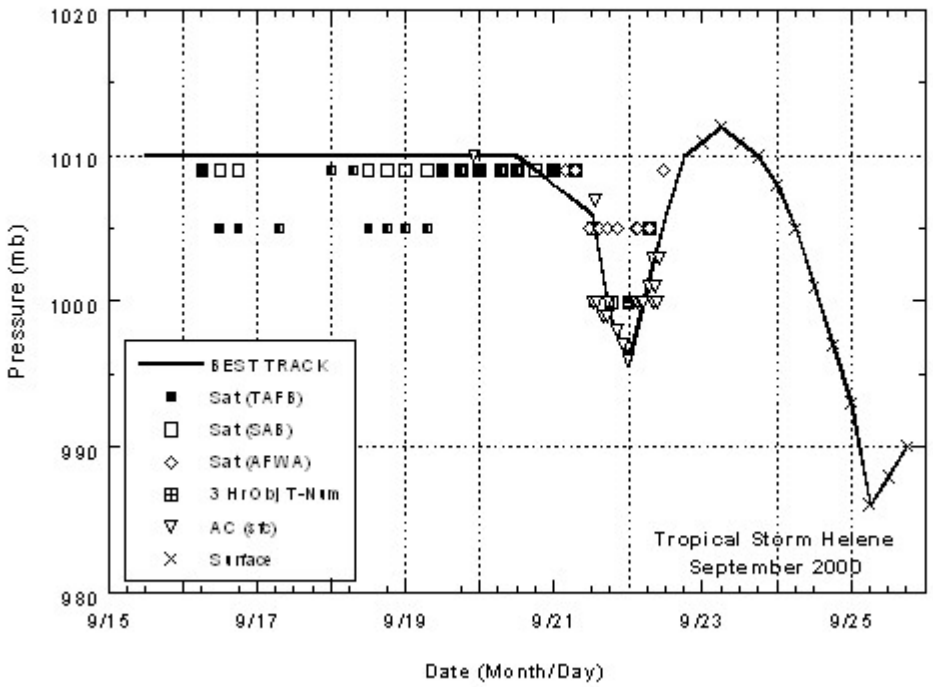


Fig. 2. Best track maximum sustained wind speed and minimum central pressure curves for Tropical Storm Helene.

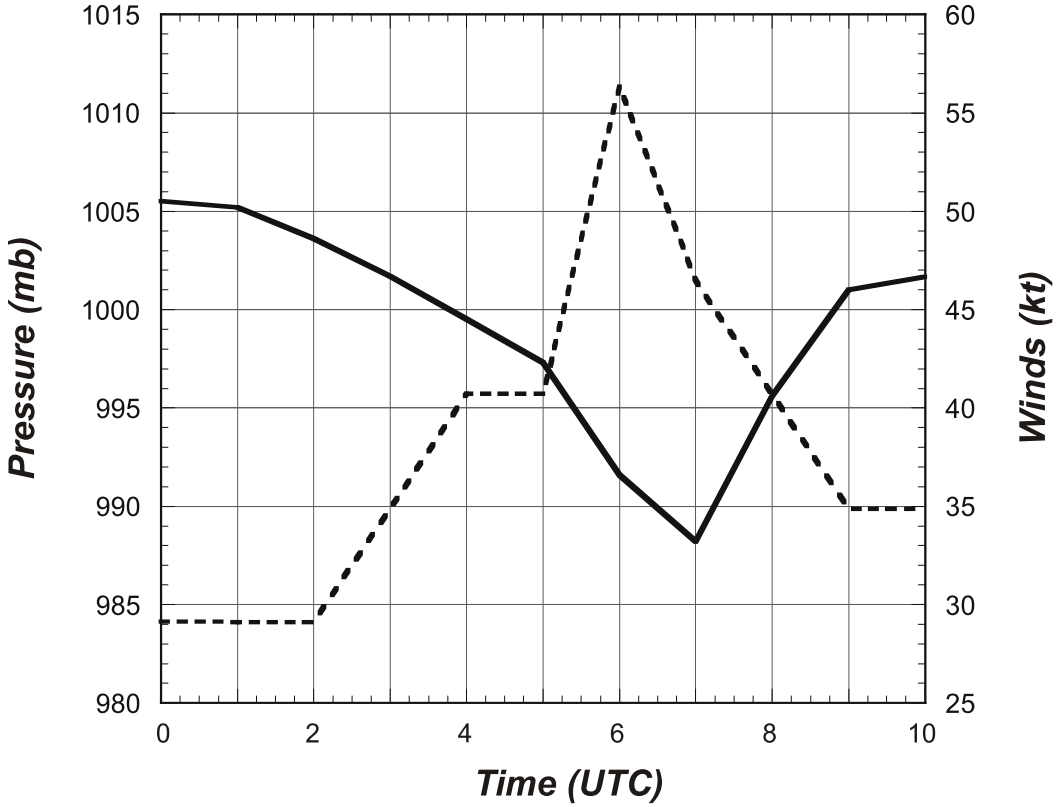


Fig. 3. Hourly wind and pressure reports from vessel Koeln Express from 00 to 10 UTC 25 September, 2000.

Table 1. Best track for Tropical Storm Helene, 15-25 September, 2000.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
15 / 1200	14.9	52.2	1010	25	tropical depression
15 / 1800	15.3	53.0	1010	25	"
16 / 0000	15.6	53.6	1010	25	"
16 / 0600	15.8	54.4	1010	25	"
16 / 1200	16.1	55.9	1010	30	"
16 / 1800	16.4	58.0	1010	30	tropical wave*
17 / 0000	16.6	59.9	1010	30	"
17 / 0600	16.6	61.7	1010	30	"
17 / 1200	16.4	63.6	1010	30	"
17 / 1800	16.7	65.6	1010	30	"
18 / 0000	17.0	67.1	1010	30	"
18 / 0600	17.1	68.7	1010	30	"
18 / 1200	17.2	70.6	1010	30	"
18 / 1800	17.4	72.5	1010	30	"
19 / 0000	17.6	74.4	1010	30	"
19 / 0600	18.3	76.3	1010	30	"
19 / 1200	18.9	78.3	1010	30	"
19 / 1800	19.4	79.6	1010	30	tropical depression
20 / 0000	19.9	81.0	1010	30	"
20 / 0600	20.7	82.6	1010	25	"
20 / 1200	21.8	84.3	1010	25	"
20 / 1800	23.0	85.4	1010	25	"
21 / 0000	23.9	86.1	1008	25	"
21 / 0600	24.9	86.6	1007	35	tropical storm
21 / 1200	26.1	87.0	1006	45	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
21 / 1800	27.1	87.1	999	60	"
22 / 0000	28.4	87.2	996	60	"
22 / 0600	29.5	87.2	1001	50	"
22 / 1200	30.5	86.6	1006	35	"
22 / 1800	31.6	85.4	1010	25	tropical depression
23 / 0000	32.9	83.5	1011	25	"
23 / 0600	33.6	81.7	1012	25	"
23 / 1200	34.4	80.0	1011	25	"
23 / 1800	35.4	78.0	1010	35	tropical storm
24 / 0000	36.4	76.1	1008	40	"
24 / 0600	37.2	74.7	1005	45	"
24 / 1200	38.0	72.5	1001	45	"
24 / 1800	39.2	70.1	997	45	"
25 / 0000	40.1	66.8	993	55	"
25 / 0600	41.6	62.2	986	60	"
25 / 1200	44.0	55.5	988	55	"
25 / 1800	46.1	48.8	990	45	"
26/ 0000					absorbed by a front
25 / 0600	41.6	62.2	986	60	minimum pressure
22 / 1200	30.5	86.6	1006	35	Landfall near Fort Walton Beach, FL

* estimated location of the cloud system center tracked by satellite

Table 2. Tropical Storm Helene, selected surface observations, September, 2000.

Location	Press. (mb)	Date/ time (UTC)	Sustained wind (kt)[a]	Peak gust (kt)	Date /time (UTC)[b]	Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
Lesser Antilles								
Guadeloupe (TFFR)				48	17/Unk.			
Antigua								3.14
Gulf of Mexico Buoys								
42003			34		21/1100			
42039			30	39	22/0043			
Florida								
Perdido Key			20	34	22/0730			
Panama City Beach			23	39	22/0900	1		
Pensacola Beach			23	38	22/0930	1		
Destin Airport (DTS)			24	35	22/1118	1		
Cape San Blas CMAN			26	46	22/1211			
Apalachicola (KAAF)								9.56
Sopchoppy								9.50
Tallahassee (KTLH)								7.86
North Carolina								
Frying Pan Shoals CMAN			40	47	23/1825			
Cape Lookout CMAN			36	45	23/1902			
Duck Pier CMAN			38	45	23/2215			
Diamond Shoals CMAN			51	61	23/2243			

[a]ASOS and CMAN's are 2-minute averages, buoys are 8 minute averages, all others are 1-minute averages.
[b]Date/time is for wind gust when both sustained and gust are listed.
[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).

Table 3. Watch and warning summary, Tropical Storm Helene, September, 2000.

Date/time (UTC)	Action	Location(s)
16/0300	Tropical storm watch issued	St. Maarten, Saba, St. Eustatius
16/0900	Tropical storm watch issued	Antigua, Anguilla, Barbuda, Montserrat, Nevis, St Kitts
16/1700	Tropical storm watch discontinued	St. Maarten, Saba, St. Eustatius, Antigua, Anguilla, Barbuda, Montserrat, Nevis, St Kitts
20/0300	Tropical storm warning issued	Cuban provinces of Isle of Youth, Havana, Pinar Del Rio, and the city of Havana.
20/1500	Tropical storm warning discontinued	Cuban provinces of Isle of Youth, Havana, Pinar Del Rio, and the city of Havana.
21/1500	Tropical storm warning issued	The mouth of the Pearl River on the Louisiana-Mississippi border eastward to the mouth of the Aucilla River, Florida
21/2100	Hurricane watch issued	The Florida-Alabama border eastward to the mouth of the Aucilla River, Florida
22/0300	Tropical storm warning discontinued	The mouth of the Pearl River on the Louisiana-Mississippi border eastward to west of Pascagoula, Mississippi.
22/0900	Hurricane watch discontinued	The Florida-Alabama border eastward to the mouth of the Aucilla River, Florida.
22/1500	Tropical storm warning discontinued	Pascagoula, Mississippi eastward to just west of Destin, Florida
22/1800	Tropical storm warning discontinued	Destin, Florida eastward to the mouth of the Aucilla River, Florida