

Verification Statistics for the 1983 Atlantic Hurricane Season

Miles Lawrence and A. Barry Damiano
National Hurricane Center

Tropical cyclone tracks are routinely forecast for periods up to 72 hours and verification of these forecasts is a continuing project at the National Hurricane Center (NHC). Neumann and Pelissier (1981) summarized Atlantic tropical cyclone track forecast errors for the decade of the 1970's and were unable to detect any significant trend over this period of time.

Track errors

Tropical cyclone track forecast errors are computed for all forecasts for which the best track intensity is greater than or equal to 34 knots.

definitions:

best track: best track position and intensity (maximum sustained wind speed) are determined every six hours during the lifetime of each tropical cyclone, based on a post-analysis of all available data.

initial position error is the great circle distance between the operational position of the storm at forecast time and the best track position for the same time.

track forecast error is the great circle distance between a forecast position and the best track position for the same time.

displacement forecast error is the error of a forecast position that has been adjusted by vector removal of the initial position error.

Past NHC verification studies (Neumann and Pelissier, 1981) have concentrated on displacement errors as a basis for evaluation and comparison of various forecast methods.

Table 1 gives the NHC official displacement error statistics for 1983 as well as for the previous ten year period. These errors were smaller than the average for the previous ten years at all time periods except for 72 hours. Average track forecast errors are also given in Table 1 and the difference between these and the displacement forecast errors is small.

There were only 31 verifiable 24-hour track forecasts in 1983, compared to an average of 112 cases for the past 10 years. This small number of cases precludes attaching much significance to any of these numbers. This comment also applies to the 48- and 72-hour forecasts, where even fewer cases are available.

Table 2 shows 1983 displacement forecast errors for all available forecast guidance techniques.

The U.S. Navy has developed a numerical model to forecast tropical cyclone motion and it is being run in the Atlantic basin. This guidance was not routinely available to NHC during the 1983 season, but has since been provided. Table 3 shows a comparison of the Navy model, the official, and the CLIPER average displacement errors for a homogeneous sample.

Landfall errors

Hurricane Alicia made landfall in the Galveston/Houston area on 18 August 0700 GMT. The landfall error is defined as the distance between the observed and forecast point of landfall, without regard to time of landfall. The forecast based on 17 August 0600 GMT data has a landfall error of 35 n. mi. and a 24-hour track forecast error of 53 n. mi. The landfall errors for hurricane Barry and tropical storm Dean are 83 n. mi. and 22 n. mi., respectively.

Intensity errors

Wind speed forecast errors are based on a comparison with best track intensity values. Table 4 summarizes 1983 wind speed forecast errors and Fig. 1 shows a frequency distribution of the 24-hour wind-speed forecast errors for 1983. There is a negative bias at 12 and 24 hours and a positive bias at 48 and 72 hours. The frequency of the 24-hour errors appears similar to a normal distribution.

References

- C. J. Neumann and J. M. Pelissier, 1981: An analysis of Atlantic tropical cyclone forecast errors, 1970-1979. Mon. Wea. Rev., 109, 1248-1266.

Table 1

1983 Official Track Forecast Verification
(nautical miles)

	initial position	forecast period (hours)			
		12	24	48	72
1983 average displacement forecast error (no. of cases)	10 (43)	41 (41)	83 (31)	203 (16)	415 (9)
1973-1982 avg. displ. forecast error (avg. no. of cases)	19 (129)	54 (126)	115 (112)	249 (80)	375 (58)
percent improvement	+47%	+24%	+28%	+18%	-11%
1983 average track forecast error		43	84	206	419

Table 3.

1983 average displacement errors
(nautical miles)

Official/Navy/CLIPER comparison
homogeneous sample

	initial position	forecast period (hours)			
		12	24	48	
Official	11	38	86	227	
Navy	22	59	103	264	367
CLIPER	11	36	94	166	
(number of cases)	(31)	(30)	(21)	(7)	

Table 4.

1983 official forecast verification
wind speed errors (knots)

	initial position	forecast period (hours)			
		12	24	48	
mean error	1.5	-0.7	-1.8	2.8	
mean absolute error	2.7	6.8	9.8	15.9	
standard error	4.5	9.2	12.8	18.0	17.1
number of cases	43	41	31	16	9

bl

ec

i

i

pl eme ec
e pe od (h

i

hi iq

#

1

NHC

HC

HUI RAN

7

59
9

CL ER

1

NH

9
(

1

SA BA

1

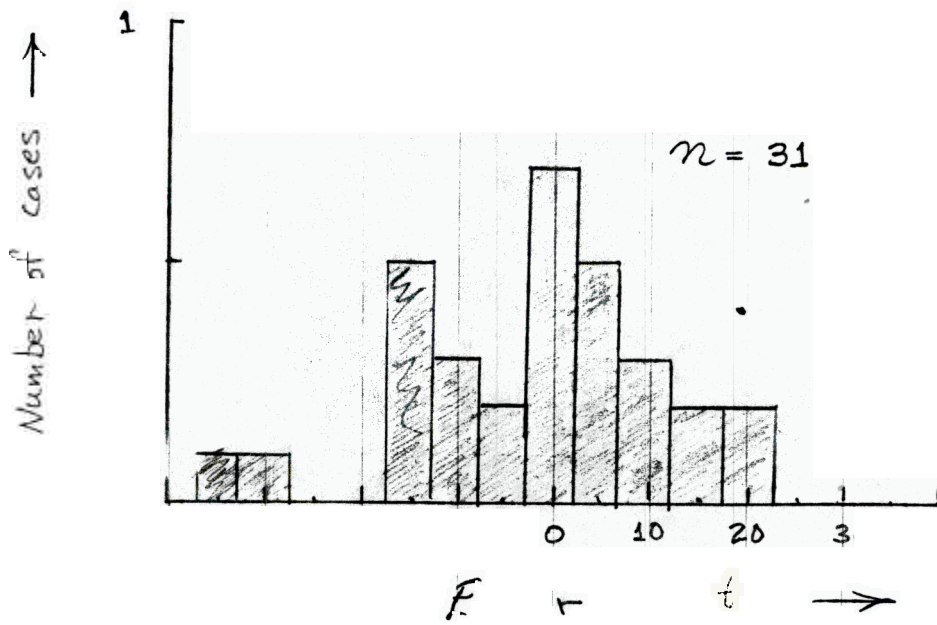
1

MFM

1

1

Fig 1



18 off 24 w period forecast
error distribution