

# 1994 NATIONAL HURRICANE CENTER FORECAST VERIFICATION

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## Abstract

The National Hurricane Center issues a 72-hour track and intensity forecast, every six hours, for all tropical cyclones in the Atlantic and eastern Pacific basins. Forecasts are verified by comparison with a best-track post analysis of all available track and intensity data. Verification statistics for 1994 are presented.

## 1. Atlantic

There were 112 official forecasts issued for tropical storms and hurricanes in the Atlantic basin in 1994. The average track errors by storm are listed in Table 1.1 along with the yearly average for all storms and a comparison with the previous ten-year average. The initial position errors are considerably less than the previous ten-year average, the 0- through 48-hour errors are near or slightly larger, and the 72-hour errors are 13 percent larger than the previous ten-year average.

Tables 1.2.1, 1.2.2 and 1.2.3 are homogeneous comparisons of various track guidance models. Table 1.2.1 includes models that are operationally available (within 1.5 hours from the 0-hour forecast time) every 6 hours. The barotropic deep BAM model has the smallest errors, except for 72-hours where the statistical-dynamical NHC90 has the smallest errors.

Table 1.2.2 includes the VICBAR and an interpolated GFDL model, both of which are run every six hours, although the VICBAR model is not available until after the official forecast has been completed (I am not positive about this). The deep BAM performs very well in comparison to these more sophisticated models, except at 72 hours when both the VICBAR and GFDL have smaller errors. Table 1.2.3 is a comparison of the all of the track guidance models used in the Atlantic basin and the number of cases becomes small, as the GFDL, QLM and Aviation models are run only every 12 hours. The GFDL and the VICBAR models continue to be the best performers, but the QLM and NHC90 also show considerable skill, except at 72 hours.

Official maximum one-minute wind speed forecast errors are given in Table 1.3. Similar to last year, the 1994 bias (mean) is closer to zero than the strongly negative previous ten-year average (not in the table), especially at 36- through 72 hours. The absolute mean average error is smaller than the previous ten-year average at all time periods. Tables 1.4.1 and 1.4.2 are homogeneous comparisons of biases and absolute errors for three intensity guidance models.

## 2. Eastern Pacific

Tables 2.1 through 2.4 are similar verification statistics for the eastern Pacific basin. Table 2.1 shows that the 1994 average

official track errors are from 8% to 19% smaller than the 1988-1993 averages. Official track errors are considerably smaller in the eastern Pacific than in the Atlantic.

A track model comparison is given in Table 2.2. CLIPER model errors in the eastern Pacific are also smaller than in the Atlantic. Even though the GFDL model errors are also smaller than in the Atlantic, there is not an equivalent improvement over the CLIPER model, as in the Atlantic. The VICBAR is not run in the Pacific at this time.

Official intensity errors show a large negative bias in 1994. that is larger than the average of the previous 5 years and the mean absolute errors are also very large.

Table 1.1. Official average track forecast errors (nautical miles), by storm, Atlantic, 1994, excluding extratropical, subtropical and tropical depression stages.

name	forecast period (hours)					
	0	12	24	36	48	72
T.S. Alberto (no. of cases)	5 (8)	40 (6)	111 (4)	224 (2)	- (0)	- (0)
T.S. Beryl	9 (4)	3 (2)	- (0)	- (0)	- (0)	- (0)
H. Chris	13 (28)	44 (26)	81 (24)	104 (22)	166 (20)	317 (16)
T.S. Debby	12 (6)	29 (4)	63 (2)	- (0)	- (0)	- (0)
T.S. Ernesto	9 (8)	20 (6)	28 (4)	53 (2)	- (0)	- (0)
H. Florence	8 (20)	47 (18)	87 (16)	111 (14)	155 (12)	415 (8)
H. Gordon	17 (38)	68 (36)	134 (34)	203 (32)	259 (30)	332 (26)
1994 average	12 (112)	52 (98)	103 (84)	152 (72)	210 (62)	342 (50)
1984-1993 average	16	52	101		199	302
1994 departure from 1984-1993 average	-25%	00%	+02%		+06%	+13%

Table 1.3. Official wind speed forecast errors (knots), Atlantic, 1994.  
Error = forecast - observed.

	forecast period (hours)					
	0	12	24	36	48	72
1994 mean	-2.5	-2.4	-1.3	-0.9	-1.3	+0.3
1994 mean absolute	4.6	7.4	10.1	12.3	14.8	18.5
max. absolute error	-30	-30	-30	-40	+40	-45
(no. of cases)	(112)	(97)	(83)	(72)	(62)	(50)
1984-1993 mean	-1.7	-1.5	-2.1		-4.3	-4.9
1984-1993 mean absolute	4.8	7.8	11.4		16.3	20.6
1994 departure from 1984-1993 mean absolute	-04%	-05%	-13%		-10%	-10%

Table 1.4.1. Intensity model homogeneous comparisons, Atlantic, 1994, mean errors (knots).

	forecast period (hours)				
	12	24	36	48	72
Official	-3.6	-2.3	-1.3	-1.7	+0.7
SHIFOR	-1.9	+0.1	+1.2	+1.0	+3.0
SHIPS	-2.8	-1.7	-2.0	-4.6	-6.5
GFDL	-3.4	+2.1	+8.6	+10.9	+19.5
(no. of cases)	(42)	(37)	(32)	(27)	(21)

Table 1.4.2. Intensity model homogeneous comparisons, Atlantic, 1994, mean absolute errors (knots).

	forecast period (hours)				
	12	24	36	48	72
Official	8.3	10.7	11.6	15.7	21.2
SHIFOR	8.0	11.0	12.4	14.6	16.5
SHIPS	8.0	9.8	12.6	18.9	27.1
GFDL	11.9	14.1	19.3	25.1	29.5
(no. of cases)	(42)	(37)	(32)	(27)	(21)

Table 1.2.1. Track model homogeneous comparison, Atlantic, 1994, errors in nautical miles.

model	forecast period (hours)				
	12	24	36	48	72
Official	52	103	152	213	344
BAM(deep)	51	90	135	191	368
BAM(medium)	60	111	166	236	434
BAM(shallow)	77	151	223	305	504
CLIPER	65	149	232	311	394
NHC90	58	109	167	244	318
(number of cases)	(95)	(81)	70)	(60)	(48)

Table 1.2.2. Track model homogeneous comparison, Atlantic, 1994, errors in nautical miles.

model	forecast period (hours)				
	12	24	36	48	72
Official	55	108	149	208	347
BAM(deep)	49	88	128	189	367
CLIPER	71	162	245	311	409
GFDL(interpolated)	62	123	166	206	290
NHC90	63	120	171	249	326
VICBAR	56	106	150	216	299
(number of cases)	(63)	(56)	(49)	(44)	(37)

Table 1.2.3. Track model homogeneous comparison, Atlantic, 1994, errors in nautical miles.

model	forecast period (hours)				
	12	24	36	48	72
Official	50	100	168	239	354
Aviation Model	77	137	197	274	459
BAM(deep)	48	84	132	215	392
CLIPER	52	121	193	261	294
GFDL	54	88	137	184	240
NHC90	49	98	148	220	319
QLM	51	101	159	248	387
VICBAR	44	86	129	185	238
(number of cases)	(37)	(29)	(22)	(20)	(14)

Table 2.1. Official average track forecast errors (nautical miles), by storm, eastern Pacific, 1994, excluding extratropical, subtropical and tropical depression stages.

name	forecast period (hours)					
	0	12	24	36	48	72
T.S. Aletta (no. of cases)	16 (9)	41 (7)	77 (5)	105 (3)	102 (1)	- (0)
T.S. Bud	14 (4)	24 (2)	- (0)	- (0)	- (0)	- (0)
H. Carlotta	14 (21)	32 (19)	52 (17)	78 (15)	104 (13)	128 (9)
T.S. Daniel	20 (11)	29 (11)	61 (11)	79 (11)	92 (11)	88 (11)
H. Emilia	12 (5)	30 (5)	50 (5)	68 (5)	65 (5)	84 (5)
Fabio	7 (5)	25 (3)	59 (1)	- (0)	- (0)	- (0)
H. Gilma	8 (9)	26 (9)	44 (9)	72 (9)	94 (9)	159 (9)
T.S. Hector	7 (8)	28 (6)	57 (4)	112 (2)	- (0)	- (0)
H. Ileana	13 (11)	51 (9)	106 (7)	173 (5)	242 (3)	- (0)
H. John	12 (37)	35 (37)	71 (37)	107 (37)	141 (37)	191 (37)
H. Kristy	4 (4)	16 (4)	39 (4)	56 (4)	59 (4)	174 (4)
H. Lane	6 (21)	20 (19)	44 (17)	77 (15)	107 (13)	113 (9)
Miriam	14 (10)	50 (8)	76 (6)	67 (4)	88 (2)	- (0)
Norman	17 (5)	61 (3)	82 (1)	- (0)	- (0)	- (0)
H. Olivia	9 (24)	35 (22)	74 (20)	111 (18)	158 (16)	239 (12)
Paul	18 (9)	48 (7)	110 (5)	190 (3)	262 (1)	- (0)
H. Rosa	8 (13)	44 (11)	80 (9)	91 (7)	82 (5)	263 (1)
1994 average	12 (206)	34 (182)	66 (158)	96 (138)	122 (120)	166 (94)
1988-1993 average	14	39	72	107	142	204
1994 departure from 1988-1993 average	-14%	-13%	-08%	-10%	-14%	-19%

Table 2.2. Track model homogeneous comparison,  
eastern Pacific, 1994, errors in nautical miles.

model	forecast period (hours)				
	12	24	36	48	72
Aviation Model	59	111	172	257	456
Official	32	60	79	102	132
BAM(deep)	35	64	83	106	158
BAM(medium)	44	82	114	154	236
BAM(shallow)	48	96	140	188	266
CLIPER	36	68	96	130	216
GFDL	40	77	108	133	182
NHC91	35	62	82	114	183
QLM	46	81	131	179	219
PSS	35	65	92	123	195
(number of cases)	(62)	(56)	(48)	(41)	(22)

Table 2.3. Official wind speed forecast errors (knots), eastern Pacific, 1994. Error = forecast - observed.

	forecast period (hours)					
	0	12	24	36	48	72
1994 mean	-0.7	-1.7	-4.0	-7.4	-11.4	-11.7
1994 mean absolute	2.2	7.1	13.7	21.0	27.4	33.3
(no. of cases)	(206)	(180)	(156)	(136)	(118)	(93)
1988-1993 mean	-0.9	-1.3	-1.9	-2.9	-4.0	-3.7
1988-1993 mean absolute	3.3	7.0	11.6	15.2	17.6	19.9
1994 departure from 1988-1993 mean absolute	-33%	+01%	+18%	+41%	+56%	+66%

Table 2.4.1 Intensity model homogeneous comparisons, eastern Pacific 1994, mean error (knots).

	forecast period (hours)				
	12	24	36	48	72
Official	-1.5	-4.7	-8.4	-12.2	-12.0
SHIFOR	-4.5	-9.9	-15.1	-19.7	-23.0
GFDL	-8.2	-11.4	-17.7	-21.9	-20.4
(no. of cases)	(74)	(65)	(57)	(49)	(37)

Table 2.4.2 Intensity model homogeneous comparisons, eastern Pacific, 1994, mean absolute error (knots).

	forecast period (hours)				
	12	24	36	48	72
Official	7.7	13.9	21.4	28.0	35.8
SHIFOR	8.6	14.7	22.2	26.6	32.0
GFDL	15.2	20.7	27.2	33.6	38.6
(no. of cases)	74	(65)	(57)	(49)	(37)