

# National Hurricane Center 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 1990 are presented.

### 1. Atlantic

Tables 1.1 lists average official track errors by storm for the Atlantic for 1990 for tropical storms and hurricanes and Table 1.2 compares 1990 with the averages from the previous ten years. Averages for 1990 are slightly less than the previous ten years, ranging from 02% less at the 12-hour forecast period to 14% less at 48 hours. Table 1.3 lists the 1990 average official track errors for tropical depression stage and it is seen that errors for depressions are 13% higher than for stronger systems at 12 hours ranging to only 02% to 03% higher at 48 and 72 hours.

Track errors are given in Table 1.4 for the primary guidance models used in 1990 and Table 1.5 lists the errors for a homogeneous set of cases for selected models. Table 1.6 also gives the homogeneous model comparison, but the model errors have been normalized by dividing them by the CLIPER errors. The QLM is an outstanding performer at 48 and 72 hours and the deep BAM is also impressive. The QLM, however, is not available in time to provide guidance for the operational forecast of the same time, but is available for the forecast six hours later.

Table 1.7 lists the 1990 average errors for the official forecast of the one-minute surface wind speed. The mean errors show a negative bias at all forecast periods. This bias is larger than the previous ten-year average at the 0-hour forecast period but is smaller at all other forecast periods. The mean absolute errors for 1990 are smaller than the previous ten-year average at all forecast periods.

### 2. Eastern Pacific

Tables 2.1 through 2.6 list errors for the eastern Pacific basin in a format similar to that of the Atlantic. The National Hurricane Center has been issuing forecasts for the eastern Pacific since 1988 and the 1990 errors, like 1988 and 1989, are smaller than the ten-year average ending in 1987.

A comparison of models shows that the statistical PSS and PSDE have the lowest errors, although CLIPER is hard to improve on, as is always the case in the eastern Pacific where most storm tracks remain rather close to the climatological expectations. It is interesting that the QLM and BAM did poorly, in contrast to their Atlantic performance.

Finally, wind speed errors in the eastern Pacific show a negative bias at all forecast periods.

Table 1.1. Official track forecast errors by storm (average in nautical miles), Atlantic, 1990.

storm	forecast period (hours)					
	0	12	24	36	48	72
Arthur (no. of cases)	13 (10)	49 (8)	104 (6)	112 (4)	133 (2)	
Bertha	16 (22)	50 (21)	90 (19)	136 (17)	173 (15)	230 (11)
Cesar	18 (18)	43 (16)	72 (14)	102 (12)	153 (10)	290 (6)
Diana	16 (13)	50 (12)	81 (11)	127 (9)	189 (7)	349 (3)
Edouard	20 (7)	78 (5)	82 (3)	20 (1)	- (0)	- (0)
Fran	33 (4)	38 (2)	- (0)	- (0)		
Gustav	10 (38)	30 (36)	71 (34)	122 (32)	196 (30)	388 (26)
Hortense	22 (15)	84 (13)	141 (11)	181 (9)		408 (3)
Isidore	19 (48)	59 (47)	108 (45)	151 (43)	176 (41)	274 (37)
Josephine	20 (28)	89 (24)	158 (20)	231 (16)	294 (13)	351 (9)
Klaus	12 (21)	39 (19)	85 (17)	129 (16)	161 (14)	189 (10)
Lili	14 (22)	75 (22)	138 (21)	175 (18)	189 (16)	370 (12)
Marco	12 (7)	43 (5)	55 (3)	49 (1)		
Nana	8 (17)	52 (15)	113 (13)	183 (11)	223 (9)	
Total	16 (269)	56 (243)	103 (215)	149 (187)	194 (163)	306 (121)

Table 1.2. Comparison of 1990 Atlantic Official track forecast errors (knots) with previous 10-year average.

	forecast period (hours)					
	0	12	24	36	48	72
1990 average	16	56	103	149	194	306
(no. of cases)	(269)	(243)	(215)	(187)	(163)	(121)
1980-1989 average	18	57	111		225	343
1980-1989 (average no. of cases)	(146)	(144)	(128)		(95)	(70)
1990 departure from 1980-1989 average	-11%	-02%	-07%		-14%	-11%
1990 range	0-107	0-276	5-362	5-514	5-691	28-944

Table 1.3. 1990 Official track forecast errors - Atlantic: tropical depression stage vs. tropical storm and hurricane stage.

	forecast period (hours)				
	12	24	36	48	72
tropical depression stage	63	113	161	198	312
(no. of cases)	(93)	(98)	(96)	(93)	(81)
tropical storm and hurricane stage	56	103	149	194	304
(no. of cases)	(243)	(215)	(187)	(163)	(121)
error ratio TD/(TS+H)	1.13	1.10	1.08	1.02	1.03

Table 1.4. Track model forecast errors (average in nautical miles), Atlantic, 1990, all cases.

model	forecast period (hours)				
	12	24	36	48	72
Official (number of cases)	56 (243)	103 (215)	149 (187)	194 (163)	306 (121)
BAM(deep)	51 (235)	91 (209)	134 (186)	183 (162)	278 (122)
BAM(medium)	52 (234)	95 (209)	143 (186)	197 (162)	300 (122)
BAM(shallow)	61 (233)	117 (208)	174 (185)	235 (162)	356 (122)
CLIPER	64 (244)	123 (216)	187 (189)	248 (165)	386 (123)
NHC90	58 (231)	99 (205)	155 (179)	216 (156)	368 (115)
QLM	63 (111)	105 (101)	143 (88)	169 (77)	233 (56)
VBAR	50 (119)	98 (108)	154 (95)	210 (84)	318 (63)

Table 1.5. Track model forecast errors (average in nautical miles), Atlantic, 1990, quasi-homogeneous set of cases.

model	forecast period (hours)				
	12	24	36	48	72
Official (number of cases)	57 (111)	107 (101)	156 (88)	201 (77)	321 (56)
BAM(deep)	50	94	136	188	290
CLIPER	62	121	193	256	411
NHC90	58	98	157	214	358
QLM	63	105	143	169	233 ✓
VBAR	49	97	154	211	321

Table 1.6. Track model forecast errors, normalized with respect to the CLIPER model, Atlantic, 1990, quasi-homogeneous set of cases. The values in this table are derived by dividing the errors in Table 1.4 by the CLIPER model error for the same forecast period.

model	forecast period (hours)				
	12	24	36	48	72
Official (number of cases)	0.92 (111)	0.88 (101)	0.81 (88)	0.79 (77)	0.78 (56)
BAM(deep)	0.81	0.78	0.70	0.73	0.71
CLIPER	1.00	1.00	1.00	1.00	1.00
NHC90	0.94	0.81	0.81	0.84	0.87
QLM	1.02	0.87	0.74	0.66	0.57
VBAR	0.79	0.80	0.80	0.82	0.78

Table 2.1 (continued). Official track forecast errors (average in nautical miles), eastern Pacific, 1990.

storm	forecast period (hours)					
	0	12	24	36	48	72
Polo	10 (6)	50 (5)	69 (3)	106 (1)	- (0)	(0)
Rachel	15 (11)	61 (9)	113 (7)	192 (5)	430 (3)	(0)
Simon	17 (15)	37 (13)	67 (11)	104 (9)	132 (7)	183 (3)
Trudy	9 (56)	33 (54)	70 (52)	112 (50)	158 (48)	269 (44)
Vance	15 (29)	48 (27)	85 (25)	134 (23)	174 (21)	232 (17)
Total	13 (451)	38 (418)	71 (383)	108 (345)	143 (308)	200 (237)

Table 2.1. Official track forecast errors by storm (average in nautical miles), eastern Pacific, 1990.

storm	forecast period (hours)					
	0	12	24	36	48	72
Alma (no. of cases)	14 (10)	42 (10)	71 (10)	87 (9)	99 (7)	194 (3)
Boris	12 (13)	51 (11)	127 (9)	209 (7)	321 (5)	502 (1)
Cristina	21 (18)	47 (16)	83 (14)	109 (12)	140 (10)	133 (6)
Douglas	13 (14)	30 (13)	58 (11)	95 (9)	133 (7)	296 (3)
Elida	13 (16)	43 (15)	85 (13)	134 (11)	148 (9)	147 (5)
Fausto	15 (19)	35 (17)	51 (15)	64 (13)	73 (11)	162 (7)
Genevieve	12 (25)	33 (23)	59 (21)	95 (19)	127 (17)	171 (13)
Hernan	14 (35)	26 (33)	43 (31)	60 (29)	76 (27)	100 (23)
Iselle	12 (32)	31 (30)	56 (29)	84 (27)	111 (25)	159 (21)
Julio	12 (24)	37 (22)	59 (20)	87 (18)	116 (16)	160 (12)
Kenna	12 (28)	45 (26)	78 (24)	128 (22)	175 (20)	213 (16)
Lowell	13 (23)	36 (21)	69 (19)	93 (17)	125 (15)	181 (11)
Marie	10 (23)	29 (23)	63 (23)	98 (23)	133 (23)	195 (23)
Norbert	14 (30)	49 (28)	101 (26)	151 (23)	179 (21)	212 (17)
Odile	10 (24)	35 (22)	76 (20)	127 (18)	179 (16)	266 (12)

Table 1.7. Official wind speed forecast errors (knots), Atlantic 1990. Error = forecast - observed.

	forecast period (hours)					
	0	12	24	36	48	72
1990 mean	-2.0	-1.3	-1.8	-2.8	-3.5	-2.7
1990 mean absolute	3.4	6.4	<u>10.1</u>	12.2	13.9	15.7
no. of cases	269	243	215	187	162	119
max. error	-25	-35	-40	-40	-50	-45
1980-1989 mean	-1.3	-1.6	-2.7		-5.4	-6.4
1980-1989 avg. no. of cases	143	141	124		90	64
1990 departure from 1980-1989 mean	+54%	-19%	-33%		-35%	-58%
1980-1989 mean absolute	5.6	8.5	11.7		15.8	19.9
1990 departure from 1980-1989 mean absolute	-39%	-25%	-14%		-12%	-21%



Table 2.2 Official track forecast errors (nautical miles),  
by year, eastern Pacific Ocean.

year	forecast period (hours)					
	0	12	24	36	48	
1978			83		156	217
1979			86		182	269
1980			81		164	263
1981			100		178	267
1982			78		169	246
1983			86		172	237
1984			89		180	277
1985			85		161	227
1986			101		223	311
1987			85		177	214
1978-1987 average			84		173	
1988	20	45	75	103	138	176
(cases)	(175)	(175)	(150)	(128)	(108)	(74)
1989	15	43	82	125	164	237
(cases)	(215)	(215)	(182)	(150)	(119)	(77)
1990	13	38	71	108	143	200
(cases)	(451)	(418)	(383)	(345)	(308)	(237)
1988-1990 average	15	41	75	111	147	

Table 2.3. Track model forecast errors (average in nautical miles), eastern Pacific, 1990, all cases.

model	forecast period (hours)				
	12	24	36	48	72
Official (number of cases)	38 (418)	71 (383)	108 (345)	143 (308)	200 (237)
BAM(deep)	50 (318)	87 (292)	122 (263)	162 (235)	250 (187)
BAM(medium)	45 (289)	80 (267)	113 (243)	147 (220)	225 (179)
BAM(shallow)	50 (289)	88 (267)	124 (243)	160 (220)	231 (179)
CLIPER	41 (417)	75 (380)	112 (339)	150 (302)	200 (232)
PSDE	40 (192)	78 (174)	115 (156)	136 (138)	194 (105)
	40 (411)	72 (374)	109 (336)	146 (299)	199 (230)
	57 (146)	80 (135)	117 (122)	163 (112)	260 (85)

Table 2.4. Track model forecast errors (average in nautical miles), eastern Pacific, 1990, quasi-homogeneous set of cases.

model	forecast period (hours)				
	12	24	36	48	72
Official (number of cases)	37 (145)	70 (134)	105 (120)	142 (110)	205 (84)
BAM(medium)	45	80	113	146	233
CLIPER	41	75	112	149	201
PSDE	38	74	110	131	198
PSS	39	71	110	145	194
QLM	57	80	117	163	260

Table 2.5. Track model forecast errors, normalized with respect to the CLIPER model, eastern Pacific, 1990, quasi-homogeneous set of cases. The values in this table are derived by dividing the errors in Table 1.4 by the CLIPER model error for the same forecast period.

model	forecast period (hours)				
	12	24	36	48	72
Official (number of cases)	0.90 (145)	0.93 (134)	0.94 (120)	0.95 (110)	1.02 (84)
BAM(medium)	1.10	1.07	1.01	0.98	1.16
PSDE	0.93	0.99	0.98	0.88	0.99
PSS	0.95	0.95	0.98	0.97	0.97
QLM	1.39	1.07	1.04	1.09	1.29