1990

# 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 is 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 easten 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.

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

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

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

| | forecast period (hours) | | | | |
|---|---|---|---|---|---|
| model | 12 | 24 | 36 | 48 | 72 |
| Official | 57 | 107 | 156 | 201 | 321 |
| (number of cases) | (111) | (101) | (88) | 77) | (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.

| | forecast period (hours) | | | | |
|---|---|---|---|---|---|
| model | 12 | 24 | 36 | 48 | 72 |
| Official | 0.92 | 0.88 | 0.81 | 0.79 | 0.78 |
| (number of cases) | (111) | (101) | (88) | (77) | (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.

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

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

| | forecast period (hours) | | | | | |
|---|---|---|---|---|---|---|
| storm | 0 | 12 | 24 | 36 | 48 | 72 |
| Alma | 14 | 42 | 71 | 87 | 99 | 194 |
| (no. of cases) | (10) | (10) | (10) | (9) | (7) | (3) |
| Boris | 12 | 51 | 127 | 209 | 321 | 502 |
| | (13) | (11) | (9) | (7) | (5) | (1) |
| Cristina | 21 | 47 | 83 | 109 | 140 | 133 |
| | (18) | (16) | (14) | (12) | (10) | (6) |
| Douglas | 13 | 30 | 58 | 95 | 133 | 296 |
| | (14) | (13) | (11) | (9) | (7) | (3) |
| Elida | 13 | 43 | 85 | 134 | 148 | 147 |
| | (16) | (15) | (13) | (11) | (9) | (5) |
| Fausto | 15 | 35 | 51 | 64 | 73 | 162 |
| | (19) | (17) | (15) | (13) | (11) | (7) |
| Genevieve | 12 | 33 | 59 | 95 | 127 | 171 |
| | (25) | (23) | (21) | (19) | (17) | (13) |
| Hernan | 14 | 26 | 43 | 60 | 76 | 100 |
| | (35) | (33) | (31) | (29) | (27) | (23) |
| Iselle | 12 | 31 | 56 | 84 | 111 | 159 |
| | (32) | (30) | (29) | (27) | (25) | (21) |
| Julio | 12 | 37 | 59 | 87 | 116 | 160 |
| | (24) | (22) | (20) | (18) | (16) | (12) |
| Kenna | 12 | 45 | 78 | 128 | 175 | 213 |
| | (28) | (26) | (24) | (22) | (20) | (16) |
| Lowell | 13 | 36 | 69 | 93 | 125 | 181 |
| | (23) | (21) | (19) | (17) | (15) | (11) |
| Marie | 10 | 29 | 63 | 98 | 133 | 195 |
| | (23) | (23) | (23) | (23) | (23) | (23) |
| Norbert | 14 | 49 | 101 | 151 | 179 | 212 |
| | (30) | (28) | (26) | (23) | (21) | (17) |
| Odile | 10 | 35 | 76 | 127 | 179 | 266 |
| | (24) | (22) | (20) | (18) | (16) | (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 | 10.1 | 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.

| | forecast period (hours) | | | | | |
|---|---|---|---|---|---|---|
| year | 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.

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

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

| | forecast period (hours) | | | | |
|---|---|---|---|---|---|
| model | 12 | 24 | 36 | 48 | 72 |
| Official | 37 | 70 | 105 | 142 | 205 |
| (number of cases) | (145) | (134) | (120) | (110) | (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.

| | forecast period (hours) | | | | |
|---|---|---|---|---|---|
| model | 12 | 24 | 36 | 48 | 72 |
| Official | 0.90 | 0.93 | 0.94 | 0.95 | 1.02 |
| (number of cases) | (145) | (134) | (120) | (110) | (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 |