# 1995 NATIONAL HURRICANE CENTER FORECAST VERIFICATION

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## Introduction

The National Hurricane Center issues every six hours a 72-hour track and intensity forecast for all tropical cyclones in the north Atlantic and east Pacific basins. Forecasts are verified by comparison with a best-track post analysis of all available track and intensity data. The best-track data used for verification excludes extratropical, subtropical and tropical depression stages. Climatology and persistence forecasts are used as standards for skill in comparing forecasts (CLIPER model forecasts for track and SHIFOR model forecasts for intensity).

Track forecast errors are determined as the great circle distance between a forecast position and a best-track position for the same time. A tropical cyclone's intensity is defined as the maximum one-minute wind speed ten meters above the ground. This maximum speed can occur anywhere within the cyclone's circulation. Intensity forecast errors are determined as the difference between the forecast wind speed and the best-track wind speed for the same time. Unlike the positive distance error associated with track, intensity errors can be positive or negative. Therefore, intensity errors are presented two ways: as the algebraic average error (the bias) and as the average of the absolute magnitude of the error. Also note that forecast and best-track intensities are rounded to the closest five knots.

Model objective track guidance is of two types, late or early. Late models require the completion of the Aviation Run of the MRF model and are run every twelve hours, three hours after synoptic time. Although they provide the best guidance each model is capable of, they arrive too late and too infrequent for the forecaster to use. Various strategies used by modelers and others provide the forecaster with more timely guidance than that derived from the late models. These modified models are classified as early and are available every six hours, one hour after synoptic time. Table 1 defines the model abbreviations used in this report.

## North Atlantic

The active 1995 North Atlantic hurricane season had 19 tropical storms and hurricanes and was second only to 1933 with 21. There were 446 official forecasts issued for tropical storms and hurricanes, exceeding the combined total for the previous three years. The average official forecast track errors by storm are listed in Table 2.1. Table 2.2 gives the average official and CLIPER track errors for 1995 and the previous ten-year average. The 1995 departures from the ten-year average error are given by forecast period in the latter portion of the Table. Although in a absolute sense the official forecast errors are low compared to the ten-year average, almost half the error reduction can be accounted for by this year's lower CLIPER error over its ten-year average.

Table 3.1 and Table 3.2 are homogeneous comparisons of the late and early Atlantic track guidance models. This year, the official forecast has the smallest error in either Table, except for the late GFDL

model at the 36-, 48- and 72-hour forecast periods. The implication is that the available guidance is being optimally used. The UKMET and NOGAPS global models' track forecasts were obtained after hurricane season, truly late. They are included because of these global models' remarkable performance over the Atlantic.

The average official and SHIFOR wind speed forecast errors (the biases) for 1995 and 1990 - 1994 are given in Table 4. The departure from the five-year average is given by forecast period in the latter portion of the Table. Except for the initial time period, the 1995 official and SHIFOR bias departures are positive and much larger than the five-year biases. The large negative SHIFOR bias for this year indicates the model's tendency to consistently under predict intensification. Table 5 is similar to Table 4, except for the absolute error. Official departures for 1995 from the five-year average are the same or less than the SHIFOR departures for all forecast time periods.

Table 6 displays the intensity objective guidance models. The official bias is near SHIFOR, except where it is less at 72 hours. SHIPS has a strong negative bias while the GFDL has a strong positive bias. For the absolute error, the official is less than all other models through 36 hours while SHIFOR's error is the smallest at 48 and 72 hours.

## East Pacific

The 1995 East Pacific hurricane season had only 10 tropical storms and hurricanes, second only in inactivity to 1977 with 8. There were 186 official forecasts issued for tropical storms and hurricanes in the basin this year, ten percent less than last year. The average official forecast track errors by storm are listed in Table 7.1. Table 7.2 gives the average official and CLIPER track errors for 1995 and the previous seven years, 1988 to 1994. This year's error departures from the seven-year average error is given in the latter portion of the Table. This year's CLIPER errors are nearly identical to their seven-year average error, except at the 24- and 36-hour forecast periods. The official forecast error departures tend to correspond to the CLIPER departures, save at 72 hours where the improvement is fifteen percent over its seven-year average.

Table 8.1 and Table 8.2 are homogeneous comparisons of various track guidance models. Again as for the Atlantic, the official forecast has the smallest error of all the early models, indicating again, that the available guidance is being used to best advantage. For the late models, displayed in Table 8.1, only the GFDL model is substantially better at the 24-, 36- and 48-hour forecast periods. Not shown is the UKMET model's east Pacific performance, which, although comparable to the error recorded by NHC91 and the GFDL models, would have reduced the number of cases by more than half. The NOGAPS results were not processed.

The 1995 average official and SHIFOR wind speed forecast errors are given in Table 9. The official biases were less than the 5-year average from 24 through 72 hours. The SHIFOR biases displayed this same tendency but beginning at 48 hours. The absolute official errors, given in Table 10, are similar to the 5-year average except at 12 and 72 hours where the departure is 15 to 6 percent better than SHIFOR departures, respectively.

For the east Pacific, the GFDL model provides the only other intensity forecast besides SHIFOR. Its results are given in Table 11. Surprisingly, opposite to the Atlantic, the GFDL model has a large negative bias at all time periods. Even more remarkable, the magnitude of the bias is almost the same as the absolute error, indicating a consistent tendency by the model to under forecast intensity for this basin.

## Conclusions

1. The official track forecasts for 1995 are better than the long-term average for both basins.
2. The early objective track guidance is being used to best advantage for both basins.
3. UKMET model forecasts should be obtained in a timely manner for the next hurricane season.

(The NOGAPS forecasts are now available operational.)

4. A large number of good official track forecasts were made during 1995. Their impact on the ten-year average may make yearly official track forecast improvement more difficult during the next ten years.
5. The GFDL model's large negative bias in forecasting intensity in the east Pacific should be corrected.
6. Forecasting intensity remains the forecaster's greatest problem. New objective guidance must be developed to forecast intensity in tropical cyclones.

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**TABLE 1**

**MODEL ABBREVIATIONS**

(Click here for model descriptions)

| | |
|---|---|
| **OFCL** | Official track or intensity forecasts |
| **CLIP** | CLImatology and PERsistence track model - CLIPER (Atl and Pac) |
| **BAMD** | Beta Advection Model Deep (Global) |
| **BAMM** | Beta Advection Model Medium (Global) |
| **BAMS** | Beta Advection Model Shallow (Global) |
| **A90E** | NHC90 Statistical-Dynamic Model...early version (Atl) |
| **A90L** | NHC90 Statistical-Dynamic Model...late version (Atl) |
| **P91E** | NHC91 Statistical-Dynamic Model...early version (Pac) |
| **P91L** | NHC91 Statistical-Dynamic Model...late version (Pac) |
| **PSS** | EPHC77 Statistical-Synoptic Model (Pac) |
| **GFDL** | GFDL Model (Atl and Pac - track and intensity)[1] |
| **GFDI** | GFDL Interpolated Track (6- and 12-hour) |
| **AVNO** | MRF Model Aviation Run (Global) |
| **UKM** | UKMET Model (Global)[2] |
| **NGPS** | Navy Operational Global Atmospheric Prediction System - NOGAPS2 |
| **VBAR** | VICtor Ooyama's BARotropic model - VICBAR (Atl) |
| **OFCI** | Official Track Forecast Interpolated from the previous 6 hours |
| **SHFR** | Statistical Hurricane Intensity Forecast Model - SHIFOR (Atl and Pac) |
| **SHIP** | Statistical Hurricane Intensity Prediction Scheme - SHIPS (Atl)[1] |

[1] Intensity forecasts from these models are considered experimental. [2] These global models' results were obtained after hurricane season ended.

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**TABLE 2.1**

NORTH ATLANTIC
1995 OFFICIAL AVERAGE TRACK FORECAST ERRORS (NM) BY STORM

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FORECAST ERRORS (NM) FOR AL0195  ALLISON
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| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 11.8 | 37.8 | 76.1 | 141.8 | 254.3 | |
| #CASES | 8 | 8 | 6 | 4 | 2 | 0 |

FORECAST ERRORS (NM) FOR AL0295 BARRY

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 8.9 | 31.3 | 64.3 | 90.7 | 106.1 | |
| #CASES | 10 | 10 | 8 | 6 | 4 | 0 |

FORECAST ERRORS (NM) FOR AL0395 CHANTAL

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 11.6 | 46.3 | 77.0 | 105.2 | 146.7 | 253.2 |
| #CASES | 25 | 25 | 23 | 21 | 19 | 15 |

FORECAST ERRORS (NM) FOR AL0495 DEAN

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | | | | | | |
| #CASES | 0 | 0 | 0 | 0 | 0 | 0 |

(Dean was a tropical storm for only a 6-hour period)

FORECAST ERRORS (NM) FOR AL0595 ERIN

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 8.7 | 53.6 | 96.9 | 103.6 | 89.0 | 138.7 |
| #CASES | 16 | 16 | 14 | 12 | 10 | 6 |

FORECAST ERRORS (NM) FOR AL0795 FELIX

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 10.5 | 38.7 | 75.5 | 112.7 | 147.2 | 227.8 |
| #CASES | 54 | 54 | 52 | 50 | 48 | 44 |

FORECAST ERRORS (NM) FOR AL0895 GABRIELLE

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 7.6 | 41.4 | 116.6 | | | |
| #CASES | 4 | 4 | 2 | 0 | 0 | 0 |

FORECAST ERRORS (NM) FOR AL0995 HUMBERTO

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 14.5 | 53.8 | 103.7 | 138.4 | 171.3 | 242.3 |
| #CASES | 38 | 38 | 36 | 34 | 32 | 28 |

FORECAST ERRORS (NM) FOR AL1095 IRIS

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 9.0 | 52.3 | 97.8 | 145.2 | 186.6 | 275.4 |
| #CASES | 49 | 49 | 47 | 45 | 43 | 39 |

FORECAST ERRORS (NM) FOR AL1195 JERRY

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 15.5 | 21.2 | 35.7 | | | |
| #CASES | 3 | 3 | 1 | 0 | 0 | 0 |

FORECAST ERRORS (NM) FOR AL1295 KAREN

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 16.1 | 55.4 | 100.5 | 113.5 | 147.8 | 253.0 |
| #CASES | 19 | 19 | 17 | 15 | 13 | 9 |

FORECAST ERRORS (NM) FOR AL1395 LUIS

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 12.3 | 31.6 | 50.4 | 71.9 | 95.3 | 168.3 |
| #CASES | 52 | 52 | 50 | 48 | 46 | 42 |

FORECAST ERRORS (NM) FOR AL1595 MARILYN

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 9.9 | 38.4 | 68.3 | 99.8 | 128.7 | 165.6 |
| #CASES | 35 | 35 | 33 | 31 | 29 | 25 |

FORECAST ERRORS (NM) FOR AL1695 NOEL

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 13.6 | 48.0 | 93.9 | 138.1 | 178.1 | 229.6 |
| #CASES | 37 | 37 | 35 | 33 | 31 | 27 |

FORECAST ERRORS (NM) FOR AL1795 OPAL

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 9.6 | 42.8 | 102.4 | 161.5 | 231.0 | 326.2 |
| #CASES | 18 | 18 | 16 | 14 | 12 | 8 |

FORECAST ERRORS (NM) FOR AL1895 PABLO

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 45.7 | 90.2 | 122.5 | 162.5 | 184.5 | |
| #CASES | 10 | 10 | 8 | 6 | 4 | 0 |

FORECAST ERRORS (NM) FOR AL1995 ROXANNE

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 10.8 | 43.0 | 83.3 | 138.8 | 198.7 | 269.7 |
| #CASES | 38 | 38 | 36 | 34 | 32 | 27 |

FORECAST ERRORS (NM) FOR AL2095 SEBASTIEN

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 20.1 | 92.9 | 190.9 | 264.0 | 248.5 | |
| #CASES | 10 | 10 | 8 | 6 | 4 | 0 |

FORECAST ERRORS (NM) FOR AL2195 TANYA

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 8.6 | 65.1 | 121.5 | 166.2 | 237.4 | 357.9 |
| #CASES | 20 | 20 | 18 | 16 | 14 | 10 |

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## TABLE 2.2

NORTH ATLANTIC
1995 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS FOR A HOMOGENEOUS SAMPLE

| PERIOD | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | 12.2 | 46.9 | 87.1 | 123.8 | 160.1 | 233.3 | (nm) |
| CLIP | 12.2 | 53.7 | 111.1 | 171.9 | 227.6 | 326.8 | (nm) |
| #CASES | 446 | 446 | 410 | 375 | 343 | 280 | |

1985 - 1994 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS FOR A HOMOGENEOUS SAMPLE

| PERIOD | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | 15.2 | 50.5 | 97.5 | 143.7 | 193.7 | 296.1 | (nm) |
| CLIP | 15.2 | 59.1 | 119.1 | 185.0 | 253.0 | 370.9 | (nm) |
| #CASES | 1408 | 1397 | 1225 | 1063 | 918 | 671 | |

1995 OFFICAL AND CLIPER AVERAGE TRACK ERROR DEPARTURE FROM THE 1985 - 1994 OFFICAL AND CLIPER AVERAGE TRACK ERROR

| PERIOD | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL DEPARTURE | -20 | -07 | -11 | -14 | -17 | -21 | (%) |
| CLIP DEPARTURE | -20 | -09 | -07 | -07 | -10 | -12 | (%) |

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**TABLE 3.1**

NORTH ATLANTIC

1995 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (LATE*)

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 11.4 | 43.9 | 81.6 | 116.8 | 149.8 | 214.0 |
| CLIP | 11.4 | 49.6 | 102.2 | 153.4 | 208.6 | 314.2 |
| BAMD | 11.4 | 51.4 | 94.6 | 136.1 | 183.0 | 285.2 |
| BAMM | 11.4 | 52.6 | 99.6 | 138.1 | 185.3 | 262.0 |
| BAMS | 11.4 | 59.2 | 115.2 | 160.8 | 216.5 | 286.3 |
| A90L | 11.4 | 46.6 | 84.8 | 125.7 | 164.0 | 273.4 |
| GFDL | 11.4 | 48.5 | 84.2 | 112.7 | 144.6 | 206.7 |
| VBAR | 11.4 | 47.3 | 95.6 | 142.5 | 190.9 | 303.2 |
| AVNO | 11.4 | 60.5 | 103.2 | 146.7 | 193.3 | 279.9 |
| NGPS | 11.4 | 53.8 | 85.3 | 104.9 | 137.5 | 205.6 |
| UKM | 11.4 | 49.5 | 77.4 | 96.0 | 120.8 | 179.5 |
| #CASES | 152 | 152 | 150 | 123 | 119 | 91 |

* Although CLIPER and BAMs are early models they are included in this Table for reference.

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**TABLE 3.2**

NORTH ATLANTIC

1995 AVERAGE MODEL TRACK ERRORS (NM)
FOR A HOMOGENEOUS SAMPLE (EARLY)

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 12.1 | 46.4 | 85.7 | 121.5 | 156.4 | 224.8 |
| CLIP | 12.1 | 53.3 | 110.8 | 172.5 | 228.9 | 328.6 |
| BAMD | 12.1 | 53.4 | 95.4 | 137.6 | 181.0 | 282.8 |
| BAMM | 12.1 | 56.8 | 102.9 | 145.6 | 187.3 | 268.2 |
| BAMS | 12.1 | 64.7 | 118.4 | 169.0 | 215.5 | 293.3 |
| A90E | 12.1 | 48.5 | 88.1 | 132.2 | 178.6 | 308.7 |
| GFDI | 12.1 | 52.0 | 89.7 | 126.5 | 166.2 | 243.4 |
| OFCI | 12.1 | 52.2 | 94.1 | 131.6 | 170.0 | 243.1 |
| #CASES | 426 | 426 | 391 | 359 | 327 | 258 |

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**TABLE 4**

NORTH ATLANTIC

1995 AVERAGE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE (BIAS)

| | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | -1.6 | -1.2 | -1.6 | -2.2 | -3.7 | -3.8 | (kt) |
| SHFR | -1.6 | -1.3 | -2.1 | -2.9 | -3.7 | -6.4 | (kt) |
| #CASES | 446 | 446 | 410 | 375 | 343 | 279 | |

1990 - 1994 AVERAGE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE (BIAS)

| | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | -1.7 | -1.0 | -.8 | -1.4 | -2.3 | -2.4 | (kt) |
| SHFR | -1.7 | -.6 | -.6 | -.9 | -1.1 | -1.5 | (kt) |
| #CASES | 639 | 631 | 543 | 471 | 398 | 292 | |

1995 OFFICAL AND SHIFOR AVERAGE WIND SPEED ERROR (BIAS) DEPARTURE
FROM THE 1990 - 1994 OFFICAL AND SHIFOR AVERAGE WIND SPEED ERROR (BIAS)

| PERIOD | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL DEPARTURE | -06 | +20 | +100 | +57 | +61 | +58 | (%) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SHFR DEPARTURE | -06 | +30 | +250 | +222 | +236 | +327 | (%) |

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**TABLE 5**

NORTH ATLANTIC

1995 AVERAGE ABSOLUTE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE

| | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | 3.3 | 6.3 | 9.4 | 11.9 | 15.2 | 19.0 | (kt) |
| SHFR | 3.3 | 7.8 | 10.9 | 13.2 | 15.3 | 17.2 | (kt) |
| #CASES | 446 | 446 | 410 | 375 | 343 | 279 | |

1990 - 1994 AVERAGE ABSOLUTE WIND SPPED ABSOLUTE ERROR
FOR A HOMOGENEOUS SAMPLE

| | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | 3.6 | 6.8 | 11.0 | 13.9 | 16.2 | 19.6 | (kt) |
| SHFR | 3.6 | 8.4 | 12.1 | 14.3 | 16.2 | 17.8 | (kt) |
| #CASES | 639 | 631 | 543 | 471 | 398 | 292 | |

1995 OFFICAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR DEPARTURE
FROM THE 1990 - 1994 OFFICAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR

| PERIOD | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL DEPARTURE | -08 | -07 | -15 | -14 | -06 | -03 | (%) |
| SHFR DEPARTURE | -08 | -07 | -10 | -08 | -06 | -03 | (%) |

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**TABLE 6**

NORTH ATLANTIC

1995 AVERAGE MODEL WIND SPEED ERROR (KT)
FOR A HOMOGENEOUS SAMPLE (BIAS)

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | -1.4 | -1.0 | -1.5 | -1.9 | -3.3 | -2.6 |
| SHFR | -1.4 | -1.1 | -1.9 | -2.7 | -3.5 | -6.0 |
| SHIP | -1.4 | -1.6 | -2.7 | -4.7 | -7.1 | -12.7 |
| GFDL | -1.4 | -.2 | 3.7 | 6.2 | 7.3 | 8.6 |
| #CASES | 218 | 218 | 202 | 184 | 166 | 131 |

1995 AVERAGE MODEL ABSOLUTE WIND SPEED ERROR (KT)
FOR A HOMOGENEOUS SAMPLE

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 3.1 | 6.2 | 9.5 | 11.8 | 15.4 | 18.4 |
| SHFR | 3.1 | 7.7 | 10.6 | 12.9 | 15.3 | 17.7 |
| SHIP | 3.1 | 7.4 | 10.5 | 12.9 | 15.7 | 20.2 |
| GFDL | 3.1 | 11.8 | 15.1 | 16.4 | 17.5 | 19.5 |
| #CASES | 218 | 218 | 202 | 184 | 166 | 131 |

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**TABLE 7.1**

EAST PACIFIC

1995 OFFICIAL AVERAGE TRACK FORECAST ERRORS (NM) BY STORM

FORECAST ERRORS (NM) FOR EP0295 ADOLPH

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 9.4 | 33.0 | 64.2 | 92.0 | 142.1 | 250.7 |
| #CASES | 16 | 16 | 14 | 12 | 10 | 6 |

FORECAST ERRORS (NM) FOR EP0395 BARBARA

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 7.7 | 23.7 | 54.2 | 84.1 | 121.4 | 185.3 |
| #CASES | 33 | 33 | 31 | 29 | 27 | 23 |

FORECAST ERRORS (NM) FOR EP0495 COSME

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 12.9 | 44.3 | 84.8 | 127.0 | 188.8 | 319.3 |
| #CASES | 11 | 11 | 9 | 7 | 5 | 1 |

FORECAST ERRORS (NM) FOR EP0595 DALILA

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 17.9 | 50.4 | 93.5 | 143.1 | 187.0 | 181.6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| #CASES | 25 | 25 | 23 | 21 | 19 | 15 |

FORECAST ERRORS (NM) FOR EP0695 ERICK

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 12.4 | 39.4 | 80.7 | 94.1 | 85.8 | |
| #CASES | 7 | 7 | 5 | 3 | 1 | 0 |

FORECAST ERRORS (NM) FOR EP0795 FLOSSIE

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 14.0 | 37.9 | 43.4 | 63.9 | 94.2 | 214.7 |
| #CASES | 15 | 15 | 13 | 11 | 9 | 5 |

FORECAST ERRORS (NM) FOR EP0895 GIL

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 12.4 | 44.3 | 91.1 | 122.3 | 143.2 | 174.7 |
| #CASES | 21 | 21 | 19 | 17 | 15 | 11 |

FORECAST ERRORS (NM) FOR EP0995 HENRIETTE

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 8.1 | 41.3 | 86.8 | 147.9 | 180.4 | 158.7 |
| #CASES | 17 | 17 | 15 | 13 | 11 | 7 |

FORECAST ERRORS (NM) FOR EP1095 ISMAEL

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 15.8 | 57.2 | 166.5 | 311.8 | 445.9 | |
| #CASES | 9 | 9 | 7 | 5 | 3 | 0 |

FORECAST ERRORS (NM) FOR EP1195 JULIETTE

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 6.3 | 35.0 | 67.5 | 78.9 | 71.6 | 104.8 |
| #CASES | 32 | 32 | 30 | 28 | 26 | 22 |

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**TABLE 7.2**

EAST PACIFIC

1995 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

| | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | 10.9 | 38.6 | 76.4 | 110.9 | 138.6 | 169.1 | (nm) |
| CLIP | 10.9 | 40.8 | 82.4 | 122.4 | 159.1 | 229.0 | (nm) |
| #CASES | 186 | 186 | 166 | 146 | 126 | 90 | |

1988 - 1994 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

| | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | 13.0 | 38.6 | 70.6 | 104.8 | 138.7 | 198.0 | (nm) |
| CLIP | 13.0 | 40.9 | 76.3 | 116.2 | 156.4 | 225.3 | (nm) |
| #CASES | 1999 | 1994 | 1804 | 1606 | 1427 | 1108 | |

1995 OFFICAL AND CLIPER AVERAGE TRACK ERROR DEPARTURE
FROM THE 1988 - 1994 OFFICAL AND CLIPER AVERAGE TRACK ERROR

| PERIOD | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL DEPARTURE | -16 | 00 | 08 | 06 | 00 | -15 | (%) |
| CLIP DEPARTURE | -16 | 00 | 08 | 05 | 02 | 02 | (%) |

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**TABLE 8.1**

EAST PACIFIC

1995 AVERAGE MODEL TRACK ERRORS (NM)
FOR A HOMOGENEOUS SAMPLE (LATE*)

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 11.0 | 38.8 | 77.1 | 116.1 | 142.5 | 154.5 |
| CLIP | 11.0 | 42.1 | 84.7 | 130.6 | 172.5 | 241.5 |
| BAMD | 11.0 | 49.3 | 87.9 | 126.5 | 156.8 | 173.5 |
| BAMM | 11.0 | 50.9 | 93.2 | 143.8 | 189.0 | 219.3 |
| BAMS | 11.0 | 54.2 | 102.4 | 156.2 | 205.5 | 265.1 |
| PSS | 11.0 | 41.8 | 82.1 | 121.5 | 158.5 | 235.2 |
| P91L | 11.0 | 40.8 | 78.7 | 115.0 | 143.5 | 191.3 |
| GFDL | 11.0 | 44.9 | 74.2 | 104.7 | 136.4 | 158.1 |
| AVNO | 11.0 | 52.3 | 90.7 | 138.6 | 208.2 | 305.0 |
| #CASES | 77 | 77 | 68 | 61 | 52 | 34 |

* Although CLIPER and BAMs are early models they are included in this Table for reference.

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**TABLE 8.2**

EAST PACIFIC

1995 AVERAGE MODEL TRACK ERRORS (NM)

FOR A HOMOGENEOUS SAMPLE (EARLY)

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 10.9 | 37.5 | 74.8 | 112.7 | 141.1 | 167.0 |
| CLIP | 10.9 | 40.1 | 81.6 | 125.6 | 164.0 | 241.0 |
| BAMD | 10.9 | 47.4 | 84.1 | 122.1 | 145.0 | 183.3 |
| BAMM | 10.9 | 48.9 | 90.1 | 141.3 | 184.1 | 238.8 |
| BAMS | 10.9 | 50.5 | 96.3 | 152.7 | 202.2 | 288.5 |
| PSS | 10.9 | 39.8 | 78.9 | 120.3 | 154.6 | 236.3 |
| P91E | 10.9 | 39.7 | 78.4 | 118.8 | 148.7 | 204.5 |
| GFDI | 10.9 | 44.5 | 80.3 | 114.2 | 148.4 | 180.4 |
| OFCI | 10.9 | 44.4 | 83.5 | 122.6 | 149.5 | 166.0 |
| #CASES | 167 | 167 | 148 | 127 | 107 | 71 |

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**TABLE 9**

EAST PACIFIC

1995 AVERAGE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE (BIAS)

| | 00 | 12 | 24 | 36 | 48 | 72 | (nm) |
|---|---|---|---|---|---|---|---|
| OFCL | -1.6 | -2.1 | -2.1 | -2.8 | -3.4 | -2.9 | (kt) |
| SHFR | -1.6 | -4.6 | -7.1 | -9.7 | -11.4 | -13.6 | (kt) |
| #CASES | 184 | 184 | 165 | 145 | 125 | 89 | |

1990 - 1994 AVERAGE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE (BIAS)

| | 00 | 12 | 24 | 36 | 48 | 72 | (nm) |
|---|---|---|---|---|---|---|---|
| OFCL | -.9 | -1.4 | -2.3 | -3.9 | -5.3 | -6.1 | (kt) |
| SHFR | -.9 | -3.1 | -6.0 | -9.3 | -11.8 | -16.4 | (kt) |
| #CASES | 1617 | 1613 | 1471 | 1333 | 1194 | 943 | |

1995 OFFICAL AND SHIFOR AVERAGE WIND SPEED ERROR (BIAS) DEPARTURE
FROM THE 1988 - 1994 OFFICAL AND SHIFOR AVERAGE WIND SPEED ERROR (BIAS)

| PERIOD | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL DEPARTURE | +78 | +50 | -09 | -28 | -36 | -52 | (%) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SHFR DEPARTURE | +78 | +48 | +18 | +04 | -03 | -17 | (%) |

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**TABLE 10**

EAST PACIFIC

1995 AVERAGE ABSOLUTE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE

| | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | 2.9 | 6.8 | 12.6 | 16.4 | 18.7 | 18.0 | (kt) |
| SHFR | 2.9 | 8.6 | 13.9 | 17.5 | 20.0 | 21.2 | (kt) |
| #CASES | 184 | 184 | 165 | 145 | 125 | 89 | |

1990 - 1994 AVERAGE ABSOLUTE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE

| | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL | 3.0 | 7.0 | 11.9 | 15.9 | 18.5 | 21.8 | (kt) |
| SHFR | 3.0 | 7.7 | 12.9 | 17.1 | 20.2 | 23.9 | (kt) |
| #CASES | 1617 | 1613 | 1471 | 1333 | 1194 | 943 | |

1995 OFFICAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR DEPARTURE
FROM THE 1988 - 1994 OFFICAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR

| PERIOD | 00 | 12 | 24 | 36 | 48 | 72 | (hr) |
|---|---|---|---|---|---|---|---|
| OFCL DEPARTURE | -03 | -03 | +06 | +03 | +01 | -17 | (%) |
| SHFR DEPARTURE | -03 | +12 | +08 | +02 | -01 | -11 | (%) |

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**TABLE 11**

EAST PACIFIC

1995 AVERAGE MODEL WIND SPEED ERROR (KT)
FOR A HOMOGENEOUS SAMPLE (BIAS)

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | -1.3 | -1.3 | -1.7 | -2.8 | -3.6 | -3.5 |
| SHFR | -1.3 | -4.1 | -7.0 | -9.9 | -12.1 | -14.8 |
| GFDL | -1.3 | -11.0 | -16.8 | -23.1 | -26.1 | -27.3 |
| #CASES | 89 | 89 | 79 | 70 | 60 | 39 |

1995 AVERAGE MODEL INTENSITY ABSOLUTE ERRORS (KT)
FOR A HOMOGENEOUS SAMPLE

| | 00 | 12 | 24 | 36 | 48 | 72 |
|---|---|---|---|---|---|---|
| OFCL | 3.1 | 7.2 | 12.8 | 16.4 | 18.9 | 19.1 |
| SHFR | 3.1 | 9.0 | 14.3 | 17.4 | 20.3 | 21.7 |
| GFDL | 3.1 | 15.3 | 21.5 | 26.5 | 29.9 | 31.3 |
| #CASES | 89 | 89 | 79 | 70 | 60 | 39 |