1999 NATIONAL HURRICANE CENTER FORECAST VERIFICATION

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Introduction

Every six hours, the National Hurricane Center (NHC) issues 72-hour track and intensity forecasts for all tropical cyclones in the North Atlantic and eastern North Pacific basins. Official forecasts are verified by comparison with the final "best-track", derived from a post-storm analysis of all available position and intensity observations. The best-track data used for verification excludes extratropical and tropical and subtropical depression stages. Climatology and persistence forecasts are used as standards for skill in comparing forecasts: the CLIPER model forecasts for track and the SHIFOR model forecasts for intensity.

Track forecast errors are 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 sustained wind speed ten meters above the ground associated with the cyclonic circulation. Forecast and best-track intensities are estimated to the nearest five knots. Intensity forecast errors are the absolute difference between the forecast wind speed and the best-track wind speed for the same time.

Objective track and intensity guidance is of two types, "late" or "early". A model is considered “late” if its forecast, initialized for a particular synoptic time, is not available to prepare the official forecast issued for that same synoptic time. Various strategies are employed to provide the forecaster with more timely guidance derived from the late models. These are the “early” models and are available at any time. Table 1 defines model abbreviations used in this report.

North Atlantic

The 1999 North Atlantic hurricane season had 12 named tropical cyclones. This is more than the annual average of 10 and two fewer then occurred in 1998. There were 288 official forecasts issued for tropical storms and hurricanes, nearly the same number as the previous year. The average official forecast track errors by storm are listed in Table 2.1. Table 2.2 gives the average official and CLIPER track error for 1999 and the previous ten-year average. The 1999 official and CLIPER errors were smaller than their long-term average at all forecast periods. As shown in the latter portion of Table 2.2, the 1999 departures for the official and CLIPER forecasts were very similar. This season’s official and CLIPER track errors, when averaged across the five forecast periods, were about 17% and 13% smaller than their long-term average, respectively.

Tables 3.1 and 3.2 are homogeneous comparisons of the late and early Atlantic track

guidance models, respectively. Like 1998, for the late models, the UKMET model had the smallest forecast errors at all time periods. For the early models, LBAR was the best performer through the 36-hour forecast period, while the interpolated UKMET model had the smallest track errors thereafter. The official forecast track average errors were within 10 nm of the best early guidance at all forecast periods.

The average official absolute wind speed errors by storm are listed in Table 4.1. Table 4.2 gives the average official and SHIFOR absolute wind speed errors for 1999 and the previous nine-year average. The 1999 official and SHIFOR intensity forecast errors were larger than their long-term average for all forecast periods, except for the official forecast at 72 hours. Thus, while the 1999 official absolute intensity forecast were skillful, their errors being less than the SHIFOR errors, they averaged 5% larger when averaged across the five forecast periods than their long-term average. By the same token, the averaged SHIFOR errors were 15% greater than their long-term average, when averaged in the same manner. When compared to the large CLIPER errors, this indicates that 1999 was a very difficult year to make tropical cyclone intensity forecasts.

Table 5 displays the absolute wind speed errors for the objective guidance from early models. The official absolute intensity errors were smaller than the objective intensity guidance at all forecast periods. For the objective guidance, the interpolated GFDL model had the smallest absolute wind speed errors through 24 hours, after which the SHIPS model provided the best objective guidance for intensity.

East Pacific

The 1999 eastern North Pacific hurricane season had 9 named tropical cyclones, considerably less than the long-term average of 16. There were 128 official forecasts issued for tropical storms and hurricanes in the basin this year, about half the number issued in 1998. The average official forecast track errors by storm are listed in Table 6.1. Table 6.2 gives the average official and CLIPER track errors for 1999 and the previous ten years. Like the Atlantic, this year's east Pacific official forecast and CLIPER track errors were smaller than their ten-year average for all forecast periods. Also, as for the Atlantic, the 1999 Pacific official and CLIPER track errors, when averaged across the five forecast periods, were about 21% and 9% smaller than their long-term average, respectively. These error departure percentages from the long-term average are given in the latter portion of the Table.

Tables 7.1 shows a homogeneous comparison of late track guidance for the east Pacific. Of the late models, the UKMET model, as in the Atlantic basin, had the smallest error at all forecast periods, except for the GDFL model at the 72-hour forecast period. For the early models, Table 7.2 shows that NHC91, the east Pacific statistical-dynamical model, had the smallest error for all forecast periods. The forecasters for this basin appeared to use the early model guidance optimally, having average track forecast errors smaller than the best objective guidance for all forecast periods.

Table 8.1 gives the average official absolute wind speed errors by storm. The average official and SHIFOR absolute wind speed errors for 1999 and the previous nine-year average are in Table 8.2. The official intensity forecast errors were skillful, with errors smaller than SHIFOR, and considerably smaller than their long-term averages for all forecast periods. The official intensity errors, when averaged across the five forecast periods, were 17% smaller than their long-term average. In the departure

section of the Table, note this year's unusually large SHIFOR error at the 72-hour forecast period over its long-term average.

The absolute wind speed errors for the objective guidance from early models are given in Table 9. The SHIPS model provided the best intensity guidance with the smallest error at all forecast periods, even performing better than the SHIFOR forecasts. The interpolated GFDL model did not produce skillful intensity forecasts.

Additional Results

This summer a disastrous fire occurred at NCEP Main Computer Facility, ruining the Cray3 computer. This was the primary computer on which NHC run its objective tropical cyclone guidance. Fortunately, a completely redundant NHC Guidance Suite ran in real time concurrently on the Cray4. Although slower than Cray3, the hurricane forecasters were not greatly hampered by the delayed receipt of the guidance. The same could not be said of the GFDL model, which was run at reduced resolution on Cray4. Fortunately, at the beginning of the hurricane season, the Navy agreed to run their version of the GFDL model (GFDN) on NHC storms. The two sections of Table 10 give the verification results for the early models before and after the fire.

1999 Conclusions

1. This year's official track forecasts for the Atlantic and Pacific basins had skill over CLIPER and had smaller average errors than their 10-year averages for all forecast periods.

2. For the late objective guidance models, the UKMET model produced the tropical cyclone track forecasts with the smallest error for the Atlantic and Pacific basins at nearly all forecast periods.

3. For the early models, LBAR produced the best track forecasts over the Atlantic basin for the early forecast periods, while the interpolated UKMET model was best for the later periods. For the east Pacific, NHC91 produced the best track forecasts for all forecast periods.

4. The early objective track guidance appeared to be used to good advantage by the forecasters since their average track forecast errors were smaller or very near the best early guidance for both basins at all forecast periods.

5. For intensity, climatologically speaking, 1999 was a very different year in the Atlantic and Pacific basins. The Atlantic SHIFOR error departures averaged 17% greater while the east Pacific SHIFOR error departures averaged 2% smaller than their long-term averages, when averaged across the five forecast periods. By contrast, the official Atlantic error departures averaged 5% greater while the east Pacific official error departures averaged 17% smaller than their long-term averages, when averaged in the same manner. For both basins, this year's official absolute intensity forecasts showed skill over SHIFOR for all forecast periods.

6. The SHIPS model had the smallest absolute intensity errors of all the objective guidance for both basins for nearly all forecast periods.

7. NCEP would be well advised to maintain a backup main computer system to obtain objective tropical cyclone guidance in case the primary main computer is incapacitated.

TABLE 1

MODEL ABBREVIATIONS*

OFCL - Official track or intensity forecasts

OFCI - Official Track Forecast Interpolated from the previous 6 hours

CLIP - CLImatology and PERsistence track model - CLIPER

A98E - NHC98 Statistical-Dynamical Model...early version (Atl)

P91E - NHC91 Statistical-Dynamical Model...early version (Pac)

BAMD - Beta Advection Model Deep (Global)

BAMM - Beta Advection Model Medium (Global)

BAMS - Beta Advection Model Shallow (Global)

LBAR - A simplified version of VICBAR

GFDL - GFDL Model (Atl and Pac - track and intensity)

GFDI - GFDL Interpolated Track and Intensity (6- and 12-hour)

GFDN - Navy GFDL Model (Atl and Pac - track and intensity)

GFNI - Nay GFDL Interpolated Track and Intensity (6- and 12-hour)

AVNO - MRF Model Aviation Run (Global)

UKM - UKMET Model (Global)

UKMI - UKMET Interpolated Track Model (6- and 12-hour)

NGPS - Navy Operational Global Atmospheric Prediction System - NOGAPS

NGPI - NOGAPS Interpolated Track Model (6- and 12-hour)

SHFR - Statistical Hurricane Intensity Forecast Model - SHIFOR

SHIP - Statistical Hurricane Intensity Prediction Scheme - SHIPS

* All model guidance is available every 6 hours and is applicable to both the Atlantic and Pacific basins, except where indicated.

TABLE 2.1

NORTH ATLANTIC

1999 OFFICIAL AVERAGE TRACK FORECAST ERRORS (NM) BY STORM

FORECAST ERRORS (NM) FOR AL0199 ARLENE

	00	12	24	36	48	72
OFCL	7.3	30.5	55.5	89.8	101.5	99.9
#CASES	16	16	14	12	10	6

FORECAST ERRORS (NM) FOR AL0399 BRET

	00	12	24	36	48	72
OFCL	4.7	31.2	65.0	107.6	155.1	255.1
#CASES	15	15	13	11	9	5

FORECAST ERRORS (NM) FOR AL0499 CINDY

	00	12	24	36	48	72
OFCL	12.3	42.9	81.8	118.7	154.7	226.6
#CASES	42	42	40	38	36	32

FORECAST ERRORS (NM) FOR AL0599 DENNIS

	00	12	24	36	48	72
OFCL	6.8	34.7	63.8	90.5	112.1	160.8
#CASES	46	46	44	42	40	36

FORECAST ERRORS (NM) FOR AL0699 EMILY

	00	12	24	36	48	72
OFCL	12.2	31.4	70.0	130.6	208.3	332.8
#CASES	13	13	11	9	7	3

FORECAST ERRORS (NM) FOR AL0899 FLOYD

	00	12	24	36	48	72
OFCL	6.1	28.8	53.9	73.2	73.6	104.4
#CASES	35	35	33	31	29	25

FORECAST ERRORS (NM) FOR AL0999 GERT

	00	12	24	36	48	72
OFCL	9.2	29.7	56.1	87.0	110.3	189.9
#CASES	42	42	40	38	36	32

FORECAST ERRORS (NM) FOR AL1099 HARVEY

	00	12	24	36	48	72
OFCL	10.4	73.5	108.2	158.8	227.0	
#CASES	7	7	5	3	1	0

FORECAST ERRORS (NM) FOR AL1399 IRENE

	00	12	24	36	48	72
OFCL	12.2	55.1	91.4	103.5	126.9	221.1
#CASES	21	21	19	17	15	11

FORECAST ERRORS (NM) FOR AL1499 JOSE

	00	12	24	36	48	72
OFCL	10.7	39.3	72.7	139.5	235.6	384.4
#CASES	27	27	25	23	21	17

FORECAST ERRORS (NM) FOR AL1599 KATRINA*

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

FORECAST ERRORS (NM) FOR AL1699 LENNY

	00	12	24	36	48	72
OFCL	9.0	41.6	95.5	159.8	219.9	335.9
#CASES	24	24	22	20	18	14

* - Katrina’s official forecasts did not span 12 hours.

TABLE 2.2

NORTH ATLANTIC

1999 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	(hr)
OFCL	9.1	37.3	70.3	106.4	139.9	211.4	(nm)
CLIP	9.1	47.0	97.1	153.3	207.1	306.8	(nm)
#CASES	288	288	266	244	222	181	

1989 - 1998 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	(hr)
OFCL	12.9	47.6	88.7	127.1	163.9	242.2	(nm)
CLIP	12.9	55.4	113.2	174.8	235.3	341.9	(nm)
#CASES	2019	2002	1785	1590	1407	1107	

1999 OFFICIAL AND CLIPER AVERAGE ERROR DEPARTURE
FROM THE 1989 - 1998 OFFICIAL AND CLIPER AVERAGE TRACK ERROR

PERIOD	00	12	24	36	48	72	(hr)
OFCL DEPARTURE	-29	-22	-21	-16	-15	-13	(%)
CLIP DEPARTURE	-29	-15	-14	-12	-12	-10	(%)

TABLE 3.1

NORTH ATLANTIC

1999 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (LATE)

PERIOD	00	12	24	36	48	72
OFCL	9.1	36.7	69.1	100.2	121.1	192.4
CLIP*	9.1	42.8	90.9	148.7	192.1	254.8
UKM	9.1	38.0	65.4	89.1	109.7	142.6
NGPS	9.1	54.9	90.1	121.7	142.2	185.3
AVNO	9.1	48.3	91.1	137.1	174.9	257.0
#CASES	97	97	93	79	66	45

* - Although CLIPER is an early model, it is included here for reference.

TABLE 3.2

NORTH ATLANTIC

1999 AVERAGE MODEL TRACK ERRORS (NM)
FOR A HOMOGENEOUS SAMPLE (EARLY)

PERIOD	00	12	24	36	48	72
OFCL	8.6	36.6	69.5	99.3	123.6	189.6
CLIP	8.6	45.0	93.7	142.6	189.8	264.6
A98E	8.6	41.1	77.3	113.0	151.3	237.9
BAMD	8.6	37.0	70.4	108.5	144.7	232.1
BAMM	8.6	44.4	86.9	128.3	176.3	277.9
BAMS	8.6	58.2	115.4	166.1	221.0	327.3
LBAR	8.6	35.7	66.7	97.8	128.1	186.5
OFCI	8.6	40.2	74.9	104.8	131.1	202.9
UKMI	8.6	43.0	71.5	98.5	116.1	180.6
NGPI	8.6	52.1	93.1	124.9	150.2	197.4
#CASES	173	173	161	141	124	94

TABLE 4.1

NORTH ATLANTIC

1999 OFFICIAL AVERAGE ABSOLUTE WIND SPEED FORECAST ERROR (KT) BY STORM

FORECAST ERRORS (KT) FOR AL0199 ARLENE

	00	12	24	36	48	72
OFCL	1.9	6.9	10.0	11.7	13.5	13.3
#CASES	16	16	14	12	10	6

FORECAST ERRORS (KT) FOR AL0399 BRET

	00	12	24	36	48	72
OFCL	3.7	9.3	19.2	31.4	30.6	34.0
#CASES	15	15	13	11	9	5

FORECAST ERRORS (KT) FOR AL0499 CINDY

	00	12	24	36	48	72
OFCL	0.5	5.1	7.8	10.0	12.1	15.9
#CASES	42	42	40	38	36	32

FORECAST ERRORS (KT) FOR AL0599 DENNIS

	00	12	24	36	48	72
OFCL	2.8	5.3	7.5	9.8	12.3	17.2
#CASES	46	46	44	42	40	36

FORECAST ERRORS (KT) FOR AL0699 EMILY

	00	12	24	36	48	72
OFCL	3.8	4.6	9.1	14.4	22.1	31.7
#CASES	13	13	11	9	7	3

FORECAST ERRORS (KT) FOR AL0899 FLOYD

	00	12	24	36	48	72
OFCL	6.0	10.7	15.0	17.6	16.9	12.0
#CASES	35	35	33	31	29	25

FORECAST ERRORS (KT) FOR AL0999 GERT

	00	12	24	36	48	72
OFCL	3.1	5.7	9.3	10.3	12.1	16.4
#CASES	42	42	40	38	36	32

FORECAST ERRORS (KT) FOR AL1099 HARVEY

	00	12	24	36	48	72
OFCL	0.7	3.6	7.0	3.3	5.0	
#CASES	7	7	5	3	1	0

FORECAST ERRORS (KT) FOR AL1399 IRENE

	00	12	24	36	48	72
OFCL	3.9	6.8	11.8	14.1	21.1	27.5
#CASES	19	19	17	16	14	10

FORECAST ERRORS (KT) FOR AL1499 JOSE

	00	12	24	36	48	72
OFCL	3.0	8.9	14.0	17.2	19.5	25.0
#CASES	27	27	25	23	21	17

FORECAST ERRORS (KT) FOR AL1599 KATRINA*

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

FORECAST ERRORS (KT) FOR AL1699 LENNY

	00	12	24	36	48	72
OFCL	3.3	13.8	21.8	26.8	26.7	25.4
#CASES	24	24	22	20	18	14

* - Katrina’s official forecasts did not span 12 hours.

TABLE 4.2

NORTH ATLANTIC

1999 AVERAGE ABSOLUTE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	(hr)
OFCL	3.0	7.4	11.6	14.4	16.3	18.6	(kt)
SHFR	3.0	9.0	13.9	17.3	20.4	23.0	(kt)
#CASES	286	286	264	243	221	180	

1990 - 1998 AVERAGE ABSOLUTE WIND SPEED ABSOLUTE ERROR
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	(hr)
OFCL	3.6	6.8	10.4	13.3	16.0	19.5	(kt)
SHFR	3.6	8.5	12.0	14.6	17.1	19.8	(kt)
#CASES	1780	1764	1567	1399	1237	978	

1999 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR DEPARTURE
FROM THE 1990 - 1998 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR

PERIOD	00	12	24	36	48	72	(hr)
OCFL DEPARTURE	-17	+09	+12	+08	+02	-05	(%)
SHFR DEPARTURE	-17	+06	+16	+18	+19	+16	(%)

TABLE 5

NORTH ATLANTIC

1999 AVERAGE MODEL ABSOLUTE WIND SPEED ERROR (KT)
FOR A HOMOGENEOUS SAMPLE (EARLY)

PERIOD	00	12	24	36	48	72
OFCL	2.9	6.6	10.2	12.8	14.4	15.0
SHFR	2.9	9.0	13.5	16.8	20.1	23.4
OFCI	2.9	7.5	10.7	13.1	15.5	16.6
SHIP	2.9	8.5	12.5	14.3	15.8	15.6
GFDI	2.9	8.2	11.7	15.1	17.3	16.3
#CASES	185	185	170	157	143	117

TABLE 6.1

EAST PACIFIC

1999 OFFICIAL AVERAGE TRACK FORECAST ERRORS (NM) BY STORM

FORECAST ERRORS (NM) FOR EP0199 ADRIAN

	00	12	24	36	48	72
OFCL	11.0	38.6	83.3	130.1	148.6	150.0
#CASES	13	13	11	9	7	3

FORECAST ERRORS (NM) FOR EP0299 BEATRIZ

	00	12	24	36	48	72
OFCL	4.9	26.2	50.8	72.5	99.1	111.7
#CASES	27	27	25	23	21	17

FORECAST ERRORS (NM) FOR EP0599 CALVIN

	00	12	24	36	48	72
OFCL	10.8	38.9				
#CASES	2	2	0	0	0	0

FORECAST ERRORS (NM) FOR EP0799 DORA

	00	12	24	36	48	72
OFCL	9.7	32.8	57.1	80.8	105.9	159.2
#CASES	30	30	30	30	30	30

FORECAST ERRORS (NM) FOR EP0899 EUGENE

	00	12	24	36	48	72
OFCL	5.3	19.7	37.8	51.5	68.0	116.2
#CASES	19	19	19	19	19	19

FORECAST ERRORS (NM) FOR EP1099 FERNANDA

	00	12	24	36	48	72
OFCL	12.9	38.7	80.4	98.1	98.2	
#CASES	10	10	8	6	4	0

FORECAST ERRORS (NM) FOR EP1299 GREG

	00	12	24	36	48	72
OFCL	5.5	35.0	59.3	98.4	132.9	
#CASES	10	10	8	6	4	0

FORECAST ERRORS (NM) FOR EP1399 HILARY

	00	12	24	36	48	72
OFCL	16.5	45.2	81.7	119.3	184.6	
#CASES	10	10	8	6	4	0

FORECAST ERRORS (NM) FOR EP1499 IRWIN

	00	12	24	36	48	72
OFCL	9.3	41.7	92.2	118.5	82.0	
#CASES	7	7	5	3	1	0

TABLE 6.2

EAST PACIFIC

1999 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	(hr)
OFCL	8.6	32.2	60.1	83.2	103.7	135.2	(nm)
CLIP	8.6	35.1	70.2	106.5	143.0	215.9	(nm)
#CASES	128	128	114	102	90	69	

1989 - 1998 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	(hr)
OFCL	12.0	37.8	70.5	103.8	135.4	194.5	(nm)
CLIP	12.0	40.1	76.8	117.2	157.0	228.7	(nm)
#CASES	2580	2574	2308	2035	1786	1367	

1999 OFFICIAL AND CLIPER AVERAGE ERROR DEPARTURE
FROM THE 1989 - 1998 OFFICIAL AND CLIPER AVERAGE TRACK ERROR

PERIOD	00	12	24	36	48	72	(hr)
OFCL DEPARTURE	-28	-15	-15	-20	-23	-30	(%)
CLIP DEPARTURE	-28	-12	-09	-09	-09	-06	(%)

TABLE 7.1

EAST PACIFIC

1999 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (LATE)

PERIOD	00	12	24	36	48	72
OFCL	8.1	28.6	53.7	80.0	105.7	132.4
CLIP*	8.1	30.3	61.7	96.3	137.8	207.2
GFDL	8.1	32.0	62.1	88.0	111.3	153.3
UKM	8.1	30.9	52.3	77.1	98.7	166.9
NGPS	8.1	37.6	68.9	113.3	138.7	222.3
#CASES	51	51	47	42	37	25

* - Although CLIPER is an early model, it is included here for reference.

TABLE 7.2

EAST PACIFIC

1999 AVERAGE MODEL TRACK ERRORS (NM)
FOR A HOMOGENEOUS SAMPLE (EARLY)

PERIOD	00	12	24	36	48	72
OFCL	8.2	28.6	49.5	68.9	98.0	137.4
CLIP	8.2	30.9	57.2	88.0	129.4	215.8
P91E	8.2	30.2	54.5	78.0	105.3	166.2
BAMD	8.2	32.8	58.4	83.8	113.2	182.3
BAMM	8.2	33.3	62.9	97.7	137.6	225.2
BAMS	8.2	35.6	72.6	111.5	159.8	268.9
LBAR	8.2	31.1	68.8	113.9	164.2	298.1
OFCI	8.2	31.9	53.0	76.3	101.9	145.5
GFDI	8.2	36.4	67.2	94.7	122.1	177.0
UKMI	8.2	30.8	57.5	86.2	113.0	202.3
NGPI	8.2	43.9	87.8	126.5	158.3	239.3
#CASES	72	72	65	58	51	39

TABLE 8.1

EAST PACIFIC

1999 OFFICIAL AVERAGE ABSOLUTE WIND SPEED FORECAST ERROR (KT) BY STORM

FORECAST ERRORS (KT) FOR EP0199 ADRIAN

	00	12	24	36	48	72
OFCL	1.5	4.2	7.3	8.3	12.1	15.0
#CASES	13	13	11	9	7	3

FORECAST ERRORS (KT) FOR EP0299 BEATRIZ

	00	12	24	36	48	72
OFCL	1.3	4.8	7.4	9.8	14.3	22.6
#CASES	27	27	25	23	21	17

FORECAST ERRORS (KT) FOR EP0599 CALVIN

	00	12	24	36	48	72
OFCL	7.5	2.5				
#CASES	2	2	0	0	0	0

FORECAST ERRORS (KT) FOR EP0799 DORA

	00	12	24	36	48	72
OFCL	1.0	6.2	10.8	14.5	18.3	21.7
#CASES	30	30	30	30	30	30

FORECAST ERRORS (KT) FOR EP0899 EUGENE

	00	12	24	36	48	72
OFCL	1.8	7.9	11.8	13.9	15.8	17.6
#CASES	19	19	19	19	19	19

FORECAST ERRORS (KT) FOR EP1099 FERNANDA

	00	12	24	36	48	72
OFCL	4.0	5.5	11.3	17.5	26.3	
#CASES	10	10	8	6	4	0

FORECAST ERRORS (KT) FOR EP1299 GREG

	00	12	24	36	48	72
OFCL	1.0	7.0	12.5	10.8	13.8	
#CASES	10	10	8	6	4	0

FORECAST ERRORS (KT) FOR EP1399 HILARY

	00	12	24	36	48	72
OFCL	3.0	4.0	6.3	7.5	6.3	
#CASES	10	10	8	6	4	0

FORECAST ERRORS (KT) FOR EP1499 IRWIN

	00	12	24	36	48	72
OFCL	2.1	4.3	10.0	11.7	15.0	
#CASES	7	7	5	3	1	0

TABLE 8.2

EAST PACIFIC

1999 AVERAGE ABSOLUTE WIND SPEED ERROR
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	(hr)
OFCL	1.8	5.6	9.7	12.3	15.9	20.5	(kt)
SHFR	1.8	6.7	11.8	15.8	20.2	29.3	(kt)
#CASES	128	128	114	102	90	69	

1990 - 1998 AVERAGE ABSOLUTE WIND SPEED ABSOLUTE ERROR
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	(hr)
OFCL	3.0	7.2	12.3	16.1	18.8	21.4	(kt)
SHFR	3.0	8.1	13.2	17.2	20.2	23.3	(kt)
#CASES	2369	2364	2126	1892	1665	1283	

1999 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR DEPARTURE
FROM THE 1990 - 1998 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR

PERIOD	00	12	24	36	48	72	(hr)
OCFL DEPARTURE	-40	-20	-21	-24	-15	-04	(%)
SHFR DEPARTURE	-40	-17	-11	-08	0	+26	(%)

TABLE 9

EAST PACIFIC

1999 AVERAGE MODEL ABSOLUTE WIND SPEED ERROR (KT)
FOR A HOMOGENEOUS SAMPLE (EARLY)

PERIOD	00	12	24	36	48	72
OFCL	1.6	5.8	9.8	12.7	16.2	20.3
SHFR	1.6	6.8	11.9	16.1	21.0	29.7
OFCI	1.6	5.8	9.9	13.7	17.1	20.8
SHIP	1.6	6.5	10.7	13.6	15.9	20.1
GFDI	1.6	11.6	18.2	24.4	28.6	35.4
#CASES	113	113	103	92	81	64

TABLE 10

NORTH ATLANTIC

1999 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (EARLY)

BEFORE THE FIRE

PERIOD	00	12	24	36	48	72
OFCL	8.6	35.4	66.3	96.5	118.0	186.1
CLIP	8.6	44.5	91.2	149.5	196.8	277.0
A98E	8.6	40.6	76.3	115.5	152.8	242.7
BAMD	8.6	35.4	68.4	106.7	140.2	231.2
BAMM	8.6	42.1	81.3	120.2	163.0	274.0
BAMS	8.6	53.8	104.3	155.1	202.2	315.7
LBAR	8.6	34.6	64.1	98.3	126.3	178.0
OFCI	8.6	38.7	72.0	101.9	125.3	201.7
UKMI	8.6	42.3	68.7	92.8	109.7	172.7
NGPI	8.6	45.5	78.1	99.1	120.5	166.0
GFDI	8.6	39.4	73.8	103.6	130.8	184.5
#CASES	128	128	118	106	94	74

NORTH ATLANTIC

1999 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (EARLY)

AFTER THE FIRE

PERIOD	00	12	24	36	48	72
OFCL	7.8	41.7	74.3	95.8	121.8	190.5
CLIP	7.8	54.8	114.8	148.1	203.1	209.9
A98E	7.8	47.6	86.3	120.9	166.8	276.1
BAMD	7.8	42.4	82.0	132.6	181.7	281.4
BAMM	7.8	59.9	122.6	170.9	247.3	335.8
BAMS	7.8	81.1	169.8	223.3	306.3	378.2
LBAR	7.8	41.3	78.8	117.2	162.2	244.4
OFCI	7.8	45.1	80.7	105.9	130.8	202.0
UKMI	7.8	49.8	82.4	124.7	141.2	206.3
NGPI	7.8	72.6	132.8	197.3	244.9	336.7
GFNI	7.8	44.3	73.1	90.2	131.7	195.4
#CASES	51	51	47	37	30	19