2001 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 the extratropical, tropical wave and remnant low stages. Beginning this year, the tropical and subtropical depression stage is included in the verification. 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.

Beginning this year NHC tested its ability and that of the objective guidance to make 96 and 120 hour track and intensity forecasts for tropical cyclones. While these forecasts have been verified along with the other track and intensity forecasts, they are strictly unofficial. In addition, new 5-day CLIPER and SHIFOR forecast models were developed for both basins to measure the skill of these extended forecasts. Please note that there are differences in errors between the old and new CLIPER and SHIFOR models for both basins through 72 hours due to their different formulations and developmental data sets.

North Atlantic

The 2001 North Atlantic hurricane season had fifteen named tropical cyclones and two tropical depressions. This is more than the annual average of ten named cyclones and one more than the number that occurred in 2000. There were 302 official forecasts issued for tropical cyclones this year. The average official forecast track errors by cyclone are listed in Table 2.1. Table 2.2 gives the average official, 3-day and 5-day CLIPER track error for 2001 and the previous ten-year average official and 3-day CLIPER error. The 2001 official track forecast errors averaged across the forecast periods were nearly 7% smaller than their ten-year average. This is in spite

of the fact that the corresponding CLIPER errors were 4% larger than their ten-year average, when averaged in the same manner. This is easily seen in the departure section of Table 2.2.

The experimental day 4 and 5 official track forecasts were quite good, surpassing their average 5-day CLIPER errors by 46%. The ten-year average official track errors increase at an essentially linear rate from the initial time to day 3. Though the number of cases was small, this nearly linear rate of increasing track error was maintained through the day 5 forecast period.

Tables 3.1 show homogeneous comparisons of selected late Atlantic track guidance models. As in 2000 with the new vortex relocation initialization, the NCEP Global Forecasting System (GFS) had the lowest track forecast errors at all time periods. The GFDL had the second smallest error through 48 hours after which the UKMET Global Model was smaller through 120 hours. Although the number of cases was small, the GFS and UKM had smaller errors at day 4 and 5 than the official forecast. The second section of the Table shows the same late models with the addition of the GFS ensemble mean, GEMN. This ensemble of ten different GFS forecasts, for which their initial conditions were perturbed, was run through 72 hours. The GEMN track forecast is the average of each ensemble members' forecast points at each forecast period. As shown in the Table, while the GFS model still had the smallest error, the GEMN was a close second, having even smaller errors than the GFS at 72 hours. Again, the number of cases was too small for these results to be significant.

Table 3.2 displays a comparison of the early Atlantic track models. Because of the GFS model's excellent performance last year, a new consensus model, GUNA, was developed, which is the average of the interpolated GFDL, UKMET, NOGAP and GFS track forecasts at each forecast period. Although the GFSI had the smallest error at all forecast periods, GUNA had the second lowest. Surprisingly, these two early models had smaller track errors than the official forecast for nearly 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, 3-day and 5-day SHIFOR absolute wind speed errors for 2001 and the previous ten-year average official and 3-day SHIFOR intensity errors. The 2001 official intensity errors showed skill over the SHIFOR models at all forecast periods. From the departure section of the Table, observe that this year's official intensity were, in general, only slightly better than their ten-year average. Through 24 hours, the skill shown by this year's official intensity forecasts occurred in spite of increased 3-day SHIFOR errors over their long-term average. Thus, the official forecast skill in these latter forecast periods may only be due to this year's SHIFOR improvement.

The average official absolute intensity errors beyond day 3 increased through day 4 and then decreased at day 5 to nearly the day 3 value. These intensity error changes at these forecast periods were much smaller than the changes that occurred between day 1, 2 and 3. Thus, unlike the official track errors, which appeared to linearly increase with forecast period, the official intensity errors appeared to linearly increase only to 72 hours, becoming nearly constant at the longer forecast periods.

Table 5 displays the absolute wind speed errors for the objective guidance from early models. SHIPS and its decay version produced the best intensity guidance forecasts. Unlike 2000, decay SHIPS did not have smaller errors than the SHIPS at the longer forecast periods because the predicted official tracks over land did not occur. For this homogeneous set, the official, 5-day SHIFOR and SHIPS models had lower day 4 and 5 absolute intensity errors than those at day 3. In this, the statistically based objective intensity guidance appeared to have a similar error growth pattern as the official intensity forecast.

Eastern North Pacific

The 2001 eastern North Pacific hurricane season produced fifteen named tropical cyclones and two tropical depressions. This was one fewer named tropical cyclones than the long-term average. There were 292 official forecasts issued for tropical cyclones in the basin this year. The average official forecast track errors by cyclone are listed in Table 6.1. Table 6.2 gives the average official, 3-day and 5-day CLIPER track errors for 2001 and for the previous ten-year average official and 3-day CLIPER errors. This year's error departures from the long-term average are given in the latter portion of the Table. The Pacific official forecast track errors were smaller than their ten-year average for all forecast periods by an average of 8%. The corresponding 2001 3-day CLIPER errors were nearly 9% larger their ten-year average for all time periods. Thus, the average 2001 official forecasts demonstrated skill at nearly all forecast periods and considerable improvement over their long-term average.

As in the Atlantic basin, the extended range track forecasts showed skill over CLIPER. Also as the Atlantic, the ten-year average track errors appeared to grow linearly with time from the initial time to day 3, although at a slower rate. Given that the day 4 and 5 official forecast errors are within 17 nm of each other, this error growth rate is even less during this period. The 5-day east Pacific average track error was under 220 nm, nearly half of the 5-day average track error for the Atlantic.

Tables 7.1 show homogeneous comparisons of selected late east Pacific track guidance models. Unlike the Atlantic, the UKMET Global Model had the smallest errors through 36 hours with NCEP GFS model having the smallest error thereafter to 96 hours. Compared to the UKM and GFS track forecasts shown in second section of the Table, the GFS ensemble mean did not perform as well in the Pacific basin as it did in the Atlantic. Note though, that the number of cases for this homogeneous comparison was small.

Table 7.2 displays a comparison of the early east Pacific track models through 120 hours. These results are similar to the Atlantic’s early models in that the consensus GUNA and the interpolated GFS model had the smallest errors. GUNA has the smallest errors until 72 hours, after which the GFSI had smaller errors. Again, the number of cases beyond 72 hours was small.

Table 8.1 gives the average official absolute wind speed errors by storm. The average official, 3-day and 5-day SHIFOR absolute wind speed errors for 2001 and the previous ten-year average official and 3-day SHIFOR errors are in Table 8.2. Except for the 12-hour forecast period, the 2001 official intensity forecast errors were smaller than their long-term averages. As shown in the latter portion of the Table, the departures between the 2001 3-day SHIFOR and its long-term average were nearly the same as the official error departures. Thus, while the official intensity forecasts had skill, their errors being less than SHIFOR, the improvement over the ten-year average may be attributed to the lower forecast difficulty as indicated by the SHIFOR error.

As was noted for the Atlantic basin, the day 4 and 5 absolute official intensity errors became nearly constant after day 3. They reached an average of 18.5 knots, while the day 5 SHIFOR errors actually became quite a bit smaller.

The east Pacific absolute wind speed errors for the objective guidance from early models are given in Table 9. Except at the 72-hour forecast period where SHIFOR had a smaller error, SHIPS and its decay version provided the best intensity guidance. There was not much difference between the intensity forecast errors of these two models since few tropical cyclones had forecast tracks over land.

Conclusions

1. The official Atlantic and east Pacific 2001 track forecasts showed skill over the 3-day and 5-day CLIPER models and had track errors smaller than their ten-year average errors for all forecast periods.

2. The GFS model, with its new vortex relocation initialization, had the smallest average track errors of the late models for the Atlantic at all forecast periods. For the east Pacific basin, the UKMET model had the smallest average track errors through 36 hours with the GFS having smaller errors, thereafter. For both basins, the number of cases at the longer forecast periods was small.

3. The new ensemble mean track forecasts from the GFS model had the second smallest average errors of the late models for the Atlantic, even surpassing the GFS model forecast at 3 days. It did not perform as well in the east Pacific.

4. For the Atlantic and east Pacific basins early models, the interpolated GFS model and its new consensus model, GUNA, produced the smallest or second smallest average track errors for nearly all forecast periods. On average for both basins, the best early track guidance had smaller errors than the official track forecasts for all forecast periods and basins.

5. The 2001 Atlantic and east Pacific official absolute average intensity errors showed skill over the 3-day and 5-day SHIFOR forecasts and, in general, were smaller than their ten-year average.

6. The SHIPS model and its decay version provided the best early objective intensity guidance at nearly all forecast periods for the Atlantic and east Pacific basins.

Day 4 and 5 Experimental Forecast Conclusions

1. The official Atlantic and east Pacific track forecasts at day 4 and 5 had skill over the 5-day CLIPER model. These average track errors increase at nearly the same linear rate as the error between initial time and 3 days for the Atlantic. The rate of increase error for the east Pacific was less and nearly constant between day 4 and day 5.

2. For both basins, the objective track guidance was excellent beyond 3 days, especially from NCEP GFS model and GUNA, the new consensus model.

3. The official absolute intensity average errors for day 4 and 5 forecasts, while showing some skill over the Atlantic 5-day SHIFOR model, did not over the east Pacific 5-day SHIFOR. These absolute intensity errors became nearly constant after day 3 for both basins.

4. The SHIPS model and its decay version provided the best early objective intensity guidance for the North Atlantic and eastern North Pacific basins at these longer forecast periods.

TABLE 1

MODEL ABBREVIATIONS*

OFCL - Official track and intensity forecasts

OFCI - Official Track Forecast Interpolated from the previous 6 hours

CLIP - 3-day CLImatology and PERsistence track model - CLIPER

CLP5 - 5-day CLImatology and PERsistence track model - CLIPER

A98E - NHC98 Statistical-Dynamical track model (Atl)

P91E - NHC91 Statistical-Dynamical track model (Pac)

BAMD, BAMM, BAMS - Beta Advection Model Deep, Medium, Shallow (Global)

LBAR - Limited-area sine transform BARotropic track model

GFDL - Geophysical Fluid Dynamics Lab GFDL track and intensity model

GFDI - Interpolated GFDL model

GFS - NCEP Global Forecasting System (Global)

GFSI - Interpolated GFS model

GEMN - GFS Ensemble Mean (Global, 12-hour)

UKM - UKMET Model (Global, 12-hour)

UKMI - Interpolated UKMET model (6- and 12-hour)

NGPS - Navy Operational Global Atmospheric Prediction System - NOGAPS (Global)

NGPI - Interpolated NGPS model

GUNS – Numerical average of the GFDI, UKMI and NGPI models

GUNA – Numerical average of the GFDI, UKMI, NGPI and GFSI models

SHFR - 3-day Statistical Hurricane Intensity FORecast Model - SHIFOR

SHF5 - 5-day Statistical Hurricane Intensity FORecast Model - SHIFOR

SHIP - Statistical Hurricane Intensity Prediction Scheme - SHIPS

DSHP - Decay SHIP (SHIPS values reduced for an OFCI forecast track over land)

* 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

2001 OFFICIAL AVERAGE TRACK FORECAST ERRORS (NM) BY STORM

FORECAST ERRORS (NM) FOR al012001 ALLISON

	00	12	24	36	48	72	96	120
OFCL	19.2	51.4	55.2	62.3	117.4			
#CASES	3	3	3	3	3	0	0	0

FORECAST ERRORS (NM) FOR al022001 TWO

	00	12	24	36	48	72	96	120
OFCL	21.0	39.3						
#CASES	4	2	0	0	0	0	0	0

FORECAST ERRORS (NM) FOR al032001 BARRY

	00	12	24	36	48	72	96	120
OFCL	4.4	33.0	66.7	96.5	137.8	245.9	377.5	
#CASES	16	16	14	12	10	6	2	0

FORECAST ERRORS (NM) FOR al042001 CHANTAL

	00	12	24	36	48	72	96	120
OFCL	8.6	45.5	78.1	111.5	170.8	302.5	413.3	651.5
#CASES	24	20	16	16	16	12	8	4

FORECAST ERRORS (NM) FOR al052001 DEAN*

	00	12	24	36	48	72	96	120
OFCL	6.0	42.6	70.3				311.4	471.1
#CASES	11	7	3	0	0	0	3	4

FORECAST ERRORS (NM) FOR al062001 ERIN

	00	12	24	36	48	72	96	120
OFCL	7.3	35.0	59.2	89.4	118.4	186.1	249.7	265.0
#CASES	50	46	42	40	38	34	30	30

FORECAST ERRORS (NM) FOR al072001 FELIX

	00	12	24	36	48	72	96	120
OFCL	11.6	41.4	65.7	90.2	116.2	169.9	259.8	389.9
#CASES	41	37	33	30	30	28	24	20

FORECAST ERRORS (NM) FOR al082001 GABRIELLE

	00	12	24	36	48	72	96	120
OFCL	10.7	49.1	87.3	128.2	167.1	234.6	352.8	581.5
#CASES	30	28	26	24	22	18	14	10

* A portion of Dean's existence was as a tropical wave.

FORECAST ERRORS (NM) FOR al092001 NINE

	00	12	24	36	48	72	96	120
OFCL	15.3	21.2						
#CASES	2	1	0	0	0	0	0	0

FORECAST ERRORS (NM) FOR al102001 HUMBERTO

	00	12	24	36	48	72	96	120
OFCL	5.3	44.0	77.7	117.9	128.5	194.8	211.8	180.5
#CASES	26	24	22	20	18	14	10	6

FORECAST ERRORS (NM) FOR al112001 IRIS

	00	12	24	36	48	72	96	120
OFCL	4.3	29.9	65.1	110.7	159.6	291.1	448.2	
#CASES	20	18	16	14	12	8	4	0

FORECAST ERRORS (NM) FOR al122001 JERRY

	00	12	24	36	48	72	96	120
OFCL	12.7	77.6	100.0	158.3	236.4			
#CASES	10	8	6	4	2	0	0	0

FORECAST ERRORS (NM) FOR al132001 KAREN

	00	12	24	36	48	72	96	120
OFCL	6.7	48.1	81.7	103.6	156.6			
#CASES	12	10	8	6	4	0	0	0

FORECAST ERRORS (NM) FOR al142001 LORENZO

	00	12	24	36	48	72	96	120
OFCL	8.5	50.5	89.1	91.8	111.8	176.5		
#CASES	16	14	12	10	8	4	0	0

FORECAST ERRORS (NM) FOR al152001 MICHELLE

	00	12	24	36	48	72	96	120
OFCL	8.9	39.4	62.4	80.0	96.5	127.5	207.5	344.1
#CASES	29	27	25	23	21	17	13	9

FORECAST ERRORS (NM) FOR al162001 NOEL

	00	12	24	36	48	72	96	120
OFCL	10.2	47.5						
#CASES	4	2	0	0	0	0	0	0

FORECAST ERRORS (NM) FOR al172001 OLGA

	00	12	24	36	48	72	96	120
OFCL	3.9	56.9	110.9	148.1	197.7	294.5	290.7	417.7
#CASES	41	39	37	35	33	29	20	14

TABLE 2.2

NORTH ATLANTIC

2001 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	96	120	(hr)
OFCL	8.0	44.0	76.9	108.0	142.4	216.9	281.9	372.0	(nm)
CLIP	9.1	55.9	114.4	174.6	238.1	372.3			(nm)
CLP5	9.0	56.7	117.7	183.9	251.0	369.1	528.8	675.6	(nm)
#CASES	339	302	263	237	217	170	128	97	

1991 - 2000 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	96	120	(hr)
OFCL	12.7	45.8	84.0	120.0	155.5	233.7			(nm)
CLIP	12.7	54.1	109.4	170.0	231.0	343.5			(nm)
#CASES	2756	2593	2400	2199	1985	1619	0	0	

2001 OFFICIAL AND CLIPER AVERAGE ERROR DEPARTURE
FROM THE 1991 - 2000 OFFICIAL AND CLIPER AVERAGE TRACK ERROR

PERIOD	00	12	24	36	48	72	(hr)
OFCL DEPARTURE	-37	-04	-08	-10	-08	-07	(%)
CLIP DEPARTURE	-28	+03	+05	+03	+03	+08	(%)

TABLE 3.1

NORTH ATLANTIC

2001 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (SELECTED LATE)

PERIOD	00	12	24	36	48	72	96	120
OFCL	6.9	43.2	76.2	105.2	140.2	222.2	297.1	428.5
CLP5*	7.3	55.4	120.1	192.4	268.4	398.3	562.7	725.9
GSF	14.7	36.2	55.6	80.5	107.4	169.8	214.5	234.5
GFDL	9.3	43.0	73.3	114.0	157.0	277.6	407.1	482.0
UKM	34.1	66.8	99.5	140.6	186.3	267.4	264.5	316.5
NGPS	25.3	54.5	81.9	120.8	170.0	279.8	353.7	536.7
#CASES	132	119	102	93	83	56	35	22

NORTH ATLANTIC

2001 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (SELECTED LATE)

PERIOD	00	12	24	36	48	72	96	120
OFCL	6.6	43.2	76.9	105.9	140.3	214.0		
CLP5*	6.9	56.1	122.1	193.6	267.9	390.7		
GFS	13.9	36.0	56.8	82.5	109.8	170.6		
GEMN	14.5	38.4	63.0	91.2	119.9	156.7		
GFDL	9.0	42.5	72.3	113.6	158.0	278.4		
UKM	35.1	68.7	100.8	142.6	188.4	267.9		
NGPS	24.2	55.1	82.2	121.0	172.7	285.3		
#CASES	124	113	96	87	77	51	0	0

* Although CLP5 is an early model, it is included here for reference.

TABLE 3.2

NORTH ATLANTIC

2001 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (EARLY)

PERIOD	00	12	24	36	48	72	96	120
OFCL	6.2	42.0	73.6	104.6	139.2	209.6	269.3	353.0
CLP5	7.4	56.1	121.7	192.4	270.4	405.5	556.5	676.2
A98E	7.4	48.6	86.9	136.3	207.0	389.9	499.5	652.2
BAMD	7.4	46.7	83.6	125.6	167.2	286.0	445.5	507.2
BAMM	7.4	45.2	83.5	124.3	170.6	266.2	401.3	553.7
BAMS	7.4	61.8	115.7	168.2	235.6	351.9	489.0	648.4
LBAR	7.4	44.7	91.1	145.2	206.7	334.9	316.9	283.3
OFCI	7.4	44.8	77.8	111.7	150.0	220.5	282.3	361.5
GFSI	7.4	39.1	64.0	91.2	120.2	182.8	224.1	263.2
GFDI	7.4	43.4	78.5	117.5	169.4	281.4	391.0	447.2
UKMI	7.4	46.9	88.0	129.0	167.7	250.4	324.7	382.8
NGPI	7.4	47.4	86.4	134.8	192.8	300.8	404.9	607.2
GUNS	7.4	40.8	73.6	109.3	154.9	244.8	315.5	405.0
GUNA	7.4	38.0	66.2	97.0	136.4	213.0	268.5	340.8
#CASES	200	185	166	151	129	92	37	25

TABLE 4.1

NORTH ATLANTIC

2001 OFFICIAL AVERAGE ABSOLUTE WIND SPEED FORECAST ERRORS (KT) BY STORM

FORECAST ERRORS (KT) FOR al012001 ALLISON

	00	12	24	36	48	72	96	120
OFCL	1.7	11.7	8.3	6.7	3.3			
#CASES	3	3	3	3	3	0	0	0

FORECAST ERRORS (KT) FOR al022001 TWO

	00	12	24	36	48	72	96	120
OFCL	0.0	5.0						
#CASES	4	2	0	0	0	0	0	0

FORECAST ERRORS (KT) FOR al032001 BARRY

	00	12	24	36	48	72	96	120
OFCL	1.6	8.4	12.1	13.3	11.5	24.2	57.5	
#CASES	16	16	14	12	10	6	2	0

FORECAST ERRORS (KT) FOR al042001 CHANTAL

	00	12	24	36	48	72	96	120
OFCL	1.9	5.8	9.1	16.3	25.9	23.3	23.1	16.3
#CASES	24	20	16	16	16	12	8	4

FORECAST ERRORS (KT) FOR al052001 DEAN*

	00	12	24	36	48	72	96	120
OFCL	2.7	5.7	15.0				35.0	17.5
#CASES	11	7	3	0	0	0	3	4

FORECAST ERRORS (KT) FOR al062001 ERIN

	00	12	24	36	48	72	96	120
OFCL	0.9	5.2	9.5	14.9	17.5	17.6	18.7	20.5
#CASES	50	46	42	40	38	34	30	30

FORECAST ERRORS (KT) FOR al072001 FELIX

	00	12	24	36	48	72	96	120
OFCL	1.0	5.8	10.6	13.8	16.3	21.4	20.2	15.3
#CASES	41	37	33	30	30	28	24	20

FORECAST ERRORS (KT) FOR al082001 GABRIELLE

	00	12	24	36	48	72	96	120
OFCL	0.5	5.9	8.5	7.9	10.2	13.9	7.1	6.5
#CASES	30	28	26	24	22	18	14	10

* A portion of Dean's existence was as a tropical wave.

FORECAST ERRORS (KT) FOR al092001 NINE

	00	12	24	36	48	72	96	120
OFCL	0.0	5.0						
#CASES	2	1	0	0	0	0	0	0

FORECAST ERRORS (KT) FOR al102001 HUMBERTO

	00	12	24	36	48	72	96	120
OFCL	2.4	8.5	13.6	15.3	15.0	10.7	11.5	15.8
#CASES	25	23	21	19	18	14	10	6

FORECAST ERRORS (KT) FOR al112001 IRIS

	00	12	24	36	48	72	96	120
OFCL	0.8	10.3	14.1	14.3	22.5	39.4	38.8	
#CASES	20	18	16	14	12	8	4	0

FORECAST ERRORS (KT) FOR al122001 JERRY

	00	12	24	36	48	72	96	120
OFCL	1.5	6.9	10.0	11.3	20.0			
#CASES	10	8	6	4	2	0	0	0

FORECAST ERRORS (KT) FOR al132001 KAREN

	00	12	24	36	48	72	96	120
OFCL	2.1	5.5	11.9	10.8	5.0			
#CASES	12	10	8	6	4	0	0	0

FORECAST ERRORS (KT) FOR al142001 LORENZO

	00	12	24	36	48	72	96	120
OFCL	0.0	1.4	4.6	7.5	8.8	15.0		
#CASES	16	14	12	10	8	4	0	0

FORECAST ERRORS (KT) FOR al152001 MICHELLE

	00	12	24	36	48	72	96	120
OFCL	1.9	6.5	8.6	13.5	17.9	22.4	33.8	48.3
#CASES	29	27	25	23	21	17	13	9

FORECAST ERRORS (KT) FOR al162001 NOEL

	00	12	24	36	48	72	96	120
OFCL	1.7	5.0						
#CASES	3	1	0	0	0	0	0	0

FORECAST ERRORS (KT) FOR al172001 OLGA

	00	12	24	36	48	72	96	120
OFCL	0.6	3.7	7.7	10.4	13.5	14.5	15.8	13.6
#CASES	41	39	37	35	33	29	20	14

TABLE 4.2

NORTH ATLANTIC

2001 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	96	120	(hr)
OFCL	1.2	6.0	9.8	12.7	15.7	18.8	20.1	19.0	(kt)
SHFR	1.6	8.5	13.0	16.0	18.7	21.4			(kt)
SHF5	1.6	8.7	12.9	15.5	18.1	20.6	23.4	20.5	(kt)
#CASES	337	300	262	236	217	170	128	97	

1991 - 2000 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	96	120	(hr)
OFCL	3.0	6.4	10.2	13.1	15.7	19.4			(kt)
SHFR	3.0	8.1	12.7	16.3	19.3	22.6			(kt)
#CASES	2757	2584	2385	2181	1960	1616	0	0	

2001 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR DEPARTURE
FROM THE 1991 - 2000 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR

PERIOD	00	12	24	36	48	72	(hr)
OFCL DEPARTURE	-60	-06	-04	-03	00	-03	(%)
SHFR DEPARTURE	-47	+05	+02	-02	-03	-05	(%)

TABLE 5

NORTH ATLANTIC

2001 AVERAGE MODEL ABSOLUTE WIND SPEED ERROR (KT)
FOR A HOMOGENEOUS SAMPLE (EARLY)

PERIOD	00	12	24	36	48	72	96	120
OFCL	1.3	6.3	9.7	12.4	14.9	17.9	16.8	12.6
SHF5	1.7	8.7	12.4	15.2	18.0	19.6	19.5	14.4
OFCI	1.7	7.4	10.5	13.2	15.9	18.8	17.9	17.3
SHIP	1.7	8.3	11.3	13.8	16.5	19.4	18.5	14.6
DSHP	1.7	7.5	10.3	12.5	15.4	19.6	22.7	17.9
GFDI	1.7	8.4	12.7	16.9	20.4	24.6	27.6	26.4
GFSI	1.7	9.7	14.7	18.6	23.2	28.3	30.1	30.9
#CASES	259	239	216	194	165	117	53	37

TABLE 6.1

EAST PACIFIC

2001 OFFICIAL AVERAGE TRACK FORECAST ERRORS (NM) BY STORM

FORECAST ERRORS (NM) FOR ep012001 ADOLPH

	00	12	24	36	48	72	96	120
OFCL	4.2	30.1	60.9	92.7	119.3	189.7	270.2	307.2
#CASES	29	27	25	23	21	17	13	9

FORECAST ERRORS (NM) FOR ep022001 BARBARA

	00	12	24	36	48	72	96	120
OFCL	11.1	24.0	31.0	36.0	43.2	76.1	122.6	156.2
#CASES	11	11	11	11	11	11	10	6

FORECAST ERRORS (NM) FOR ep032001 COSME

	00	12	24	36	48	72	96	120
OFCL	11.4	25.6	40.3	36.6	28.9			
#CASES	9	7	5	3	1	0	0	0

FORECAST ERRORS (NM) FOR ep042001 ERICK

	00	12	24	36	48	72	96	120
OFCL	8.1	35.1	63.8	103.7	157.5	254.6		
#CASES	14	12	10	8	6	2	0	0

FORECAST ERRORS (NM) FOR ep052001 DALILA

	00	12	24	36	48	72	96	120
OFCL	12.5	29.6	49.7	68.7	86.3	93.8	106.4	120.3
#CASES	31	29	27	25	23	19	15	11

FORECAST ERRORS (NM) FOR ep062001 SIX

	00	12	24	36	48	72	96	120
OFCL	23.7	79.4	114.9					
#CASES	6	4	2	0	0	0	0	0

FORECAST ERRORS (NM) FOR ep072001 FLOSSIE

	00	12	24	36	48	72	96	120
OFCL	2.8	29.5	58.9	90.6	120.6	181.6	256.1	325.7
#CASES	28	26	24	22	20	16	12	8

FORECAST ERRORS (NM) FOR ep082001 GIL

	00	12	24	36	48	72	96	120
OFCL	9.7	60.9	126.6	168.2	177.6	195.3	272.7	172.4
#CASES	23	21	19	17	15	11	7	3

FORECAST ERRORS (NM) FOR ep092001 HENRIETTE

	00	12	24	36	48	72	96	120
OFCL	6.0	42.3	85.0	117.9	165.5	319.7	660.4	
#CASES	17	15	13	11	9	5	1	0

FORECAST ERRORS (NM) FOR ep102001 IVO

	00	12	24	36	48	72	96	120
OFCL	9.7	42.1	67.4	80.2	102.5	178.1	202.0	
#CASES	17	16	14	12	10	6	2	0

FORECAST ERRORS (NM) FOR ep112001 JULIETTE

	00	12	24	36	48	72	96	120
OFCL	15.9	42.4	67.4	90.6	118.4	162.2	191.8	220.6
#CASES	44	42	40	38	38	35	30	26

FORECAST ERRORS (NM) FOR ep122001 KIKO

	00	12	24	36	48	72	96	120
OFCL	7.7	39.2	59.8	61.5	69.2	124.8		
#CASES	16	14	12	10	8	4	0	0

FORECAST ERRORS (NM) FOR ep132001 LORENA

	00	12	24	36	48	72	96	120
OFCL	5.7	57.7	106.6	115.2	62.3			
#CASES	12	10	8	6	4	0	0	0

FORECAST ERRORS (NM) FOR ep142001 FOURTEEN

	00	12	24	36	48	72	96	120
OFCL	11.1	58.5						
#CASES	4	2	0	0	0	0	0	0

FORECAST ERRORS (NM) FOR ep152001 MANUEL

	00	12	24	36	48	72	96	120
OFCL	17.2	47.2	81.1	106.9	139.4	187.5	224.5	209.5
#CASES	30	28	26	24	22	18	13	10

FORECAST ERRORS (NM) FOR ep162001 NARDA

	00	12	24	36	48	72	96	120
OFCL	5.9	28.9	57.6	86.3	106.9	119.9	143.0	
#CASES	14	14	14	14	12	8	4	0

FORECAST ERRORS (NM) FOR ep172001 OCTAVE

	00	12	24	36	48	72	96	120
OFCL	11.0	25.1	51.7	73.6	98.7	228.9		
#CASES	16	14	12	10	8	4	0	0

TABLE 6.2

EAST PACIFIC

2001 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	96	120	(hr)
OFCL	10.2	38.7	68.5	92.1	115.2	163.5	202.1	218.9	(nm)
CLIP	11.2	48.5	92.5	134.7	179.3	245.2			(nm)
CLP5	11.1	49.0	94.8	136.5	177.4	232.7	271.7	319.1	(nm)
#CASES	321	292	262	234	208	156	107	73	

1991 - 2000 OFFICIAL AND CLIPER AVERAGE TRACK ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	96	120	(hr)
OFCL	12.3	38.7	72.4	106.4	138.2	197.6			(nm)
CLIP	12.3	41.3	80.3	123.9	167.0	248.6			(nm)
#CASES	3432	3264	3009	2725	2459	1991	0	0	

2001 OFFICIAL AND CLIPER AVERAGE ERROR DEPARTURE
FROM THE 1991 - 2000 OFFICIAL AND CLIPER AVERAGE TRACK ERROR

PERIOD	00	12	24	36	48	72	(hr)
OFCL DEPARTURE	-17	00	-05	-13	-17	-17	(%)
CLIP DEPARTURE	-09	+17	+15	+09	+07	-01	(%)

TABLE 7.1

EAST PACIFIC

2001 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (SELECTED LATE)

PERIOD	00	12	24	36	48	72	96	120
OFCL	10.6	38.2	69.1	90.8	113.9	165.3	242.3	239.5
CLP5*	11.2	48.5	97.1	134.2	176.5	235.4	317.5	519.7
GFS	17.1	41.1	66.7	90.1	108.8	134.8	169.7	235.9
GFDL	13.3	46.4	77.3	109.7	145.5	214.3	281.3	333.8
UKM	19.9	40.6	62.4	84.1	112.7	188.4	346.3	478.1
NGPS	33.2	51.8	78.7	109.8	137.7	166.1	231.1	207.9
#CASES	114	100	87	71	58	34	16	6

EAST PACIFIC

2001 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (SELECTED LATE)

PERIOD	00	12	24	36	48	72	96	120
OFCL	11.5	39.0	70.4	89.3	112.2	155.8		
CLP5*	12.1	49.1	98.0	130.3	170.2	234.1		
GFS	17.9	40.5	61.0	79.9	97.2	124.7		
GEMN	19.2	49.5	83.4	103.1	122.1	151.7		
GFDL	14.6	46.2	74.9	104.0	138.7	204.4		
UKM	19.7	40.3	59.7	78.0	107.7	190.0		
NGPS	33.6	49.7	78.0	108.7	135.2	163.1		
#CASES	95	82	70	57	46	28	0	0

* Although CLP5 is an early model, it is included here for reference.

TABLE 7.2

EAST PACIFIC

2001 AVERAGE MODEL TRACK ERROR (NM)
FOR A HOMOGENEOUS SAMPLE (EARLY)

PERIOD	00	12	24	36	48	72	96	120
OFCL	9.7	39.5	71.8	97.2	112.8	165.4	214.6	263.0
CLP5	10.3	47.5	94.3	135.7	167.8	221.2	252.5	316.8
P91E	10.3	47.5	93.1	135.5	162.4	259.5	397.2	591.0
BAMD	10.3	45.8	86.1	126.6	140.4	168.3	150.4	193.4
BAMM	10.3	41.5	77.0	109.8	129.2	178.6	221.5	309.0
BAMS	10.3	47.2	84.2	121.2	146.2	217.4	287.2	303.1
LBAR	10.3	44.1	82.7	120.8	150.2	224.4	337.1	456.9
OFCI	10.2	43.0	74.4	100.9	116.4	167.0	248.4	247.1
GFSI	10.2	37.0	66.7	94.9	116.3	152.3	154.3	177.8
GFDI	10.2	41.2	78.6	117.0	150.9	232.0	302.5	358.7
UKMI	10.2	40.4	70.6	103.1	120.0	226.3	375.5	447.6
NGPI	10.2	46.5	84.3	120.5	136.3	186.4	244.6	232.3
GUNS	10.2	37.4	67.3	94.7	109.4	164.0	228.5	244.8
GUNA	10.2	35.0	62.6	86.4	101.5	152.3	190.7	202.6
#CASES	143	140	130	118	95	50	14	4

TABLE 8.1

EAST PACIFIC

2001 OFFICIAL AVERAGE ABSOLUTE WIND SPEED FORECAST ERRORS (KT) BY STORM

FORECAST ERRORS (KT) FOR ep012001 ADOLPH

	00	12	24	36	48	72	96	120
OFCL	0.7	8.7	13.4	16.3	21.4	28.8	23.1	19.4
#CASES	29	27	25	23	21	17	13	9

FORECAST ERRORS (KT) FOR ep022001 BARBARA

	00	12	24	36	48	72	96	120
OFCL	0.0	2.7	4.1	3.6	3.2	4.5	4.0	3.3
#CASES	11	11	11	11	11	11	10	6

FORECAST ERRORS (KT) FOR ep032001 COSME

	00	12	24	36	48	72	96	120
OFCL	1.7	8.6	19.0	18.3	5.0			
#CASES	9	7	5	3	1	0	0	0

FORECAST ERRORS (KT) FOR ep042001 ERICK

	00	12	24	36	48	72	96	120
OFCL	0.0	2.5	3.5	5.6	5.0	5.0		
#CASES	14	12	10	8	6	2	0	0

FORECAST ERRORS (KT) FOR ep052001 DALILA

	00	12	24	36	48	72	96	120
OFCL	1.9	4.3	8.5	14.4	16.7	15.3	19.7	22.7
#CASES	31	29	27	25	23	19	15	11

FORECAST ERRORS (KT) FOR ep062001 SIX

	00	12	24	36	48	72	96	120
OFCL	0.8	0.0	2.5					
#CASES	6	4	2	0	0	0	0	0

FORECAST ERRORS (KT) FOR ep072001 FLOSSIE

	00	12	24	36	48	72	96	120
OFCL	1.1	5.0	6.7	8.0	9.8	20.0	21.3	22.5
#CASES	27	26	24	22	20	16	12	8

FORECAST ERRORS (KT) FOR ep082001 GIL

	00	12	24	36	48	72	96	120
OFCL	1.5	6.9	12.4	20.0	22.0	21.4	31.4	41.7
#CASES	23	21	19	17	15	11	7	3

FORECAST ERRORS (KT) FOR ep092001 HENRIETTE

	00	12	24	36	48	72	96	120
OFCL	1.8	6.3	8.8	11.4	12.2	6.0	15.0	
#CASES	17	15	13	11	9	5	1	0

FORECAST ERRORS (KT) FOR ep102001 IVO

	00	12	24	36	48	72	96	120
OFCL	0.0	3.4	8.2	14.6	20.0	35.0	37.5	
#CASES	17	16	14	12	10	6	2	0

FORECAST ERRORS (KT) FOR ep112001 JULIETTE

	00	12	24	36	48	72	96	120
OFCL	3.8	9.9	13.1	13.9	12.2	14.9	18.5	20.2
#CASES	44	42	39	37	37	35	30	26

FORECAST ERRORS (KT) FOR ep122001 KIKO

	00	12	24	36	48	72	96	120
OFCL	4.1	7.9	11.7	16.5	12.5	18.8		
#CASES	16	14	12	10	8	4	0	0

FORECAST ERRORS (KT) FOR ep132001 LORENA

	00	12	24	36	48	72	96	120
OFCL	0.4	5.5	13.1	15.0	25.0			
#CASES	12	10	8	6	4	0	0	0

FORECAST ERRORS (KT) FOR ep142001 FOURTEEN

	00	12	24	36	48	72	96	120
OFCL	1.3	2.5						
#CASES	4	2	0	0	0	0	0	0

FORECAST ERRORS (KT) FOR ep152001 MANUEL

	00	12	24	36	48	72	96	120
OFCL	2.6	6.5	11.2	13.5	14.5	18.5	15.6	7.4
#CASES	29	27	25	23	21	17	12	9

FORECAST ERRORS (KT) FOR ep162001 NARDA

	00	12	24	36	48	72	96	120
OFCL	0.0	5.4	11.1	11.8	11.3	7.5	2.5	
#CASES	14	14	14	14	12	8	4	0

FORECAST ERRORS (KT) FOR ep172001 OCTAVE

	00	12	24	36	48	72	96	120
OFCL	0.3	5.4	10.0	13.5	16.9	5.0		
#CASES	16	14	12	10	8	4	0	0

TABLE 8.2

EAST PACIFIC

2001 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	96	120	(hr)
OFCL	1.6	6.2	10.3	13.2	14.4	16.9	18.4	18.6	(kt)
SHFR	2.0	7.3	11.7	14.7	16.8	18.5			(kt)
SHF5	2.0	7.2	11.5	14.1	15.8	19.1	18.3	15.0	(kt)
#CASES	319	291	260	232	206	155	106	72	

1991 - 2000 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERRORS
FOR A HOMOGENEOUS SAMPLE

PERIOD	00	12	24	36	48	72	96	120	(hr)
OFCL	2.4	6.1	10.8	14.5	17.1	20.3			(kt)
SHFR	2.4	7.2	12.0	15.9	18.9	22.2			(kt)
#CASES	3432	3250	2972	2705	2429	1985	0	0	

2001 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR DEPARTURE
FROM THE 1991 - 2000 OFFICIAL AND SHIFOR AVERAGE ABSOLUTE WIND SPEED ERROR

PERIOD	00	12	24	36	48	72	(hr)
OFCL DEPARTURE	-33	+02	-05	-09	-16	-17	(%)
SHFR DEPARTURE	-17	+01	-03	-08	-11	-17	(%)

TABLE 9

EAST PACIFIC

2001 AVERAGE MODEL ABSOLUTE WIND SPEED ERROR (KT)
FOR A HOMOGENEOUS SAMPLE (EARLY)

PERIOD	00	12	24	36	48	72	96	120
OFCL	2.0	6.8	11.0	13.6	15.0	19.9	27.5	31.0
SHF5	2.4	7.6	11.6	13.3	15.1	17.6	21.3	25.6
OFCI	2.4	7.4	11.2	12.6	14.5	21.0	30.3	39.4
SHIP	2.4	7.5	11.5	13.1	15.5	17.8	19.1	21.8
DSHP	2.4	7.5	11.2	12.8	15.2	17.8	19.1	21.8
GFDI	2.4	9.6	12.1	14.6	18.2	23.9	28.1	26.8
GFSI	2.4	9.3	14.6	18.8	23.0	30.7	40.1	41.8
#CASES	201	196	182	160	128	59	14	5