U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
NATIONAL METEOROLOGICAL CENTER

OFFICE NOTE 368

OPC UNIFIED MARINE DATABASE VERIFICATION SYSTEM

Vera M. Gerald
National Meteorological Center

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
OCEAN PRODUCTS CENTER

TECHNICAL NOTE*

OPC Unified Marine Database Verification System

Vera M. Gerald

*OPC Contribution No. 43
NMC Office Note No. 368

OPC CONTRIBUTIONS SERIES

1.	Development of Forecast Guidance for Santa Ana Conditions.	L. BURROUGHS	NWA DIGEST	10/87
2.	Lake Erie Wave Height Forecasts Generated by Empirical and Dynamical Methods -- Comparison and Verification.	W. RICHARDSON D.J. SCHWAB Y.Y. CHAO D.M. WRIGHT	TECH. NOTE GLERL CON. #471	7/86
3.	Determination of Errors in LFM Forecasts Surface Lows Over the Northwest Atlantic Ocean.	S.J. AUER	OFF. NOTE 313	7/86
4.	A Method of Calculating the Total Flow from A Given Sea Surface Topography.	D. B. Rao S.D. Steinrod B.V. SANCHEZ	NASA TECH. MEMO 87799	4/87
5.	Compendium of Marine Meteorological and Oceanographic Products of the Ocean Products Center.	D.M. FEIT	NWA TECH MEMO	9/86
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16.	Determining Equivalent Depths of the Atmospheric Boundary Layer Over the Ocean.	T.W. YU	J. OF GEO. RES.	4/88
17.	Analysis of the Atmospheric Mixed Layer Heights Over the Oceans.	T.W. YU	SAME AS NO. 15	
18.	An Operational Forecast System for Superstructure Icing.	D.M. FEIT	NWA DIGEST PREPRINT	
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21.	El Nino and Related Variability in Sea Surface Temperature Along Central California Coast.	L.C. BREAKER	PACLIM AGU MONOGRAPH in press	
22.	Oceanic Processes Contributing to the Displacement of Oil Spill by the Puerto Rican Tanker off San Francisco.	A. BRATKOVICH L.C. BREAKER	J. OF GEO. RESEARCH (submitted)	
23.	Open Ocean Fog and Visibility Forecasting Guidance System.	L. D. BURROUGHS	OFF. NOTE 348 TECH. NOTE	
24.	Synoptic Surface Marine Data Monitoring.	V. GERALD	TECH NOTE OFF. NOTE 335	11/87
25.	Estimating and Removing Sensor Induce Correlation from AVHRR Data.	L.C. BREAKER	J.OF GEO. RES in press	
26.	Infinite Elements for Water Wave Radiation and Scattering.	H.S. Chen	INTERNATIONAL J. FOR NUMERICAL METHODS IN FLUIDS in press	
27.	A Statistical Comparison of Methods for Determining Ocean Surface Winds.	W.H. GEMMILL T.W. YU D.M. FEIT	WEATHER AND FORECASTING	6/88
28.	A Review of the Program Product Dev. of the OPC.	D.B. RAO	WEATHER AND FORECASTING Vol. 4 pp.427-433	
29.	Infinite Elements for Combined Diffraction and Refraction.	H.S. Chen	PRESENTED 4/3-7/89 AT 7TH INTERNATIONAL CONFERENCE OF FINITE ELEMENT METHODS FLOW PROBLEMS	
30.	An Operational Spectral Wave Forecasting Model for the Gulf of Mexico.	Y.Y. CHAO	2ND INTERNATIONAL WORKSHOP ON WAVE FORECASTING AND HINDCASTING	
31.	Improving Global Wave Forecasts Incorporating Altimeter Data.	D.C. ESTEVA	2ND INTERNATIONAL WORKSHOP ON WAVE FORECASTING AND HINDCASTING	
32.	Computer-Worded Marine Forecasts.	W.S. RICHARDSON J.M. NAULT D.M. FEIT	COASTAL ZONE	1/89
33.	A Columbia River Entrance Wave Forecasting Program Developed at the Ocean Products Center.	Y.Y.CHAO T.L. BERTUCCI	TECH. NOTE OFFICE NOTE #361	5/89 10/89
34.	Forecasting Open Ocean Fog and Visibility.	L.D. BURROUGHS	PREPRINT	
35.	Local and Regional Scale Wave Models.	D.B. RAO	PROCEEDING(CMM/WMO) TECH.CONF. ON WAVES in press	
36.	Gulf of Mexico Wave Model (approx.).	Y.Y. CHAO DUFFY		
37.	OPC Product Rev. Summary.	L.D. BURROUGHS	TECH. NOTE OFFICE NOTE #359	
38.	Compendium of Marine Meteorological & Oceanographic Products of the Ocean Products Center. (rev.1)	D.M. FEIT	NOAA TECH. MEMO. NWS NMC 68	6/89
39.	Directional Wave Spectra for the Labrador Extreme Wave Experimental (Lewex).	D.C. ESTEVA Y.Y. CHAO	APL TECH. REPORT in press	
40.	An Analysis of Monthly Sea Surface Temperature Anomalies in Waters off the U. S. East and West Coasts.	L.C. Breaker W.B. Campbell	Fisheries Bulletin	8/89
41.	A Definition for Vector Correlation and its Application to Marine Surface Winds.	D.S. Crosby L.C. Breaker W.H. Gemmill	TECH NOTE OFFICE NOTE #365	
42.	Expert System for Quality Control and Marine Forecasting Guidance.	D.M. Feit W.S. Richardson		
43.	OPC Unified Marine Database Verification System.	V.M. Gerald	TECH NOTE NMC OFFICE NOTE #361	
44.	Sea Ice Edge Forecast Verification Program for the Bering Sea.	G.Wohl	TECH NOTE NMC OFFICE NOTE #370	
45.	An Operational Marine Fog Prediction Model.	D. Feit J. Alpert		
46.	The Circulation of Monterey Bay and Related Processes	L.C. Breaker W.W. Broenkow		

Abstract

This Office Note provides general information about the capabilities of the unified marine database verification system at the Ocean Products Center. It also describes the data format and the procedures for accessing the data by the users.

INTRODUCTION

The Marine Prediction Branch(MPB) of the National Meteorological Center(NMC) and the Ocean Products Center (OPC) is responsible for producing objective analysis and forecast products on various marine meteorological and oceanographic variables. These analyses and forecasts are provided directly to the marine community for use in weather forecasting guidance and as boundary conditions to ocean models.

An important activity of MPB involves evaluating and monitoring the performance of these models. To address this matter a unified marine products verification database system was designed to provide easy access to marine information from NMC's diverse database system. This common database matches analyses and forecasts of wind speed and direction, fog and visibility, air and sea surface temperature, wave height and direction, relative humidity and mean sea level pressure with the observed data reported by ships, fixed and drifting buoys, and other marine platforms.

Monthly verification statistics, such as, root mean square error, bias, and correlation coefficient, are used in monitoring and evaluating these analyses and forecasts. Statistical results from selected marine models are presented and discussed each month during the OPC's products performance review. For a complete

summary of the monthly performance evaluation of selected operational marine products see Burroughs(1989).

METHOD

A. Model Outputs

The analyses and forecasts monitored within the unified marine database verification system come from the NMC's regional(RGL) and aviation(AVA) models, the MPB's models, and Fleet Numerical Oceanographic Center's (FNOC) Global Spectral Oceanographic Wave Model(GSOWM).

In general, output fields from these models are saved at 12-hour increments out to 72 hours. Table I. gives complete details of all fields extracted during the 00z GMT cycle.

B. VERIFICATION DATA

The observed data, Table II, come from NMC's synoptic surface marine datasets. These datasets contain real-time marine observations reported by Volunteering Observing Ships (VOS), Navy and NOAA research vessels, fixed and drifting buoys, ocean weather stations (OWS), and marine reporting stations (MARS). NMC receives these reports via the Global Telecommunication System (GTS), the Geostationary Operational Environmental Satellite (GOES) network, and Coastal radio station transmissions.

DATA MATCH-UP

A. Record Format

All analysis and forecast fields verifying with the current 00z and 12z ship data are extracted from an 8-day circular file. For each report a value of the gridded field at the observed position(latitude,longitude) is generated by quadratic interpolation. Table III depicts the unified marine verification database 164 indexed array/record format.

The daily match-up of the observed data and the model outputs are written to a 17-day circular file called, NWS.WD21.OPC.UNF-DATA.CYC00. Approximately 1800 records are processed daily. Each record is packed and blocked with format control. At the end of a 15-day cycle the dataset is transferred from disk to tape.

B. Statistical Evaluations

The boundary layer wind model is verified against fixed buoy data. Statistics of bias and root mean square(RMS) error are used to evaluate the analyses and forecasts. Figure 1 shows the 24hr forecast RMS and bias errors in meters/second for the OPC and FNOC boundary layer winds for June 1989 - January 1990. Figure 2 displays OPC wind analysis and forecast errors of bias and RMS in meters/second for Sept 1989 - Jan 1990.

The OPC wave model is verified against 14 offshore deep water

fixed buoys. The evaluation of the OPC wave model performance is based upon statistics of bias(m), RMS(m) error, and correlation coefficient. Figure 3 shows the statistical comparison between the OPC and GSOWM wave models.

Figure 4 depicts statistical verification of air and sea surface temperature analyses, air/sea temperature differences, and mean sea level pressure with fixed buoy data.

SUMMARY

The development of the unified marine verification database system allows statistical evaluation and comparison of selected operational marine products in a timely fashion. These performance statistics(RMS error, bias, and correlation coefficient) are presented and discussed each month during the OPC products performance review.

ACKNOWLEDGEMENT

The author would like to thank Dr. D. B. Rao, Mr. W. Gemmill, and Mr. D. Feit for their suggestions and guidance during the writing of this office note. Thanks to Susan Hubbard for the typing.

Table I: Parameters saved for verification from models.

		ANALYS	FCST(12	24	36	48	60	72)
OPC	Wind Speed	X	X	X	X	X	X	X
	Wind Dir	X	X	X	X	X	X	X
	Wave Hgt	X	X	X	X	X	X	X
	Period Prim	X	X	X	X	X	X	X
	Period of Sec	X	X	X	X	X	X	X
	Wave Dir	X	X	X	X	X	X	X
	Fog/Vis	X		X		X		X
	Blended SST	X						
	Satellite SST	X						
NMC RGL	Bdyu	X	X	X	X	X		
	Bdyv	X	X	X	X	X		
	1000mb rh	X	X	X	X	X		
	1000mb T	X	X	X	X	X		
	1000mb u	X	X	X	X	X		
	1000mb v	X	X	X	X	X		
	MSLP	X	X	X	X	X		
NMC AVA	Bdyu	X	X	X	X	X	X	X
	Bdyv	X	X	X	X	X	X	X
	1000mb rh	X	X	X	X	X	X	X
	1000mb T	X	X	X	X	X	X	X
	1000mb u	X	X	X	X	X	X	X
	1000mb v	X	X	X	X	X	X	X
	MSLP	X	X	X	X	X	X	X
FNOC	SST	X						
	Bdyu	X	X	X	X	X		X
	Bdyv	X	X	X	X	X		X
	Wave Hgt	X	X	X	X	X		X
	Prd Prim	X	X	X	X	X		X
	Prd Sec	X	X	X	X	X		X
	Wave Dir	X	X	X	X	X		X

Table II: Measurements of verification parameters (and units).

Mean Sea Level Pressure	Tenth of MB
Wind Direction	Degrees
Wind speed	Knots
Air Temp	Tenth deg C
Dew Point Dep	Tenth deg C
Sea Surface Temp	Tenth deg C
Present Weather	Code Figure*
Past Weather	Code Figure*
Horizontal Visibility	Code Figure*
Period of Wave	Seconds
Height of Wave	1/2 yards
Period of Swell	Seconds
Height of Swell	1/2 Yards
Direction of Swell	Code figure*

* World Meteorological Organization(WMO) coded Standard

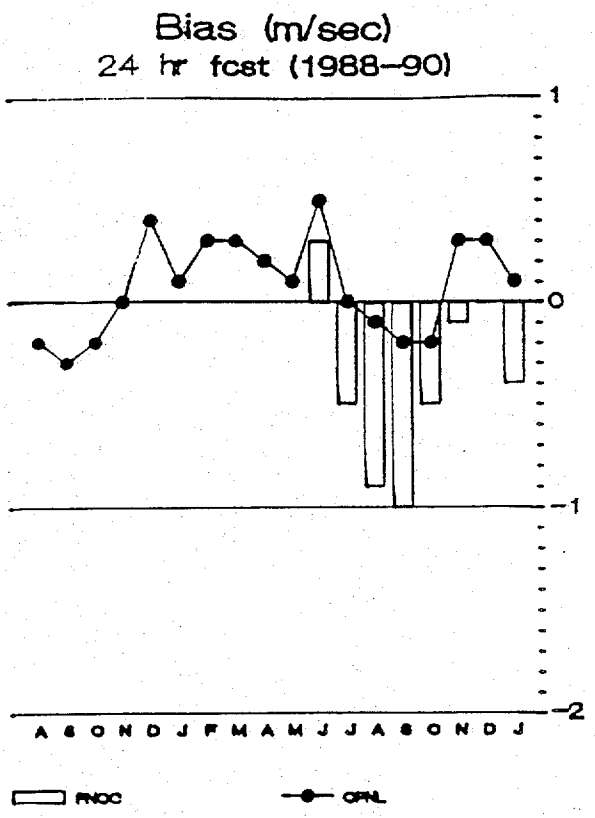
Table III: The unified marine database record format.

Record(1)	Report Type
" 2	YYMM
" 3	DDHH
" 4	Latitude
" 5	Longitude
" 6	Mean Sea Level Pressure
" 7	Wind Direction(deg)
" 8	Wind Speed(s)
" 9	Air Temperature(tenth deg C)
" 10	Dew Point Depression(tenth deg C)
" 11	Sea Surface Temperature(tenth deg C)
" 12	Present Weather
" 13	Past Weather
" 14	Visibility
" 15	Period of the Wave(s)
" 16	Wave Height(1/2 yd)
" 17	Period of the Swell(s)
" 18	Height of the Swell(1/2 yd)
" 19	Direction of the Swell
" 20	Blended Sea Surface Temp(tenth deg C)
" 21	-999
" 22	-999
" 23	-999
" 24	-999
" 25	-999
" 26	-999
" 27	-999
" 28	-999
" 29	Bdy Wind Direction (00hr) RGL
" 30	" " Speed " "
" 31	1000mb Rh " "
" 32	" Temperature " "
" 33	" Wind Direction " "
" 34	" " Speed " "
" 35	MSLP " "
" 36	Bdy Wind Direction (00hr) AVA
" 37	" " Speed " "
" 38	1000mb Rh " "
" 39	" Temperature " "
" 40	" Wind Direction " "
" 41	" " Speed " "
" 42	MSLP " "
" 43	Bdy Wind Direction (00hr) NVY
" 44	" " Speed " "
" 45	Hgt of Wave " "
" 46	Prd Pri Wave " "

"	47	" Sec "	"	"
"	48	Wav Dir	"	"
"	49	-999		
"	50	Wnd Spd	(00hr)	NOW
"	51	" Direction	"	"
"	52	Hgt of Wave	"	"
"	53	Dir " "	"	"
"	54	Prd " "	"	"
"	55	-999		
"	56	-999		
"	57	-999		
"	58	-999		
"	59	-999		
"	60	-999		
"	61	-999		
"	62	-999		
"	63	-999		
"	64	Bdy Wind Direction	(24hr)	RGL
"	65	" " Speed	"	"
"	66	1000mb Rh	"	"
"	67	" Temperature	"	"
"	68	" Wind Direction	"	"
"	69	" " Speed	"	"
"	70	MSLP	"	"
"	71	Bdy Wind Direction	(24hr)	AVA
"	72	" " Speed	"	"
"	73	1000mb Rh	"	"
"	74	" Temperature	"	"
"	75	" Wind Direction	"	"
"	76	" " Speed	"	"
"	77	MSLP	"	"
"	78	Bdy Wind Direction	(24hr)	NVY
"	79	" " Speed	"	"
"	80	Wave HGT	"	"
"	81	Prd Pri Wav	"	"
"	82	" Sec "	"	"
"	83	Dir Wav	"	"
"	84	-999		
"	85	Bdy Wind Speed	(24hr)	NOW
"	86	" " Direction	"	"
"	87	Wav Hgt	"	"
"	88	" Dir	"	"
"	89	" Prd	"	"
"	90	-999		
"	91	-999		
"	92	FOG/VIS	(00hr)	OPC
"	93	"	(24hr)	"
"	94	"	(48hr)	"
"	95	"	(72hr)	"
"	96	-999		
"	98	-999		
"	99	Bdy Wind Direction	(48hr)	RGL

"	100	" " Speed	"	"
"	101	1000mb Rh	"	"
"	102	" Temperature	"	"
"	103	" Wind Direction	"	"
"	104	" " Speed	"	"
"	105	MSLP	"	"
"	106	Bdy Wind direction	(48hr)	AVA
"	107	" " Speed	"	"
"	108	1000mb Rh	"	"
"	109	" Temperature	"	"
"	110	" Wind Direction	"	"
"	111	" " Speed	"	"
"	112	MSLP	"	"
"	113	Bdy Wind Direction	(48hr)	NVY
"	114	" " Speed	"	"
"	115	Wav Hgt	"	"
"	116	Prd Pri Wav	"	"
"	117	" Sec "	"	"
"	118	Dir Wav	"	"
"	119	-999		
"	120	Bdy Wind Speed	(48hr)	NOW
"	121	" " Direction	"	"
"	122	Wav Hgt	"	"
"	123	Wav Dir	"	"
"	124	Wav Prd	"	"
"	125	-999		
"	126	-999		
"	127	-999		
"	128	-999		
"	129	-999		
"	130	-999		
"	131	-999		
"	132	-999		
"	133	-999		
"	141	Bdy Wind Direction	(72hr)	AVA
"	142	" " Speed	"	"
"	143	1000mb Rh	"	"
"	144	" Temperature	"	"
"	145	" Wind Direction	"	"
"	146	" " Speed	"	"
"	147	MSLP	"	"
"	148	Bdy Wind Direction	(72hr)	NVY
"	149	" " Speed	"	"
"	150	Wav Hgt	"	"
"	151	Prd Pri Wav	"	"
"	152	" Sec "	"	"
"	153	Dir Wav	"	"
"	154	-999		
"	155	Bdy Wind Speed	(72hr)	NOW
"	156	" " Direction	"	"
"	157	Wav Hgt	"	"
"	158	" Dir	"	"

"	159	" Prd	" "
"	160	-999	
"	161	-999	
"	162	-999	
"	163	SST ANL	(00hr) NVY



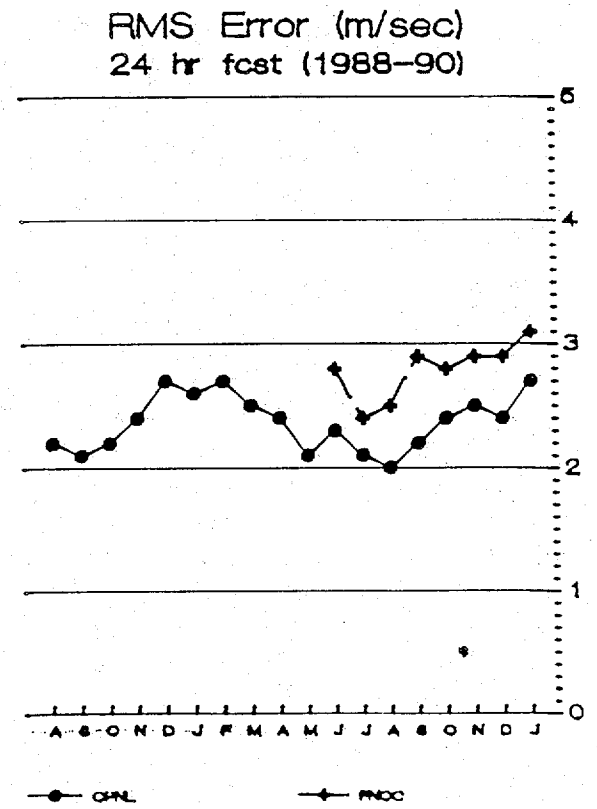
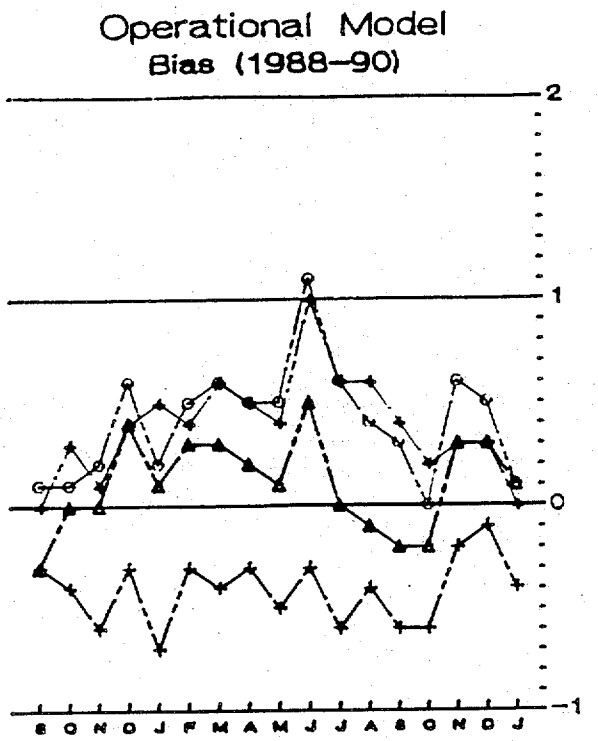


Figure 1
Comparision of OPC & FNOC
Boundary Layer Winds 24hr FCST



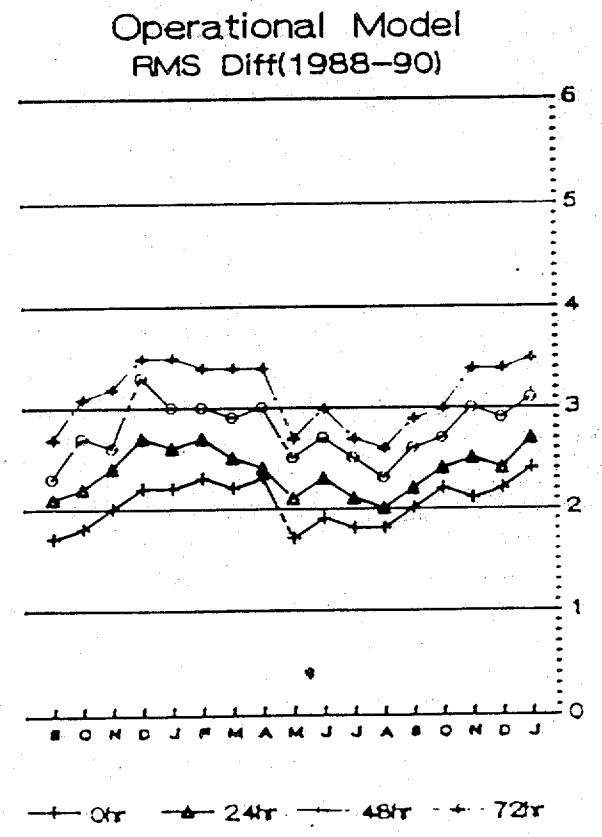
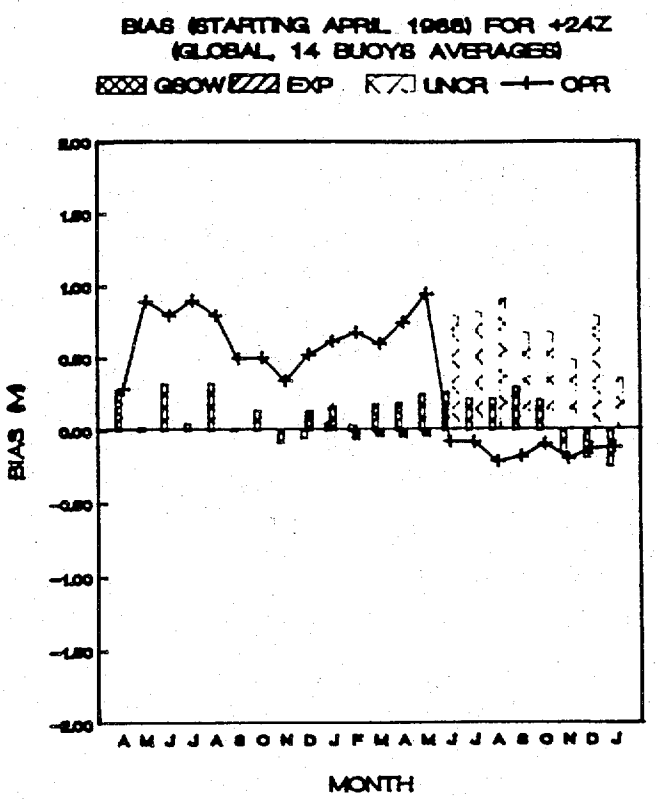
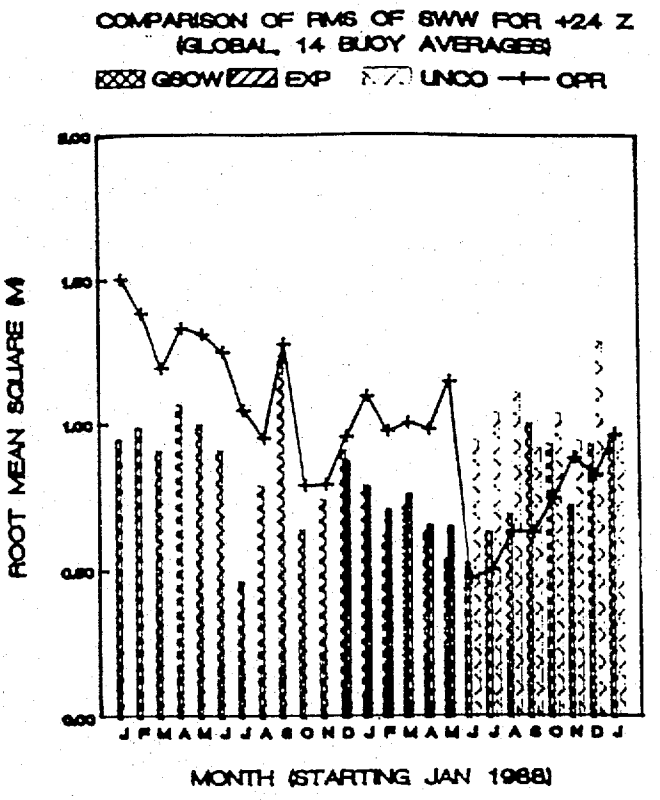


Figure 2

OPC Boundary Layer Winds ANL & FCSTS





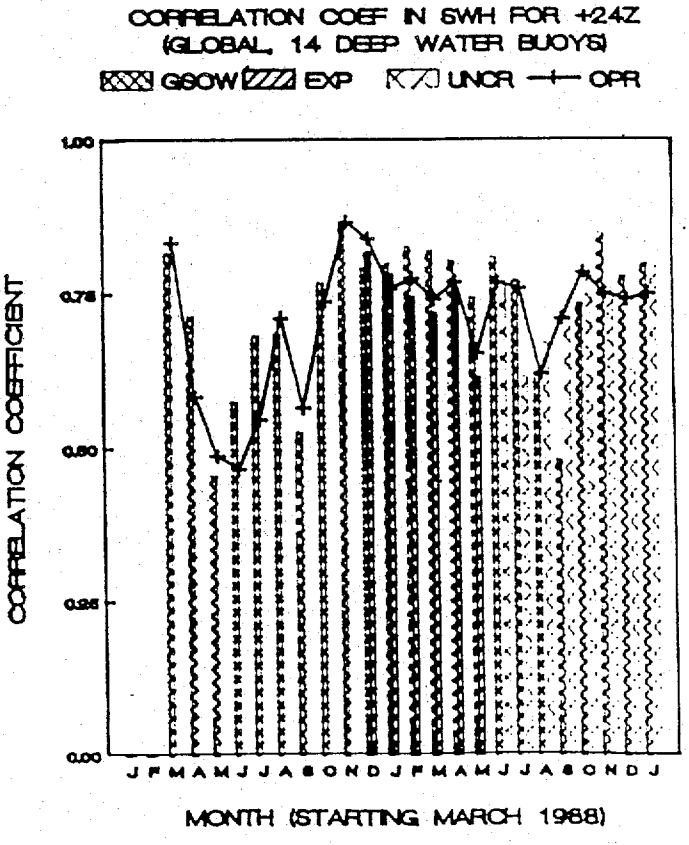


Figure 3

Comparision of OPC & FNOC GSOWM Wave Models

NH STAT AVA 1000MB AIR T VS FIXED BUOYS

ANALYSIS	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR
MEAN OF OBS	20.3	19.9	17.3	14.3	11.0	10.3	12.2	13.0	15.2
MEAN OF MOD	21.9	21.9	18.9	15.6	12.2	11.9	13.7	14.3	16.7
MODEL BIAS	1.65	2.00	1.67	1.34	1.17	1.60	1.46	1.31	1.54
RMS	2.47	2.62	2.33	2.08	1.88	2.47	2.47	2.52	2.51
CORREL	0.97	0.97	0.97	0.98	0.98	0.97	0.97	0.97	0.96

NH STAT OF OPC BLDSST VS FIXED BUOYS

ANALYSIS	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR
MEAN OF OBS	20.5	20.5	18.7	16.3	14.0	12.1	14.2	14.4	15.9
MEAN OF MOD	20.4	20.8	19.4	17.2	14.8	13.9	14.7	14.7	16.0
MODEL BIAS	-0.1	0.28	0.70	0.82	0.82	0.64	0.51	0.28	0.09
RMS	1.11	1.24	1.43	1.54	1.71	1.75	1.92	1.62	1.35
CORREL	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.99

NH STAT OF AIR/SEA (T) DIFF (MODEL - OBSV)

ANALYSIS	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR
MEAN OF OBS	-0.2	-0.7	-1.4	-2.1	-3.0	-2.1	-1.9	-1.5	-0.7
MEAN OF MOD	1.6	1.1	-0.4	-1.5	-2.6	-1.2	-1.0	-0.4	0.7
MODEL BIAS	-1.79	1.72	0.91	0.51	0.36	0.95	0.94	1.03	1.44
RMS	2.53	2.41	2.01	1.83	2.01	2.16	2.10	2.22	2.41
CORREL	0.54	0.56	0.69	0.88	0.91	0.87	0.85	0.83	0.68

NH STAT OF AVA MSLP VS FIXED BUOYS

ANALYSIS	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR
MEAN OF OBS	1015.6	1016.3	1015.2	1014.9	1014.9	1013.5	1017.3	1017.3	1016.4
MEAN OF MOD	1015.0	1015.7	1014.9	1014.6	1014.2	1013.1	1016.9	1016.9	1016.1
MODEL BIAS	-0.55	-0.57	-0.30	-0.34	-0.64	-0.36	-0.48	-0.42	-0.33
RMS	1.19	1.24	1.27	1.30	1.55	1.66	1.41	1.25	1.14
CORREL	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Figure 4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