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PRELIMINARY ASSESSMENT NEW GLOBAL FORECAST SYSTEM

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Preliminary Assessment New Global Forecast System

1. Introduction

Between June 30 and September 15 of 1984, a series of sixteen, five-day forecasts were produced with a new global forecast model. These forecasts were produced to assess both the general level of model performance and the need for model improvement. During the period of the experimental work, changes were introduced into the forecast model and into the analysis system which specified the model's initial data. Thus, the statistical results, documenting forecast accuracy, were not drawn from a homogeneous population. Under the presumption that changes in the model will improve its performance, we may consider the comparative statistics reported here to underestimate the skill that will be achieved subsequently.

2. The Model

By extending to eighteen the number of levels of the NMC global spectral model, we expected to match the vertical resolution of the model to that of the GFDL model employed by Miyakoda in his experimental forecasts. The physics of the model were adopted in large measure from the GFDL parameterizations referred to as the E2 package. In particular, the radiation parameterization of Fels has been incorporated into the model. The surface layer is treated using Monin-Obukhov similarity theory together with a soil heat and hydrology package, involving three soil layers.

The parameterization of moist convection has been adopted from the Kuo-type scheme used at ECMWF rather than the moist-adiabatic adjustment scheme. Dry convective adjustment will be retained, as at GFDL, until such time as the Yamada-Mellor (E-4) scheme can be computationally afforded. (This will require the use of 1/2 word logic on the CYBER 205.)

The specification of clouds for use with the radiation computation is restricted to climatological zonal mean fields. Similarly soil properties are specified using climatological estimtates provided by GFDL.

The horizontal resolution of the model remains rhomboidal forty. The treatment of horizontal diffusion was modified during the course of the experiments so that it acts over the full spectrum. It was found that this adjustment prevented the formation of erroneous tropical storms. Vertical diffusion based on a mixing length specification of the austauch coefficient was incorporated into the model about one-third of the way through the period. This modification was found to be advantageous, particularly in one case, for a Pacific extratropical cyclone.

In very recent studies, we have found several fine points of the model coding which required adjustment. It is expected that these changes may improve the cool bias in low level temperatures that manifested itself during the summer period, especially over the continents. Other ajustments of the model related to the thermal bias are also under consideration jointly with GFDL.

3. Statistical Results

We have available two types of verification statistics. The Medium-Range Prediction Group of MOD under F. Hughes' direction calculated standardized anomally correlation coefficients for 72, 96 and 120 hour forecasts over the North American region. These scores were also available for the operational global model and for the ECMWF forecasts. All sixteen experimental forecasts were evaluated at both mean sea level and 500 millibar levels. The results are tabulated below.

		NEW MODEL	OPERATIONAL	ECMWF
	72	59.9	60.1	74.5
1000	96	43.1	44.4	61.9
	120	34.1	32.6	45.6
	72	68.2	64.4	74.6
500	96	52.4	53.6	56.0
	120	46.4	47.3	41.7

Table 1. Standardized Anomally Correlation Coefficient, North America Region

Dr. J. Ward of the Development Division Diagnostics Group carried out a verification (against analyses) of the new model's and the operational model's forecasts. The verification study was limited to the last ten cases. Both the mean error and the standard deviation of the error were computed at twenty-four hour intervals. These results are tabulated below for the 1000 mb and 500 mb levels.

10 CASE AVERAGES — GFDL PHYSICS EXP'S.

NORTHERN HEMISPHERE

1000 MB

	MEAN		STND DEV	
FCST HR	OPNL	NEW	OPNL	NEW
24	-1.6	0.5	20.8	21.8
48	-2.6	1.4	26.2	28.7
72	-5.2	-4.5	42.2	41.7
96	-4.9	-0.5	52.6	50.4
120	-5.6	-1.9	60.4	57.4

	MEAN		500 MB	STND DEV	
FCST HR	OPNL	NEW		OPNL	NEW
24	4.6	-8.1		22.8	22.7
48	12.0	-22.8		37.9	37.2
72	21.4	-33.1		54.9	50.3
96	28.9	-37.5		73.3	70.1
120	32.1	-43.2		86.9	76.8

4. Discussion

Based on the preliminary experiments reported here, we may expect that the introduction of the new model into operations would have a small positive influence on forecast skill, especially in the time range beyond two days. We have not yet been able to assess the potential improvements to the initial analysis which may be achieved by incorporating the new model into the global data assimilation system. We are encouraged to believe therefore, that an overall significant improvement in NMC's medium-range forecasting system will be achieved in the near future.

5. Acknowledgement

The support provided by A. Desmarais was essential to the conduct of the experiments reported in this note.