EVALUATION OF THE ETA MODEL VERSUS THE LFM

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[Editor's Note: Eta model graphics will replace the LFM model graphics on AFOS beginning with the 1200 UTC model cycle on June 9. The original implementation date was pushed back one day to ensure continuity during the severe weather event over the central United States on June 8. Eta model gridded data for PCGRIDS will continue to be available for dial-in users from the Local Area Network (LAN) at WSFO Salt Lake City. The following information is a summary of subjective and objective verification results of the Eta model from an April 28, 1993 Committee on Analysis and Forecast Technique Implementation (CAFTI) meeting.]

With the introduction of a new model into the operational environment and the cessation of transmitting the output of another, a period of transition will occur, in which many of the known biases of the LFM must be replaced by understanding the Eta model and any associated biases. To assist in this endeavor, as well as comparing the Eta model to an established model, the National Meteorological Center (NMC) performed a verification of the Eta model from 0000 UTC 1 March through 1200 UTC 31 March 1993. In concert with this verification, forecaster evaluations of the model were also completed with the assistance of forecasters at the Weather Forecast Branch, Monitoring and Aviation Branch, Marine Forecast Branch, and the Severe Environmental Local Storms Unit. Forecasters within each of these groups evaluated model fields most pertinent to their product preparation. All 62 model runs were evaluated in addition to case studies for particular events. Verification was completed by using observations, as well as NGM and AVN analyses.

Summary of Verification Results

Evaluations from the Weather Forecast Branch identified the superiority of the Eta model in forecasting 500 mb heights and vorticity, 700 mb heights and relative humidity, 850 mb heights and temperatures, mean sea-level pressure, vertical velocities, and precipitation. The LFM performed better than the Eta model with digging upper-level lows in high amplitude patterns, and also provided better forecasts of the lifted-index gradients. Both models demonstrated a tendency to over-forecast 700 mb relative humidity over the West, and experienced problems with several convective outbreaks.

The Monitoring and Aviation Branch evaluations also identified Eta model superiority in the 500 mb heights and vorticity, 700 mb heights and relative humidity, 850 mb heights and temperatures, and mean sea-level pressure. Additionally, the low-level wind circulations also appeared superior within the Eta model. In comparison to the LFM, the Eta model displayed more 1000-500 mb thickness cold bias with generally higher low-level relative humidity.

The Eta model showed superiority for position and depth of both Pacific and Atlantic low centers, as evaluated by the Marine Forecast Branch, although the Eta model did demonstrate occasional significant errors.

The Eta model and the NGM displayed superiority over the LFM for synoptic patterns associated with severe storm development and the location and strength of jet streaks (the LFM was weaker with these features), as identified by the evaluations completed by the Severe Environmental Local Storms Unit. The Eta model low-level winds were found to be better than the weaker NGM low-level winds, and even weaker LFM low-level winds. The Eta model lifted-index pattern displayed better detail than the LFM, and the magnitudes were better than the NGM in indicating severe thunderstorm potential. Likewise, the Eta model low-level moisture displayed better detail than the LFM, and more accurate magnitudes of the low-level moisture than the NGM.

In general, the conclusions reached as a result of this verification state that the Eta model was clearly superior to the LFM. This verification identified potential areas for improvement of the Eta model, such as the demonstrated cold bias and very low-level moisture. Additional experience with the Eta model over a number of different seasons and synoptic regimes will further assist the understanding of any model biases.

Model Implementation

The version of the Eta model, replacing the LFM, has 38 vertical layers (Fig. 1) and a domain as illustrated in Fig. 2. The Eta model will be run in the same position in the model production cycle previously occupied by the LFM. With the longer running Eta, the Eta model graphics will appear on AFOS later than their LFM predecessors. In comparison to the 2-3 minutes of processing time required for the LFM, the Eta model processing (analysis and forecasts) will take approximately 45 minutes on the Cray computer. An illustration comparing the processing schedule of the Eta model with the LFM is presented in Fig. 3. After implementation of the Eta model, the Cray computer will run continuously through the entire model production cycle beginning with the ERL (Early or Eta) model run and ending with the AVN run. The LFM will continue to run at the NMC until NGM MOS is developed for Alaska, which is expected to occur sometime within fiscal year 1994.
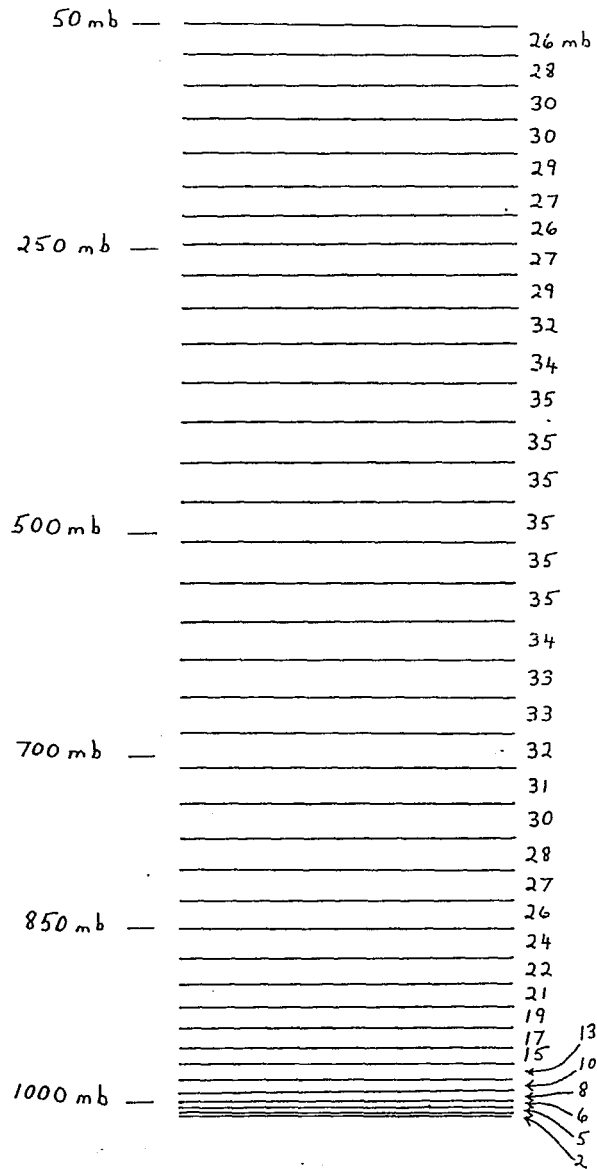
Fig. 1 Distribution of the 38 layers within the Eta model. The depth of each layer is given on the right-hand side of the figure.
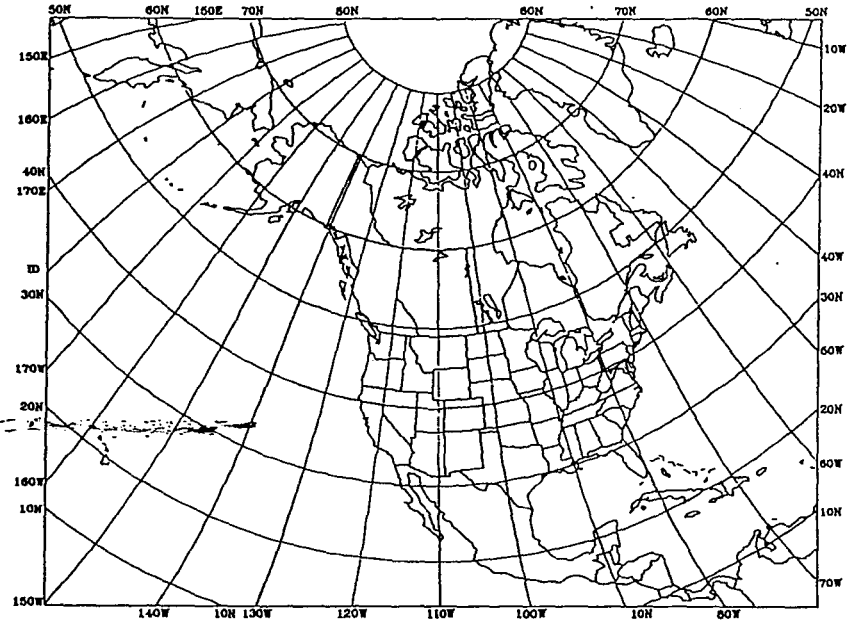
80 KM ETA MODEL DOMAIN

Fig. 2 80 km Eta model domain.

ETA Processing

The ETA pre-processing on the front-end computer takes 2 minutes. Then ETA processing is transferred to the back-end Cray where the analysis takes 12 minutes and the forecast along with built-in post-processing 32 minutes. A total of 46 minutes.

The larger and longer running ETA model can not be run in parallel with the RGL analysis or forecast, as we could the LFM model, and it can't be run on the front-end either which we could also do with the LFM.

LFM and ETA processing start from the same data dump

0115Z		Start ETA & LFM processing	
0125Z	ETA data-prep	0125Z	LFM data-prep & analysis
0128Z	ETA analysis		
		0130Z	LFM initialization
		0132Z	Start LFM forecast
		0136Z	LFM forecast end
0140Z	ETA analysis end		
		0145Z	12&24hr LFM graphics end
		0147Z	36&48hr LFM graphics end
0150Z	ETA 12hr forecast		
	0157Z	ETA 12hr graphics end	
0158Z	ETA 24hr forecast		
	0205Z	ETA 24hr graphics end	
0206Z	ETA 36hr forecast		
	0213Z	ETA 36hr graphics end	
0214Z	ETA 48hr forecast		
	0221Z	ETA 48hr graphics end	

Fig. 3 Comparison of processing times for the Eta model and the LFM. Reprinted from the notes of the April 28, 1993 CAFTI meeting.