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BIAS-CORRECTED TEMPERATURE GUIDANCE FROM THE ETA MODEL

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Introduction

Temperature forecasting is often a difficult and challenging task for the operational forecaster. To aid the operational forecaster in temperature forecasting, statistical guidance from the Nested Grid Model (NGM) and the Global Spectral Model (AVN and MRF) are readily available. However, often the Eta model is preferred over the previously mentioned models and often performs "better" in the West. During these times, statistical guidance from the Eta model would be a great asset to the operational forecaster, taking advantage of the Eta's superior resolution and physics package.

Methodology

Using raw hourly site-specific model output, it is possible to use actual forecast fields to provide temperature guidance from the Eta. As stated by Baldwin et al. (1998), continuous changes and improvements to the Eta and Mesoscale Eta (MESO) models have led to frequent updates not allowing a long period of stable statistics needed to produce Model Output Statistics (MOS). To adjust for systematic errors, Baldwin et al. (1998) suggested using a seven-day running mean bias of the model 2-meter temperature data from the MESO.

Using the Eta's hourly 2-meter temperature data (in BUFR format) from NCEP and the bias-correction, a crude temperature guidance from the Eta is created. First, the high and low forecasts for each site are extracted from Eta's hourly BUFR data. These forecast data are then compared with the actual highs and lows to compute a running seven-day bias for the given site and forecast time period. This seven-day running bias is then used to adjust the Eta's 2-meter temperature forecast. If this technique is successful, it would eliminate the need to have a "frozen" model to provide temperature guidance.

Results

Table 1 is a comparison of the mean absolute error (MAE) for the first period (1200 UTC cycle) and second period (0000 UTC cycle) low temperature forecasts of the Eta (2-meter bias corrected) and NGM MOS from 04 May to 22 June 1998. Out of a total of 169 low temperature forecasts for two sites in southern Montana, the Eta's MAE was 1.5° larger than the MOS MAE for the 0000 UTC forecasts and 0.5° for the 1200 UTC cycle. These errors are likely due to the Eta's problem handling boundary layer temperatures and moisture during the morning hours.

Table 2 is a comparison of the first period (0000 UTC cycle) and second period (1200 UTC cycle) high temperature forecasts of the Eta and NGM MOS from the same time period. For the same two sites and times (0000 and 1200 UTC), the Eta's MAE was about one degree better than MOS (slightly less for 1200 UTC).

Table 3 shows the results of a total of the 338 forecasts for the two sites in southern Montana. The Eta (MAE of 3.43°) was very competitive with the NGM (MAE of 3.31°).

Future Plans

Our main objective is to experiment with the bias. A trend that has been forming involves the high temperature forecast during clear and cloudy days. During observed cloudy days, the raw 2-meter temperatures (non-bias adjusted) are normally within 0 to 3 degrees of the actual high temperature. While during clear days, the 2-meter forecast normally has a cool bias of 5 to 10 degrees at Billings (the error is greater for sites at higher elevations). Therefore, with a stretch of three or more cloudy days, the seven-day running bias is reduced. When the cloudy cycle ends, the bias corrected 2-meter temperature forecast is often too cool. This problem may be solved by extending the bias period beyond seven days to dampen this effect. Other plans are to add more stations, extend the forecast to the third period, and collect data over a longer period encompassing multiple seasons. As we continue to gather these data, we will experiment with the bias period to hopefully improve the overall bias adjustment.

References

Baldwin, et al., 1998: Experiments with Bias-Corrected Temperature Guidance Using NCEP's Mesoscale Eta Model, *16th Conference on Weather Analysis and Forecasting,* pp. 388.

Table 1

Low Temperature Forecast Results
04 May - 22 June 1998

00 UTC Cycle

Station	# of Forecasts	Mean Absolute Error (Degree F)	
		Eta	NGM
BIL	44	4.34	2.80
MLS	44	4.64	3.05
BOTH	88	4.49	2.92

12 UTC Cycle

BIL	41	2.73	2.29
MLS	40	3.38	2.48
BOTH	81	3.05	2.38

Table 2
High Temperature Forecast Results
04 May - 22 June 1998

00 UTC Cycle

Station	# of Forecasts	Mean Absolute Error (Degrees F)	
		Eta	NGM
BIL	44	2.59	3.68
MLS	44	3.02	3.64
BOTH	88	2.81	3.66

12 UTC Cycle

BIL	41	3.20	3.95
MLS	40	2.93	4.63
BOTH	81	3.06	4.28

Table 3
Overall Temperature Forecast Results
04 May - 22 June 1998

Station	# of Forecasts	Mean Absolute Error (Degrees F)	
		Eta	NGM
BIL	170	3.29	3.18
MLS	168	3.57	3.44
BOTH	338	3.43	3.31