EASTERN REGION TECHNICAL ATTACHMENT
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NGM AND LFM MODEL PERFORMANCE FOR DECEMBER 1987-FEBRUARY 1988
NWS Eastern Region, Garden City, NY

Each WSFO should have received a copy of the NMC Seasonal Performance Summary for the period December 1987 to February 1988. With the winter season fast approaching, every forecaster should review this bulletin. This technical attachment highlights the important differences and similarities between the LFM and NGM models for this past winter season.

Table 1 shows the Threat score (CSI) and Bias precipitation statistics for the LFM and NGM models for the winter season. For the .01 threshold, the models have essentially the equivalent Threat Scores and Biases for all forecast periods. For amounts greater than a half inch, the LFM shows greater skill in the first 24-hour forecast period than the NGM. For the other forecast periods, the NGM is the better model. Surprisingly, the LFM is better with the higher precipitation amounts, while the NGM is too dry. A comparison of the Threat Scores for the last evaluation period depicts a degradation in scores for both models.

For precipitation amounts above .25 inch, the Table reveals that the LFM has a significantly higher Bias than the NGM. This implies that the LFM is too wet while the NGM is too dry.

The low Bias in the NGM can be attributed to the temperature adjustment change that went into effect October 1987 (see NWS TPB Bulletin No.373). This temperature correction was introduced into the NGM to correct radiational heating calculations which produced a progressively colder temperature field, at the rate of about -1.5 degrees in 48 hours. A small correction to the potential temperature for each of the 16 levels was introduced to correct this cold bias. This warms the models atmosphere and reduces the relative humidities. The Bias of the NGM during the first forecast period is lower than for the second forecast period. This implies that the NGM is still having a "spin-up problem."

Figure 1 depicts the daily variation of the 500 mb anomaly correlation for the LFM and NGM (RAFS) 48-hour forecasts for December 1987 to February 1988.

Some advice: Precipitation forecasts from either model should be used only as a "first guess" when making QPF/precipitation forecasts. 500 mb circulation patterns can be used with more reliability than the model's precipitation forecasts.

References

NOAA, 1988: NMC Seasonal Performance Summary December 1987-February 1988, Vol 1, No. 1, National Meteorological Center, Washington D.C., 58 pp.

NOAA, 1987: NMC Quarterly Performance Summary October-December 1987, Vol 1, No. 2, National Meteorological Center, Washington D.C., 53 pp.

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Attachments (Figures 1 through 5)

As a reminder, the anomaly correlation is a forecast evaluation score. This is the auto correlation between (daily climatology minus observed) and (daily climatology minus forecast). A perfect anomaly correlation is 100%.

The NGM is superior to the LFM with respect to this statistic. The LFM displayed large variations during the latter half of December. Both models showed significant fluctuations during the month of January.

Figure 2 displays the Root-Mean-Square (RMS) errors for 48-hour forecasts of height at 850 and 250 mb for the LFM and NGM for the winter season. Figure 3 shows the Root-Mean-Square (RMS) errors for 48-hour forecasts of vector wind at 850 and 250 mb.

The RMS is the square root of the difference between forecast and observed fields squared. The RMS measures the variation of the error between a forecast and an observation.

The NGM is clearly the winner for the RMS height errors (850 mb and 250 mb), over the Eastern U.S. Both models have significant height errors over western Canada and the Northern Pacific. The RMS vector errors are more pronounced for the LFM, especially for the 250 mb level over the central and western U.S.

Figures 4 and 5 show the 850 and 250 mb mean 48-hour forecast height and wind speed errors respectively, for the LFM and NGM during the winter season. Superimposed on the LFM maps is the mean analysis of these fields from the Aviation run, which is used as the verification. The analysis shows a long wave trough over Eastern Canada extending southward and a trough located west of Alaska. A mean analyzed jet maximum (winds > 40 m/s) is observed along the East coast.

In the east, both models contain significant errors in their mean upper-level height forecasts. The LFM underestimates the heights which means this model overestimated the depth of the eastern trough. Conversely, the NGM overestimated the heights, which means this model underestimated the trough. The LFM <u>overforecasts</u> while the NGM <u>underforecasts</u> the intensity of the eastern trough.

Errors in low-level wind forecasts from each model for the Eastern half of the U.S are negligible. Both models underforecast the strength of the analyzed eastern jet maximum.

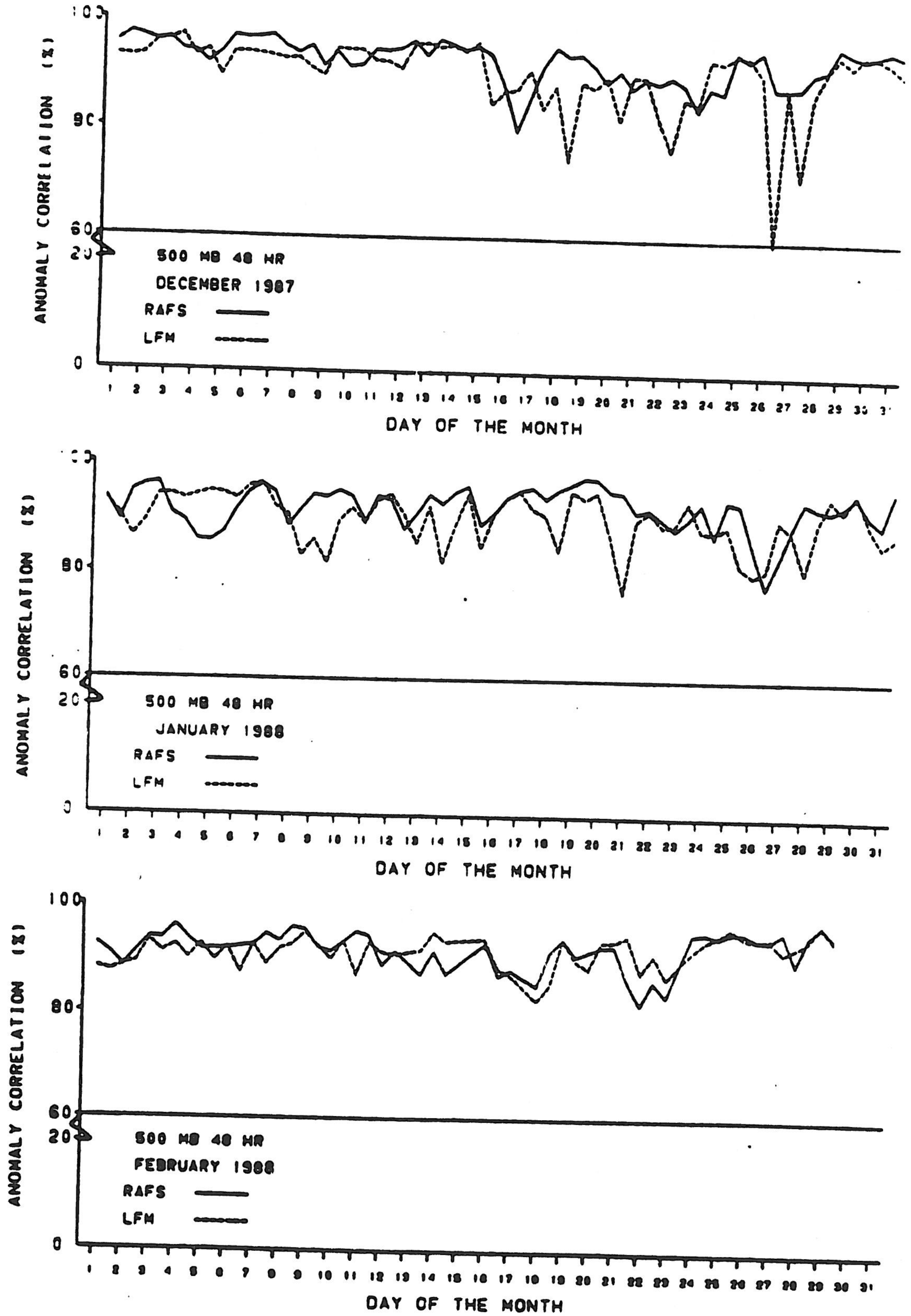
TABLE 1. **MEAN VERIFICATION STATISTICS (THREAT SCORE AND BIAS) FOR LFM AND NGM FORECAST DERIVED FROM DAILY PRECIPITATION SCORES FOR THE WINTER SEASON. VERIFICATION GRID IS LFM GRID WITH NGM FORECAST AMOUNTS INTERPOLATED FROM THE NGM GRID C AND OBSERVED AMOUNTS INTERPOLATED FROM THE 32 KM GRID OF THE NMC 24-HR PRECIPITATION ANALYSIS BY A METHOD THAT CONSERVES TOTAL AREAL PRECIPITATION. 'PTS' INDICATES THE AVERAGE NUMBER OF VERIFYING GRID POINTS OVER THE THREE 24-HOUR FORECAST PERIODS. ONLY LAND POINTS EAST OF THE ROCKY MOUNTAINS ARE CONSIDERED. (BOLD FACE TYPE INDICATES THE WINNER.)**

DECEMBER - FEBRUARY 1987-88 -- WINTER SEASON

THRESH-OLD (IN.)	0-24 HOUR FORECAST				12-36 HOUR FORECAST				24-48 HOUR FORECAST				PTS.
	THREAT		BIAS		THREAT		BIAS		THREAT		BIAS		
	LFM	NGM	LFM	NGM	LFM	NGM	LFM	NGM	LFM	NGM	LFM	NGM	
0.01	0.45	**0.47**	0.89	**0.98**	0.47	0.47	**1.06**	1.09	0.43	**0.46**	**1.16**	1.17	8270
0.25	0.38	0.38	**1.10**	0.87	0.34	**0.38**	1.48	**1.08**	0.29	**0.35**	1.61	**1.16**	1601
0.50	**0.30**	0.29	**1.26**	0.65	0.25	**0.28**	1.74	**0.91**	0.20	**0.23**	1.87	**0.96**	763
0.75	**0.24**	0.17	**1.34**	0.45	0.18	**0.19**	1.90	**0.81**	0.13	**0.15**	2.06	**0.84**	421
1.00	**0.17**	0.10	**1.55**	0.32	0.12	**0.13**	2.36	**0.70**	0.10	0.10	2.41	**0.64**	225
1.50	**0.11**	0.07	**1.68**	0.14	**0.08**	0.01	**3.24**	0.22	0.05	**0.08**	2.65	**0.39**	85
2.00	**0.08**	0.00	**1.30**	0.08	**0.04**	0.00	**3.84**	0.00	**0.03**	0.00	**2.27**	0.11	35
2.50	**0.03**	0.00	**1.25**	0.00	**0.03**	0.00	**3.87**	0.00	**0.02**	0.00	**1.87**	0.00	16
3.00	0.00	0.00	**0.33**	0.00	0.00	0.00	**4.50**	0.00	0.00	0.00	**1.67**	0.00	6
3.50	0.00	0.00	0.00	0.00	0.00	0.00	**2.75**	0.00	0.00	0.00	0.00	0.00	4
4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

Figure 1.

DAILY VARIATION OF 500 MB ANOMALY CORRELATION FOR 48-HOUR FORECASTS FROM THE NGM AND LFM MODELS OVER THE SEASON. FORECASTS ARE VALID ON INDICATED DAY OF THE MONTH.



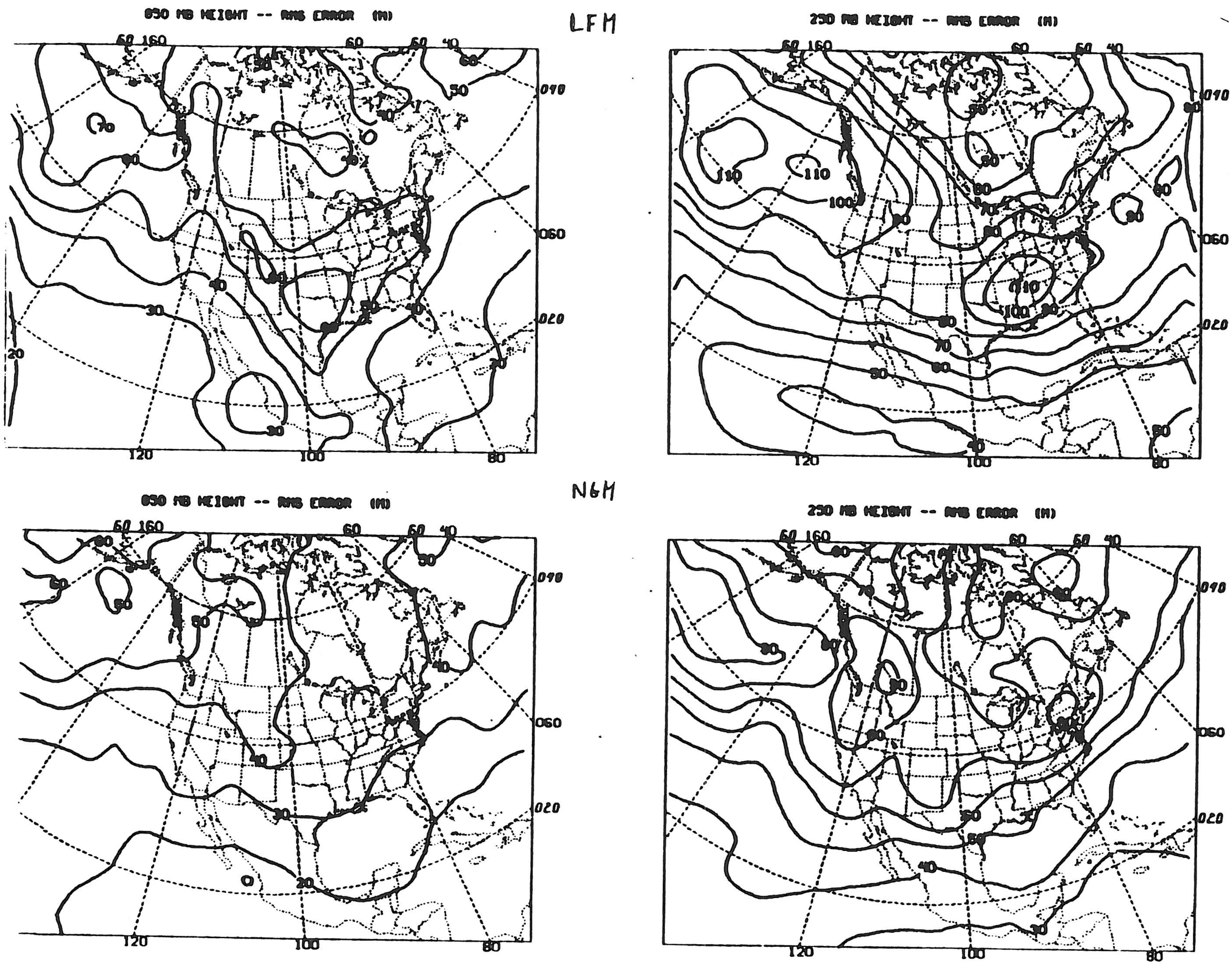


Figure 2. NGM and LFM 48-HOUR FORECAST ROOT-MEAN-SQUARE ERRORS FOR 850 & 250 mb HEIGHT: DEC-FEB 1987-1988

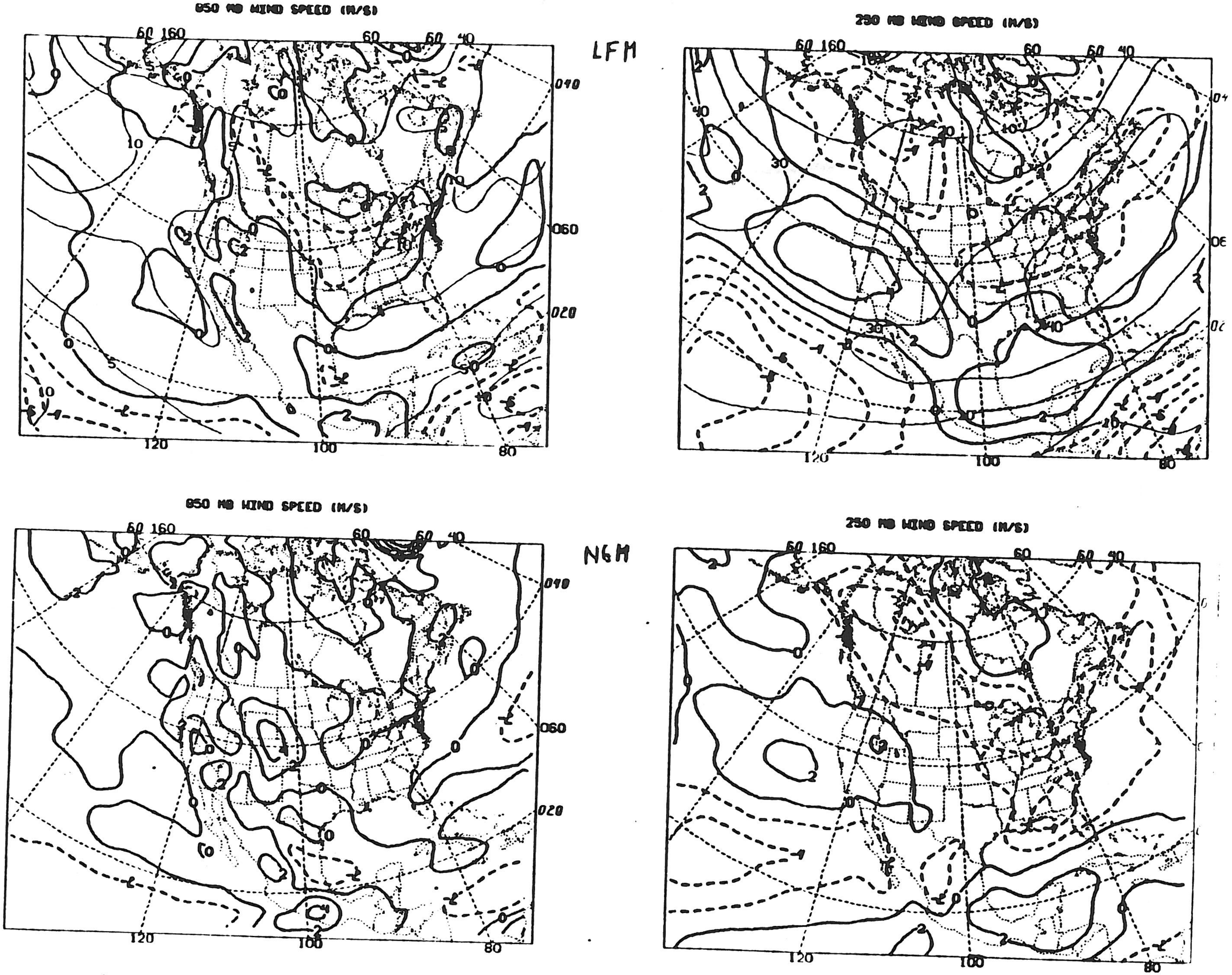


Figure 3. NGM and LFM 48-HOUR FORECAST ROOT-MEAN-SQUARE ERRORS FOR 850 & 250 mb VECTOR WIND: DEC-FEB 1987-1988

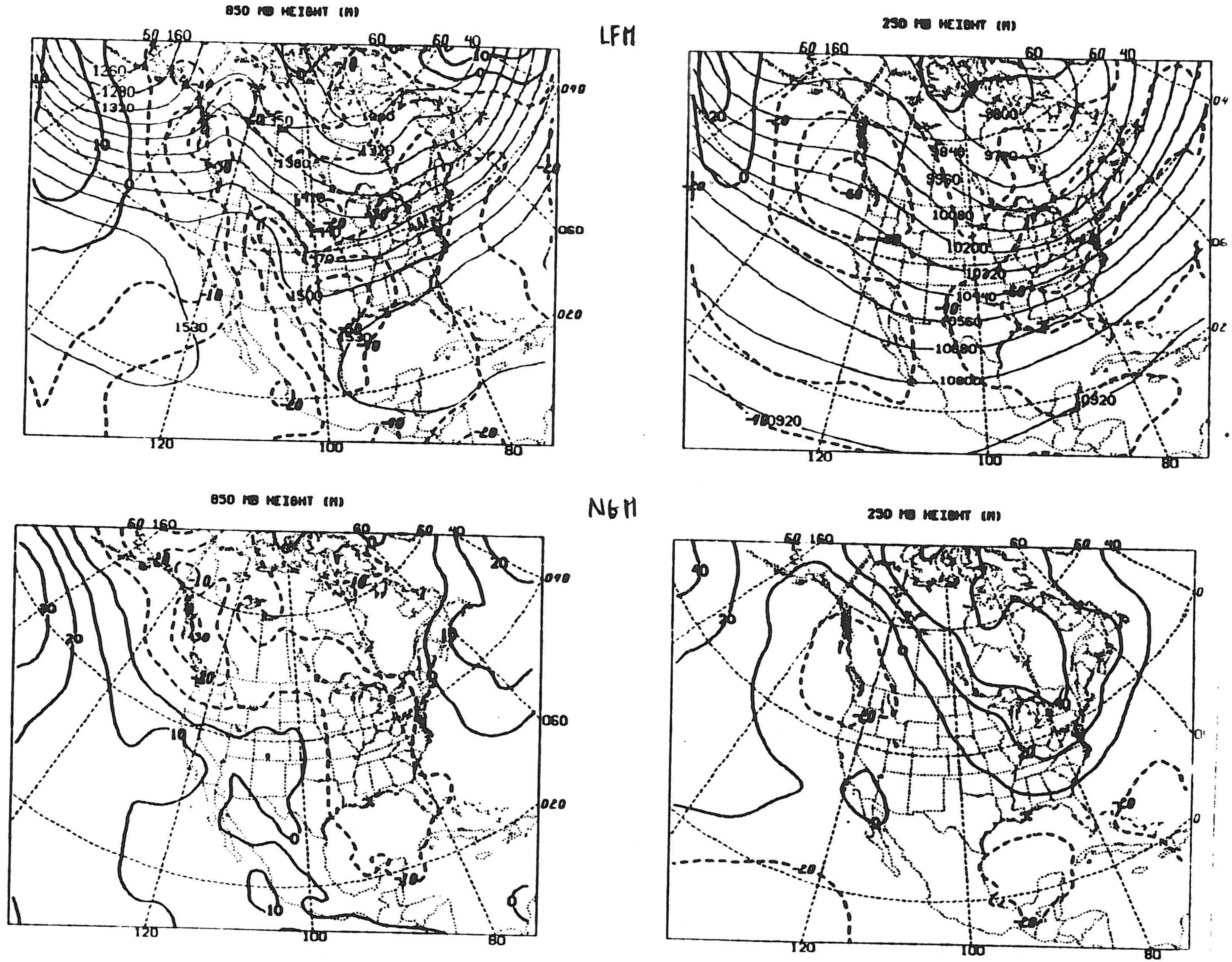


Figure 4. MEAN NGM AND LFM FORECAST ERRORS FOR 850 and 250 mb HEIGHT: DEC-FEB 1987-1988 (THIN LINES ARE THE VERIFICATION.)

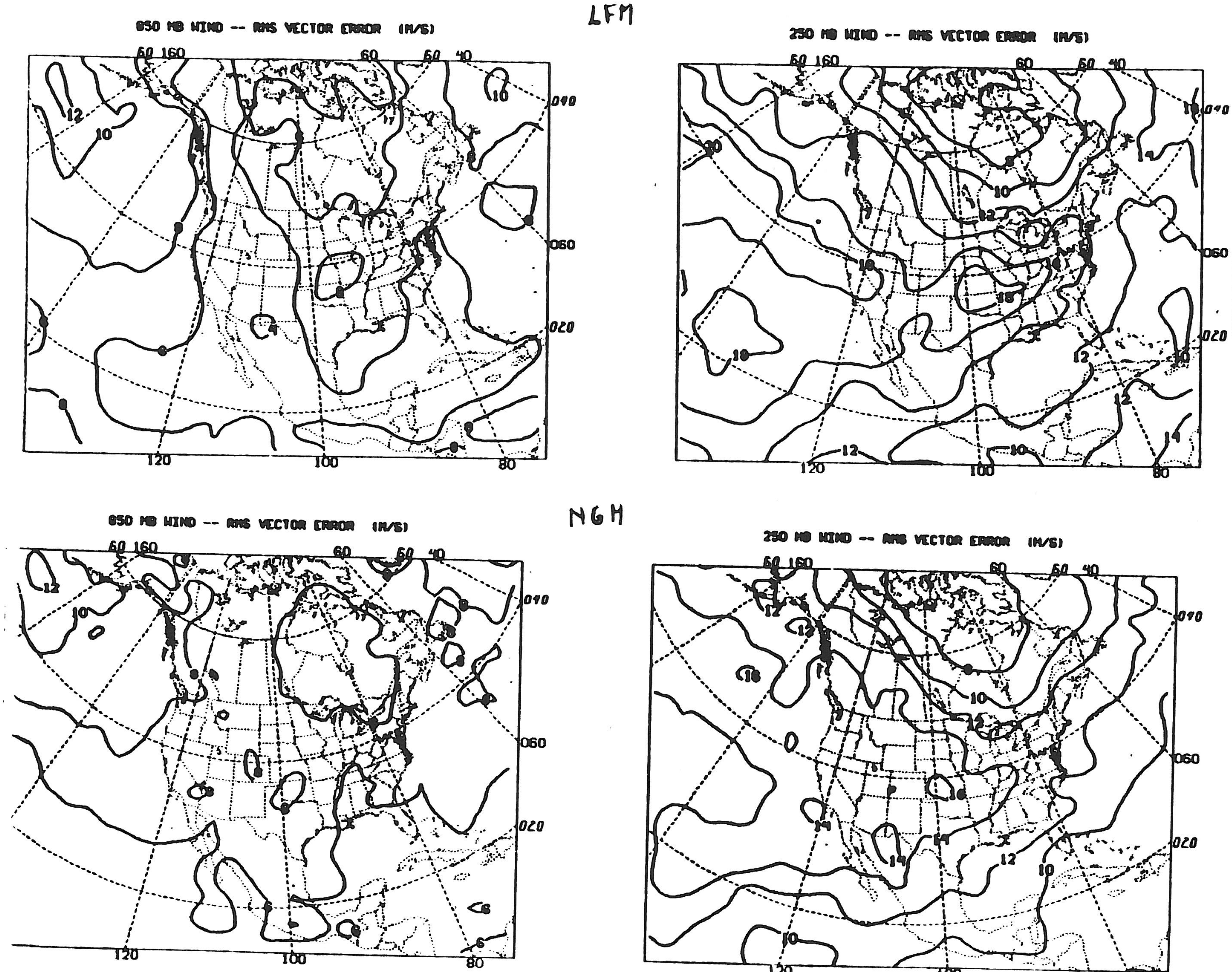


Figure 5. MEAN NGM AND LFM FORECAST ERRORS FOR 850 and 250 mb WIND SPEED: DEC-FEB 1987-1988