WESTERN REGION TECHNICAL ATTACHMENT
NO. 88-16
April 19, 1988

REVIEW OF THE NMC NUMERICAL GUIDANCE SUITE IN 1987 AND A PREVIEW OF CHANGES IN 1988 PART III

Ronald D. McPherson, Editor
Meteorological Operations Division

4. RAFS Precipitation Performance in 1987: David Olson

Figures C-1 through C-4 present verification statistics of rain/no rain predictions by the RAFS (NGM) and the LFM. These statistics--threat score and bias--are calculated for the rain gauges of a 60-station network in the lower 48 states and are averaged by months. The abscissa of each graph is time labeled in months beginning in January 1986; the ordinate is threat score (the higher the better) or bias (unity is perfect), as appropriate.

The threat scores for both 12-24 h (C-1) and 24-36 h (C-3) periods clearly indicate that the LFM has been the better model over the period shown, at least by this measure. Figures C-2 and C-4 suggest that a wet bias in the NGM is at least a contributing factor. During the period July 1986 (when the full physics package was introduced) through August 1987, the NGM bias ranged generally between 1.5 and 2.0, while the LFM averaged 1.2 in the 12-24 h period, and a little higher in the 24-36 h period.

A bright spot is that the NGM bias has declined sharply since August 1987. This may be partly seasonal--a smaller decline is evident in the autumn of 1986--but the decline appears more precipitous than can be explained by seasonal variability. One possibility is that the introduction of the MRF87 into the GDAS in August, substantially improved the moisture first guess for the ROI, but there is no proof of this. The removal of the NGM's cold bias in October also reduced the bias, as noted previously, and this is apparent for November, 1987 in all four diagrams.

We move now to quantitative precipitation forecast verifications. Figures C-5 through C-8 are threat scores and bias' for half-inch 24-48 h forecasts, and the one-inch 12-36 h forecasts. The forecasts are from the LFM, NGM, and the MRF* in the Aviation Run, denoted AVN in the figures. These scores are calculated differently than the rain/no rain scores discussed above. Instead of point verifications, the QPF scores are area-integrals, where "truth" is an analysis of 24 h rainfall reports from all sources such as first order stations, SAO's, and cooperative observers.

Figure C-5 shows the improved warm season performance which started in August 1986, after the introduction of full physics, continued into the warm season of 1987. Interestingly, the AVN had the best cool season scores, and showed sharp improvement in the warm season of 1987. In the one-inch predictions, generally the same statements can be made. One interesting anomaly is November 1987, where the AVN was best, followed closely by the LFM; the NGM was a distant third.

It turns out that this score, even though averaged over a month, was dominated by one event, a major rain episode in the gulf states. Figure C-9 shows the scores only for November 16-17, the time of this episode. The percentages at the bottom of the graph indicate the fraction of the indicated isohyet that this episode contributed to the monthly score. It accounted for 31% of the one-inch verification for the month. Thus, a model doing badly in this one episode will look bad for the month.

Figures C-10 through C-13 are included to illustrate this is indeed the case with the NGM. The actual rainfall for the 24 h period ending 12Z Novermber 17, is shown in Figure C-10. The LFM did quite a remarkable job, not only on the principal maximum in Louisiana and Mississippi, but on the eastward extension into northern Georgia. The AVN, although greatly underestimating the amounts, was also creditable in the placement of the major events. The RAFS misplaced the main event, and greatly underplayed the eastward extension of the rainfall. It thus scored much worse than the other models, in this case.

The above serves as a reminder that verification statistics often bear a much closer examination than is usually given.

---

* The MRF and AVN models have the same physics and are both spectral. The MRF is run only for the 00Z cycle, however, and has forecasts to 10 days. It also has more satellite data in it's analysis because of a later data cutoff time.

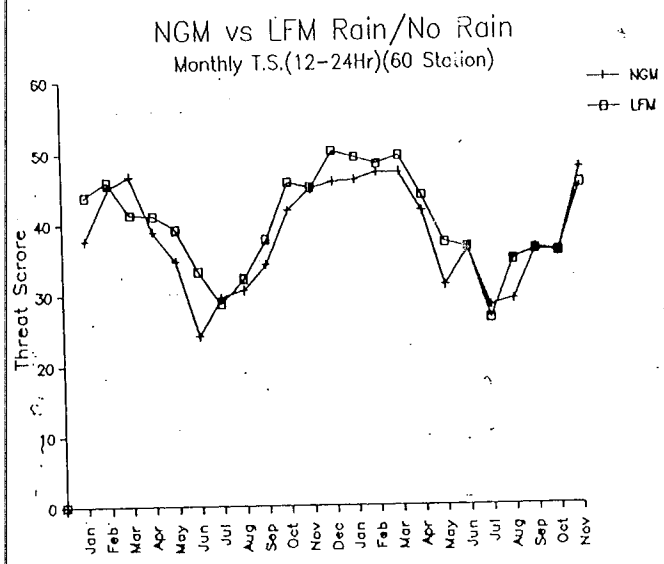

FIGURE C-1

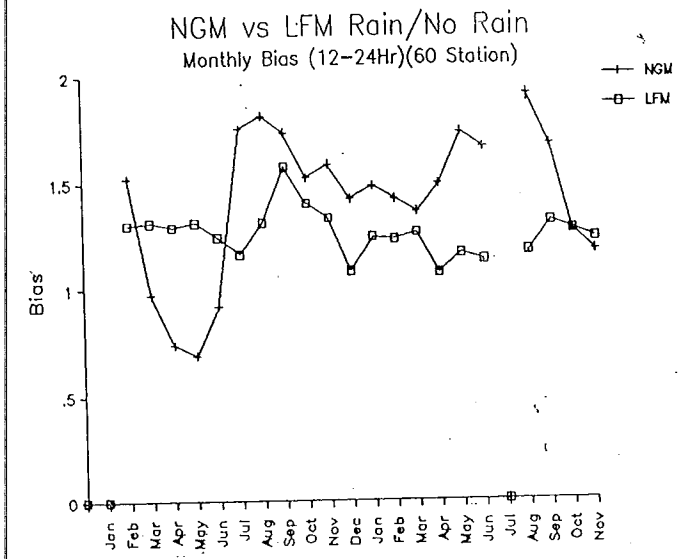

FIGURE C-2

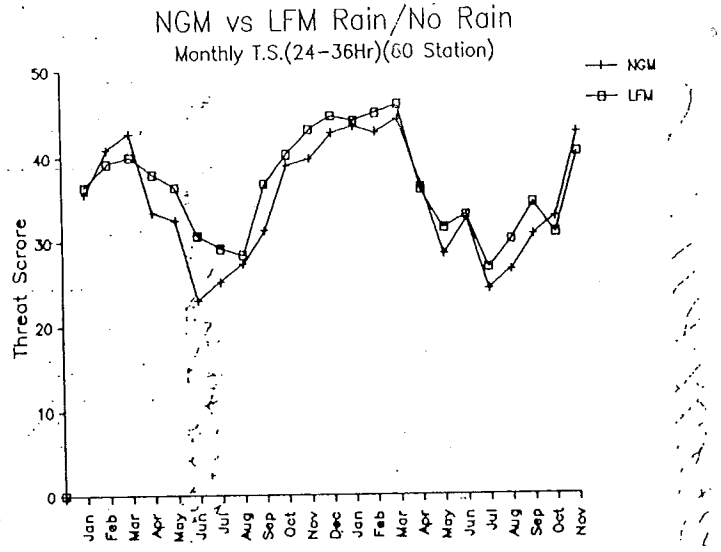

FIGURE C-3

Figure C - 3

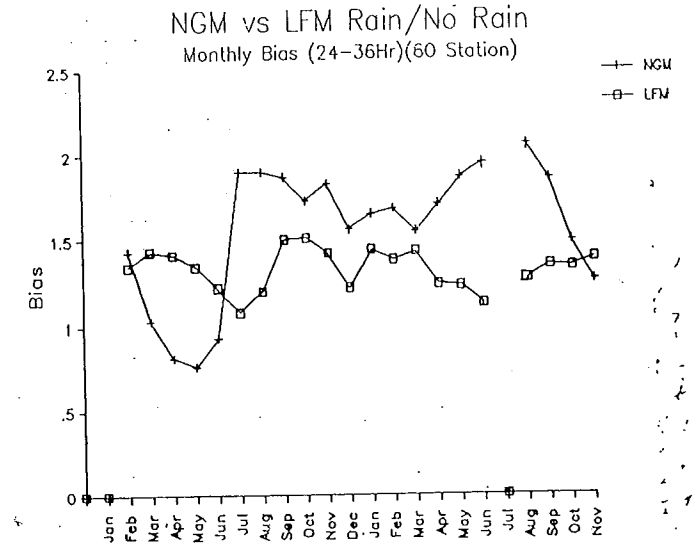

FIGURE C-4

Figure C - 4

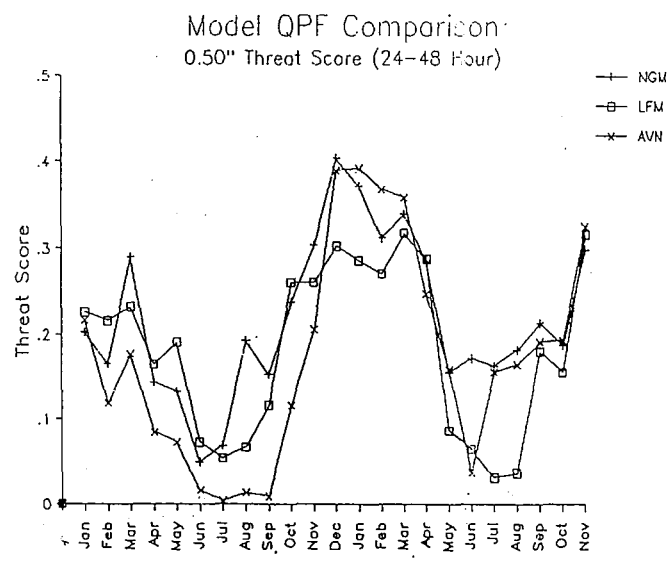

FIGURE C-5

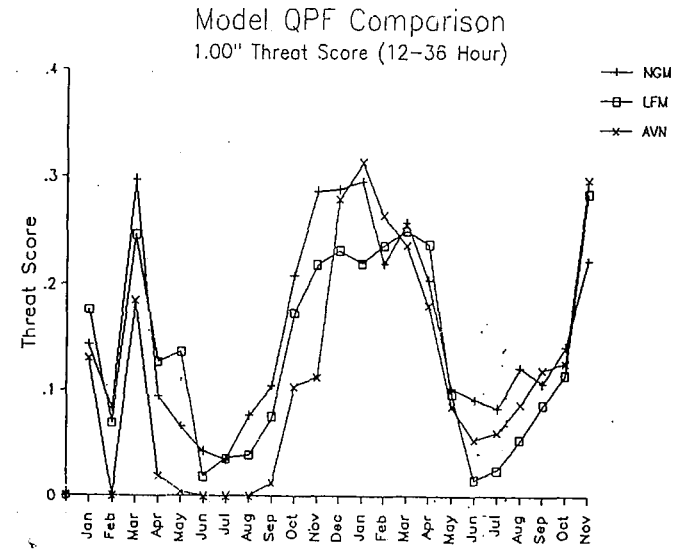

FIGURE C-7

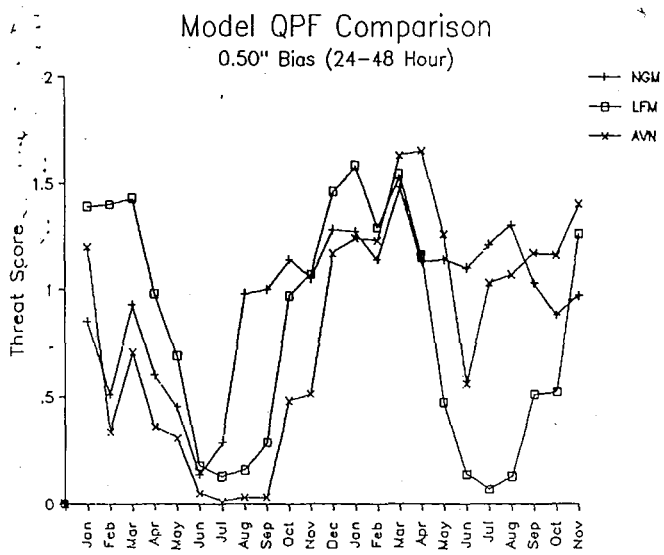

FIGURE C-6

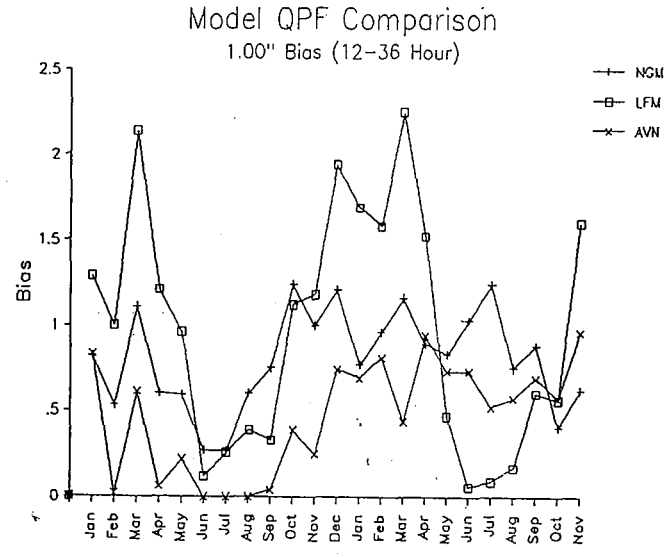

FIGURE C-8

12-36Hr NGM

Nov 16

	TS	Bs
.50	0.397	0.83
1.00	0.169	0.44
2.00	0.020	0.07
3.00	0.0	0.00

Nov 17

TS	Bs
0.359	0.57
0.227	0.67
0.132	0.94
0.061	1.98

LFM

TS	BS
0.406	1.70
0.363	1.65
0.303	1.34
0.076	0.98

TS	BS
0.646	1.37
0.436	1.78
0.238	2.04
0.208	3.28

AVN

TS	BS
0.505	1.58
0.467	0.92
0.225	0.32
0.0	0.00

TS	BS
0.546	1.29
0.377	1.44
0.109	0.81
0.0	0.00

24-48Hr

Nov 16

TS	BS
0.360	0.98
0.034	0.37
0.0	0.00
0.0	0.00

Nov 17

TS	BS
0.324	0.90
0.180	0.81
0.169	0.92
0.207	0.60

TS	BS
0.318	0.74
0.224	0.51
0.0	0.00
0.0	0.00

TS	BS
0.455	1.21
0.353	1.24
0.387	1.81
0.310	2.11

TS	BS
0.464	1.75
0.313	1.52
0.045	0.06
0.0	0.00

TS	BS
0.513	1.22
0.306	1.36
0.045	1.06
0.0	0.23

.50	23%
1.00	31%
2.00	52%
3.00	62%

FIGURE C-9

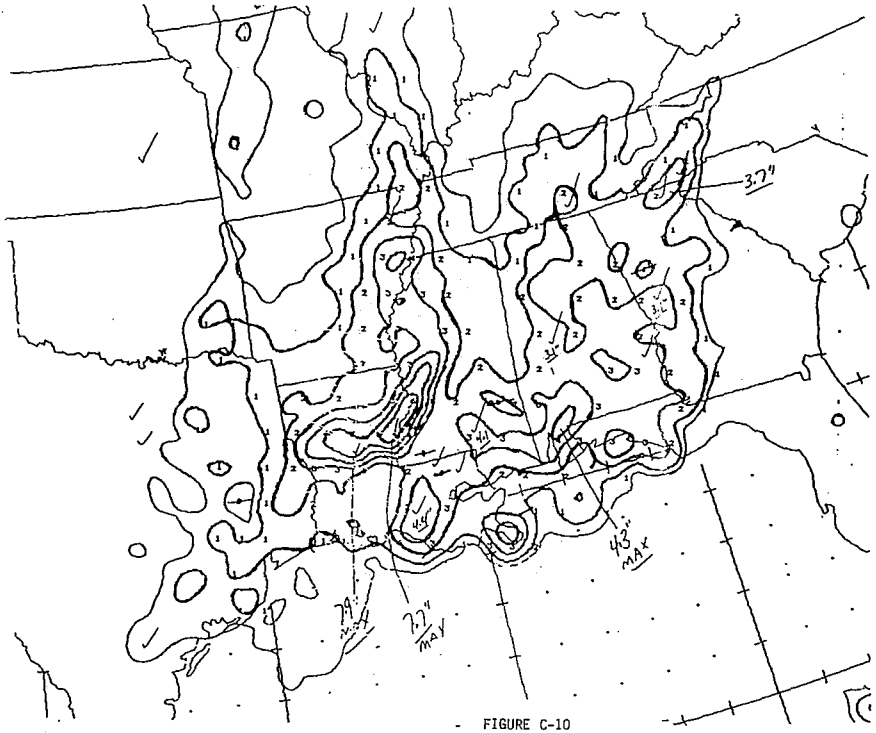

FIGURE C-10

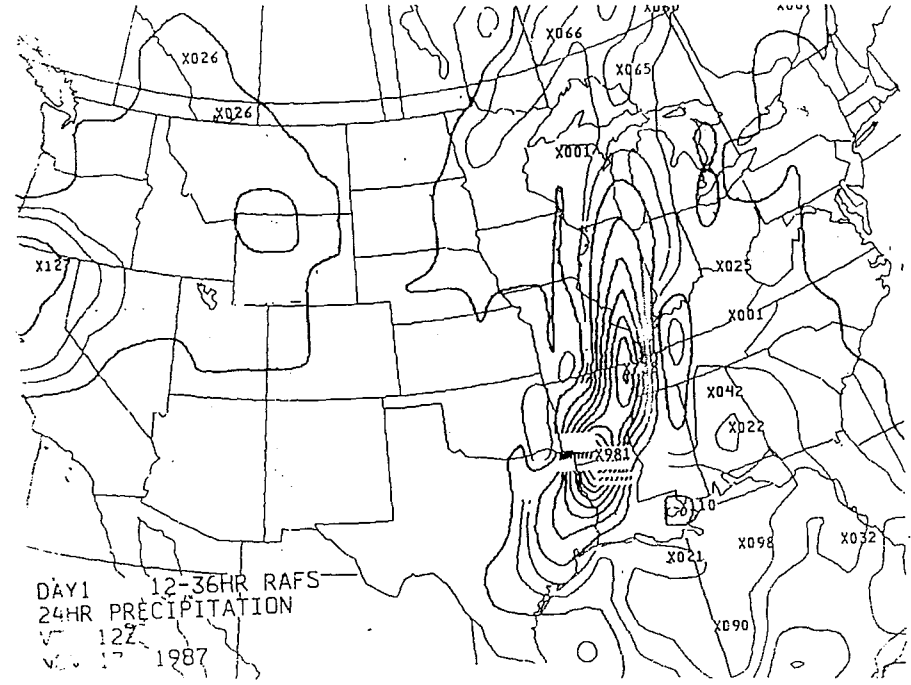

FIGURE C-12

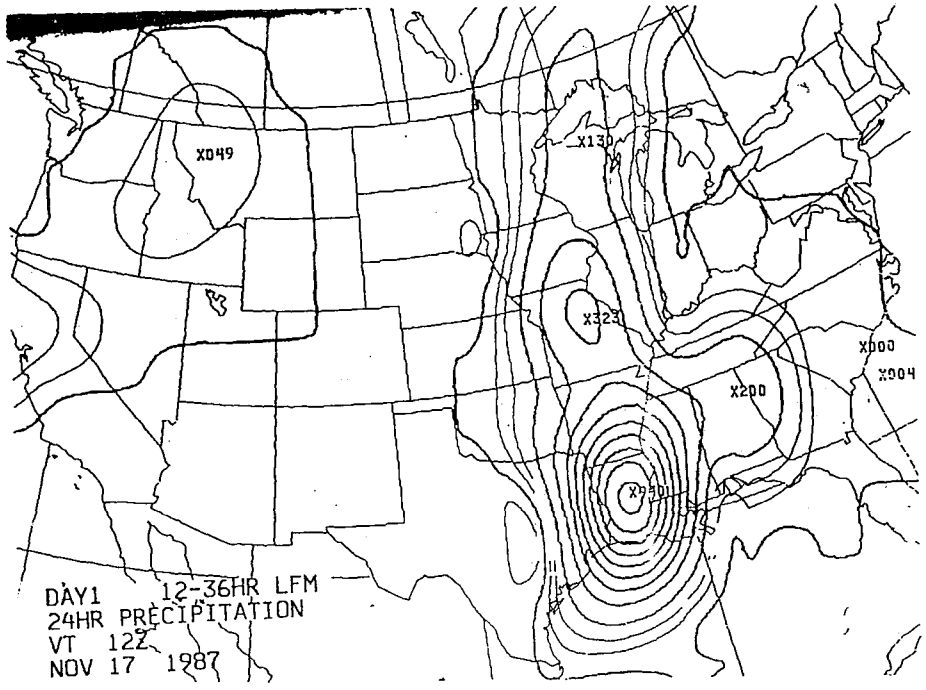

FIGURE C-11

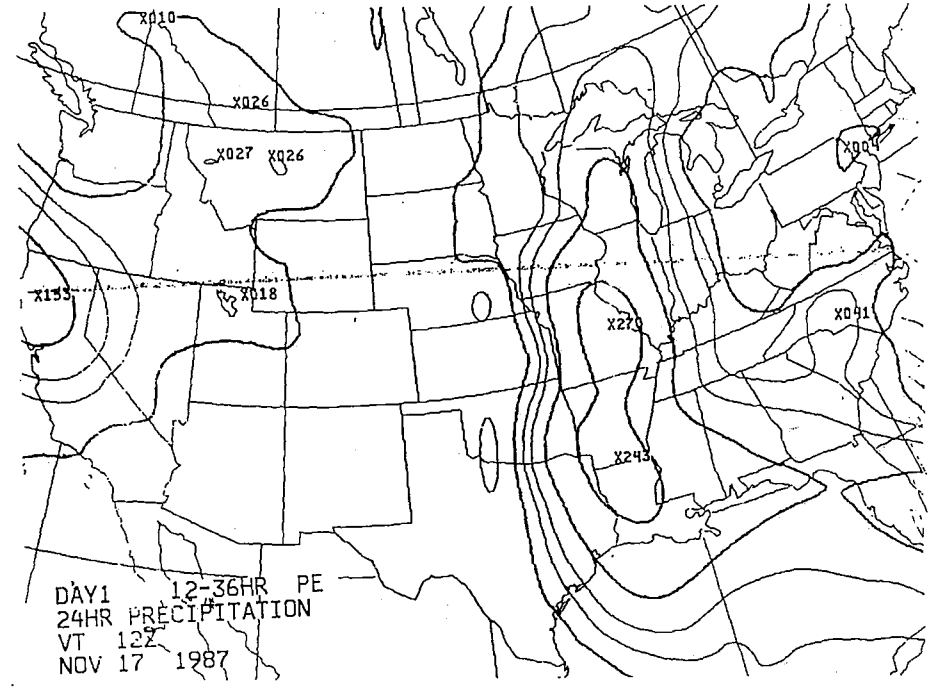

FIGURE C-13