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CENTRAL REGION TECHNICAL ATTACHMENT 89-5

# A SECOND LOOK AT THE 3-5 DAY TEMPERATURE FORECAST ACCURACY

Robert R. Carle
National Weather Service Office
Grand Rapids, Michigan

## 1. Introduction

This paper is a follow-up to Central Region Technical Attachment 88-28, "How accurate are the 3-5 Day Temperature Forecast." In the previous paper, the three to five day temperature forecasts were examined in the winter months. This paper will take a look at the 3-5 day temperature guidance in the summer months. The temperatures were obtained from the AFOS graphics 93P, 94P, and 95P. These graphics contain a maximum-minimum temperature forecast, a POP forecast, and deviations from normal. The Medium Range Forecast Model (MRF) was the main source of numerical guidance used to produce these charts.

## 2. Data

The three months examined were June, July, and August of 1988. All three months recorded above normal average monthly temperatures. July and August averages were more than three degrees above normal. Many record high temperatures were recorded over this three month period, as well as a new record for the number of 90 degree days. The forecast temperatures, along with observed and normal temperatures for the verifying day, are listed in Tables 1-3. The 95P column is the day 5 forecast, 94P-day 4, and 93P-day 3.

TABLE 1
Three to Five Day Maximum/Minimum Temperatures for June 1988

| DATE | 95P MAX/MIN | | 94P MAX/MIN | | 93P MAX/MIN | | OBSERVED MAX/MIN | | NORMAL MAX/MIN | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 85 | 59 | 83 | 60 | 85 | 60 | 91 | 57 | 75 | 51 |
| 2 | 83 | 59 | 84 | 60 | 81 | 58 | 68 | 48 | 75 | 51 |
| 3 | 80 | 59 | 78 | 53 | 75 | 53 | 71 | 41 | 76 | 52 |
| 4 | 75 | 53 | 78 | 53 | 75 | 51 | 75 | 40 | 76 | 52 |
| 5 | 82 | 56 | 78 | 52 | 77 | 51 | 86 | 46 | 76 | 53 |
| 6 | 82 | 54 | 78 | 54 | 84 | 56 | 90 | 59 | 77 | 53 |
| 7 | 82 | 56 | 85 | 57 | 87 | 58 | 90 | 58 | 77 | 53 |
| 8 | 88 | 59 | 88 | 60 | 90 | 60 | 69 | 42 | 77 | 53 |
| 9 | 91 | 60 | 89 | 61 | 82 | 57 | 69 | 41 | 77 | 54 |
| 10 | 91 | 60 | 84 | 55 | 78 | 49 | 73 | 40 | 78 | 54 |
| 11 | 81 | 59 | 85 | 59 | 77 | 49 | 80 | 42 | 78 | 54 |
| 12 | 87 | 60 | 88 | 53 | 87 | 56 | 86 | 57 | 78 | 55 |
| 13 | 92 | 59 | 90 | 60 | 90 | 61 | 91 | 58 | 79 | 55 |
| 14 | 96 | 59 | 88 | 60 | 86 | 61 | 92 | 68 | 79 | 55 |
| 15 | 86 | 58 | 79 | 56 | 85 | 60 | 86 | 64 | 79 | 55 |
| 16 | 77 | 52 | 78 | 54 | 78 | 56 | 81 | 55 | 79 | 56 |
| 17 | 81 | 53 | 78 | 52 | 74 | 49 | 83 | 52 | 79 | 56 |
| 18 | 83 | 53 | 79 | 53 | 82 | 51 | 88 | 56 | 80 | 56 |
| 19 | 84 | 57 | 86 | 60 | 90 | 60 | 92 | 68 | 80 | 56 |
| 20 | 85 | 62 | 91 | 63 | 94 | 68 | 92 | 65 | 80 | 57 |
| 21 | 91 | 59 | 92 | 66 | 87 | 61 | 98 | 58 | 80 | 57 |
| 22 | 92 | 64 | 86 | 58 | 90 | 66 | 91 | 68 | 81 | 57 |
| 23 | 85 | 59 | 86 | 64 | 84 | 64 | 82 | 56 | 81 | 57 |
| 24 | 84 | 60 | 85 | 60 | 84 | 57 | 87 | 56 | 81 | 58 |
| 25 | 87 | 61 | 90 | 64 | 93 | 62 | 97 | 65 | 81 | 58 |
| 26 | 86 | 63 | 88 | 62 | 79 | 63 | 78 | 55 | 81 | 58 |
| 27 | 82 | 57 | 81 | 57 | 79 | 59 | 81 | 49 | 81 | 58 |
| 28 | 84 | 62 | 76 | 53 | 79 | 55 | 70 | 57 | 82 | 58 |
| 29 | 80 | 54 | 78 | 56 | 84 | 59 | 77 | 50 | 82 | 58 |
| 30 | 81 | 58 | 90 | 63 | 75 | 56 | 77 | 45 | 82 | 59 |

TABLE 2
Three to Five Day Maximum/Minimum Temperatures for July 1988

| DATE | 95P MAX/MIN | | 94P MAX/MIN | | 93P MAX/MIN | | OBSERVED MAX/MIN | | NORMAL MAX/MIN | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 91 | 66 | 75 | 54 | 75 | 53 | 78 | 46 | 82 | 59 |
| 2 | 77 | 55 | 79 | 53 | 79 | 53 | 82 | 47 | 82 | 59 |
| 3 | 83 | 56 | 83 | 58 | 81 | 59 | 87 | 47 | 82 | 59 |
| 4 | 85 | 59 | 83 | 59 | 87 | 62 | 93 | 53 | 82 | 59 |
| 5 | 84 | 61 | 89 | 64 | 88 | 62 | 98 | 59 | 83 | 59 |
| 6 | 92 | 66 | 90 | 65 | 94 | 68 | 100 | 65 | 83 | 59 |
| 7 | 90 | 64 | 94 | 70 | 95 | 71 | 98 | 66 | 83 | 60 |
| 8 | 96 | 71 | 95 | 73 | 96 | 72 | 96 | 66 | 83 | 60 |
| 9 | 91 | 72 | 94 | 72 | 92 | 67 | 95 | 66 | 83 | 60 |
| 10 | 88 | 69 | 89 | 65 | 90 | 67 | 89 | 67 | 83 | 60 |
| 11 | 83 | 62 | 84 | 66 | 83 | 66 | 84 | 64 | 83 | 60 |
| 12 | 81 | 58 | 85 | 63 | 84 | 59 | 86 | 56 | 83 | 60 |
| 13 | 86 | 60 | 86 | 62 | 86 | 57 | 92 | 54 | 83 | 60 |
| 14 | 89 | 65 | 89 | 65 | 89 | 63 | 91 | 66 | 83 | 60 |
| 15 | 88 | 64 | 87 | 64 | 86 | 62 | 91 | 59 | 83 | 60 |
| 16 | 83 | 60 | 84 | 59 | 95 | 66 | 94 | 70 | 83 | 60 |
| 17 | 87 | 60 | 93 | 67 | 92 | 65 | 90 | 67 | 83 | 60 |
| 18 | 96 | 71 | 89 | 63 | 90 | 67 | 81 | 65 | 83 | 60 |
| 19 | 91 | 64 | 90 | 66 | 86 | 64 | 87 | 66 | 83 | 60 |
| 20 | 88 | 64 | 80 | 60 | 85 | 65 | 81 | 66 | 83 | 60 |
| 21 | 81 | 56 | 83 | 58 | 81 | 58 | 81 | 64 | 84 | 60 |
| 22 | 83 | 55 | 83 | 58 | 85 | 58 | 83 | 60 | 84 | 60 |
| 23 | 89 | 58 | 88 | 59 | 87 | 59 | 84 | 59 | 84 | 60 |
| 24 | 90 | 62 | 91 | 63 | 90 | 62 | 85 | 57 | 84 | 60 |
| 25 | 93 | 64 | 91 | 63 | 92 | 65 | 82 | 63 | 83 | 60 |
| 26 | 89 | 66 | 91 | 67 | 87 | 64 | 84 | 57 | 83 | 60 |
| 27 | 90 | 68 | 88 | 62 | 85 | 61 | 84 | 55 | 83 | 60 |
| 28 | 90 | 62 | 87 | 62 | 89 | 62 | 93 | 66 | 83 | 60 |
| 29 | 89 | 65 | 91 | 65 | 91 | 65 | 90 | 71 | 83 | 60 |
| 30 | 91 | 65 | 90 | 67 | 95 | 74 | 85 | 68 | 83 | 60 |
| 31 | 89 | 65 | 91 | 67 | 90 | 68 | 86 | 61 | 83 | 60 |

TABLE 3
Three to Five Day Maximum/Minimum Temperatures for August 1988

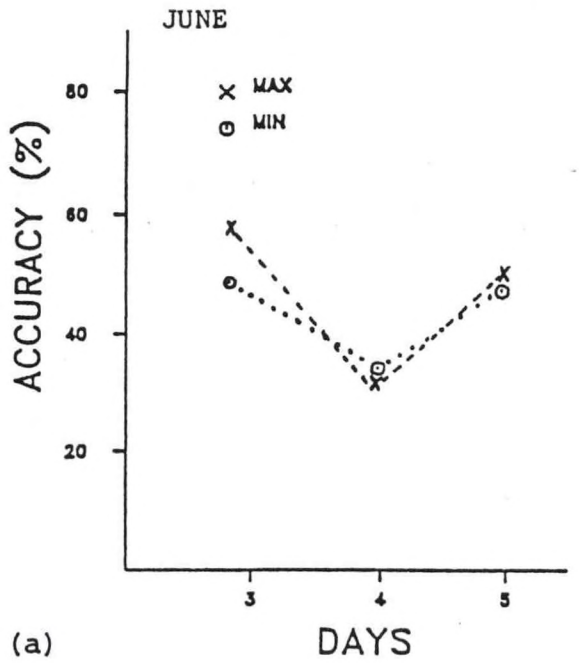
| DATE | 95P MAX/MIN | | 94P MAX/MIN | | 93P MAX/MIN | | OBSERVED MAX/MIN | | NORMAL MAX/MIN | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 91 | 67 | 91 | 66 | 88 | 64 | 98 | 72 | 83 | 60 |
| 2 | 90 | 66 | 90 | 68 | 88 | 68 | 95 | 74 | 83 | 60 |
| 3 | 90 | 69 | 89 | 69 | 90 | 71 | 97 | 76 | 83 | 60 |
| 4 | 89 | 70 | 90 | 71 | 93 | 73 | 96 | 72 | 83 | 60 |
| 5 | 88 | 70 | 89 | 71 | 92 | 71 | 89 | 68 | 83 | 60 |
| 6 | 84 | 63 | 87 | 64 | 88 | 69 | 87 | 65 | 83 | 60 |
| 7 | 89 | 65 | 87 | 66 | 90 | 64 | 93 | 59 | 83 | 59 |
| 8 | 91 | 66 | 91 | 64 | 91 | 65 | 93 | 66 | 82 | 59 |
| 9 | 90 | 64 | 90 | 65 | 89 | 67 | 83 | 72 | 82 | 59 |
| 10 | 89 | 64 | 86 | 64 | 83 | 67 | 83 | 67 | 82 | 59 |
| 11 | 84 | 62 | 86 | 63 | 89 | 64 | 91 | 69 | 82 | 59 |
| 12 | 86 | 61 | 91 | 65 | 92 | 68 | 95 | 72 | 82 | 59 |
| 13 | 92 | 67 | 90 | 65 | 93 | 68 | 93 | 73 | 82 | 59 |
| 14 | 90 | 65 | 90 | 70 | 90 | 71 | 91 | 75 | 82 | 59 |
| 15 | 91 | 69 | 92 | 69 | 93 | 71 | 91 | 64 | 82 | 58 |
| 16 | 94 | 72 | 91 | 68 | 96 | 66 | 95 | 59 | 81 | 58 |
| 17 | 89 | 65 | 92 | 67 | 93 | 68 | 98 | 70 | 81 | 58 |
| 18 | 86 | 66 | 88 | 69 | 85 | 69 | 73 | 59 | 81 | 58 |
| 19 | 82 | 61 | 81 | 59 | 78 | 58 | 76 | 59 | 81 | 58 |
| 20 | 79 | 56 | 79 | 56 | 82 | 57 | 81 | 55 | 81 | 58 |
| 21 | 81 | 59 | 87 | 62 | 86 | 61 | 79 | 54 | 80 | 58 |
| 22 | 82 | 64 | 83 | 66 | 82 | 59 | 75 | 52 | 80 | 57 |
| 23 | 85 | 64 | 88 | 62 | 86 | 63 | 76 | 59 | 80 | 57 |
| 24 | 89 | 67 | 84 | 64 | 81 | 64 | 76 | 59 | 80 | 57 |
| 25 | 84 | 60 | 80 | 57 | 82 | 60 | 75 | 59 | 80 | 57 |
| 26 | 79 | 54 | 81 | 57 | 81 | 56 | 73 | 52 | 79 | 56 |
| 27 | 79 | 56 | 80 | 57 | 74 | 52 | 69 | 51 | 79 | 56 |
| 28 | 76 | 55 | 74 | 54 | 75 | 54 | 71 | 52 | 79 | 56 |
| 29 | 73 | 51 | 72 | 52 | 72 | 54 | 71 | 47 | 79 | 56 |
| 30 | 73 | 49 | 72 | 47 | 76 | 50 | 75 | 46 | 78 | 56 |
| 31 | 77 | 49 | 77 | 50 | 77 | 50 | 80 | 55 | 78 | 55 |

4. Results

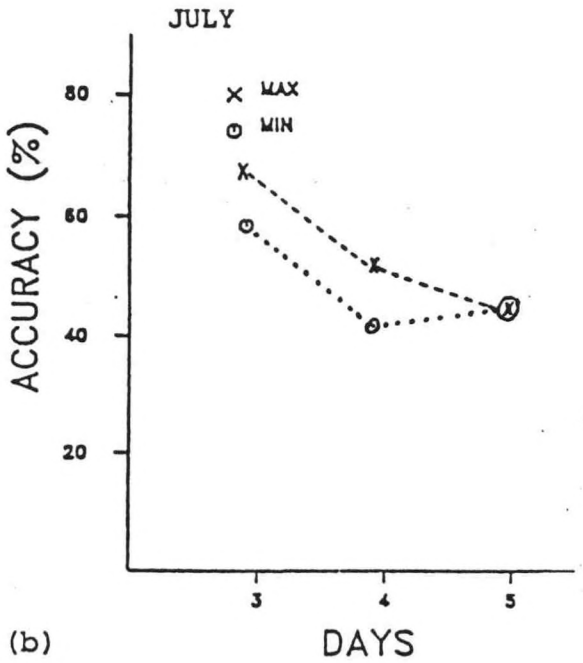
The same criteria, a plus or minus four degree temperature spread, was used to check the forecast temperature accuracy. If the forecast temperature was within the eight degree spread, then it was considered to be an accurate forecast. The accuracy has been calculated on a month by month basis. Accuracy of the forecasts are displayed in Figures 1a-c. The most accurate month overall, of the three, was July.

Over the six months studied, the Medium Range Forecast did its worst job at the end of August. The big break from the summer's heat wave finally came with observed high temperatures in the 70's and lows in the 50's. The MRF did not pick up this major change in the atmosphere and start forecasting temperatures close to what was occurring until about a week after we cooled off. Figure 1d represents the average accuracy of the forecast temperatures for the three month period. Figure 1e is the average accuracy for the six months studied. In most cases, forecast accuracy deteriorated from day 3 to day 5 with the maximum temperature forecast being more accurate than the minimum temperature forecast. The exception was June (Figure 1a) when the 5 day forecast was almost as good as the 3 day forecast.

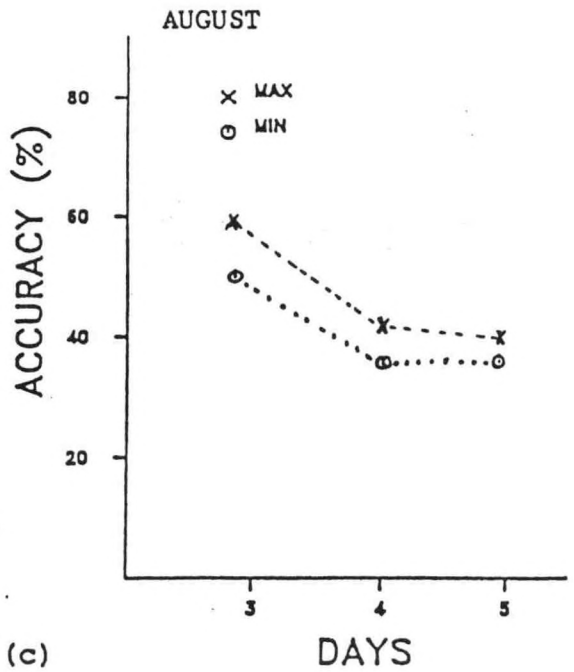
It was expected that the MRF would do a better job of forecasting temperatures in the summer. This is simply because the localized effects of Lake Michigan, on temperatures in the Grand Rapids area, are quite a bit less than in the winter. There was a little improvement in forecast accuracy during the summer, but not much. It appears the best it can hope for, from the MRF guidance, is about 50 to 60 percent accuracy for day 3 and around 40 percent accuracy for days 4 and 5.


JUNE
MAX
MIN
ACCURACY (%)
80
60
40
20
3
4
5
DAYS

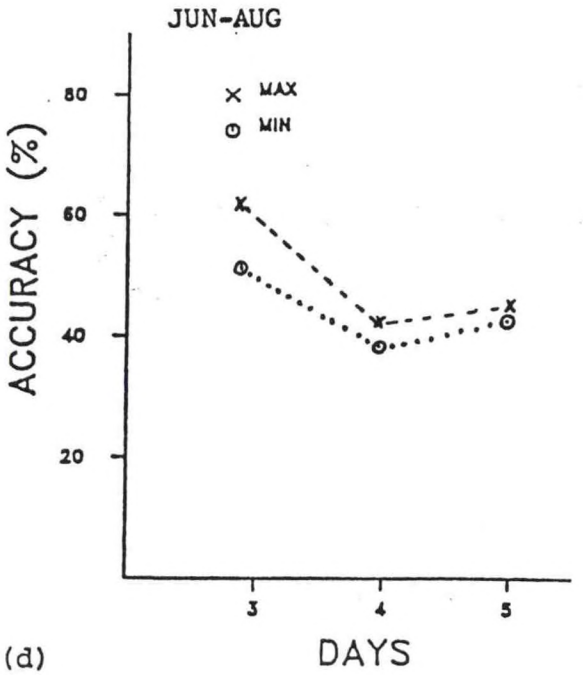
(a)


JULY
MAX
MIN
ACCURACY (%)
80
60
40
20
3
4
5
DAYS

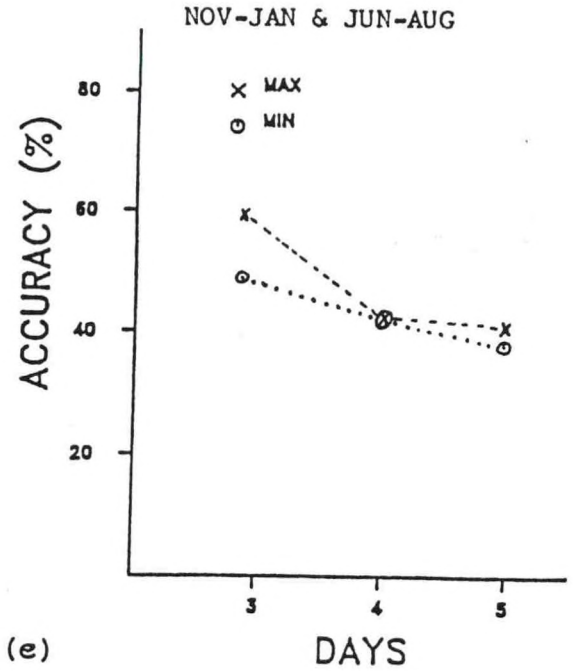
(b)


AUGUST
MAX
MIN
ACCURACY (%)
80
60
40
20
3
4
5
DAYS

(c)


JUN-AUG
MAX
MIN
ACCURACY (%)
80
60
40
20
3
4
5
DAYS

(d)




(e)