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## CENTRAL REGION TECHNICAL ATTACHMENT 88-28

## HOW ACCURATE ARE THE 3-5 DAY TEMPERATURE FORECASTS?

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## 1. Introduction

Anyone who has ever worked as a forecaster at a WSFO has had to make an extended forecast (EFP). The backbone of making the extended temperature forecasts are the AFOS graphics 93P, 94P, and 95P. These graphics contain a maximum-minimum temperature forecast, as well as a POP forecast. They also indicate the deviation from normal for temperature and precipitation. Since Grand Rapids, Michigan is one of the forecast points, three months of maximum/minimum temperature data were easily obtained for analysis. It was hoped that the accuracy of the extended forecasts in predicting cold air outbreaks could be determined. Cold air outbreaks in the winter months usually mean lake effect snow for the east shore of Lake Michigan.

## 2. How The Maps Are Produced

The main numerical guidance used to produce the three to five day temperature forecast comes from the 00Z run of the Medium Range Forecast Model (MRF). The MRF is an 18 layer spectral model that is run out to ten days (240 hours). Other numerical guidance is available in the form of output from the European Center for Medium Range Forecasting (ECMRF) and the United Kingdom Medium Range Forecast Model (UKMET). The forecasters at NMC make adjustments to the output before committing to set final values.

## 3. Data

Three months of data were collected for November and December 1987, and January 1988. The forecast temperatures along with the 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 November 1987

DATE	95P		94P		93P		OBSERVED		NORMAL	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	44	27	63	45	66	41	53	46	53	35
2	62	47	73	46	69	48	66	52	53	35
3	72	50	66	55	72	53	73	55	52	35
4	57	49	64	49	61	49	68	48	52	35
5	56	43	52	45	44	30	48	36	51	34
6	44	36	43	28	37	28	45	28	51	34
7	45	32	44	23	46	30	55	30	50	34
8	49	37	47	37	51	38	55	36	50	33
9	41	28	44	36	43	33	39	28	49	33
10	39	28	37	28	38	29	38	20	49	33
11	32	23	29	25	44	27	39	18	48	32
12	45	32	50	34	48	33	53	30	48	32
13	49	39	50	39	47	34	52	36	47	32
14	49	39	48	35	46	35	49	35	46	32
15	51	36	48	38	47	38	61	31	46	31
16	48	38	54	41	56	40	64	41	46	31
17	46	39	53	38	56	44	64	42	45	31
18	53	40	43	39	40	37	45	32	45	30
19	29	25	25	24	33	26	44	30	44	30
20	31	14	31	22	33	22	31	20	44	30
21	35	23	39	21	37	24	29	14	43	29
22	43	30	46	30	45	28	46	22	43	29
23	43	32	46	32	46	32	50	39	42	28
24	46	34	47	34	41	32	42	35	42	28
25	50	36	41	29	45	29	36	34	41	28
26	43	28	46	31	48	32	38	30	41	27
27	45	30	48	33	44	29	38	33	40	27
28	46	31	42	27	45	30	47	37	40	26
29	46	30	47	33	46	38	48	34	40	26
30	45	32	45	30	44	34	41	33	39	26

TABLE 2  
 Three to Five Day Maximum/Minimum Temperatures for December 1987

<u>DATE</u>	<u>95P</u>		<u>94P</u>		<u>93P</u>		<u>OBSERVED</u>		<u>NORMAL</u>	
	<u>MAX</u>	<u>MIN</u>	<u>MAX</u>	<u>MIN</u>	<u>MAX</u>	<u>MIN</u>	<u>MAX</u>	<u>MIN</u>	<u>MAX</u>	<u>MIN</u>
1	43	33	38	31	38	29	34	29	39	25
2	39	29	38	29	36	28	31	27	38	25
3	38	29	39	28	36	27	33	29	38	25
4	41	30	38	28	34	25	33	28	38	24
5	40	31	35	26	35	30	34	23	37	24
6	38	29	43	34	38	27	34	20	37	24
7	43	34	38	30	41	31	36	29	36	23
8	37	28	43	31	48	38	50	35	36	23
9	39	31	44	37	44	37	53	39	36	23
10	39	32	39	32	38	33	42	28	35	22
11	34	29	37	29	37	30	41	31	35	22
12	34	28	35	28	35	31	39	32	35	22
13	31	26	32	27	31	28	34	32	34	21
14	29	23	27	24	27	23	33	30	34	21
15	28	20	29	23	34	23	35	29	34	21
16	30	22	27	21	30	24	34	30	33	20
17	25	18	26	21	26	19	30	25	33	20
18	28	20	27	18	28	19	30	25	33	20
19	28	17	28	21	32	22	36	30	33	20
20	32	21	31	22	39	28	39	31	32	19
21	33	23	32	27	31	27	39	29	32	19
22	27	19	32	23	32	24	35	32	32	19
23	33	26	37	29	33	24	37	31	32	19
24	33	28	38	29	32	27	45	33	31	18
25	37	29	26	24	25	20	41	32	31	18
26	20	19	19	14	22	18	32	24	31	18
27	18	8	27	17	34	21	34	24	31	18
28	31	23	34	26	37	26	32	23	31	18
29	36	28	34	26	37	29	26	3	31	17
30	34	26	41	33	37	28	29	0	30	17
31	42	36	40	33	35	25	37	20	30	17

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

DATE	95P		94P		93P		OBSERVED		NORMAL	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
1	35	30	32	26	22	21	20	13	30	17
2	26	18	19	14	23	12	24	12	30	17
3	31	22	27	14	23	8	30	16	30	16
4	27	21	22	14	24	12	27	4	29	16
5	17	5	16	5	12	3	9	-5	29	16
6	11	-3	8	-4	8	-5	13	-12	29	16
7	14	0	17	0	18	-1	11	-15	29	16
8	19	11	24	10	20	5	20	-13	29	15
9	12	1	16	4	15	0	17	1	29	15
10	13	-2	25	7	19	5	15	-5	29	15
11	29	14	22	7	29	11	29	6	29	15
12	34	16	33	20	35	18	40	22	29	15
13	30	16	25	13	26	15	24	4	29	15
14	24	8	22	8	21	7	18	-6	29	15
15	32	15	33	13	27	12	31	18	29	15
16	40	21	32	17	37	20	45	30	29	15
17	39	22	45	29	41	29	42	32	28	15
18	40	29	45	31	44	31	35	22	28	15
19	47	39	44	31	38	26	34	22	28	15
20	42	31	37	20	35	23	42	29	29	14
21	31	17	28	18	32	21	31	19	29	14
22	28	17	32	18	33	19	29	14	29	14
23	26	13	28	17	26	17	27	22	29	14
24	26	11	21	7	27	14	33	22	29	14
25	24	9	30	16	28	13	29	12	29	14
26	29	16	23	10	19	6	21	11	29	14
27	25	10	25	13	17	5	19	5	29	14
28	34	19	31	14	22	7	29	15	29	14
29	38	24	36	19	31	14	45	20	29	14
30	34	24	37	23	44	31	52	43	29	14
31	36	22	34	26	42	30	52	36	29	14

#### 4. Results

To check the accuracy of the 3-5 day temperature forecasts, a four degree temperature spread in the forecast to the observed temperature was allowed. If the forecast temperature was within the four degree spread, then it was considered to be an accurate forecast. The accuracy was calculated on a month by month basis.

As you would expect, the temperature forecasts were most accurate when they were forecast close to the normals for that time of the year. Grand Rapids did not see any Arctic outbreaks of cold air in December. Temperatures were above

normal most of the month, except for the last few days when minimums fell to near zero. The minimum temperature forecasts at that time were not even close. The numerical guidance tried to pick up on the cold air outbreak that occurred during the first part of January, when record low temperatures were set, but failed to forecast accurate temperatures! The accuracy of the forecast are displayed in Figures 1a-c. Notice that the forecast temperatures deteriorated as the forecast progressed in time from three to five days. The average accuracy for forecast temperatures for the three months (Figure 1d) reflects the same trend in deterioration. Clearly, forecasters must approach the three to five day forecast with caution and use all information available to them to adjust the guidance.

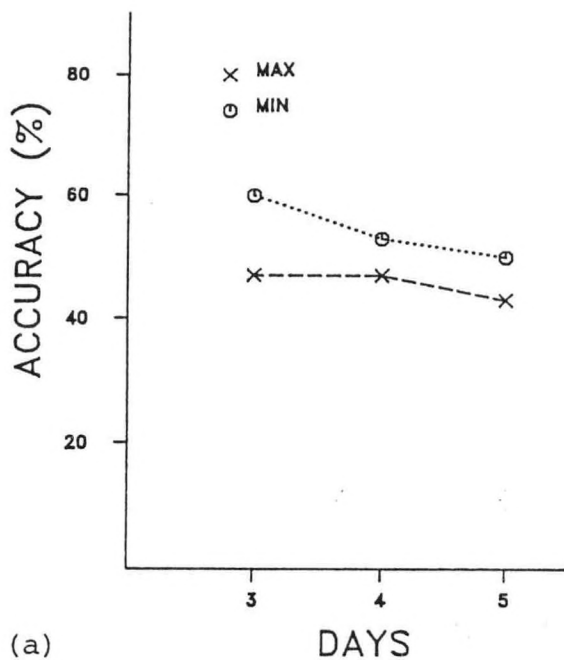
## 5. References

National Weather Service, 1982: Operations of National Meteorological Center, Forecast Division, Basic Weather Branch, Medium Range Forecast Function. NWS Technical Procedures Bulletin No. 402, NOAA, Washington D.C., 4 pp.

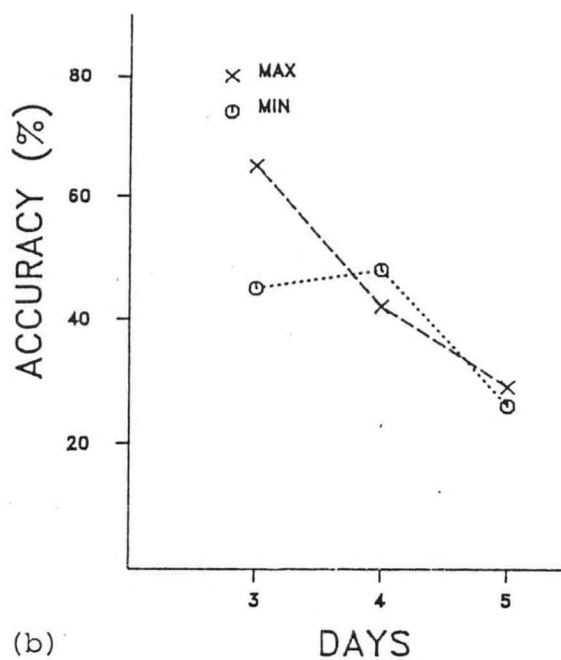
National Weather Service, 1985: Forecasting Handbook No. 1 Chapter VII, Section B. Medium Range Forecasts, pp. 37-43.



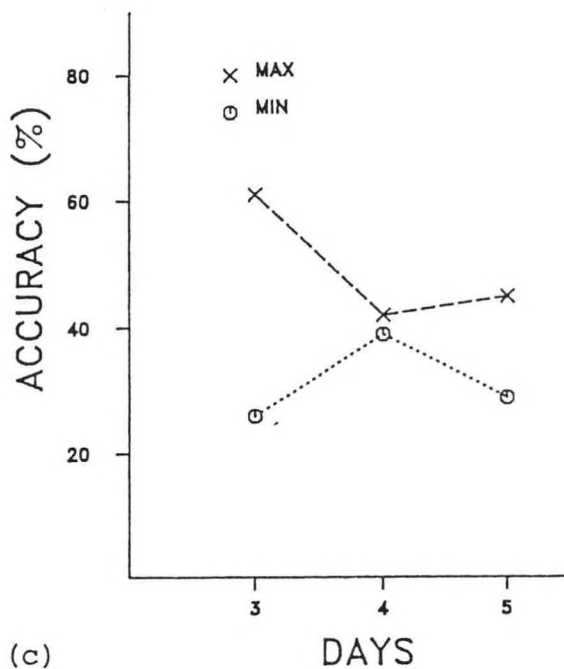
NOVEMBER



DECEMBER



JANUARY



NOV - JAN

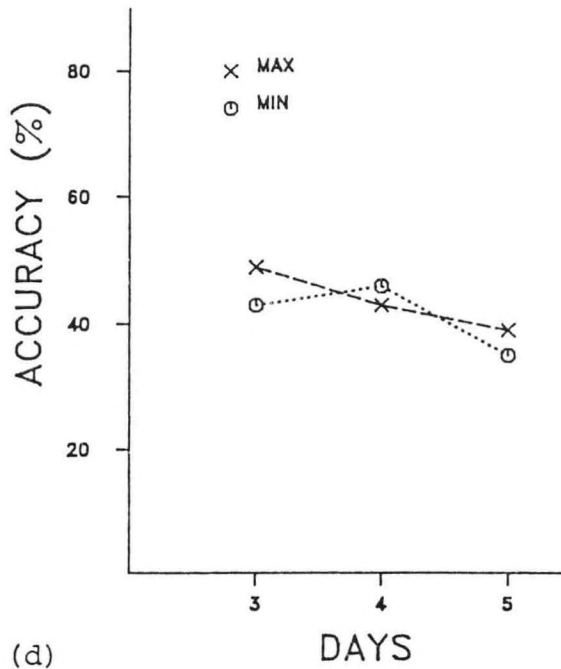


Figure 1. Accuracy of maximum and minimum temperatures for the 3-5 day forecast period from the Medium Range Forecast Model: (a) November, (b) December, (c) January, and (d) November-January three month average.