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CRH SSD
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CENTRAL REGION TECHNICAL ATTACHMENT 86-6

RECORD WARMTH...MOS CAN'T COPE

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January 1986 was the warmest in 115 years of record at Denver. Maximum temperatures exceeded the previous high mean by 1.8°F and were 11.6° above normal. Minimum temperatures were 10.0° above normal.

As the attached Figs. 1 through 4 (produced by Western Region's verification package) show, MOS was generally unable to cope with the persistent unseasonable warmth. The proportion of MOS forecasts that were underforecasts ranged from 67 to 85 percent. The problems were severe in all periods, but in the extreme 32 percent of all 4th period maximums (from 12Z) were 10 or more degrees too low. (As an editorial comment there probably would have been several more large busts on maximums except for several days when wave clouds depressed maximums. It's doubtful that the MOS forecasts "considered" the probability of wave cloud formation.)

Local forecasts were able to improve on MOS, partly by recognizing that we were in a very anomalous pattern which was unusually persistent. The Mean Algebraic Errors (which give the bias) show that in all projections for both cycles the bias was better for the local forecaster than for MOS.

Although specific MOS equations for Denver were not available, climatology is a MOS predictor which often shows up in the MOS equations. An example is the sine/cosine of the day of the year (see Technical Procedures Bulletin No. 356). Climatology becomes more important in the later periods and is probably a most important predictor in the last period which is forecasting a maximum/minimum for 0 to 12 hours beyond the last available LFM forecasts (this is suggested in the referenced TPB). This would explain why MOS's performance deteriorates with time.

Pueblo and Colorado Springs, which are not verified in the NVP but are verified manually, experienced similar errors during January. Colorado Springs also had a record warm January while Pueblo missed a record by 0.1°F.

TEMPERATURE VERIFICATION

FROM 1/ 1 TO 1/ 31 FCSTR: ALL

CYCLE 12Z STATION: DEN PERIOD ALL

	1		2		3		4		ALL	
	FCSTR	MOS	FCSTR	MOS	FCSTR	MOS	FCSTR	MOS	FCSTR	MOS
* FCSTS	31		31		31		31		124	
MAE (DEG)	3.9	5.0	3.5	4.9	4.7	4.8	6.1	7.9	4.5	5.7
% FCSTR IMP OVR MOS (MAE)	23		27		2		22		19	
% HIGH	32	22	29	6	32	16	32	22	31	16
% LOW	48	77	54	77	58	77	64	70	56	75
% CORRECT	19	0.0	16	16	9	6	3	6	12	7
% GE 2 DEG ERR	64	87	70	77	77	80	93	87	76	83
% GE 10 DEG ERR	6	9	6	9	9	9	22	35	11	16
% MOS UNCHANGED	9		9		22		6		12	
% MOS RAISED	74		67		48		77		66	
% MOS LOWERED	16		22		29		16		20	
% MOS CHGD CORRECT	75		60		54		68		30	
* ACTUAL TEMP CHGS >10 DEG	7		7		7		6		27	
MAE (DEG) WHEN >10 DEG CHGS	5.8	6.2	3.8	4.5	4.2	5.7	5.1	7.3	4.7	5
MEAN ALG. ERROR	-2.6	-3.8	-1.6	-4.1	-2.4	-3.5	-3.4	-5.1		

Fig. 1. Temperature verification statistics for Denver -- January 1986, 12Z cycle.

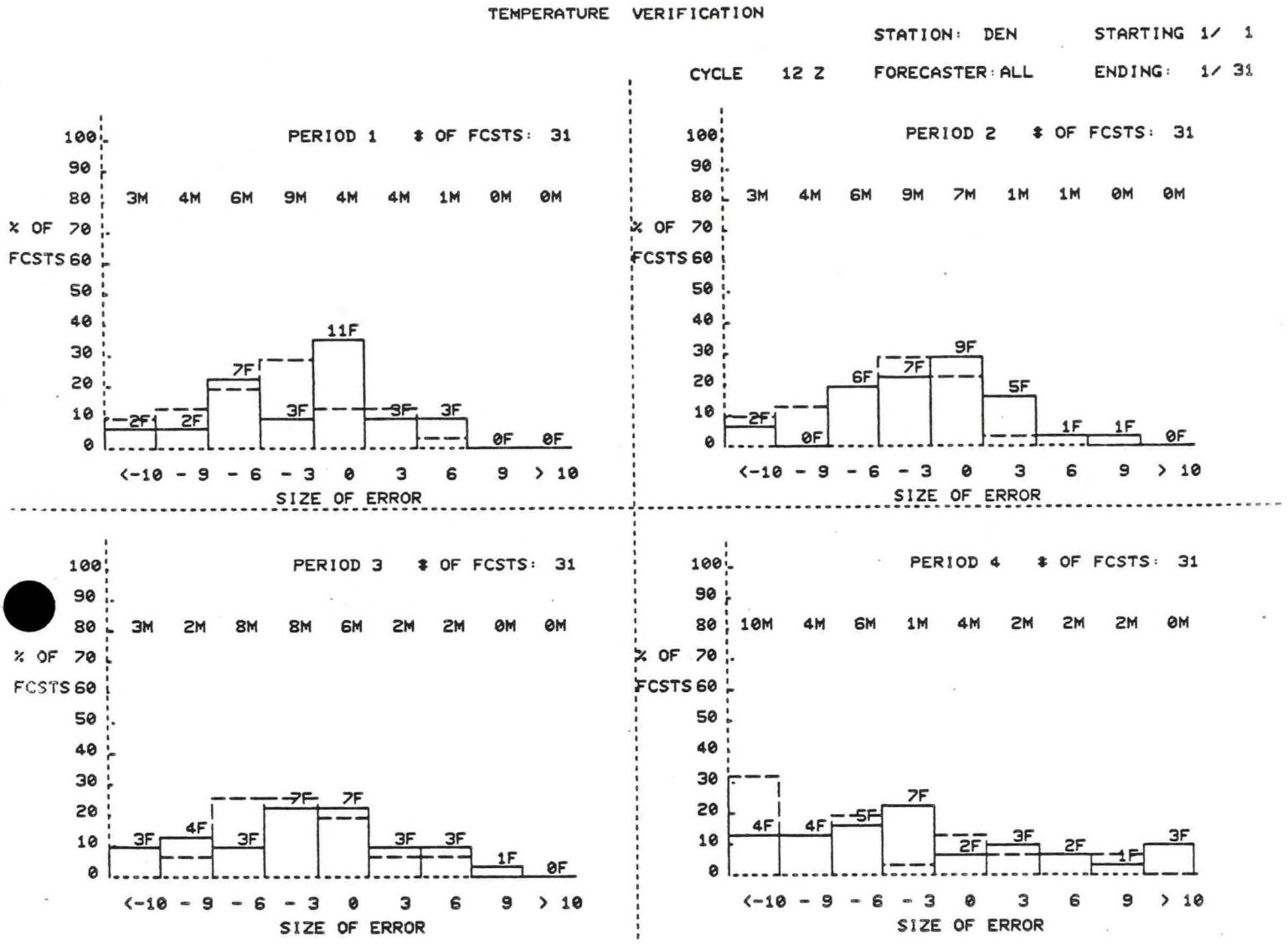

Fig. 2. Bar graphs (solid for local forecaster and dashed for MOS) showing percentages of total forecasts that were in each range. Numbers followed by F are numbers of WSFO forecasts in each range, and numbers followed by M are likewise for MOS. 12Z cycle -- Janaury 1986.

TEMPERATURE VERIFICATION

FROM 1/ 1 TO 1/ 31 FCSTR: ALL

CYCLE 00Z STATION: DEN PERIOD ALL

	1		2		3		4		ALL	
	FCSTR	MOS	FCSTR	MOS	FCSTR	MOS	FCSTR	MOS	FCSTR	MOS
* FCSTS	30		30		30		30		120	
MAE (DEG)	3.8	4.0	4.1	4.7	5.0	6.0	4.7	5.7	4.4	5.1
% FCSTR IMP OVR MOS (MAE)	6		13		17		17		14	
% HIGH	26	20	26	30	36	6	33	26	30	20
% LOW	63	70	63	70	63	86	60	70	62	74
% CORRECT	10	10	10	0.0	0.0	6	6	3	6	5
% GE 2 DEG ERR	76	66	73	86	86	90	83	90	80	83
% GE 10 DEG ERR	6	10	6	13	13	16	20	16	11	14
% MOS UNCHANGED	6		6		16		10		10	
% MOS RAISED	56		63		70		60		62	
% MOS LOWERED	36		30		13		30		27	
% MOS CHGD CORRECT	42		50		52		59		24	
* ACTUAL TEMP CHGS >10 DEG	9		9		9		9		36	
MAE (DEG) WHEN >10 DEG CHGS	4.0	5.1	5.0	7.1	4.5	8.2	8.5	8.8	5.5	
MEAN ALG. ERROR	-1.7	-2.9	-1.6	-3.3	-2.7	-5.4	-2.3	-3.5		

Fig. 3. Same as Fig. 1, except for 00Z cycle.

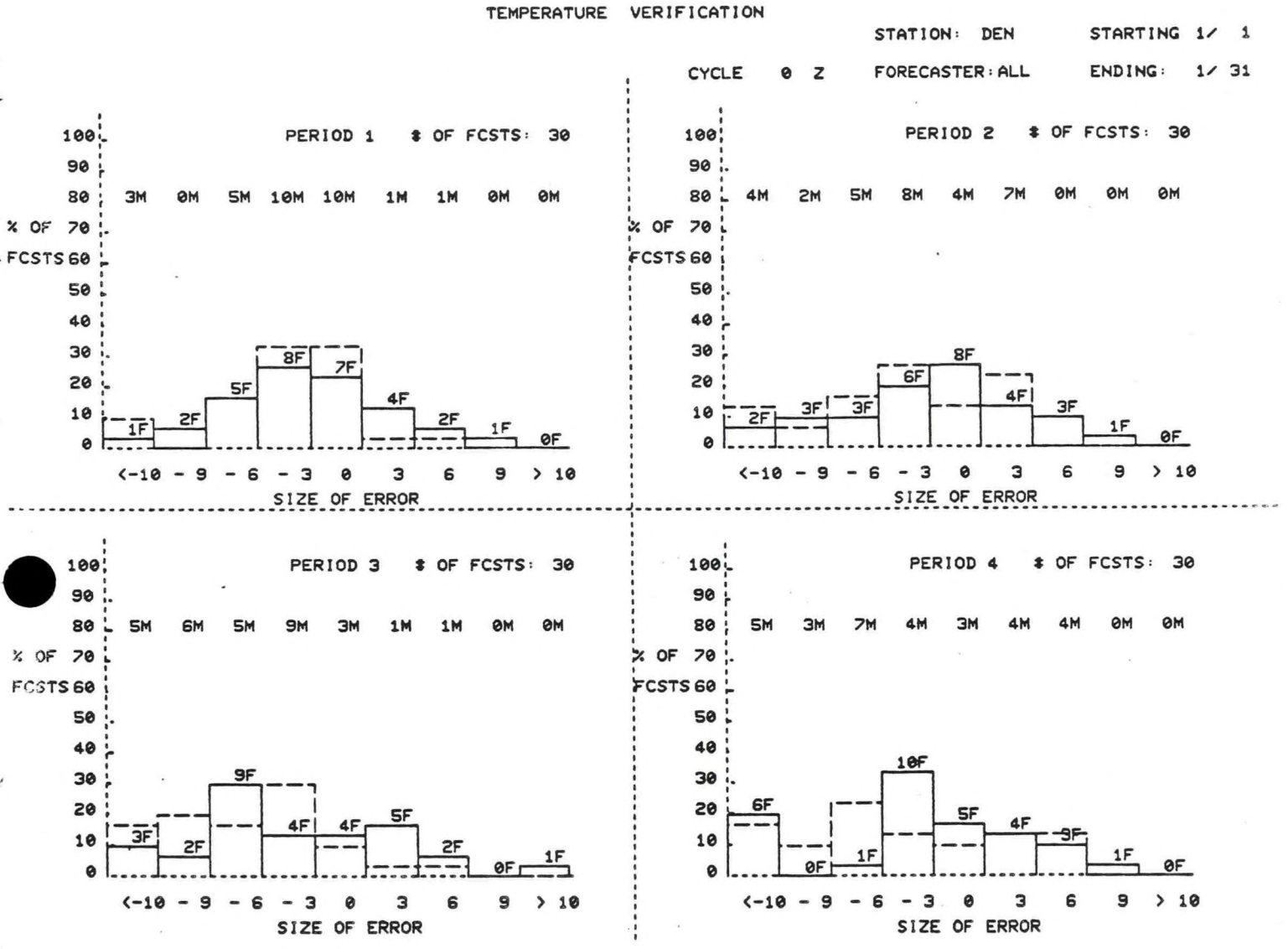

Fig. 4. Same as Fig. 2, except for 00Z cycle.