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A LOOK AT HIGH POP EVENTS IN A SEMIARID STATE

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1. Introduction

Forecasters are always striving to find ways to improve on the guidance products from Model Output Statistics (MOS). Over the years, certain "rules of thumb" are developed at National Weather Service forecast offices that help accomplish this task. These rules are designed to enable forecasters to consistently "beat" MOS in certain weather situations (i.e., "MOS fails to handle station XXX's minimum temperature with snow cover on the ground" or "MOS overestimates temperatures with a cold front in the vicinity of station XXX"). A summary of such rules concerning precipitation events was presented by Hendrickson (1983).

Most of Wyoming has a semiarid climate (Martner, 1986). Aside from the various mountain ranges in the state, Wyoming generally receives from 10 to 18 inches of precipitation per year. MOS equations were developed for five stations in Wyoming: Cheyenne, Casper, Lander, Sheridan, and Rock Springs. The annual precipitation averages for these stations are listed below:

Cheyenne	13.29	Casper	11.43
Lander	13.20	Sheridan	14.93
Rock Springs	8.84		

In this particular study the authors only examined cases in Wyoming where MOS had forecasted high probability of precipitation (POP) values. Only MOS POP's of 60 percent or higher were used since 60 percent is the first POP value when precipitation becomes "likely," according to the NWS guidance on expressions of uncertainty. The study was undertaken to find if a "rule of thumb" could be developed with confidence in regard to lowering or raising a MOS POP for high POP events in Wyoming.

2. Methodology

The authors looked at nearly three years of data, examining each MOS POP for the five Wyoming MOS sites from February 1, 1986, through December 31, 1988. Only the first three forecast periods were used since the national verification

software does not verify the fourth period. It was noted as to whether measurable precipitation (0.01 or more) occurred during any given period where MOS had forecasted a 60 percent or higher POP.

3. Results

Approximately 31,000 POP forecasts were examined in this study (based on two cycles per day for 1064 days, five stations, and three forecast periods). Of these forecasts, only 1099 (less than 3.5 percent) showed MOS POP's of 60 percent or higher. This low number was not surprising since the MOS equations rely heavily on local climatology, especially in later forecast periods.

The following results were obtained:

Percentage of Time Precipitation Occurred

MOS POP	1st Pd	2nd Pd	3rd Pd	Total
60%	71.8%	61.9%	63.6%	66.9%
70%	79.0%	72.7%	76.7%	76.0%
80%	83.3%	75.0%	71.4%	78.6%
90%	94.0%	77.8%	100.0%	90.4%
100%	90.9%	100.0%	66.7%	90.9%

These results (with a few exceptions) compared favorably with the results found by Sangster (1982). However, 60 percent results were wetter than those found by Sangster indicating that the MOS equations were indeed able to adjust to the drier climate.

Of the 1099 MOS POP forecasts examined, 810 (or 73.7 percent) verified with measurable precipitation. Excluding the 60 percent numbers from the other four POP's, precipitation occurred 79.2 percent of the time.

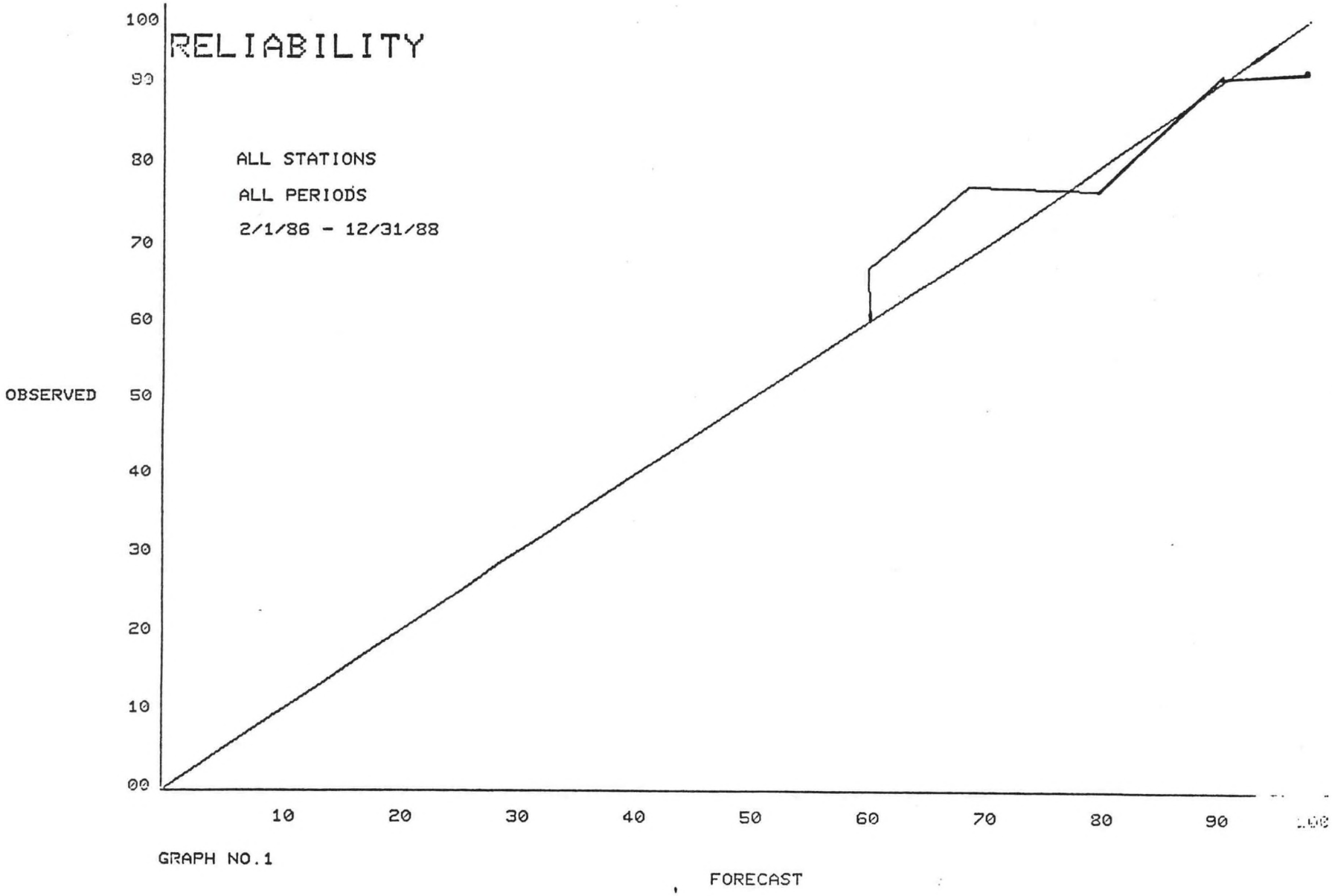
Graph 1 is a reliability graph based on the one found in the AFOS REL program (Barker and Dunn, 1986). It shows in graphic form that MOS POP's generally underforecast precipitation events when MOS forecasted a 60 percent probability. The reliability curve approaches the idealized forecast line when POP forecasts are greater than 70 percent.

One note of interest: POPS of 100 percent occurred only 33 times...or about 0.1 percent of the 31,000 forecasts made. Only three of these 33 failed to verify.

4. Conclusion

Obviously, it would not benefit a forecaster to cut MOS POP'S when POP's are 70 percent or higher since precipitation occurred over three-quarters of the time. Indeed, MOS POP's of 90 and 100 percent verified about 90 percent of the time, and forecasters should only lower these POP's in rare events. Surprisingly, this also is true for the 2nd and 3rd periods.

Some gains can be made when MOS forecasts a 60 percent POP, but even then forecasters must be careful as precipitation occurred 67 percent of the time.



GRAPH NO.1

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Probably the best time to decrease a MOS POP would be in the 1st period when a precipitation event is ending. Forecasters have the advantage of now-casting in that situation since the MOS data is based on information that is approximately ten hours old.

Finally, this "rule of thumb" is valid for only the five MOS sites in Wyoming. We are certain that forecasters who must contend with a more moist climate would experience radically different results.

5. References

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