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MOS VS. NGM - PERFECT PROG GUIDANCE WINTER 1987 - 1988

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This study is a follow-up of Western Region Technical Attachment No. 87-35 by John Jannuzzi, Seattle WSFO, which compared the LFM MOS and NGM Perfect Prog temperature and probability of precipitation (POP) forecasts for the 1987 warm season. This study shows a similar comparison of the LFM MOS and NGM Perfect Prog forecasts for the state of Oregon. Since Oregon is comprised of several differing climatological areas, comparisons were made for three of these major areas: Portland (PDX) in the northwest, Medford (MFR) in the southwest interior, and Pendleton (PDT) in the drier northeast. Forecast and verification data were collected from October 21, 1987 until March 11, 1988. This study differs slightly from Jannuzzi's study in that the verification scores have been divided into two forecast time frames, the OOZ and 12Z cycles. This was done to see if there were any time consideration biases by the models.

Table 1 is the POP Brier Score verification. An asterisk was placed next to the lowest Brier Score for each period to highlight the best score. For the most part, at all three stations, LFM MOS was consistently better than the NGM Perfect Prog. Although not reflected in the Brier Scores, the higher NGM scores were usually the result of over forecast POPs, especially with increased projection time. This is not unexpected since the LFM POPs tend more toward climatology with model time. The NGM has no such constraints. This was, however, an abnormally dry winter at all three forecast locations and may have had an impact on the results. Likewise, the sample size of the high forecast POPs was quite small, especially at PDT and MFR, because of the abnormal dryness.

Editor's Note: *[It is also important, at this point, to remind the reader the basic difference between MOS and Perfect Prog guidance. LFM MOS equations are developed by correlating model output with observed precipitation/temperature values, over a long period of time. NGM Perfect Prog equations are developed by correlating observed fields forecast by the model with observed precipitation/temperature values. Therefore, even if the LFM has a tendency to over forecast RH or vertical motion with increased projection time, the statistical methods used to develop the MOS equations will compensate for this tendency. The Perfect Prog equations do not take any model tendencies in account. They simply assume that the model fields are correct.]*

Table 2 shows the temperature verification results. Three values are shown: the bias, the absolute error and the number of times the model forecast error was plus or minus 10 degrees or more. Both models tended to have a cool bias at MFR and PDT. At PDX, the LFM MOS has no noticeable bias, while the NGM Perfect Prog bias was slightly negative. A distinct pattern showed up at all three sites for both model runs with respect to the absolute error. At the 12-hour forecast period, neither model proved better than the other; however, from 24 to 48 hours, the LFM MOS absolute error was considerably lower than the NGM Perfect Prog absolute error. This result is also reflected in the number of temperature errors greater than 10 degrees. The NGM Perfect Prog had more, especially in the 24 to 48 hour forecasts. At most sites and for most cycles, there was also disparity between maximum and minimum temperature forecasts. The absolute error was generally quite a bit higher for maximum temperature forecasts than for minimum temperature forecasts. Likewise, the biases tended to be more pronounced for maximum temperatures than for minimum temperatures.

Table 3 shows the temperature bias during precipitation episodes only. Sixty-nine percent (31/48) of the values shown indicate a negative temperature bias when precipitation occurred. The negative bias was much more pronounced in the NGM than it was in the LFM. The biases at PDX are very interesting, in that both models tended to be too cold at minimum temperature time and too warm at maximum temperature time. This makes sense in that during precipitation episodes, cloud cover would keep the maximum temperatures down and the minimums up. Model errors which didn't catch the cloudiness and precipitation would naturally tend toward the biases presented here. It should be noted that the sample size used here was rather small, especially at PDT, due to the dry year. As a result, the numbers may not reflect long-term model biases.

Overall, the LFM MOS generally out performed the NGM Perfect Prog guidance during the winter months of 1987-88 for all three Oregon locations. Because of the limited and climatologically abnormal verification period used in this study, however, caution should be exercised when using the results presented here as a tool for improving the local forecast product. It would be instructive to conduct a similar study over this upcoming winter to compare and consolidate the results of the two winter seasons.

Acknowledgements

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Reference

Jannuzzi, John A., 1987, "MOS vs. NGM - Perfect Prog Guidance", Western Regional Technical Attachment No. 87-35, September 15, 1987.

Brier Scores - Precipitation Forecasts - Table I

PDX		MOS (LFM)	NGM
00Z	1st pd	12.68 *	13.01
	2nd pd	15.86	13.89 *
	3rd pd	18.86	18.80 *
	4th pd	15.06 *	19.42
12Z	1st pd	10.54 *	10.66
	2nd pd	15.74 *	18.25
	3rd pd	14.68 *	18.05
	4th pd	15.19 *	18.20

MFR		MOS	NGM
00Z	1st pd	14.48 *	15.95
	2nd pd	13.41 *	16.21
	3rd pd	15.34 *	18.93
	4th pd	11.52 *	15.85
12Z	1st pd	12.54	11.83 *
	2nd pd	14.35 *	15.50
	3rd pd	12.82 *	16.59
	4th pd	11.03 *	13.97

PDT		MOS	NGM
00Z	1st pd	9.29 *	10.07
	2nd pd	13.77	13.56 *
	3rd pd	11.69 *	15.56
	4th pd	13.93 *	14.04
12Z	1st pd	13.33	10.78 *
	2nd pd	8.13 *	12.81
	3rd pd	12.43 *	14.43
	4th pd	11.24 *	16.20

Table 2 - Temperature Errors

Station	Run	Forecast	MOS Bias	absolute error	+/- 10 deg err	NGM Bias	absolute error	+/- 10 deg error
PDX								
	00Z	12 hr	0.3	2.9	1/1	0.2	3.1	1/2
		24 hr	0.1	2.0	1/3	-0.9	4.0	3/7
		36 hr	0.2	3.6	3/6	0.1	5.0	11/2
		48 hr	0.3	3.5	2/1	-0.5	5.0	5/10
	12Z	12 hr	-0.9	2.8	0/1	-0.3	3.1	2/1
		24 hr	-0.2	3.4	2/5	0.5	4.6	9/5
		36 hr	-0.2	3.3	1/3	-1.2	3.9	1/6
		48 hr	0.8	3.9	3/3	-0.2	5.4	12/5
MFR								
	00Z	12 hr	-0.9	4.4	3/6	-0.3	4.4	3/5
		24 hr	-1.3	4.1	0/7	-1.0	5.2	0/14
		36 hr	-1.3	5.0	4/16	-2.2	5.4	5/17
		48 hr	-1.6	4.9	3/4	-2.0	5.2	2/18
	12Z	12 hr	-1.1	3.6	1/5	-0.9	3.5	0/4
		24 hr	-1.7	4.9	4/15	-2.0	5.4	6/15
		36 hr	-0.7	4.0	3/7	-3.2	5.1	1/18
		48 hr	-1.9	5.3	6/19	-3.5	6.1	5/23
PDT								
	00Z	12 hr	-1.3	4.6	0/5	-0.7	4.2	2/4
		24 hr	0.2	3.7	5/2	-0.8	5.0	5/9
		36 hr	-1.9	5.7	6/19	-2.6	5.8	6/18
		48 hr	0.3	4.1	5/5	-0.2	6.0	10/11
	12Z	12 hr	0.2	3.1	1/0	1.2	3.9	6/0
		24 hr	-2.2	5.5	2/18	-1.4	6.3	11/14
		36 hr	-0.4	3.9	8/3	0.3	5.2	9/6
		48 hr	-1.3	5.9	10/17	-2.7	7.0	9/22

Table 3 Temperature Bias - Precipitation Cases Only

		00Z		12Z	
		MOS	NGM	MOS	NGM
PDX	12 hr	0.5	0.4	-1.3	-0.7
	24 hr	-1.0	2.4	1.5	0.1
	36 hr	1.4	0.5	-2.3	-2.1
	48 hr	-1.0	-1.8	1.8	-0.9
MFR	12 hr	0.8	0.3	-0.9	-0.7
	24 hr	-1.8	-3.2	+/-0.0	-4.1
	36 hr	-1.8	-4.2	-2.0	-4.9
	48 hr	-2.2	-3.2	-0.9	-5.4
PDT	12 hr	-0.4	-0.5	0.2	0.1
	24 hr	-1.1	-1.5	-0.4	-1.9
	36 hr	4.3	-3.0	1.9	-1.7
	48 hr	-0.9	-1.5	0.3	-3.6