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AN EVALUATION OF NMC NUMERICAL MODEL RELATIVE HUMIDITY FORECASTS

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It has been noted during the past year that the relative humidity forecasts, from the National Meteorological Center's (NMC) numerical models, tend to overforecast the higher RH values as projection time increases. In other words, when examining a series of humidity prognoses it can be observed that the area covered by the 90%, and higher, relative humidity expands considerably with time. This characteristic is visible on every forecast, and it is especially noticeable in the 7LPE output.

It has also been evident that the 7LPE probability of precipitation (PoP) forecasts tend to be too high on the average. A reliability study of PoPs was made for six locations in the WSFO Washington, D.C. area of responsibility for the third period, 36- to 48-hour, 7LPE forecasts. It was found that the PoP forecasts averaged about 10% too high. In other words, the observed frequency of precipitation occurrence was approximately 10% less than that forecast by the 7LPE PoPs. A MOS approach would normally compensate for a systematic bias in one of its predictors. The MOS equations which produce the 7LPE (Final) PoPs for the third period were derived from the 6LPE model. A possible explanation for the apparent bias in the MOS PoPs is a difference in the performance of the 6LPE and 7LPE models in forecasting one, or more, of the MOS predictors.

Since the mean relative humidity is the most important predictor for the MOS PoPs, this was the forecast parameter that was examined. The 48-hour LFM and 7LPE relative humidity PROGS were verified for the month of March 1979. Because not all of the observed and forecast charts were available, only 56 of the 62 possible forecasts were verified. Sixteen points were selected to be verified, 5 of them were west of 105°W and 11 east of 105°W. The points were about equally distant so that examination of the results could be interpreted as areal coverage. The relative humidities were classified in range according to the forecast charts and are equal to and greater than 90%, 70% to 89%, 50% to 69%, 30% to 49%, and 29% or less. Approximately 900 values were available from the observed, LFM and 7LPE relative humidity charts.

Table 1 shows the percentage of the relative humidity values in each range. This table definitely shows that both the LFM and 7LPE 90% and greater relative humidity values cover a much larger area than is observed. For example, for the United States as a whole, the 90% and greater area covered approximately 6% of the United States, while the LFM charts showed 15% coverage and the 7LPE 22%. For the eastern part of the United States the observed area was 8%, while the LFM coverage was 13% and the 7LPE coverage 20%. This means that the LFM 90% area was about half again larger than observed while the 7LPE was 2½ times the area observed.

Both the LFM and 7LPE models incorporate a systematic inflation of relative humidity which essentially means that the relative humidity values could be considered as mislabeled. The method used is to compute a saturation thickness based on the temperatures of the sounding and to multiply it by a certain percentage.

For March the LFM saturation thickness was multiplied by 96% and the 7LPE by 90%. The reduced saturation thickness values when computed using the observed or forecast moisture essentially increases the LFM relative humidity by 4% and the 7LPE by 10%. In other words, the LFM 90% relative humidity isopleth could be relabeled 86% and the 7LPE 90% isopleth relabeled 81%. This would tend to decrease the very large apparent bias in the 7LPE relative humidities--but not entirely remove it.

Forecasters who are independently evaluating the LFM and 7LPE relative humidity charts should realize that the labeled values on the LFM and 7LPE PROGS are not what they seem. They should also realize that the areal coverage is too large in any case, and this is especially true of the 7LPE PROGS. It would be very helpful and surely not too much of a task numerically for the computer to remove this boosting factor before the product is output to the field.

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Attachment: Table 1

Table 1

Comparison of Observed vs. LFM & 7LPE 48-Hour Relative Humidity Forecast (Inflated) for March 1979

Relative Humidity Ranges in Percent	Percent of Total in Each Range								
	United States			West of 105°			East of 105°W		
	Observed	LFM	7LPE	Observed	LFM	7LPE	Observed	LFM	7LPE
≥ 90	6	15	22	2	19	28	8	13	20
70-89	16	19	21	16	17	23	16	20	20
50-69	34	28	26	36	31	23	33	27	27
30-49	29	25	19	25	23	17	31	26	19
≤ 29	15	13	12	21	10	9	12	15	13

A verification of 48-hour LFM and 7LPE relative humidity forecasts (inflated) by analyzed ranges. A total of 16 points at 10° latitude and longitude intersections were selected, 5 west of 105°W and 11 east. A total of 56 observed, LFM and 7LPE charts during March 1979 were used. Figures in the table can loosely be interpreted as representing areal coverage of the indicated relative humidity ranges.