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AN ANALYSIS OF OVERPREDICTED HIGH TEMPERATURES BY NGM MOS GUIDANCE AT MEDFORD, OREGON

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INTRODUCTION

Errors in NGM MOS output are not uncommon during transitional weather. On the other hand, when conditions are stable and unchanging, the MOS guidance is expected to perform well. Several times during the summer of 1995 the NGM high temperature predictions for Medford, Oregon, were overforecast by as much as eight degrees Fahrenheit. This study is an investigation of what caused such errors during stable conditions.

PROCEDURES

Data from ten different cases of poorly forecast high temperatures during the summer of 1995 were collected. Any forecast four or more degrees above the observed maximum was considered poor. Frontal passages, air mass changes, and cloudy days were carefully excluded. Sky conditions in this study were almost entirely clear with only thin scattered cirrus in a couple of examples.

To achieve a proper comparison, data from ten good forecast days were considered. Any forecast that was within three degrees of the observed maximum was considered "good". These cases occurred during the same general time period as the poor forecasts and met the same air mass and clear sky criteria.

Good and bad forecasts from both the 00Z and 12Z model runs were considered.

Individual variables used as input into the MOS equations for each day were obtained from the Techniques and Development Laboratory (TDL) at the National Center for Environmental Prediction (NCEP). Archived NGM model gridded data of forecast heights and temperatures were analyzed.

ANALYSIS

Fifteen different variables are used in the NGM MOS equations to forecast high temperature at Medford. One objective was to determine whether specific variables had more influence on the final forecast. The average weight each variable contributed to the final forecast value was investigated. It became apparent that the two meter (2m) temperature was the most influential. On average, 78% of the 24 hour high temperature forecast from the 00Z model run was contributed by the 2m temperature, and 60% of the 36 hour high temperature forecast from the 12Z model run was contributed by the 2m temperature (Figs. 1 and 2). Most of the other variables did not vary significantly from model run to model run. Thus, it was easy to see that high temperature errors arose almost entirely from the NGM's 2m temperature prediction.

The process by which the model computes a 2m temperature forecast is somewhat complex. Basically, the temperatures at the two model levels that straddle the model elevation for Medford (900 and 950 mb) are interpolated to Medford's model elevation. Although there is a significant discrepancy between Medford's actual elevation and the model's elevation for Medford, this is implicitly accounted for in the MOS equations, since the equations were derived using the model elevation for Medford.

Since the 2m temperature is interpolated from the temperature at two model pressure surfaces, it was thought that a poor height prediction for the pressure surface could account for some of the 2m temperature discrepancy. To test this theory, model sea level pressure forecasts were compared to actual sea level pressures for the days in question.

Finally, the forecast temperature fields nearest Medford's model height (778 meters) were examined and compared to the verifying temperature fields for the days in question.

RESULTS

No significant correlation could be found between the actual sea level pressure and the model's forecast. The difference between the model's forecast sea level pressure and the verifying pressure was nearly the same on days with good forecasts as it was on days with bad forecasts.

The same could not be said for the temperature fields. When discrepancies between the forecast and actual temperatures at 900 mb and 950 mb were compared, a correlation was apparent. In nearly all cases, when the NGM's 900 mb and 950 mb temperatures were forecast too high, the resulting MOS high temperature prediction was too high. On the days when the NGM's 900 mb and 950 mb temperature prediction was slightly low, the MOS high temperature forecast was good (Fig. 3). In fact, a model bias was discovered. Low-level temperature fields that averaged three to four degrees Celsius lower than the actual values yielded MOS high temperature forecasts that were within three degrees of the verifying high.

CONCLUSIONS

Summer season high temperature forecasts for Medford are overwhelmingly influenced by the 2m temperature prediction. Therefore, a forecaster who is suspicious that the NGM MOS high temperature guidance is too high must look at the NGM low-level temperature fields. If the predicted temperatures are unreasonably warm, the MOS guidance will be poor. It should be emphasized that the variables and their weighting used as input into the NGM MOS equations differ from site to site and season to season.

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Figure 1
Percentage of weight that each variable carries in 00Z equation

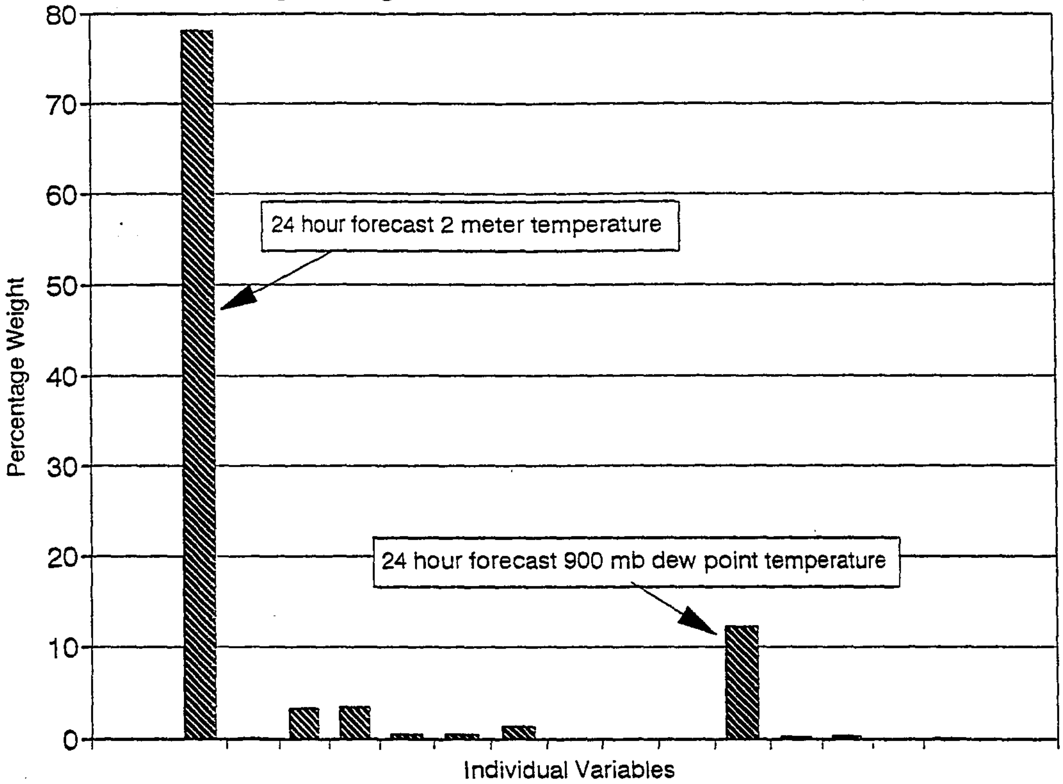

Figure 2
Percentage of weight that each variable carries in 12Z equation

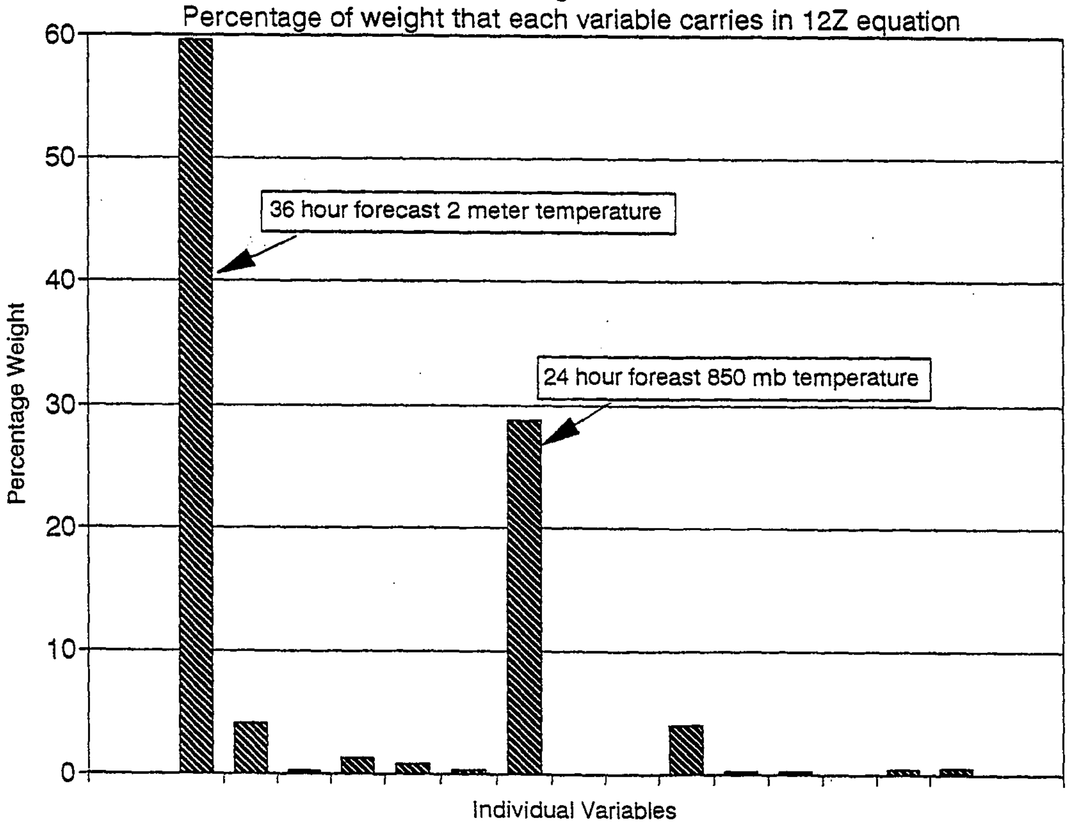

Figure 3

Correlation of temperature discrepensies at 900 mb to surface