

U.S. DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
NATIONAL WEATHER SERVICE  
OFFICE OF SYSTEMS DEVELOPMENT  
TECHNIQUES DEVELOPMENT LABORATORY

TDL OFFICE NOTE 84-15

APOS-ERA VERIFICATION OF GUIDANCE AND  
LOCAL AVIATION/PUBLIC WEATHER FORECASTS--NO. 1  
(OCTOBER 1983-MARCH 1984)

Gary M. Carter, Valery J. Dagostaro, J. Paul Dallavalle,  
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SEPTEMBER 1984



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1. INTRODUCTION

This is the first in a new series of Techniques Development Laboratory (TDL) office notes which compare the performance of TDL's automated guidance with National Weather Service (NWS) local forecasts made at Weather Service Forecast Offices (WSFO's). All of the forecasts (both local and guidance) were collected locally at the WSFO's, transmitted via the Automation of Field Operations and Services (AFOS) system to the National Meteorological Center, and archived centrally by TDL. The local collection system is described by Heffernan et al. (1983), while guidelines for the public/aviation forecast verification program are given in National Weather Service (1983a).

In this report, we present verification statistics for the cool season months of October 1983 through March 1984 for probability of precipitation (PoP), precipitation type (rain, freezing rain, or snow), surface wind, cloud amount, ceiling height, visibility, and maximum/minimum (max/min) temperature. Snow amount forecast verification results are not available for the 1983-84 cool season due to a problem with the local AFOS software which decodes the synoptic reports. Verification summaries are provided for both forecast cycles, 0000 and 1200 GMT. The scores are those recommended in the NWS National Verification Plan (National Weather Service, 1982a).

The local public weather PoP and max/min forecasts used for this verification were official forecasts obtained from the Coded City Forecast (FPUS4) bulletin. All of the local aviation weather forecasts (except for precipitation type and cloud amount) were obtained from NWS official terminal forecasts (FT's). The local precipitation type and cloud amount forecasts were manually entered by the forecasters at the WSFO's. The local subjective forecasts may or may not be based on the objective guidance. Also, surface observations as late as 2 hours before the first valid forecast time may have been used in preparation of the local forecasts.

The automated guidance was based on forecast equations developed through application of the Model Output Statistics (MOS) technique (Glahn and Lowry, 1972). In particular, these prediction equations were derived by using archived surface observations and forecast fields from the Limited-area Fine Mesh (LFM) model (Gerrity, 1977; Newell and Deaven, 1981; National Weather Service, 1981a). The surface observations used in these equations were taken at least 9 hours before the first verification valid time.

As noted in the sections which follow for each of the various weather elements, implementation of the new AFOS-era verification system has introduced significant changes from past verifications in regard to the characteristics of the local forecasts and verifying observations. For example, the max/min temperature forecasts are now being verified by using max/min temperatures

observed during 12-h instead of 24-h (calendar day) periods. Also, the cloud amount observations are given in terms of total sky cover rather than opaque sky cover. Many other changes are associated with obtaining the local forecasts from the FT's. Hence, in most cases, we do not think it is meaningful to compare results for the 1983-84 cool season with those for prior years which were based on the pre-AFOS verification system (e.g., Carter et al., 1983).

## 2. PROBABILITY OF PRECIPITATION

MOS PoP forecasts were produced by the cool season prediction equations described in Technical Procedures Bulletin No. 289 (National Weather Service, 1980b). This guidance was available for the first, second, and third periods, which correspond to 12-24, 24-36, and 36-48 hours, respectively, after 0000 and 1200 GMT. The predictors for the equation development were forecast fields from the LFM model and weather elements observed at the forecast site at 0300 or 1500 GMT. However, because of time restraints in day-to-day operations, surface observations at 0200 or 1400 GMT are used as input to the prediction equations about 50% of the time.

The forecasts were verified by computing Brier scores (Brier, 1950) for 93 of the 94 stations listed in Table 2.1. Please note that we used the standard NWS Brier score for PoP which is one-half the original score defined by Brier. Brier scores will vary from one station to the next and from one year to the next because of changes in the relative frequency of precipitation. In particular, the scores usually are better for periods of below normal precipitation. Therefore, we also computed the percent improvement over climate, that is, the percent improvement of Brier scores obtained from the local or guidance forecasts over analogous Brier scores produced by climatic forecasts. Climatic forecasts are defined as relative frequencies of precipitation by month and by station determined from a 15-yr sample (Jorgensen, 1967). Because local forecasters should be encouraged to depart from the guidance if they have reason to believe it is incorrect, the number of times local forecasters deviated from the guidance and the percent of these changes that were in the correct direction also were tabulated.

Tables 2.2 and 2.7 present the 1983-84 results for all 93 stations combined for the 0000 and 1200 GMT cycle forecasts, respectively. Tables 2.3-2.6 and Tables 2.8-2.11 show scores for the NWS Eastern, Southern, Central, and Western Regions, for the 0000 and 1200 GMT cycles, respectively. Comparison of the overall Brier scores and improvements over climate in Table 2.2 indicates the 0000 GMT cycle local forecasts were better than the guidance for all three periods. Local forecasters deviated from the guidance nearly 60% of the time and were correct when they did so 62%, 61%, and 57% of the time for the first, second, and third periods, respectively. On the regional level for the 0000 GMT cycle (Tables 2.3-2.6), with the exception of the third period forecasts for the Eastern and Central Regions, the local forecasts for all regions and periods were as good as, or better than, the guidance. Overall, as shown in Table 2.7, the 1200 GMT cycle local forecasts also were better than the guidance for all three periods. Local forecasters deviated from the guidance nearly 60% of the time and were correct when they did so 65%, 56%, and 62% of the time for the first, second, and third periods from 1200 GMT, respectively. Regionally (Tables 2.8-2.11), with the exceptions of the second period Eastern

Region and the third period Central Region forecasts, the local forecasts for all regions and periods were better than the guidance.

In terms of percent improvement over climate, the local and guidance forecasts for the 0000 GMT cycle were worse than the 1982-83 cool season (Carter et al., 1983) forecasts for the first and third periods, but better for the second period. For the 1200 GMT cycle, the 1983-84 forecasts were better than those for the previous cool season for the first and third period, but worse for the second period.

### 3. PRECIPITATION TYPE

The objective conditional probability of precipitation type (PoPT) forecast system described in Technical Procedures Bulletin No. 319 (National Weather Service, 1982b) and Bocchieri and Maglaras (1983) provides categorical forecasts for three categories: frozen (snow or ice pellets), freezing (freezing rain or drizzle), and liquid (rain). Precipitation in the form of mixed snow and ice pellets is included in the frozen category; any mixed precipitation type that includes freezing rain or drizzle is included in the freezing category; all other mixed precipitation types are included in the liquid category. In this report, the frozen, freezing, and liquid categories will be referred to as snow, freezing rain, and rain, respectively.

For verification purposes, local categorical forecasts of precipitation type are given for the 18-, 30-, and 42-h projections from 0000 and 1200 GMT. Note, this is a conditional forecast, that is, it's a forecast of the type of precipitation if precipitation actually occurs. Therefore, a precipitation type forecast is always recorded. Similarly, the PoPT guidance forecasts are conditional and are available whether or not precipitation occurs.

Table 3.1 lists the 86 stations used for the precipitation type verification. The sample included only those cases in which precipitation actually occurred either at or within  $\pm 1$  hour of the forecast valid time. Also, since we were concerned that some forecasters may not have put much effort into making the conditional forecasts when they considered precipitation to be unlikely, we used cases only when the local PoP was  $\geq 30\%$ . The PoP forecasts were valid for 12-h periods centered on the 18-, 30-, and 42-h projections from both 0000 and 1200 GMT.

Tables 3.2 and 3.3 show the contingency tables for the three categories of precipitation type for the local and guidance forecasts for the 18-, 30-, and 42-h projections from 0000 and 1200 GMT, respectively. From these tables, bias by category,<sup>1</sup> probability of detection (POD),<sup>2</sup> false alarm ratio (FAR),<sup>3</sup> skill

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<sup>1</sup>In the discussion of precipitation type, surface wind, opaque sky cover, ceiling height, and visibility, bias by category refers to the number of forecasts of a particular category (event) divided by the number of observations of that category. A value of 1.0 denotes unbiased forecasts for a particular category.

<sup>2</sup>The POD is the ratio of the number of times a particular category was correctly forecast to the total number of observations of that category.

<sup>3</sup>The FAR is the ratio of the number of times a particular category was incorrectly forecast to the total number of forecasts of that category.

score,<sup>4</sup> and percent correct were calculated. Tables 3.4 and 3.5 show the verification results for 0000 and 1200 GMT, respectively. The bias by category, POD, and FAR scores for freezing rain are shown but will not be mentioned in this discussion because of the small number of cases. For the 0000 GMT cycle (Table 3.4), the results in terms of percent correct and skill score for all stations combined indicate the local forecasts were better than the guidance for all three projections. In terms of bias by category, POD, and FAR, the comparisons varied from projection to projection, but the overall quality of the local and guidance forecasts was about the same. The 1200 GMT verification results for all stations combined (Table 3.5) indicate that, in terms of percent correct and skill score, the local forecasts were as good as the guidance for the 18-h projection, better than the guidance for the 30-h projection, and slightly worse than the guidance for the 42-h projection. In terms of bias by category, POD, and FAR, the results were similar to those for the 0000 GMT cycle which showed there was little difference overall between local and guidance forecasts.

#### 4. SURFACE WIND

The objective surface wind forecasts were generated by the cool season, LFM-based equations described in Technical Procedures Bulletin No. 335 (National Weather Service, 1983b). Prior to the 1983-84 cool season, the surface wind prediction equations were rederived in order to take into account the most recent data available from the LFM model.

We verified the 12-, 18-, and 30-h forecasts from both 0000 and 1200 GMT. The objective surface wind forecast is defined in the same way as the observed wind, namely, the 1-min average wind direction and speed for a specific time. All objective forecasts of wind speed were adjusted by an "inflation" technique (Klein et al., 1959) involving the multiple correlation coefficient and the mean value of wind speed for each particular station and forecast valid time.

The local forecasts were obtained from the FT's. Since the FT's do not mention wind if the speed is expected to be less than 10 knots, the wind forecasts were verified in two ways. First, for all those cases where the FT's specified wind and for which the MOS speed forecasts were at least 10 knots, the mean absolute error (MAE) and the mean algebraic error of the speed forecasts were computed. Cases where the observed wind was calm were then eliminated from this sample and the MAE of direction was computed. Second, for all cases where both the FT's and the MOS forecasts were available, skill score, percent correct, bias by category, and the threat score<sup>5</sup> were computed from contingency tables of wind speed.

The threat score used here was calculated by combining events of the upper two categories. In addition, for all cases in which the wind speeds (forecasts and/or corresponding observations) were at least 10 knots, the skill score for

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<sup>4</sup>The skill score used throughout this report is the Heidke skill score (Panofsky and Brier, 1965).

<sup>5</sup>Threat score =  $H/(F+O-H)$  where H is the number of correct forecasts of a category, and F and O are the number of forecasts and observations of that category, respectively.

the wind direction forecasts was computed from contingency tables. The definitions of the categories used in the contingency tables for wind speed and direction are given in Table 4.1. The stations used in the verification are listed in Table 2.1.

It is important to note that several fundamental differences exist between the objective MOS forecasts and the local forecasts obtained from the FT's. In particular, the FT's are not as precise in regard to valid time as are the objective forecasts. Also, the 30-h local forecasts are different than the FT's issued for earlier time periods in that they are obtained from the last forecast group before the outlook period which corresponds to a 27- or 28-h projection depending on the time zone. Another point that needs to be considered is the nature of the wind forecast as it is given in the FT. It is unclear whether aviation forecasters tend to concentrate on a specific extreme wind or on an average wind over the forecast period. In this respect, an additional comparison was made between the objective and local forecasts using the highest observed wind within  $\pm 3$  hours surrounding the verification time. Since the comparative results were similar to the results using the single observation at the verification time, they will not be presented here. Due to these and other possible differences between the MOS forecasts and local forecasts as obtained from the FT's, only conclusions of a general nature should be drawn from these verification statistics.

In addition, 42-h forecasts of winds  $>22$  knots were collected as part of the AFOS-era verification system. The local forecasts were manually entered by forecasters at the WSFO's. However, the initial 6 months of this verification program did not result in a sufficient sample of 42-h forecasts for a meaningful comparative verification. We think this situation will improve as the local forecasters become more familiar with the new system.

The results for all 93 (94) stations combined for the 0000 (1200) GMT cycles are presented in Tables 4.2-4.4 (Tables 4.9-4.11). The direction MAE's and skill scores for the 0000 and 1200 GMT cycles, as given in Tables 4.2 and 4.9, show the local forecasters were superior to the guidance at the 12-h projection. In contrast, the guidance was better than the locals for both the 18- and 30-h projections. The speed MAE's, skill scores, and percents correct generally indicate the guidance was superior to the locals, except for the 12-h projection after 0000 GMT. The speed bias by category values in Tables 4.2 and 4.9 and the contingency tables in Tables 4.4 and 4.11, show the guidance overestimated winds stronger than 22 knots (i.e., categories 4, 5, and 6) for all three forecast projections, whereas the local forecasts underestimated speeds in these categories. This bias appears to be more pronounced for the 0000 GMT cycle scores. In terms of threat score for categories 5 and 6 combined, the local forecasters were superior to the guidance for the 12- and 18-h projections after both 0000 and 1200 GMT; the guidance was better at the 30-h projection.

Tables 4.5-4.8 and 4.12-4.15 show scores for the NWS Eastern, Southern, Central, and Western Regions, for 0000 and 1200 GMT, respectively. The regional comparisons generally have the same characteristics as for the entire group of stations. However, the advantage of the guidance over the local forecasts at 18 and 30 hours is less for the Western Region.

## 5. CLOUD AMOUNT

During the 1983-84 cool season, the opaque sky cover forecasts were produced by the prediction equations described in Technical Procedures Bulletin No. 303 (National Weather Service, 1981b). These regional, generalized-operator equations used LFM model output and 0300 (1500) GMT surface observations to produce probability forecasts of the four categories of cloud amount shown in Table 5.1. We converted the probability estimates to "best category" forecasts in a manner which produced good bias characteristics, that is, a bias value of approximately 1.0 for each category. The threshold technique described in Technical Procedures Bulletin No. 303 was used to obtain the best category.

We compared the local forecasts with a matched sample of MOS guidance forecasts for the 88 (86) stations listed in Table 2.1 for the 12-, 18-, and 24-h forecast projections from 0000 (1200) GMT. The local forecasts and the surface observations used for verification were converted to the cloud amount categories given in Table 5.1. Four-category (clear, scattered, broken, and overcast), forecast-observed contingency tables were prepared from the local and objective categorical predictions. Using these tables, we computed the percent correct, skill score, and bias by category. In past verifications only opaque sky cover amounts from surface observations were used in determining the observed categories. However, the hourly surface reports which are used now do not include the total opaque sky cover as part of the observation; hence, thin clouds also must be taken into account. For example, a report of overcast with eight tenths opaque and two tenths thin was put in the broken category previously, but now this report is categorized as overcast. The result of this change is to decrease (increase) the number of observations of the broken (overcast) category compared to previous verifications. This change has greatly affected the overall bias by category results for the guidance.

The results for all stations combined are shown in Tables 5.2 and 5.7 for the 0000 and 1200 GMT cycle forecasts, respectively. In terms of skill score, the 0000 GMT cycle local forecasts did better than the guidance for all three projections and were better than the guidance for the 12- and 18-h projections in terms of percent correct. Examination of the bias by category scores shows that the guidance forecasts were better (i.e., closer to 1.0) than the locals for most projections and categories. The bias results for the broken category for local and guidance forecasts were extremely poor; most likely, this was because of the changes in the verification process which were mentioned before. For 1200 GMT (Table 5.7), the local forecasts were better than, equal to, and worse than the guidance in terms of percent correct for the 12-, 18-, and 24-h projections, respectively. In regard to skill score, the local forecasts were better than the guidance for the 12- and 18-h projections. Again, the bias by category scores show that the guidance was better overall, and the results for the broken category were poor for both the local and guidance forecasts.

Tables 5.3-5.6 and Tables 5.8-5.11 show scores for the NWS Eastern, Southern, Central, and Western Regions, for the 0000 and 1200 GMT cycles, respectively. For both cycles, the scores varied from region to region, but in general followed the same trend as the overall results for each cycle.



## 6. CEILING AND VISIBILITY

During the 1983-84 cool season, the ceiling and visibility guidance was produced by the prediction equations described in Technical Procedures Bulletin No. 303 (National Weather Service, 1981b). Operationally, the guidance was based primarily on LFM model output and 0300 (1500) GMT surface observations.

Verification scores were computed for both local and guidance forecasts for the stations listed in Table 2.1. The local forecasts were obtained from the FT's. Persistence based on an observation taken at 0900 (2100) GMT for the 0000 (1200) GMT forecast cycle was used as a standard of comparison. The objective forecasts were verified for both cycles for 12-, 18-, and 24-h projections. The local and persistence forecasts were verified for 12-, 15-, 18-, and 24-h projections from 0000 and 1200 GMT. On station, the guidance and persistence observations usually were available in time for preparation of the local forecasts. As was the case for surface wind, the local ceiling and visibility forecasts from the FT's are not given for a specific valid time. Hence any comparisons with the results for the objective forecasts must be of a very general nature.

We constructed forecast-observed contingency tables for the four categories of ceiling and visibility given in Table 6.1. These categories were used for computing several different scores: bias by category, percent correct, skill score, and log score.<sup>6</sup> We have summarized the results in Tables 6.2-6.5. It should be noted that the persistence and local forecasts for the 12-, 15-, 18-, and 24-h projections are actually 3-, 6-, 9-, and 15-h forecasts, respectively, from the latest available surface observation, and in this sense, the guidance forecasts for the 12-, 18-, and 24-h projections are actually 9-, 15-, and 21-h forecasts.

Tables 6.2 and 6.4 show the scores for the ceiling forecasts from 0000 and 1200 GMT, respectively. In terms of log score, skill score, and percent correct, the 0000 GMT cycle local forecasts were better than persistence forecasts for all four projections, and better than the guidance forecasts for the 12- and 18-h projections (guidance forecasts are not available for the 15-h projection). Also, the persistence forecasts were better than the guidance for the 12-h projection. The 1200 GMT cycle comparisons among the three forecast systems were similar to those for the 0000 GMT cycle, except the local forecasts were also slightly better than the guidance for the 24-h projection. In addition, the persistence forecasts were better than the 1200 GMT cycle guidance for both the 12- and 18-h projections. In terms of bias by category, the guidance forecasts had the best overall scores for both cycles.

Tables 6.3 and 6.5 show the scores for the visibility forecasts for the 0000 and 1200 GMT cycle, respectively. In terms of log score and percent correct,

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<sup>6</sup>This is proportional to the absolute value of  $\log_{10}f_i - \log_{10}O_i$  where  $f_i$  is the forecast category for each case and  $O_i$  is the observed category for each case. The result is averaged over all cases and scaled by multiplying by 50.

the 0000 GMT cycle local forecasts of visibility were worse than persistence for the 12-h projection, but they were better than persistence for the 15-, 18-, and 24-h projections. The locals were better than the guidance for the 12-, 18-, and 24-h projections. In contrast, the persistence forecasts were better than the guidance for the 12-h projection only. In terms of bias by category, the 0000 GMT cycle guidance forecasts had the best scores. Overall, the 1200 GMT cycle local forecasts were better than persistence for the 15-, 18-, and 24-h projections, and the locals were better than the guidance for the 12- and 18-h projections. However, persistence was the best forecast for the 12-h projection.

## 7. MAXIMUM/MINIMUM TEMPERATURE

The objective max/min temperature guidance for the 1983-84 cool season was generated by the LFM-based regression equations described in Technical Procedures Bulletin No. 285 (National Weather Service, 1980a). The guidance was based on equations developed by stratifying archived LFM model forecasts, station observations, and the first two harmonics of the day of the year into seasons of 3-mo duration (Dallavalle et al., 1980). We defined fall as September-November, winter as December-February, and spring as March-May. Since the MOS max/min guidance is valid for the local calendar day, the first period (approximately 24-h) objective forecast of the max based on 0000 GMT model data is for the calendar day starting at the subsequent midnight. The max/min guidance for the other periods (projections of approximately 36, 48, and 60 hours) also corresponds to specific calendar days. In contrast, the subjective local forecasts are for daytime max and nighttime min. Thus, the first period subjective max forecast from 0000 GMT data is for today's high. The second period forecast is for tonight's low and so forth. A similar procedure is followed for the 1200 GMT cycle except that the first period is tonight's min. For the local forecast, daytime is defined to be approximately from 1200 to 0000 GMT. Nighttime then extends approximately from 0000 to 1200 GMT except in the western parts of the Central and Southern Regions and throughout the Western Region where nighttime may go to nearly 1800 GMT. In this report, we present results for both objective guidance and subjective local forecasts which were verified by using an observation that is valid for a 12-h period. Thus, we used the 0000 GMT synoptic report of the max which is valid for the 1200 to 0000 GMT period. Similarly, the min temperature observation reported at 1200 GMT for the preceding 0000 to 1200 GMT period was used. While the 0000 GMT max temperature observation reasonably represents the daytime high, particularly during the cool season, the 1200 GMT min temperature observation is an inadequate indication of the nighttime low. Even in the eastern part of the United States, the wintertime low often occurs after 1200 GMT. Obviously, this problem is exacerbated in the western United States where 1200 GMT corresponds to 0400 LST, a time preceding the hour when the nighttime low usually occurs. Thus, we suspect that the errors for the min forecasts may be overestimates. Unfortunately, no synoptic report adequately represents the nighttime min. This problem with the verifying observations should be corrected next winter when new software is implemented on AFOS to derive an appropriate daytime max and nighttime low from both the synoptic and hourly reports.

We verified the local and MOS max/min temperature forecasts for both the 0000 and 1200 GMT cycles. The mean algebraic error (forecast minus observed

temperature), mean absolute error, the number of absolute errors  $>10^{\circ}\text{F}$ , the probability of detection<sup>7</sup> of min temperatures  $\leq 32^{\circ}\text{F}$ , and the false alarm ratio<sup>8</sup> for min temperatures  $\leq 32^{\circ}\text{F}$  were computed for 93 stations in the conterminous United States (Table 2.1). At 0000 (1200) GMT, the local max temperature forecasts are valid for daytime periods ending approximately 24 (36) and 48 (60) hours after 0000 (1200) GMT. Similarly, at 0000 (1200) GMT, the local min temperature forecasts are valid for nighttime periods ending approximately 36 (24) and 60 (48) hours after 0000 (1200) GMT.

For all stations combined, the results for 0000 and 1200 GMT are shown in Tables 7.1 and 7.6, respectively. A matched sample of approximately 12,000 cases per forecast projection was available. Similarly, Tables 7.2-7.5 give the 0000 GMT verification scores for the Eastern, Southern, Central, and Western Regions, respectively. Tables 7.7-7.10 show analogous scores by NWS region for the 1200 GMT cycle.

For all regions, both forecast cycles, and all projections, the local and MOS min temperature forecasts exhibited a pronounced cold bias (negative algebraic error). Tables 7.1 and 7.6 show for all stations combined that the bias in the MOS min forecasts ranged from  $-2.6^{\circ}\text{F}$  for tonight's min (0000 GMT) to  $-3.1^{\circ}\text{F}$  for tomorrow night's min (0000 GMT). For the local forecasts, the biases for the same projections were  $-1.2^{\circ}\text{F}$  and  $-2.0^{\circ}\text{F}$ , respectively. Although the cold bias in the min forecasts was persistent from region to region, the negative algebraic errors of both the guidance and local forecasts were greatest in the Western Region. As discussed previously, a large portion of this bias is likely due to the time of observation and not to a specific meteorological factor. Correspondingly, large mean absolute errors were associated with the large algebraic errors. For the four min projections and all stations combined, the mean absolute errors of the local forecasts were better than those for the MOS guidance by approximately  $0.9^{\circ}\text{F}$ . For these same projections, the guidance had a much higher percentage of forecasts with absolute errors greater than  $10^{\circ}\text{F}$  than did the local forecasters. Part of this large difference in quality between the local forecasts and the objective guidance is due to the improvement that the forecasters make to the MOS predictions; the particular verifying observation used also explains part of the discrepancy. Note, too, that, in general, the probability of detection of temperatures  $\leq 32^{\circ}\text{F}$  is greater for the guidance, but the local forecasts have a smaller false alarm ratio.

The biases for the max guidance tended to be much smaller than those for the min forecasts. For nearly all regions and all max forecast projections, both the MOS and local forecasts had a warm bias (positive algebraic error). The exception was in the Eastern Region for the forecast of tomorrow's max (both 0000 and 1200 GMT cycles) when the local forecasters had a very slight cold bias. As with the min forecasts, the bias in the max temperature guidance was much larger than that found in the local forecasts. We again think that the

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<sup>7</sup>Here, the probability of detection or prefigurance is defined to be the fraction of time the min temperature was correctly forecast to be  $\leq 32^{\circ}\text{F}$  when the previous day's min was  $\geq 40^{\circ}\text{F}$ .

<sup>8</sup>Here, the false alarm ratio is defined to be the fraction of forecasts of  $\leq 32^{\circ}\text{F}$  that failed to verify when the previous day's min was  $\geq 40^{\circ}\text{F}$ .

particular verifying observation used contributes to the forecast bias. Note, that for all regions and all projections combined, the local max temperature forecasts were about 0.4°F more accurate than the guidance in terms of mean absolute error.

Finally, the verifications in Tables 7.1 and 7.6 indicate that for approximately similar projections the min temperature was much more difficult to predict than the max. As an example, the mean absolute error for the 24-h projection of the min (tonight's min) from 1200 GMT was 3.7°F and 4.7°F for the local forecasts and the guidance, respectively. For the 24-h projection of the max (today's max) from 0000 GMT, the corresponding errors were 3.3°F and 3.9°F for the local forecasts and the guidance, respectively. For all four projections combined, the absolute error of the local and MOS min forecasts averaged 0.3°F and 0.8°F, respectively, more than the max forecasts. This trend in the relative difficulty of forecasting the max or min was evident in the scores for all four regions and all projections, but it was most pronounced in the Western Region. Although the time of the verifying observation contributed to this difference, we also know that during the cool season the min is usually more difficult to forecast than the max because of the greater variability of min temperatures. The difference in predictability is likely due to the effects of mesoscale phenomena on nighttime cooling. Factors such as drainage winds, soil moisture, stratus, and snow cover influence the minimum temperature. Clearly, both the guidance and the local forecasters often have similar difficulties in resolving these factors.

## 8. SUMMARY

Highlights of the 1983-84 cool season verification results, summarized by general type of weather element, are:

- o Probability of Precipitation - The PoP verification involved 93 stations and forecast projections of 12-24, 24-36, and 36-48 hours from 0000 and 1200 GMT. The NWS Brier scores for all stations combined indicate the local forecasts were better than the MOS guidance for all three periods and for both forecast cycles. Improvements of the locals over guidance ranged from 7.8% for the first period, 0000 GMT cycle, to 1.7% for the third period, 1200 GMT cycle. Depending on the projection and cycle, the local forecasters deviated from the guidance about 60% of the time, and these changes were in the correct direction from 56% to 65% of the time.
- o Precipitation Type - Local and guidance forecasts for 86 stations and projections of 18, 30, and 42 hours from 0000 and 1200 GMT comprised the comparative verification. Only those cases where the local PoP was  $\geq 30\%$  were verified, and surface observations at 1 hour before or after the forecast valid time were used whenever the verifying observation was missing or did not include precipitation. In regard to percent correct and skill score based on 3-category (freezing rain, snow, rain) contingency tables, the 0000 GMT cycle results for all stations combined indicate the local forecasts were better than the guidance for all three projections. For the 1200 GMT cycle the local forecasts were as good as or better than the guidance for the 18- and 30-h projections. In terms of bias by

category, false alarm ratio, and probability of detection for the snow forecasts, the scores varied from projection to projection, but overall, the local and guidance forecasts were about the same.

- o Surface Wind - The AFOS-era wind verification involved the comparison of surface wind speed and direction forecasts for 93 (94) stations for projections of 12, 18, and 30 hours from 0000 (1200) GMT. In this system, the local forecasts were obtained from NWS official terminal forecasts. Several fundamental differences exist between the MOS wind forecasts and those in the FT's. For example, the FT's are not as precise in regard to valid time as are the objective forecasts. Due to these differences, only conclusions of a general nature can be drawn from the results.

The results for all stations combined for wind direction indicate the locals were able to improve upon MOS for the 12-h forecast projections from both 0000 and 1200 GMT. The guidance was superior to the locals for the 18- and 30-h projections. The overall results for the speed forecasts indicate the guidance was generally better than the locals for all three projections in terms of percent correct and skill score. However, there was little difference in the mean absolute errors associated with the two sets of forecasts.

- o Cloud Amount - AFOS-era verification for cloud amount involved 88 (86) stations and forecasts for projections of 12, 18, and 24 hours from 0000 (1200) GMT. The skill scores for all stations combined indicate the 0000 GMT cycle local forecasts were better than the guidance for all three projections. In terms of percent correct, the local forecasts were better than the guidance for the 12- and 18-h projections. For the 1200 GMT cycle, the percents correct for local forecasts were better than, equal to, and worse than the guidance for the 12-, 18-, and 24-h projections, respectively. In regard to skill score, the local forecasts were better than the guidance for the 12- and 18-h projections. In terms of bias by category (clear, scattered, broken, and overcast) for both cycles and all projections, the results varied by category and forecast projection, but overall, the guidance was slightly better.
- o Ceiling and Visibility - The verification involved the comparison of local forecasts, MOS guidance, and persistence for 93 (94) stations for projections of 12, 15, 18, and 24 hours from 0000 (1200) GMT. Direct comparison of local, MOS, and persistence forecasts was possible for the 12-, 18-, and 24-h projections. These are actually 3-, 9-, and 15-h forecasts from the latest available surface observations for the locals and persistence, and in this sense, they are 9-, 15-, and 21-h forecasts for the guidance. The results for both forecast cycles show that for the 12-h forecasts of visibility, persistence was better than either the guidance or the local forecasts. For the 0000 GMT cycle, most of the verification scores for ceiling and visibility indicate the local and persistence forecasts were better than the guidance for the 12-h projection. For the 18-h projection, the local forecasts were still better than the guidance, but persistence was not. For the 24-h projection, the

guidance was slightly better than both the local forecasts and persistence. Overall, the 1200 GMT cycle local forecasts were more accurate than the guidance for all three projections.

- o Maximum/Minimum Temperature - Objective and local forecasts were verified for 93 stations for both the 0000 and 1200 GMT cycles. At 0000 (1200) GMT, the local maximum temperature forecasts were valid for daytime periods approximately 24 (36) and 48 (60) hours in advance, while the minimum temperature forecasts were valid for nighttime periods ending approximately 36 (24) and 60 (48) hours after the initial model time. In contrast, the MOS guidance was valid for calendar day periods. As verifying observations, we used the max or min temperatures for 12-h periods ending at 0000 and 1200 GMT, respectively, which had been transmitted from the local stations over AFOS. For all stations and projections combined, we found that the mean absolute error of the local min (max) temperature forecasts averaged 0.9°F (0.4°F) less than that for the MOS guidance. Clearly, the local forecasters are improving over the guidance, although some of this improvement probably is associated with the differences between the valid periods of the two types of forecasts and the verifying observations. As is usual during the cool season, the maximum temperature forecasts verified better for the same projection than did the minimum temperature forecasts.

#### 9. ACKNOWLEDGMENTS

We are grateful to Fred Marshall and Eston Pennington for assistance in archiving the data, and also to Belinda Davis and Gladys Hodge for typing the text and the many tables shown in this report. Special thanks are extended to Normalee Foat for her dedicated assistance in error checking the observations used for verification and proofreading the text.

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Table 2.1. Ninety-four stations used for comparative verification of MOS guidance and local probability of precipitation, surface wind, cloud amount, ceiling height, visibility, and max/min temperature forecasts. Please note that LAX was not included in the PoP and max/min temperature verifications. MEM, BNA, DTW, GRR, LAX, and SAN were not included in the cloud amount verifications. TCC was not available during the 0000 GMT cycle for surface wind, ceiling height, and visibility. In addition, TOP and ICT were not available during the 1200 GMT cycle for cloud amount.

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|     |                                |     |                            |
|-----|--------------------------------|-----|----------------------------|
| DCA | Washington, D.C.               | ORF | Norfolk, Virginia          |
| PWM | Portland, Maine                | CON | Concord, New Hampshire     |
| BOS | Boston, Massachusetts          | PVD | Providence, Rhode Island   |
| ALB | Albany, New York               | BTV | Burlington, Vermont        |
| BUF | Buffalo, New York              | SYR | Syracuse, New York         |
| LGA | New York (LaGuardia), New York | EWR | Newark, New Jersey         |
| RDU | Raleigh-Durham, North Carolina | CLT | Charlotte, North Carolina  |
| CLE | Cleveland, Ohio                | CMH | Columbus, Ohio             |
| PHL | Philadelphia, Pennsylvania     | ACY | Atlantic City, New Jersey  |
| PIT | Pittsburgh, Pennsylvania       | ERI | Erie, Pennsylvania         |
| CAE | Columbia, South Carolina       | CHS | Charleston, South Carolina |
| CRW | Charleston, West Virginia      | BKW | Beckley, West Virginia     |
| BHM | Birmingham, Alabama            | MOB | Mobile, Alabama            |
| LIT | Little Rock, Arkansas          | FSM | Fort Smith, Arkansas       |
| MIA | Miami, Florida                 | TPA | Tampa, Florida             |
| ATL | Atlanta, Georgia               | SAV | Savannah, Georgia          |
| MSY | New Orleans, Louisiana         | SHV | Shreveport, Louisiana      |
| JAN | Jackson, Mississippi           | MEI | Meridian, Mississippi      |
| ABQ | Albuquerque, New Mexico        | TCC | Tucumcari, New Mexico      |
| OKC | Oklahoma City, Oklahoma        | TUL | Tulsa, Oklahoma            |
| MEM | Memphis, Tennessee             | BNA | Nashville, Tennessee       |
| DFW | Dallas-Ft. Worth, Texas        | ABI | Abilene, Texas             |
| LBB | Lubbock, Texas                 | ELP | El Paso, Texas             |
| SAT | San Antonio, Texas             | IAH | Houston, Texas             |
| DEN | Denver, Colorado               | GJT | Grand Junction, Colorado   |
| ORD | Chicago (O'Hare), Illinois     | SPI | Springfield, Illinois      |
| IND | Indianapolis, Indiana          | SBN | South Bend, Indiana        |
| DSM | Des Moines, Iowa               | ALO | Waterloo, Iowa             |
| TOP | Topeka, Kansas                 | ICT | Wichita, Kansas            |
| SDF | Louisville, Kentucky           | LEX | Lexington, Kentucky        |
| DTW | Detroit, Michigan              | GRR | Grand Rapids, Michigan     |
| MSP | Minneapolis, Minnesota         | DLH | Duluth, Minnesota          |
| STL | St. Louis, Missouri            | MCI | Kansas City, Missouri      |
| OMA | Omaha, Nebraska                | LBF | North Platte, Nebraska     |
| BIS | Bismarck, North Dakota         | FAR | Fargo, North Dakota        |
| FSD | Sioux Falls, South Dakota      | RAP | Rapid City, South Dakota   |
| MKE | Milwaukee, Wisconsin           | MSN | Madison, Wisconsin         |
| CYS | Cheyenne, Wyoming              | CPR | Casper, Wyoming            |
| PHX | Phoenix, Arizona               | TUS | Tucson, Arizona            |
| LAX | Los Angeles, California        | SAN | San Diego, California      |
| SFO | San Francisco, California      | FAT | Fresno, California         |
| BOI | Boise, Idaho                   | PIH | Pocatello, Idaho           |
| GTF | Great Falls, Montana           | HLN | Helena, Montana            |
| RNO | Reno, Nevada                   | LAS | Las Vegas, Nevada          |
| PDX | Portland, Oregon               | MFR | Medford, Oregon            |
| SLC | Salt Lake City, Utah           | CDC | Cedar City, Utah           |
| SEA | Seattle-Tacoma, Washington     | GEG | Spokane, Washington        |

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Table 2.2. Comparative verification of MOS guidance and local PoP forecasts for 93 stations, 0000 GMT cycle.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .0965<br>.0890 | 7.8                     | 41.7<br>46.3            | 12067              | 6954                          | 61.7                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .1081<br>.1045 | 3.4                     | 36.7<br>38.8            | 12052              | 6854                          | 60.9                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .1211<br>.1189 | 1.8                     | 26.8<br>28.2            | 12022              | 6744                          | 57.2                              |

Table 2.3. Same as Table 2.2 except for 24 stations in the Eastern Region.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .1108<br>.1106 | 0.1                     | 48.0<br>48.1            | 2708               | 1666                          | 56.8                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .1225<br>.1215 | 0.9                     | 42.0<br>42.5            | 2739               | 1613                          | 57.8                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .1434<br>.1445 | -0.8                    | 32.4<br>31.8            | 2697               | 1551                          | 57.2                              |

Table 2.4. Same as Table 2.2 except for 24 stations in the Southern Region.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .0775<br>.0688 | 11.2                    | 37.0<br>44.0            | 3320               | 1843                          | 68.5                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .0864<br>.0818 | 5.3                     | 36.9<br>40.0            | 3255               | 1873                          | 69.2                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .0921<br>.0895 | 2.8                     | 26.2<br>28.3            | 3299               | 1919                          | 65.2                              |

Table 2.5. Same as Table 2.2 except for 28 stations in the Central Region.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .0974<br>.0883 | 9.3                     | 43.2<br>48.5            | 3871               | 2259                          | 59.8                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .1121<br>.1101 | 1.7                     | 37.1<br>38.2            | 3890               | 2177                          | 58.4                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .1233<br>.1236 | -0.2                    | 28.7<br>28.6            | 3858               | 2042                          | 49.4                              |

Table 2.6. Same as Table 2.2 except for 17 stations in the Western Region.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .1062<br>.0939 | 11.6                    | 34.1<br>41.7            | 2168               | 1186                          | 61.5                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .1154<br>.1069 | 7.4                     | 26.8<br>32.2            | 2168               | 1191                          | 56.6                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .1338<br>.1243 | 7.8                     | 14.5<br>21.2            | 2168               | 1232                          | 57.5                              |

Table 2.7. Comparative verification of MOS guidance and local PoP forecasts for 93 stations, 1200 GMT cycle.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .0967<br>.0903 | 6.6                     | 43.1<br>46.8            | 11821              | 6932                          | 65.4                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .1098<br>.1076 | 2.0                     | 33.1<br>34.5            | 11795              | 6787                          | 56.3                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .1200<br>.1180 | 1.7                     | 28.7<br>29.9            | 11770              | 6647                          | 61.5                              |

Table 2.8. Same as Table 2.7 except for 24 stations in the Eastern Region.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .1103<br>.1093 | 0.9                     | 47.4<br>47.8            | 2615               | 1648                          | 59.9                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .1287<br>.1296 | -0.7                    | 39.0<br>38.6            | 2563               | 1556                          | 56.0                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .1366<br>.1346 | 1.5                     | 34.1<br>35.1            | 2593               | 1561                          | 59.7                              |

Table 2.9. Same as Table 2.7 except for 24 stations in the Southern Region.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .0813<br>.0724 | 11.0                    | 40.5<br>47.1            | 3211               | 1831                          | 72.1                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .0852<br>.0820 | 3.7                     | 31.1<br>33.6            | 3268               | 1882                          | 59.5                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .0966<br>.0914 | 5.3                     | 28.4<br>32.2            | 3206               | 1891                          | 68.6                              |

Table 2.10. Same as Table 2.7 except for 28 stations in the Central Region.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .0999<br>.0928 | 7.2                     | 44.3<br>48.3            | 3793               | 2224                          | 65.0                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .1116<br>.1113 | 0.3                     | 35.2<br>35.3            | 3765               | 2071                          | 50.9                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .1280<br>.1314 | -2.7                    | 28.6<br>26.7            | 3784               | 1989                          | 57.8                              |

Table 2.11. Same as Table 2.7 except for 17 stations in the Western Region.

| Projection<br>(h)     | Type of<br>Forecast | Brier<br>Score | % Imp.<br>Over<br>Guid. | % Imp.<br>Over<br>Clim. | No.<br>of<br>Cases | No. of<br>Changes<br>to Guid. | % Changes<br>Correct<br>Direction |
|-----------------------|---------------------|----------------|-------------------------|-------------------------|--------------------|-------------------------------|-----------------------------------|
| 12-24<br>(1st period) | MOS<br>Local        | .0971<br>.0895 | 7.8                     | 37.1<br>42.1            | 2202               | 1229                          | 63.7                              |
| 24-36<br>(2nd period) | MOS<br>Local        | .1212<br>.1135 | 6.3                     | 22.6<br>27.5            | 2199               | 1278                          | 60.6                              |
| 36-48<br>(3rd period) | MOS<br>Local        | .1211<br>.1142 | 5.7                     | 20.5<br>25.0            | 2187               | 1206                          | 58.5                              |

Table 3.1. Eighty-six stations used for comparative verification of MOS guidance and local probability of precipitation type forecasts.

|     |                                |     |                            |
|-----|--------------------------------|-----|----------------------------|
| DCA | Washington, D.C.               | ORF | Norfolk, Virginia          |
| PWM | Portland, Maine                | CON | Concord, New Hampshire     |
| BOS | Boston, Massachusetts          | PVD | Providence, Rhode Island   |
| ALB | Albany, New York               | BTV | Burlington, Vermont        |
| BUF | Buffalo, New York              | SYR | Syracuse, New York         |
| LGA | New York (LaGuardia), New York | EWR | Newark, New Jersey         |
| RDU | Raleigh-Durham, North Carolina | CLT | Charlotte, North Carolina  |
| CLE | Cleveland, Ohio                | CMH | Columbus, Ohio             |
| PHL | Philadelphia, Pennsylvania     | ACY | Atlantic City, New Jersey  |
| PIT | Pittsburgh, Pennsylvania       | ERI | Erie, Pennsylvania         |
| CAE | Columbia, South Carolina       | CHS | Charleston, South Carolina |
| CRW | Charleston, West Virginia      | BKW | Beckley, West Virginia     |
| BHM | Birmingham, Alabama            | MOB | Mobile, Alabama            |
| LIT | Little Rock, Arkansas          | FSM | Fort Smith, Arkansas       |
| ATL | Atlanta, Georgia               | SAV | Savannah, Georgia          |
| MSY | New Orleans, Louisiana         | SHV | Shreveport, Louisiana      |
| JAN | Jackson, Mississippi           | MEI | Meridian, Mississippi      |
| ABQ | Albuquerque, New Mexico        | TCC | Tucumcari, New Mexico      |
| OKC | Oklahoma City, Oklahoma        | TUL | Tulsa, Oklahoma            |
| MEM | Memphis, Tennessee             | BNA | Nashville, Tennessee       |
| DFW | Dallas-Ft. Worth, Texas        | ABI | Abilene, Texas             |
| LBB | Lubbock, Texas                 | ELP | El Paso, Texas             |
| SAT | San Antonio, Texas             | IAH | Houston, Texas             |
| DEN | Denver, Colorado               | GJT | Grand Junction, Colorado   |
| ORD | Chicago (O'Hare), Illinois     | SPI | Springfield, Illinois      |
| IND | Indianapolis, Indiana          | SBN | South Bend, Indiana        |
| DSM | Des Moines, Iowa               | ALO | Waterloo, Iowa             |
| TOP | Topeka, Kansas                 | ICT | Wichita, Kansas            |
| SDF | Louisville, Kentucky           | LEX | Lexington, Kentucky        |
| DTW | Detroit, Michigan              | GRR | Grand Rapids, Michigan     |
| MSP | Minneapolis, Minnesota         | DLH | Duluth, Minnesota          |
| STL | St. Louis, Missouri            | MCI | Kansas City, Missouri      |
| OMA | Omaha, Nebraska                | LBF | North Platte, Nebraska     |
| BIS | Bismarck, North Dakota         | FAR | Fargo, North Dakota        |
| FSD | Sioux Falls, South Dakota      | RAP | Rapid City, South Dakota   |
| MKE | Milwaukee, Wisconsin           | MSN | Madison, Wisconsin         |
| CYS | Cheyenne, Wyoming              | CPR | Casper, Wyoming            |
| BOI | Boise, Idaho                   | PIH | Pocatello, Idaho           |
| GTF | Great Falls, Montana           | HLN | Helena, Montana            |
| RNO | Reno, Nevada                   | LAS | Las Vegas, Nevada          |
| PDX | Portland, Oregon               | MFR | Medford, Oregon            |
| SLC | Salt Lake City, Utah           | CDC | Cedar City, Utah           |
| SEA | Seattle-Tacoma, Washington     | GEG | Spokane, Washington        |

Table 3.2. Contingency tables for MOS guidance and local forecasts of PoPT for 86 stations, 0000 GMT cycle. Only cases where the local PoP was  $\geq 30\%$  were included.

| 18-h Forecasts |    |       |     |     |      |     |    |     |     |     |      |
|----------------|----|-------|-----|-----|------|-----|----|-----|-----|-----|------|
|                |    | Local |     |     |      |     |    | MOS |     |     |      |
|                |    | ZR    | S   | R   | T    |     |    | ZR  | S   | R   | T    |
|                | ZR | 12    | 17  | 2   | 31   |     | ZR | 9   | 16  | 6   | 31   |
| OBS            | SN | 8     | 491 | 23  | 522  | OBS | SN | 9   | 494 | 19  | 522  |
|                | RN | 7     | 33  | 836 | 876  |     | RN | 12  | 49  | 815 | 876  |
|                | T  | 27    | 541 | 861 | 1429 |     | T  | 30  | 559 | 840 | 1429 |
| 30-h Forecasts |    |       |     |     |      |     |    |     |     |     |      |
|                |    | Local |     |     |      |     |    | MOS |     |     |      |
|                |    | ZR    | S   | R   | T    |     |    | ZR  | S   | R   | T    |
|                | ZR | 13    | 18  | 9   | 40   |     | ZR | 17  | 16  | 7   | 40   |
| OBS            | SN | 6     | 487 | 13  | 506  | OBS | SN | 26  | 461 | 19  | 506  |
|                | RN | 17    | 59  | 744 | 820  |     | RN | 25  | 42  | 753 | 820  |
|                | T  | 36    | 564 | 766 | 1366 |     | T  | 68  | 519 | 779 | 1366 |
| 42-h Forecasts |    |       |     |     |      |     |    |     |     |     |      |
|                |    | Local |     |     |      |     |    | MOS |     |     |      |
|                |    | ZR    | S   | R   | T    |     |    | ZR  | S   | R   | T    |
|                | ZR | 11    | 10  | 6   | 27   |     | ZR | 13  | 9   | 5   | 27   |
| OBS            | SN | 12    | 364 | 28  | 404  | OBS | SN | 22  | 353 | 29  | 404  |
|                | RN | 6     | 56  | 693 | 755  |     | RN | 15  | 53  | 687 | 755  |
|                | T  | 29    | 430 | 727 | 1186 |     | T  | 50  | 415 | 721 | 1186 |



Table 3.3. Same as Table 3.2 except for the 1200 GMT cycle.

| 18-h Forecasts |       |    |     |     |      |     |    |    |     |     |      |
|----------------|-------|----|-----|-----|------|-----|----|----|-----|-----|------|
|                | Local |    |     |     |      | MOS |    |    |     |     |      |
|                | ZR    | S  | R   | T   |      | ZR  | S  | R  | T   |     |      |
|                | ZR    | 18 | 17  | 3   | 38   |     | ZR | 19 | 16  | 3   | 38   |
| OBS            | SN    | 10 | 493 | 20  | 523  | OBS | SN | 20 | 484 | 19  | 523  |
|                | RN    | 18 | 61  | 751 | 830  |     | RN | 21 | 51  | 758 | 830  |
|                | T     | 46 | 571 | 774 | 1391 |     | T  | 60 | 551 | 780 | 1391 |
| 30-h Forecasts |       |    |     |     |      |     |    |    |     |     |      |
|                | Local |    |     |     |      | MOS |    |    |     |     |      |
|                | ZR    | S  | R   | T   |      | ZR  | S  | R  | T   |     |      |
|                | ZR    | 9  | 11  | 4   | 24   |     | ZR | 10 | 9   | 5   | 24   |
| OBS            | SN    | 14 | 415 | 20  | 449  | OBS | SN | 18 | 409 | 22  | 449  |
|                | RN    | 10 | 46  | 691 | 747  |     | RN | 23 | 50  | 674 | 747  |
|                | T     | 33 | 472 | 715 | 1220 |     | T  | 51 | 468 | 701 | 1220 |
| 42-h Forecasts |       |    |     |     |      |     |    |    |     |     |      |
|                | Local |    |     |     |      | MOS |    |    |     |     |      |
|                | ZR    | S  | R   | T   |      | ZR  | S  | R  | T   |     |      |
|                | Z     | 10 | 20  | 7   | 37   |     | Z  | 18 | 15  | 4   | 37   |
| OBS            | S     | 14 | 425 | 21  | 460  | OBS | S  | 33 | 397 | 30  | 460  |
|                | R     | 22 | 57  | 617 | 696  |     | R  | 27 | 31  | 638 | 696  |
|                | T     | 46 | 502 | 645 | 1193 |     | T  | 78 | 443 | 672 | 1193 |

Table 3.4. Comparative verification of MOS guidance and local forecasts of PoPT for 86 stations, 0000 GMT cycle. Only cases where the local PoP was >30% were included. Data for TCC were not available for the 30-h projection. The long dash (--) indicates there were no observations of freezing rain.

| Projection (h) | Region (No. Stns) | Type of Forecast | Bias |      |      | Percent Correct | Skill Score | POD  |      | FAR  |      | Number of Cases |
|----------------|-------------------|------------------|------|------|------|-----------------|-------------|------|------|------|------|-----------------|
|                |                   |                  | ZR   | S    | R    |                 |             | ZR   | S    | ZR   | S    |                 |
| 18             | Eastern (24)      | MOS              | 1.19 | 1.11 | 0.93 | 89.4            | .789        | 0.31 | 0.93 | 0.74 | 0.16 | 548             |
|                |                   | Local            | 0.75 | 1.09 | 0.96 | 93.6            | .870        | 0.38 | 0.96 | 0.50 | 0.12 |                 |
|                | Southern (22)     | MOS              | 1.00 | 0.90 | 1.01 | 96.4            | .830        | 0.33 | 0.86 | 0.67 | 0.05 | 194             |
|                |                   | Local            | 0.33 | 1.00 | 1.01 | 97.4            | .878        | 0.33 | 0.90 | 0.00 | 0.10 |                 |
|                | Central (28)      | MOS              | 0.45 | 1.07 | 0.95 | 93.5            | .875        | 0.18 | 0.98 | 0.60 | 0.09 | 433             |
|                |                   | Local            | 1.00 | 1.04 | 0.96 | 93.3            | .872        | 0.36 | 0.96 | 0.64 | 0.07 |                 |
|                | Western (12)      | MOS              | 3.00 | 1.02 | 0.97 | 92.9            | .852        | 1.00 | 0.92 | 0.67 | 0.10 | 254             |
|                |                   | Local            | 3.00 | 0.93 | 1.03 | 91.7            | .825        | 1.00 | 0.85 | 0.67 | 0.08 |                 |
|                | All Stations      | MOS              | 0.97 | 1.07 | 0.96 | 92.2            | .843        | 0.29 | 0.95 | 0.70 | 0.12 | 1429            |
|                |                   | Local            | 0.87 | 1.04 | 0.98 | 93.7            | .872        | 0.39 | 0.94 | 0.56 | 0.09 |                 |
| 30             | Eastern (24)      | MOS              | 2.17 | 1.07 | 0.92 | 90.1            | .806        | 0.50 | 0.94 | 0.77 | 0.12 | 504             |
|                |                   | Local            | 1.67 | 1.12 | 0.91 | 89.5            | .793        | 0.33 | 0.96 | 0.80 | 0.15 |                 |
|                | Southern (21)     | MOS              | 1.25 | 1.00 | 0.99 | 94.6            | .678        | 0.50 | 0.73 | 0.60 | 0.27 | 221             |
|                |                   | Local            | 0.88 | 1.18 | 1.00 | 96.8            | .808        | 0.63 | 0.91 | 0.29 | 0.23 |                 |
|                | Central (28)      | MOS              | 1.63 | 1.00 | 0.95 | 90.3            | .819        | 0.44 | 0.93 | 0.73 | 0.07 | 443             |
|                |                   | Local            | 0.56 | 1.07 | 0.95 | 92.1            | .847        | 0.25 | 0.98 | 0.56 | 0.09 |                 |
|                | Western (12)      | MOS              | 1.50 | 1.03 | 0.97 | 84.9            | .699        | 0.00 | 0.83 | 1.00 | 0.19 | 198             |
|                |                   | Local            | 0.00 | 1.25 | 0.87 | 86.4            | .730        | 0.00 | 0.95 | --   | 0.24 |                 |
|                | All Stations      | MOS              | 1.70 | 1.03 | 0.95 | 90.1            | .808        | 0.42 | 0.91 | 0.75 | 0.11 | 1366            |
|                |                   | Local            | 0.90 | 1.11 | 0.93 | 91.1            | .825        | 0.32 | 0.96 | 0.64 | 0.14 |                 |
| 42             | Eastern (24)      | MOS              | 1.53 | 1.09 | 0.93 | 86.4            | .726        | 0.53 | 0.86 | 0.65 | 0.21 | 469             |
|                |                   | Local            | 0.94 | 1.10 | 0.95 | 88.1            | .754        | 0.47 | 0.88 | 0.50 | 0.20 |                 |
|                | Southern (22)     | MOS              | 2.33 | 0.71 | 1.01 | 93.6            | .732        | 0.33 | 0.62 | 0.86 | 0.13 | 173             |
|                |                   | Local            | 1.00 | 0.86 | 1.02 | 96.0            | .824        | 0.67 | 0.81 | 0.33 | 0.06 |                 |
|                | Central (28)      | MOS              | 2.17 | 1.01 | 0.95 | 90.2            | .813        | 0.33 | 0.92 | 0.85 | 0.08 | 356             |
|                |                   | Local            | 1.33 | 1.09 | 0.90 | 88.8            | .784        | 0.17 | 0.94 | 0.88 | 0.13 |                 |
|                | Western (12)      | MOS              | 4.00 | 1.05 | 0.95 | 87.8            | .740        | 1.00 | 0.84 | 0.75 | 0.19 | 188             |
|                |                   | Local            | 2.00 | 0.98 | 1.00 | 92.0            | .826        | 0.00 | 0.88 | 1.00 | 0.11 |                 |
|                | All Stations      | MOS              | 1.85 | 1.03 | 0.95 | 88.8            | .772        | 0.48 | 0.87 | 0.74 | 0.15 | 1186            |
|                |                   | Local            | 1.07 | 1.06 | 0.96 | 90.1            | .795        | 0.41 | 0.90 | 0.62 | 0.15 |                 |

Table 3.5. Same as Table 3.4 except for 1200 GMT cycle. Data for TCC were not available for the 18- and 42-h projections.

| Projection (h) | Region (No. Stns) | Type of Forecast | Bias |      |      | Percent Correct | Skill Score | POD  |      | FAR  |      | Number of Cases |
|----------------|-------------------|------------------|------|------|------|-----------------|-------------|------|------|------|------|-----------------|
|                |                   |                  | ZR   | S    | R    |                 |             | ZR   | S    | ZR   | S    |                 |
| 18             | Eastern (24)      | MOS              | 1.58 | 1.14 | 0.89 | 87.7            | .763        | 0.25 | 0.94 | 0.84 | 0.18 | 497             |
|                |                   | Local            | 0.92 | 1.15 | 0.91 | 88.3            | .771        | 0.25 | 0.94 | 0.73 | 0.18 |                 |
|                | Southern (21)     | MOS              | 1.86 | 1.00 | 0.97 | 95.3            | .754        | 0.86 | 0.83 | 0.54 | 0.17 | 212             |
|                |                   | Local            | 1.71 | 1.00 | 0.97 | 95.8            | .774        | 0.86 | 0.83 | 0.50 | 0.17 |                 |
|                | Central (28)      | MOS              | 1.71 | 1.01 | 0.93 | 93.0            | .868        | 0.71 | 0.95 | 0.58 | 0.06 | 442             |
|                |                   | Local            | 1.50 | 1.03 | 0.93 | 92.5            | .858        | 0.64 | 0.96 | 0.57 | 0.07 |                 |
|                | Western (12)      | MOS              | 0.80 | 0.99 | 1.01 | 88.3            | .756        | 0.00 | 0.83 | 1.00 | 0.16 | 240             |
|                |                   | Local            | 0.40 | 1.15 | 0.93 | 87.9            | .753        | 0.00 | 0.92 | 1.00 | 0.21 |                 |
|                | All Stations      | MOS              | 1.58 | 1.05 | 0.94 | 90.7            | .819        | 0.50 | 0.93 | 0.68 | 0.12 | 1391            |
|                |                   | Local            | 1.21 | 1.09 | 0.93 | 90.7            | .819        | 0.47 | 0.94 | 0.61 | 0.14 |                 |
| 30             | Eastern (24)      | MOS              | 2.07 | 1.08 | 0.90 | 86.7            | .745        | 0.47 | 0.91 | 0.77 | 0.16 | 467             |
|                |                   | Local            | 1.13 | 1.09 | 0.94 | 88.2            | .766        | 0.33 | 0.91 | 0.71 | 0.17 |                 |
|                | Southern (22)     | MOS              | --   | 0.94 | 0.99 | 96.4            | .806        | --   | 0.81 | 1.00 | 0.13 | 168             |
|                |                   | Local            | --   | 0.69 | 1.02 | 97.0            | .813        | --   | 0.69 | 1.00 | 0.00 |                 |
|                | Central (28)      | MOS              | 1.63 | 1.05 | 0.91 | 90.9            | .825        | 0.38 | 0.96 | 0.77 | 0.09 | 362             |
|                |                   | Local            | 1.38 | 1.05 | 0.92 | 92.3            | .851        | 0.38 | 0.96 | 0.73 | 0.08 |                 |
|                | Western (12)      | MOS              | 4.00 | 0.96 | 1.00 | 88.3            | .751        | 0.00 | 0.82 | 1.00 | 0.14 | 223             |
|                |                   | Local            | 3.00 | 1.04 | 0.97 | 92.4            | .839        | 1.00 | 0.91 | 0.67 | 0.12 |                 |
|                | All Stations      | MOS              | 2.13 | 1.04 | 0.94 | 89.6            | .794        | 0.42 | 0.91 | 0.80 | 0.13 | 1220            |
|                |                   | Local            | 1.38 | 1.05 | 0.96 | 91.4            | .827        | 0.38 | 0.92 | 0.73 | 0.12 |                 |
| 42             | Eastern (24)      | MOS              | 2.75 | 0.97 | 0.94 | 88.0            | .770        | 0.58 | 0.86 | 0.79 | 0.12 | 459             |
|                |                   | Local            | 1.92 | 1.07 | 0.92 | 86.5            | .738        | 0.17 | 0.89 | 0.91 | 0.16 |                 |
|                | Southern (21)     | MOS              | 2.00 | 0.58 | 1.00 | 93.6            | .651        | 0.60 | 0.50 | 0.70 | 0.14 | 172             |
|                |                   | Local            | 1.20 | 1.00 | 0.99 | 95.9            | .783        | 0.40 | 0.83 | 0.67 | 0.17 |                 |
|                | Central (28)      | MOS              | 2.00 | 0.99 | 0.91 | 87.6            | .771        | 0.50 | 0.92 | 0.75 | 0.07 | 378             |
|                |                   | Local            | 0.94 | 1.08 | 0.90 | 88.1            | .770        | 0.38 | 0.95 | 0.60 | 0.11 |                 |
|                | Western (12)      | MOS              | 0.75 | 0.94 | 1.04 | 85.3            | .697        | 0.00 | 0.78 | 1.00 | 0.17 | 184             |
|                |                   | Local            | 0.50 | 1.22 | 0.88 | 85.3            | .710        | 0.00 | 0.93 | 1.00 | 0.24 |                 |
|                | All Stations      | MOS              | 2.11 | 0.96 | 0.97 | 88.3            | .777        | 0.49 | 0.86 | 0.77 | 0.10 | 1193            |
|                |                   | Local            | 1.24 | 1.09 | 0.93 | 88.2            | .773        | 0.27 | 0.92 | 0.78 | 0.15 |                 |

Table 4.1. Definition of the categories used for MOS guidance, local forecasts, and surface observations of wind direction and speed.

| Category | Direction<br>(degrees) | Speed<br>(knots) |
|----------|------------------------|------------------|
| 1        | 340-20                 | $\leq 12$        |
| 2        | 30-60                  | 13-17            |
| 3        | 70-110                 | 18-22            |
| 4        | 120-150                | 23-27            |
| 5        | 160-200                | 28-32            |
| 6        | 210-240                | $\geq 33$        |
| 7        | 250-290                | ---              |
| 8        | 300-330                | ---              |

Table 4.2. Comparative verification of MOS guidance and local surface wind forecasts for 93 stations, 0000 GMT cycle.

| Fcst. Proj. (h) | Speed         |                       |             |              |                       |                       |              |             |                       |                        |                  |             |             |             |             |             |              |
|-----------------|---------------|-----------------------|-------------|--------------|-----------------------|-----------------------|--------------|-------------|-----------------------|------------------------|------------------|-------------|-------------|-------------|-------------|-------------|--------------|
|                 | Direction     |                       |             |              |                       | Contingency Table     |              |             |                       |                        |                  |             |             |             |             |             |              |
|                 | Type of Fcst. | Mean Abs. Error (Deg) | Skill Score | No. of Cases | Mean Alg. Error (Kts) | Mean Abs. Error (Kts) | No. of Cases | Skill Score | Percent Fcst. Correct | Threat Score (>27 Kts) | Bias by Category |             |             |             |             |             | No. of Cases |
|                 |               |                       |             |              |                       |                       |              |             |                       |                        | 1 (No. Obs)      | 2 (No. Obs) | 3 (No. Obs) | 4 (No. Obs) | 5 (No. Obs) | 6 (No. Obs) |              |
| 12              | MOS           | 20                    | .590        | 2868         | 3.2                   | 1.2                   | 2881         | .414        | 86.9                  | .10                    | 1.00             | 1.02        | 0.87        | 1.12        | 0.86        | ***         | 12116        |
|                 | Local         | 18                    | .605        |              | 3.0                   | 1.4                   |              | .453        | 86.6                  | .26                    | 0.97 (10606)     | 1.35 (1125) | 0.85 (306)  | 0.65 (57)   | 0.73 (22)   | *           |              |
| 18              | MOS           | 24                    | .488        | 4926         | 3.4                   | 1.2                   | 4969         | .398        | 75.7                  | .07                    | 1.02             | 0.92        | 0.95        | 1.35        | 1.75        | 2.00        | 12007        |
|                 | Local         | 26                    | .458        |              | 3.4                   | 0.8                   |              | .350        | 73.8                  | .09                    | 1.01 (8916)      | 1.10 (2262) | 0.71 (655)  | 0.43 (146)  | 0.79 (24)   | 0.50 (4)    |              |
| 30              | MOS           | 28                    | .463        | 2982         | 4.1                   | 2.2                   | 3021         | .327        | 83.5                  | .05                    | 0.99             | 1.06        | 0.98        | 1.83        | 1.44        | **          | 11948        |
|                 | Local         | 35                    | .377        |              | 4.4                   | 2.4                   |              | .257        | 79.5                  | .00                    | 0.94 (10355)     | 1.48 (1197) | 1.06 (333)  | 1.06 (47)   | 0.50 (16)   | ** (0)      |              |

\* This category was forecast once but was not observed.  
 \*\* This category was forecast three times but was not observed.  
 \*\*\* This category was forecast four times but was not observed.

Table 4.3. Contingency tables for MOS guidance and local surface wind direction forecasts for 93 stations, 0000 GMT cycle.

| 12-h Forecasts |     |     |     |     |     |     |     |     |      | 18-h Forecasts |     |     |     |     |     |     |     |     |      | 30-h Forecasts |     |     |     |     |     |     |     |     |      |   |     |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|------|----------------|-----|-----|-----|-----|-----|-----|-----|-----|------|----------------|-----|-----|-----|-----|-----|-----|-----|-----|------|---|-----|
| MOS            |     |     |     |     |     |     |     |     |      | MOS            |     |     |     |     |     |     |     |     |      | MOS            |     |     |     |     |     |     |     |     |      |   |     |
| 1              | 2   | 3   | 4   | 5   | 6   | 7   | 8   | T   |      | 1              | 2   | 3   | 4   | 5   | 6   | 7   | 8   | T   |      | 1              | 2   | 3   | 4   | 5   | 6   | 7   | 8   | T   |      |   |     |
| 1              | 346 | 36  | 10  | 2   | 4   | 7   | 11  | 85  | 501  | 1              | 413 | 64  | 14  | 6   | 7   | 8   | 28  | 186 | 726  | 1              | 257 | 34  | 8   | 4   | 9   | 10  | 14  | 126 | 462  |   |     |
| 2              | 56  | 89  | 25  | 2   | 0   | 0   | 1   | 5   | 178  | 2              | 63  | 86  | 51  | 17  | 10  | 9   | 4   | 11  | 251  | 2              | 63  | 59  | 26  | 8   | 5   | 10  | 7   | 6   | 184  |   |     |
| 3              | 6   | 26  | 131 | 38  | 8   | 2   | 0   | 1   | 212  | 3              | 13  | 37  | 155 | 63  | 20  | 8   | 2   | 3   | 301  | 3              | 13  | 34  | 101 | 47  | 22  | 5   | 3   | 4   | 229  |   |     |
| OBS            | 4   | 1   | 1   | 25  | 127 | 60  | 7   | 0   | 221  | OBS            | 4   | 5   | 2   | 36  | 164 | 133 | 9   | 12  | 0    | 361            | OBS | 4   | 2   | 4   | 25  | 115 | 77  | 10  | 7    | 5 | 245 |
| 5              | 1   | 0   | 4   | 43  | 266 | 60  | 12  | 3   | 389  | 5              | 6   | 2   | 6   | 91  | 521 | 185 | 27  | 3   | 841  | 5              | 4   | 3   | 10  | 54  | 271 | 73  | 22  | 8   | 445  |   |     |
| 6              | 1   | 0   | 2   | 5   | 47  | 250 | 65  | 4   | 374  | 6              | 1   | 0   | 0   | 3   | 134 | 446 | 167 | 13  | 764  | 6              | 5   | 1   | 1   | 8   | 60  | 242 | 86  | 11  | 414  |   |     |
| 7              | 8   | 0   | 2   | 1   | 5   | 61  | 326 | 68  | 471  | 7              | 10  | 0   | 0   | 2   | 22  | 139 | 528 | 134 | 835  | 7              | 15  | 0   | 0   | 2   | 17  | 79  | 272 | 86  | 471  |   |     |
| 8              | 67  | 7   | 3   | 2   | 4   | 9   | 105 | 325 | 522  | 8              | 132 | 6   | 6   | 4   | 6   | 16  | 214 | 463 | 847  | 8              | 85  | 6   | 2   | 3   | 6   | 15  | 125 | 290 | 532  |   |     |
| T              | 486 | 159 | 202 | 220 | 394 | 396 | 520 | 491 | 2868 | T              | 643 | 197 | 268 | 350 | 853 | 820 | 982 | 813 | 4926 | T              | 444 | 141 | 173 | 241 | 467 | 444 | 536 | 536 | 2982 |   |     |
| Local          |     |     |     |     |     |     |     |     |      | Local          |     |     |     |     |     |     |     |     |      | Local          |     |     |     |     |     |     |     |     |      |   |     |
| 1              | 2   | 3   | 4   | 5   | 6   | 7   | 8   | T   |      | 1              | 2   | 3   | 4   | 5   | 6   | 7   | 8   | T   |      | 1              | 2   | 3   | 4   | 5   | 6   | 7   | 8   | T   |      |   |     |
| 1              | 362 | 46  | 7   | 5   | 3   | 3   | 4   | 71  | 501  | 1              | 424 | 77  | 13  | 6   | 8   | 10  | 26  | 162 | 726  | 1              | 230 | 71  | 13  | 14  | 15  | 13  | 13  | 93  | 462  |   |     |
| 2              | 31  | 110 | 31  | 4   | 0   | 0   | 0   | 2   | 178  | 2              | 65  | 100 | 42  | 17  | 8   | 4   | 6   | 9   | 251  | 2              | 48  | 59  | 32  | 16  | 12  | 7   | 4   | 6   | 184  |   |     |
| 3              | 0   | 19  | 138 | 47  | 5   | 1   | 1   | 1   | 212  | 3              | 16  | 45  | 133 | 73  | 22  | 5   | 5   | 2   | 301  | 3              | 15  | 29  | 84  | 61  | 26  | 7   | 2   | 5   | 229  |   |     |
| OBS            | 4   | 1   | 1   | 20  | 134 | 62  | 1   | 1   | 221  | OBS            | 4   | 5   | 4   | 40  | 172 | 118 | 13  | 6   | 3    | 361            | OBS | 4   | 4   | 5   | 20  | 111 | 90  | 8   | 4    | 3 | 245 |
| 5              | 2   | 0   | 4   | 37  | 277 | 58  | 10  | 1   | 389  | 5              | 8   | 1   | 13  | 125 | 526 | 131 | 28  | 9   | 841  | 5              | 5   | 5   | 13  | 60  | 251 | 76  | 25  | 10  | 445  |   |     |
| 6              | 1   | 0   | 3   | 3   | 47  | 244 | 69  | 7   | 374  | 6              | 5   | 1   | 3   | 9   | 177 | 394 | 153 | 22  | 764  | 6              | 13  | 5   | 4   | 12  | 80  | 181 | 96  | 23  | 414  |   |     |
| 7              | 8   | 2   | 2   | 0   | 11  | 61  | 285 | 102 | 471  | 7              | 32  | 1   | 2   | 7   | 43  | 127 | 420 | 203 | 835  | 7              | 28  | 4   | 4   | 12  | 34  | 63  | 197 | 129 | 471  |   |     |
| 8              | 84  | 0   | 5   | 3   | 4   | 8   | 74  | 344 | 522  | 8              | 166 | 4   | 3   | 7   | 12  | 17  | 164 | 474 | 847  | 8              | 123 | 8   | 14  | 10  | 14  | 22  | 73  | 268 | 532  |   |     |
| T              | 489 | 178 | 210 | 233 | 409 | 376 | 444 | 529 | 2868 | T              | 721 | 233 | 249 | 416 | 914 | 701 | 808 | 884 | 4926 | T              | 466 | 186 | 184 | 296 | 522 | 377 | 414 | 537 | 2982 |   |     |

Table 4.4. Contingency tables for MOS guidance and local surface wind speed forecasts for 93 stations, 0000 GMT cycle.

|     |       | 12-h Forecasts |     |    |    |   |       | 18-h Forecasts |      |      |     |     |    | 30-h Forecasts |       |   |       |      |     |    |    |    |       |   |    |    |   |   |
|-----|-------|----------------|-----|----|----|---|-------|----------------|------|------|-----|-----|----|----------------|-------|---|-------|------|-----|----|----|----|-------|---|----|----|---|---|
|     |       | MOS            |     |    |    |   |       | MOS            |      |      |     |     |    | MOS            |       |   |       |      |     |    |    |    |       |   |    |    |   |   |
|     |       | 1              | 2   | 3  | 4  | 5 | 6     | T              | 1    | 2    | 3   | 4   | 5  | 6              | T     | 1 | 2     | 3    | 4   | 5  | 6  | T  | 1     | 2 | 3  | 4  | 5 | 6 |
| 1   | 9987  | 552            | 57  | 8  | 2  | 0 | 10606 | 1              | 7908 | 861  | 131 | 12  | 4  | 0              | 8916  | 1 | 9481  | 741  | 106 | 22 | 4  | 1  | 10355 |   |    |    |   |   |
| 2   | 559   | 443            | 102 | 17 | 3  | 1 | 1125  | 2              | 1055 | 919  | 227 | 55  | 6  | 0              | 2262  | 2 | 649   | 397  | 116 | 28 | 7  | 0  | 1197  |   |    |    |   |   |
| 3   | 56    | 140            | 84  | 20 | 6  | 0 | 306   | 3              | 94   | 262  | 208 | 72  | 15 | 4              | 655   | 3 | 102   | 114  | 84  | 25 | 8  | 0  | 333   |   |    |    |   |   |
| OBS | 4     | 8              | 14  | 17 | 11 | 6 | 1     | 57             | OBS  | 4    | 4   | 30  | 50 | 46             | 14    | 2 | 146   | OBS  | 4   | 5  | 14 | 17 | 7     | 2 | 2  | 47 |   |   |
| 5   | 1     | 4              | 5   | 8  | 2  | 2 | 22    | 5              | 1    | 3    | 6   | 10  | 3  | 1              | 24    | 5 | 3     | 3    | 4   | 4  | 2  | 0  | 16    |   |    |    |   |   |
| 6   | 0     | 0              | 0   | 0  | 0  | 0 | 0     | 6              | 0    | 0    | 1   | 2   | 0  | 1              | 4     | 6 | 0     | 0    | 0   | 0  | 0  | 0  | 0     |   |    |    |   |   |
| T   | 10611 | 1153           | 265 | 64 | 19 | 4 | 12116 | T              | 9062 | 2075 | 623 | 197 | 42 | 8              | 12007 | T | 10240 | 1269 | 327 | 86 | 23 | 3  | 11948 |   |    |    |   |   |
|     |       | Local          |     |    |    |   |       | Local          |      |      |     |     |    | Local          |       |   |       |      |     |    |    |    |       |   |    |    |   |   |
| 1   | 2     | 3              | 4   | 5  | 6  | T | 1     | 2              | 3    | 4    | 5   | 6   | T  | 1              | 2     | 3 | 4     | 5    | 6   | T  |    |    |       |   |    |    |   |   |
| 1   | 9782  | 782            | 40  | 2  | 0  | 0 | 10606 | 1              | 7700 | 1139 | 72  | 4   | 1  | 0              | 8916  | 1 | 9001  | 1183 | 157 | 12 | 2  | 0  | 10355 |   |    |    |   |   |
| 2   | 449   | 583            | 86  | 7  | 0  | 0 | 1125  | 2              | 1108 | 984  | 158 | 10  | 2  | 0              | 2262  | 2 | 655   | 418  | 101 | 18 | 4  | 1  | 1197  |   |    |    |   |   |
| 3   | 44    | 144            | 105 | 9  | 4  | 0 | 306   | 3              | 151  | 313  | 156 | 31  | 4  | 0              | 655   | 3 | 103   | 137  | 75  | 14 | 2  | 2  | 333   |   |    |    |   |   |
| OBS | 4     | 2              | 12  | 25 | 13 | 5 | 0     | 57             | OBS  | 4    | 14  | 42  | 65 | 15             | 9     | 1 | 146   | OBS  | 4   | 8  | 23 | 12 | 4     | 0 | 47 |    |   |   |
| 5   | 2     | 2              | 4   | 6  | 7  | 1 | 22    | 5              | 2    | 6    | 12  | 2   | 1  | 1              | 24    | 5 | 1     | 6    | 7   | 2  | 0  | 0  | 16    |   |    |    |   |   |
| 6   | 0     | 0              | 0   | 0  | 0  | 0 | 0     | 6              | 1    | 0    | 0   | 1   | 2  | 0              | 4     | 6 | 0     | 0    | 0   | 0  | 0  | 0  | 0     |   |    |    |   |   |
| T   | 10279 | 1523           | 260 | 37 | 16 | 1 | 12116 | T              | 8976 | 2484 | 463 | 63  | 19 | 2              | 12007 | T | 9768  | 1767 | 352 | 50 | 8  | 3  | 11948 |   |    |    |   |   |

Table 4.5. Same as Table 4.2 except for 24 stations in the Eastern Region.

| Fcst. Proj. (h) | Type of Fcst. | Direction             |             |              |                       | Speed                 |             |                       |                        |                   |             | No. of Cases |             |             |             |             |
|-----------------|---------------|-----------------------|-------------|--------------|-----------------------|-----------------------|-------------|-----------------------|------------------------|-------------------|-------------|--------------|-------------|-------------|-------------|-------------|
|                 |               | Mean Abs. Error (Deg) | Skill Score | No. of Cases | Mean Abs. Error (Kts) | Mean Alg. Error (Kts) | Skill Score | Percent Fcst. Correct | Threat Score (>27 Kts) | Contingency Table |             |              |             |             |             |             |
|                 |               |                       |             |              |                       |                       |             |                       |                        | 1 (No. Obs)       | 2 (No. Obs) |              | 3 (No. Obs) | 4 (No. Obs) | 5 (No. Obs) | 6 (No. Obs) |
| 12              | MOS           | 21                    | .554        | 741          | 2.9                   | 1.0                   | .408        | 86.3                  | .20                    | 1.01              | 0.96        | 0.83         | 1.56        | 0.57        | **          | 2881        |
|                 | Local         | 20                    | .559        |              | 3.0                   | 1.5                   | .427        | 84.6                  | .10                    | 0.95              | 1.46        | 0.77         | 1.22        | 0.43        | **          |             |
| 18              | MOS           | 24                    | .453        | 1294         | 3.1                   | 0.9                   | .390        | 74.4                  | .13                    | 1.03              | 0.89        | 0.92         | 1.86        | 1.17        | 0.33        | 2841        |
|                 | Local         | 27                    | .428        |              | 3.2                   | 0.8                   | .337        | 71.6                  | .20                    | 0.99              | 1.11        | 0.66         | 0.95        | 1.33        | 0.33        |             |
| 30              | MOS           | 26                    | .466        | 756          | 3.8                   | 1.7                   | .336        | 83.1                  | .14                    | 1.01              | 0.89        | 0.91         | 1.92        | 1.67        | *           | 2844        |
|                 | Local         | 34                    | .352        |              | 4.5                   | 2.5                   | .279        | 78.1                  | .00                    | 0.93              | 1.40        | 1.22         | 1.50        | 0.67        | ***         |             |

\* This category was neither forecast nor observed.  
 \*\* This category was forecast once but was not observed.  
 \*\*\* This category was forecast twice but was not observed.



Table 4.6. Same as Table 4.2 except for 23 stations in the Southern Region.

| Fcst. Proj. (h) | Type of Fcst. | Direction             |             |              |                       | Speed                 |                        |                   |     |      |      | No. of Cases |      |      |     |      |
|-----------------|---------------|-----------------------|-------------|--------------|-----------------------|-----------------------|------------------------|-------------------|-----|------|------|--------------|------|------|-----|------|
|                 |               | Mean Abs. Error (Deg) | Skill Score | No. of Cases | Mean Abs. Error (Kts) | Mean Alg. Error (Kts) | Threat Score (>27 Kts) | Contingency Table |     |      |      |              |      |      |     |      |
|                 |               |                       |             |              |                       |                       |                        | Bias by Category  |     |      |      |              |      |      |     |      |
|                 |               | 1 (No. Obs)           | 2 (No. Obs) | 3 (No. Obs)  | 4 (No. Obs)           | 5 (No. Obs)           | 6 (No. Obs)            |                   |     |      |      |              |      |      |     |      |
| 12              | MOS           | 22                    | .557        | 690          | 3.5                   | 2.0                   | .360                   | 88.9              | .14 | 0.98 | 1.31 | 0.93         | 2.00 | 1.50 | **  | 3187 |
|                 | Local         | 19                    | .599        |              | 3.1                   | 1.8                   | .407                   | 88.9              | .67 | 0.96 | 1.68 | 0.67         | 0.50 | 1.50 | *   |      |
| 18              | MOS           | 25                    | .461        | 1269         | 3.5                   | 1.4                   | .366                   | 76.0              | .06 | 1.00 | 0.97 | 0.97         | 1.48 | 0.88 | *** | 3122 |
|                 | Local         | 28                    | .447        |              | 3.4                   | 0.5                   | .308                   | 74.4              | .00 | 1.01 | 1.17 | 0.46         | 0.21 | 0.00 | *   |      |
| 30              | MOS           | 31                    | .419        | 717          | 4.2                   | 2.9                   | .314                   | 85.7              | .25 | 0.96 | 1.36 | 1.35         | 2.17 | 0.25 | *   | 3177 |
|                 | Local         | 39                    | .339        |              | 4.2                   | 2.5                   | .228                   | 83.2              | .00 | 0.95 | 1.76 | 0.65         | 0.67 | 0.00 | *   |      |

\* This category was neither forecast nor observed.  
 \*\* This category was forecast three times but was not observed.  
 \*\*\* This category was forecast four times but was not observed.

Table 4.7. Same as Table 4.2 except for 28 stations in the Central Region.

| Fcst. Proj. (h) | Direction     |                       |             |                   | Speed                 |                       |              |             |                       |                        |                   |            |            |           |           |              |      |
|-----------------|---------------|-----------------------|-------------|-------------------|-----------------------|-----------------------|--------------|-------------|-----------------------|------------------------|-------------------|------------|------------|-----------|-----------|--------------|------|
|                 | Type of Fcst. | Mean Abs. Error (Deg) | Skill Score | No. of Cases      | Mean Abs. Error (Kts) | Mean Alg. Error (Kts) | No. of Cases | Skill Score | Percent Fcst. Correct | Threat Score (>27 Kts) | Contingency Table |            |            |           |           | No. of Cases |      |
|                 |               | Bias by Category      |             | Contingency Table |                       |                       |              |             |                       |                        |                   |            |            |           |           |              |      |
|                 |               | 1                     | 2           | 3                 | 4                     | 5                     | 6            |             |                       |                        |                   |            |            |           |           |              |      |
|                 |               | (No. Obs)             | (No. Obs)   | (No. Obs)         | (No. Obs)             | (No. Obs)             | (No. Obs)    |             |                       |                        |                   |            |            |           |           |              |      |
| 12              | MOS           | 17                    | .630        | 1146              | 3.1                   | 0.8                   | 1150         | .454        | 84.2                  | .05                    | 1.02              | 0.91       | 0.85       | 1.07      | 1.00      | *            | 3866 |
|                 | Local         | 16                    | .627        |                   | 2.8                   | 1.0                   |              | .482        | 83.7                  | .36                    | 0.97 (3193)       | 1.22 (488) | 0.92 (144) | 0.60 (30) | 0.73 (11) | *            |      |
| 18              | MOS           | 21                    | .526        | 1939              | 3.2                   | 1.0                   | 1951         | .415        | 72.5                  | .03                    | 1.04              | 0.86       | 0.91       | 1.23      | 4.40      | **           | 3887 |
|                 | Local         | 24                    | .471        |                   | 3.2                   | 0.7                   |              | .357        | 69.3                  | .00                    | 1.00 (2637)       | 1.10 (894) | 0.85 (277) | 0.43 (74) | 1.60 (5)  | *            |      |
| 30              | MOS           | 26                    | .486        | 1207              | 4.1                   | 1.9                   | 1219         | .334        | 79.8                  | .00                    | 1.01              | 0.91       | 0.80       | 2.50      | 2.83      | **           | 3830 |
|                 | Local         | 33                    | .396        |                   | 4.3                   | 2.0                   |              | .266        | 74.8                  | .00                    | 0.94 (3136)       | 1.35 (499) | 1.04 (171) | 1.17 (18) | 0.83 (6)  | *            |      |

\* This category was neither forecast nor observed.

\*\* This category was forecast three times but was not observed.

Table 4.8. Same as Table 4.2 except for 18 stations in the Western Region.

| Fcst. Proj. (h) | Direction     |                       |             |              | Speed                 |                       |              |             |                       |                        | No. of Cases |                   |       |      |      |      |      |
|-----------------|---------------|-----------------------|-------------|--------------|-----------------------|-----------------------|--------------|-------------|-----------------------|------------------------|--------------|-------------------|-------|------|------|------|------|
|                 | Type of Fcst. | Mean Abs. Error (Deg) | Skill Score | No. of Cases | Mean Abs. Error (Kts) | Mean Alg. Error (Kts) | No. of Cases | Skill Score | Percent Fcst. Correct | Threat Score (>27 Kts) |              | Contingency Table |       |      |      |      |      |
|                 |               |                       |             |              |                       |                       |              |             |                       |                        |              | Bias by Category  |       |      |      |      |      |
|                 |               | 1                     | 2           | 3            | 4                     | 5                     | 6            |             |                       |                        |              |                   |       |      |      |      |      |
|                 |               | (No. Obs)             | (No. Obs)   | (No. Obs)    | (No. Obs)             | (No. Obs)             | (No. Obs)    |             |                       |                        |              |                   |       |      |      |      |      |
| 12              | MOS           | 26                    | .508        | 291          | 4.1                   | 1.5                   | 295          | .357        | 89.6                  | .00                    | 0.99         | 1.15              | 0.89  | 0.71 | 0.50 | *    | 2182 |
|                 | Local         | 24                    | .561        |              | 3.5                   | 1.5                   |              | .437        | 90.9                  | .00                    | 1.00         | 1.12              | 1.00  | 0.43 | 1.00 | *    |      |
| 18              | MOS           | 31                    | .433        | 424          | 4.6                   | 2.6                   | 442          | .372        | 82.5                  | .09                    | 0.98         | 1.07              | 1.16  | 1.09 | 1.20 | 0.00 | 2157 |
|                 | Local         | 32                    | .449        |              | 4.3                   | 1.7                   |              | .346        | 83.9                  | .11                    | 1.03         | 0.90              | 0.77  | 0.23 | 0.60 | 1.00 |      |
| 30              | MOS           | 33                    | .366        | 302          | 4.9                   | 3.5                   | 311          | .286        | 87.3                  | .00                    | 0.96         | 1.59              | 1.43  | 0.45 | 0.00 | *    | 2097 |
|                 | Local         | 40                    | .354        |              | 5.3                   | 3.7                   |              | .164        | 84.4                  | .00                    | 0.95         | 1.66              | 1.71  | 0.64 | 0.33 | **   |      |
|                 |               |                       |             |              |                       |                       |              |             |                       |                        |              | (1933)            | (122) | (28) | (11) | (3)  | (0)  |

\* This category was neither forecast nor observed.

\*\* This category was forecast once but was not observed.

Table 4.9. Comparative verification of MOS guidance and local surface wind forecasts for 94 stations, 1200 GMT cycle.

| Fest. Proj. (h) | Type of Fcast. | Direction             |             |              |                       | Speed                 |              |             |                       |                        |                   | No. of Cases |           |           |           |      |       |
|-----------------|----------------|-----------------------|-------------|--------------|-----------------------|-----------------------|--------------|-------------|-----------------------|------------------------|-------------------|--------------|-----------|-----------|-----------|------|-------|
|                 |                | Mean Abs. Error (Deg) | Skill Score | No. of Cases | Mean Abs. Error (Kts) | Mean Alg. Error (Kts) | No. of Cases | Skill Score | Percent Fcst. Correct | Threat Score (>27 Kts) | Contingency Table |              |           |           |           |      |       |
|                 |                |                       |             |              |                       |                       |              |             |                       |                        | Bias by Category  |              |           |           |           |      |       |
|                 |                | 1                     | 2           | 3            | 4                     | 5                     | 6            |             |                       |                        |                   |              |           |           |           |      |       |
|                 |                | (No. Obs)             | (No. Obs)   | (No. Obs)    | (No. Obs)             | (No. Obs)             | (No. Obs)    | (No. Obs)   | (No. Obs)             | (No. Obs)              | (No. Obs)         | (No. Obs)    | (No. Obs) | (No. Obs) | (No. Obs) |      |       |
| 12              | MOS            | .520                  | .520        | 3593         | 3.4                   | 1.2                   | 3619         | .412        | 82.8                  | .07                    | 1.01              | 0.96         | 0.88      | 1.40      | 0.81      | 0.57 | 11999 |
|                 | Local          | .528                  | .528        |              | 3.4                   | 1.6                   |              | .401        | 80.5                  | .24                    | 0.95              | 1.32         | 1.14      | 0.74      | 0.52      | 1.00 |       |
| 18              | MOS            | .512                  | .512        | 2798         | 3.7                   | 1.6                   | 2825         | .372        | 85.2                  | .06                    | 1.00              | 1.01         | 0.90      | 1.40      | 0.88      | *    | 11861 |
|                 | Local          | .425                  | .425        |              | 3.8                   | 1.6                   |              | .324        | 83.2                  | .12                    | 0.98              | 1.20         | 0.93      | 0.47      | 0.47      | *    |       |
| 30              | MOS            | .453                  | .453        | 3772         | 3.6                   | 1.4                   | 3798         | .355        | 74.1                  | .03                    | 1.01              | 0.96         | 1.00      | 1.17      | 1.42      | 4.00 | 11656 |
|                 | Local          | .372                  | .372        |              | 3.7                   | 0.2                   |              | .247        | 73.6                  | .00                    | 1.11              | 0.75         | 0.50      | 0.30      | 0.25      | 1.00 |       |

\* This category was forecast three times but was not observed.

Table 4.10. Contingency tables for MOS guidance and local surface wind direction forecasts for 94 stations, 1200 GMT cycle.

|     |     | 12-h Forecasts |     |     |     |       |     |     |      | 18-h Forecasts |     |     |     |       |     |     |     | 30-h Forecasts |      |     |     |     |     |     |     |     |     |     |      |   |     |     |   |
|-----|-----|----------------|-----|-----|-----|-------|-----|-----|------|----------------|-----|-----|-----|-------|-----|-----|-----|----------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|---|-----|-----|---|
|     |     | MOS            |     |     |     | T     |     |     |      | MOS            |     |     |     | T     |     |     |     | MOS            |      |     |     | T   |     |     |     |     |     |     |      |   |     |     |   |
|     |     | 1              | 2   | 3   | 4   | 5     | 6   | 7   | 8    | 1              | 2   | 3   | 4   | 5     | 6   | 7   | 8   | 1              | 2    | 3   | 4   | 5   | 6   | 7   | 8   | 1   | 2   | 3   | 4    | 5 | 6   | 7   | 8 |
| 1   | 333 | 43             | 10  | 6   | 5   | 4     | 19  | 111 | 531  | 1              | 264 | 34  | 11  | 3     | 7   | 5   | 17  | 101            | 442  | 1   | 321 | 43  | 12  | 8   | 14  | 12  | 35  | 168 | 613  |   |     |     |   |
| 2   | 66  | 82             | 43  | 5   | 1   | 4     | 6   | 7   | 214  | 2              | 55  | 61  | 19  | 9     | 9   | 3   | 2   | 3              | 161  | 2   | 45  | 67  | 31  | 10  | 9   | 7   | 9   | 8   | 186  |   |     |     |   |
| 3   | 10  | 34             | 138 | 59  | 11  | 4     | 2   | 5   | 263  | 3              | 12  | 28  | 119 | 45    | 15  | 2   | 2   | 2              | 225  | 3   | 12  | 31  | 103 | 52  | 27  | 7   | 3   | 7   | 242  |   |     |     |   |
| OBS | 4   | 2              | 8   | 42  | 174 | 77    | 9   | 2   | 2    | 316            | OBS | 4   | 1   | 4     | 43  | 139 | 69  | 7              | 2    | 3   | 268 | OBS | 4   | 3   | 3   | 23  | 99  | 98  | 16   | 6 | 3   | 251 |   |
| 5   | 3   | 2              | 6   | 64  | 311 | 84    | 18  | 3   | 491  | 5              | 2   | 2   | 6   | 52    | 262 | 72  | 21  | 2              | 419  | 5   | 3   | 0   | 2   | 48  | 321 | 126 | 29  | 6   | 535  |   |     |     |   |
| 6   | 2   | 4              | 0   | 5   | 65  | 254   | 120 | 12  | 462  | 6              | 3   | 2   | 0   | 4     | 45  | 223 | 79  | 5              | 361  | 6   | 2   | 1   | 0   | 7   | 96  | 333 | 100 | 12  | 551  |   |     |     |   |
| 7   | 4   | 1              | 2   | 3   | 14  | 93    | 436 | 99  | 652  | 7              | 5   | 1   | 1   | 2     | 8   | 65  | 280 | 71             | 433  | 7   | 15  | 1   | 3   | 5   | 21  | 121 | 409 | 112 | 687  |   |     |     |   |
| 8   | 106 | 1              | 2   | 4   | 5   | 6     | 154 | 386 | 664  | 8              | 74  | 3   | 3   | 2     | 6   | 11  | 117 | 273            | 489  | 8   | 98  | 4   | 4   | 2   | 7   | 16  | 212 | 364 | 707  |   |     |     |   |
| T   | 526 | 175            | 243 | 320 | 489 | 458   | 757 | 625 | 3593 | T              | 416 | 135 | 202 | 256   | 421 | 388 | 520 | 460            | 2798 | T   | 499 | 150 | 178 | 231 | 593 | 638 | 803 | 680 | 3772 |   |     |     |   |
|     |     | Local          |     |     |     | Local |     |     |      | Local          |     |     |     | Local |     |     |     |                |      |     |     |     |     |     |     |     |     |     |      |   |     |     |   |
|     |     | 1              | 2   | 3   | 4   | 5     | 6   | 7   | 8    | 1              | 2   | 3   | 4   | 5     | 6   | 7   | 8   | 1              | 2    | 3   | 4   | 5   | 6   | 7   | 8   | 1   | 2   | 3   | 4    | 5 | 6   | 7   | 8 |
| 1   | 360 | 32             | 4   | 4   | 6   | 3     | 9   | 113 | 531  | 1              | 239 | 60  | 12  | 7     | 9   | 6   | 12  | 97             | 442  | 1   | 308 | 63  | 11  | 10  | 23  | 20  | 36  | 142 | 613  |   |     |     |   |
| 2   | 62  | 93             | 47  | 3   | 1   | 4     | 1   | 3   | 214  | 2              | 41  | 63  | 31  | 7     | 7   | 3   | 2   | 7              | 161  | 2   | 51  | 60  | 35  | 10  | 6   | 4   | 8   | 12  | 186  |   |     |     |   |
| 3   | 6   | 16             | 144 | 67  | 20  | 3     | 1   | 6   | 263  | 3              | 11  | 27  | 103 | 61    | 17  | 1   | 1   | 4              | 225  | 3   | 15  | 40  | 87  | 60  | 25  | 9   | 3   | 3   | 242  |   |     |     |   |
| OBS | 4   | 6              | 2   | 23  | 143 | 128   | 11  | 2   | 316  | OBS            | 4   | 6   | 3   | 31    | 108 | 100 | 16  | 3              | 1    | 268 | OBS | 4   | 6   | 5   | 27  | 114 | 78  | 11  | 6    | 4 | 251 |     |   |
| 5   | 2   | 1              | 2   | 36  | 317 | 114   | 17  | 2   | 491  | 5              | 2   | 3   | 4   | 51    | 250 | 85  | 20  | 4              | 419  | 5   | 6   | 5   | 7   | 92  | 283 | 104 | 24  | 14  | 535  |   |     |     |   |
| 6   | 2   | 2              | 2   | 3   | 49  | 255   | 128 | 21  | 462  | 6              | 2   | 0   | 4   | 7     | 50  | 188 | 89  | 21             | 361  | 6   | 7   | 3   | 7   | 18  | 99  | 276 | 111 | 30  | 551  |   |     |     |   |
| 7   | 8   | 1              | 1   | 7   | 12  | 75    | 399 | 149 | 652  | 7              | 15  | 3   | 2   | 5     | 19  | 51  | 210 | 128            | 433  | 7   | 48  | 7   | 8   | 11  | 50  | 101 | 289 | 173 | 687  |   |     |     |   |
| 8   | 108 | 1              | 0   | 1   | 8   | 11    | 105 | 430 | 664  | 8              | 122 | 2   | 5   | 2     | 9   | 16  | 82  | 251            | 489  | 8   | 145 | 10  | 5   | 9   | 26  | 27  | 153 | 332 | 707  |   |     |     |   |
| T   | 554 | 148            | 223 | 264 | 541 | 476   | 662 | 725 | 3593 | T              | 438 | 161 | 192 | 248   | 461 | 366 | 419 | 513            | 2798 | T   | 586 | 193 | 187 | 324 | 590 | 552 | 630 | 710 | 3772 |   |     |     |   |

Table 4.11. Contingency tables for MOS guidance and local surface wind speed forecasts for 94 stations, 1200 GMT cycle.

|     | 12-h Forecasts |      |     |     |     |     | 18-h Forecasts |     |       |      |     |     | 30-h Forecasts |       |       |      |      |      |     |     |      |    |       |   |     |
|-----|----------------|------|-----|-----|-----|-----|----------------|-----|-------|------|-----|-----|----------------|-------|-------|------|------|------|-----|-----|------|----|-------|---|-----|
|     | MOS            | MOS  | MOS | MOS | MOS | MOS | MOS            | MOS | MOS   | MOS  | MOS | MOS | MOS            | MOS   | MOS   | MOS  | MOS  | MOS  |     |     |      |    |       |   |     |
| 1   | 2              | 3    | 4   | 5   | 6   | T   | 1              | 2   | 3     | 4    | 5   | 6   | T              | 1     | 2     | 3    | 4    | 5    | 6   | T   |      |    |       |   |     |
| 1   | 9183           | 668  | 73  | 13  | 0   | 0   | 9937           | 1   | 9586  | 621  | 69  | 15  | 0              | 10291 | 1     | 7598 | 965  | 143  | 17  | 0   | 8723 |    |       |   |     |
| 2   | 753            | 619  | 131 | 35  | 1   | 1   | 1540           | 2   | 621   | 429  | 113 | 23  | 4              | 0     | 1190  | 2    | 1034 | 832  | 234 | 52  | 5    | 1  | 2158  |   |     |
| 3   | 72             | 167  | 118 | 39  | 10  | 3   | 409            | 3   | 81    | 125  | 83  | 22  | 7              | 0     | 318   | 3    | 127  | 235  | 176 | 52  | 14   | 6  | 610   |   |     |
| OBS | 4              | 27   | 31  | 20  | 3   | 0   | 85             | OBS | 4     | 3    | 22  | 13  | 2              | 2     | 3     | 45   | OBS  | 4    | 10  | 34  | 46   | 30 | 14    | 4 | 138 |
| 5   | 3              | 1    | 8   | 9   | 0   | 0   | 21             | 5   | 1     | 4    | 9   | 1   | 2              | 0     | 17    | 5    | 1    | 2    | 10  | 10  | 1    | 0  | 24    |   |     |
| 6   | 0              | 1    | 0   | 3   | 3   | 0   | 7              | 6   | 0     | 0    | 0   | 0   | 0              | 0     | 0     | 6    | 0    | 1    | 0   | 1   | 0    | 1  | 3     |   |     |
| T   | 10015          | 1483 | 361 | 119 | 17  | 4   | 11999          | T   | 10292 | 1201 | 287 | 63  | 15             | 3     | 11861 | T    | 8770 | 2069 | 609 | 162 | 34   | 12 | 11656 |   |     |
|     | Local          |      |     |     |     |     | Local          |     |       |      |     |     | Local          |       |       |      |      |      |     |     |      |    |       |   |     |
| 1   | 2              | 3    | 4   | 5   | 6   | T   | 1              | 2   | 3     | 4    | 5   | 6   | T              | 1     | 2     | 3    | 4    | 5    | 6   | T   |      |    |       |   |     |
| 1   | 8761           | 1075 | 91  | 10  | 0   | 0   | 9937           | 1   | 9345  | 837  | 105 | 3   | 1              | 0     | 10291 | 1    | 7903 | 751  | 67  | 2   | 0    | 0  | 8723  |   |     |
| 2   | 622            | 732  | 181 | 5   | 0   | 0   | 1540           | 2   | 663   | 430  | 87  | 8   | 2              | 0     | 1190  | 2    | 1458 | 577  | 109 | 12  | 2    | 0  | 2158  |   |     |
| 3   | 40             | 193  | 142 | 28  | 4   | 2   | 409            | 3   | 85    | 136  | 90  | 5   | 1              | 1     | 318   | 3    | 282  | 233  | 80  | 12  | 2    | 1  | 610   |   |     |
| OBS | 4              | 23   | 40  | 15  | 2   | 1   | 85             | OBS | 4     | 9    | 20  | 9   | 4              | 1     | 2     | 45   | OBS  | 4    | 33  | 49  | 39   | 13 | 2     | 2 | 138 |
| 5   | 0              | 3    | 11  | 4   | 2   | 1   | 21             | 5   | 2     | 5    | 6   | 1   | 3              | 0     | 17    | 5    | 4    | 8    | 12  | 0   | 0    | 0  | 24    |   |     |
| 6   | 0              | 0    | 0   | 1   | 3   | 3   | 7              | 6   | 0     | 0    | 0   | 0   | 0              | 0     | 0     | 6    | 1    | 0    | 0   | 2   | 0    | 0  | 3     |   |     |
| T   | 9427           | 2026 | 465 | 63  | 11  | 7   | 11999          | T   | 10104 | 1428 | 297 | 21  | 8              | 3     | 11861 | T    | 9681 | 1618 | 307 | 41  | 6    | 3  | 11656 |   |     |

Table 4.12. Same as Table 4.9 except for 24 stations in the Eastern Region.

| Fcst. Proj. (h) | Direction     |                       |             |              | Speed                 |                       |              |             |                       |                        |                   |             |             |             |             |             |              |
|-----------------|---------------|-----------------------|-------------|--------------|-----------------------|-----------------------|--------------|-------------|-----------------------|------------------------|-------------------|-------------|-------------|-------------|-------------|-------------|--------------|
|                 | Type of Fcst. | Mean Abs. Error (Deg) | Skill Score | No. of Cases | Mean Abs. Error (Kts) | Mean Alg. Error (Kts) | No. of Cases | Skill Score | Percent Fcst. Correct | Threat Score (>27 Kts) | Contingency Table |             |             |             |             |             |              |
|                 |               |                       |             |              |                       |                       |              |             |                       |                        | Bias by Category  |             |             |             |             |             | No. of Cases |
|                 |               |                       |             |              |                       |                       |              |             |                       |                        | 1 (No. Obs)       | 2 (No. Obs) | 3 (No. Obs) | 4 (No. Obs) | 5 (No. Obs) | 6 (No. Obs) |              |
| 12              | MOS           | 24                    | .475        | 780          | 3.3                   | 1.0                   | 787          | .423        | 84.6                  | .11                    | 1.02              | 0.88        | 0.79        | 1.41        | 0.60        | 1.00        | 2715         |
|                 | Local         | 24                    | .438        |              | 3.5                   | 1.4                   |              | .372        | 80.4                  | .25                    | 0.95 (2277)       | 1.41 (330)  | 0.87 (85)   | 0.82 (17)   | 0.20 (5)    | 3.00 (1)    |              |
| 18              | MOS           | 24                    | .462        | 714          | 3.5                   | 1.3                   | 722          | .350        | 83.8                  | .20                    | 1.01              | 0.90        | 1.03        | 1.56        | 1.00        | *           | 2737         |
|                 | Local         | 30                    | .361        |              | 3.8                   | 1.6                   |              | .309        | 81.4                  | .00                    | 0.98 (2338)       | 1.11 (325)  | 1.23 (62)   | 0.78 (9)    | 0.67 (3)    | ** (0)      |              |
| 30              | MOS           | 26                    | .468        | 1005         | 3.3                   | 1.2                   | 1008         | .339        | 71.9                  | .00                    | 1.01              | 0.92        | 0.96        | 2.30        | 1.17        | 1.00        | 2618         |
|                 | Local         | 33                    | .354        |              | 3.5                   | 0.1                   |              | .257        | 71.7                  | .00                    | 1.11 (1894)       | 0.79 (556)  | 0.41 (141)  | 0.40 (20)   | 0.33 (6)    | 0.00 (1)    |              |

\* This category was neither forecast nor observed.  
 \*\* This category was forecast once but was not observed.

Table 4.13. Same as Table 4.9 except for 24 stations in the Southern Region.

| Fcst. Proj. (h) | Type of Fcst. | Direction             |             |              |              | Speed            |             |             |             |             |             | No. of Cases | Mean Alg. Error (kts) | Mean Abs. Error (kts) | Skill Score | Percent Fcst. Correct | Threat Score (>27 Kts) | Contingency Table |  |  |  |  |  | No. of Cases |
|-----------------|---------------|-----------------------|-------------|--------------|--------------|------------------|-------------|-------------|-------------|-------------|-------------|--------------|-----------------------|-----------------------|-------------|-----------------------|------------------------|-------------------|--|--|--|--|--|--------------|
|                 |               | Mean Abs. Error (Deg) | Skill Score | No. of Cases | No. of Cases | Bias by Category |             |             |             |             |             |              |                       |                       |             |                       |                        |                   |  |  |  |  |  |              |
|                 |               |                       |             |              |              | 1 (No. Obs)      | 2 (No. Obs) | 3 (No. Obs) | 4 (No. Obs) | 5 (No. Obs) | 6 (No. Obs) |              |                       |                       |             |                       |                        |                   |  |  |  |  |  |              |
| 12              | MOS           | 24                    | .475        | 875          | 3.6          | 1.6              | 887         | .394        | 85.6        | .14         | 1.00        | 0.97         | 1.07                  | 1.35                  | 0.40        | 0.00                  | 3276                   |                   |  |  |  |  |  |              |
|                 | Local         | 23                    | .514        |              | 3.5          | 2.2              |             | .412        | 83.2        | .25         | 0.93        | 1.54 (325)   | 1.36 (86)             | 0.85 (20)             | 0.40 (5)    | 2.00 (1)              |                        |                   |  |  |  |  |  |              |
| 18              | MOS           | 25                    | .484        | 639          | 3.9          | 2.1              | 642         | .341        | 87.1        | .25         | 0.99        | 1.14         | 1.03                  | 2.40                  | 0.25        | *                     | 3147                   |                   |  |  |  |  |  |              |
|                 | Local         | 27                    | .403        |              | 3.8          | 1.8              |             | .296        | 85.8        | .50         | 0.98        | 1.38 (242)   | 0.66 (67)             | 0.40 (5)              | 0.50 (4)    | (0)                   |                        |                   |  |  |  |  |  |              |
| 30              | MOS           | 30                    | .431        | 934          | 3.8          | 1.4              | 941         | .309        | 74.4        | .00         | 1.02        | 0.91         | 0.95                  | 1.37                  | 0.75        | ***                   | 3200                   |                   |  |  |  |  |  |              |
|                 | Local         | 37                    | .369        |              | 3.8          | 0.3              |             | .203        | 74.3        | .00         | 1.11        | 0.72 (560)   | 0.41 (150)            | 0.22 (27)             | 0.00 (8)    | ** (0)                |                        |                   |  |  |  |  |  |              |

\* This category was neither forecast nor observed.  
 \*\* This category was forecast once but was not observed.  
 \*\*\* This category was forecast twice but was not observed.



Table 4.14. Same as Table 4.9 except for 28 stations in the Central Region.

| Fcst. Proj. (h) | Direction     |                       |             |              | Speed                 |                       |              |             |                       |                        |                   | No. of Cases |            |           |          |          |             |
|-----------------|---------------|-----------------------|-------------|--------------|-----------------------|-----------------------|--------------|-------------|-----------------------|------------------------|-------------------|--------------|------------|-----------|----------|----------|-------------|
|                 | Type of Fcst. | Mean Abs. Error (Deg) | Skill Score | No. of Cases | Mean Abs. Error (Kts) | Mean Alg. Error (Kts) | No. of Cases | Skill Score | Percent Fcst. Correct | Threat Score (>27 Kts) | Contingency Table |              |            |           |          |          |             |
|                 |               |                       |             |              |                       |                       |              |             |                       |                        | Bias by Category  |              |            |           |          |          | 1 (No. Obs) |
| 12              | MOS           | 19                    | .588        | 1362         | 3.3                   | 1.1                   | 1367         | .414        | 80.0                  | .05                    | 1.01              | 0.95         | 0.79       | 1.71      | 3.00     | 1.50     |             |
|                 | Local         | 19                    | .572        |              | 3.2                   | 1.6                   |              | .422        | 77.6                  | .33                    | 0.92 (2973)       | 1.35 (578)   | 1.21 (170) | 0.68 (28) | 1.25 (4) | 0.50 (2) |             |
| 18              | MOS           | 21                    | .557        | 1124         | 3.5                   | 1.1                   | 1129         | .417        | 82.9                  | .00                    | 1.03              | 0.88         | 0.72       | 1.63      | 1.57     | **       | 3759        |
|                 | Local         | 25                    | .463        |              | 3.6                   | 1.0                   |              | .351        | 79.6                  | .10                    | 0.99 (3078)       | 1.14 (493)   | 0.83 (162) | 0.37 (19) | 0.43 (7) | *        |             |
| 30              | MOS           | 25                    | .456        | 1502         | 3.4                   | 1.3                   | 1508         | .380        | 70.8                  | .03                    | 1.01              | 0.96         | 0.99       | 0.84      | 3.00     | 9.00     | 3649        |
|                 | Local         | 32                    | .369        |              | 3.6                   | 0.0                   |              | .243        | 68.0                  | .00                    | 1.14 (2499)       | 0.74 (828)   | 0.64 (245) | 0.27 (70) | 0.67 (6) | 1.00 (1) |             |

\* This category was forecast once but was not observed.  
 \*\* This category was forecast three times but was not observed.

Table 4.15. Same as Table 4.9 except for 18 stations in the Western Region.

| Fcast. Proj. (h) | Type of Fcast. | Direction             |             |              |                       | Speed                 |                        |                        |             |             |             |             | No. of Cases |             |             |             |      |
|------------------|----------------|-----------------------|-------------|--------------|-----------------------|-----------------------|------------------------|------------------------|-------------|-------------|-------------|-------------|--------------|-------------|-------------|-------------|------|
|                  |                | Mean Abs. Error (Deg) | Skill Score | No. of Cases | Mean Abs. Error (Kts) | Mean Alg. Error (Kts) | Threat Score (>27 Kts) | Contingency Table      |             |             |             |             |              |             |             |             |      |
|                  |                |                       |             |              |                       |                       |                        | Percent Fcast. Correct | Skill Score | 1 (No. Obs) | 2 (No. Obs) | 3 (No. Obs) |              | 4 (No. Obs) | 5 (No. Obs) | 6 (No. Obs) |      |
| 12               | MOS            | 27                    | .438        | 576          | 3.5                   | 1.0                   | .00                    | .405                   | 81.5        | .00         | 0.99        | 1.07        | 1.00         | 1.00        | 0.00        | 0.00        | 2253 |
|                  | Local          | 25                    | .525        |              | 3.5                   | 1.1                   | .17                    | .365                   | 81.3        |             | 1.02 (1848) | 0.91 (307)  | 1.01 (68)    | 0.65 (20)   | 0.43 (7)    | 0.33 (3)    |      |
| 18               | MOS            | 29                    | .421        | 321          | 4.5                   | 2.8                   | .00                    | .311                   | 88.1        | .00         | 0.96        | 1.54        | 1.41         | 0.50        | 0.00        | *           | 2218 |
|                  | Local          | 35                    | .383        |              | 4.8                   | 3.0                   | .00                    | .266                   | 87.9        |             | 0.98 (2046) | 1.32 (130)  | 1.56 (27)    | 0.42 (12)   | 0.33 (3)    | **          |      |
| 30               | MOS            | 37                    | .364        | 331          | 5.0                   | 2.9                   | .14                    | .338                   | 82.0        | .14         | 0.97        | 1.17        | 1.19         | 0.95        | 0.75        | 0.00        | 2189 |
|                  | Local          | 38                    | .349        |              | 4.7                   | 1.4                   | .00                    | .254                   | 84.0        | .00         | 1.06 (1875) | 0.77 (214)  | 0.41 (74)    | 0.38 (21)   | 0.00 (4)    | 1.00 (1)    |      |

\* This category was neither forecast nor observed.

\*\* This category was forecast once but was not observed.

Table 5.1. Definitions of the cloud amount categories used for the local forecasts and observations. The MOS guidance was based on these same categories for opaque amounts only.

| Category | Cloud Amount             |
|----------|--------------------------|
| 1        | CLR, -SCT -BKN, -OVC, -X |
| 2        | SCT                      |
| 3        | BKN                      |
| 4        | OVC, X                   |

Table 5.2. Comparative verification of MOS guidance and local forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 88 stations, 0000 GMT cycle.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 0.99             | 0.93 | 1.41 | 0.94 | 62.7               | .448           | 10422              |
|                   | Local               | 0.90             | 1.14 | 1.33 | 0.97 | 75.0               | .631           |                    |
|                   | No. Obs.            | 3603             | 1229 | 1016 | 4574 |                    |                |                    |
| 18                | MOS                 | 0.97             | 0.93 | 1.67 | 0.84 | 56.8               | .396           | 10439              |
|                   | Local               | 0.81             | 1.25 | 1.75 | 0.82 | 58.6               | .429           |                    |
|                   | No. Obs.            | 3177             | 1590 | 1321 | 4351 |                    |                |                    |
| 24                | MOS                 | 1.03             | 0.98 | 1.61 | 0.82 | 55.9               | .382           | 10425              |
|                   | Local               | 0.85             | 1.24 | 1.84 | 0.80 | 55.4               | .386           |                    |
|                   | No. Obs.            | 3363             | 1685 | 1152 | 4225 |                    |                |                    |

Table 5.3. Same as Table 5.2 except for 24 stations in the Eastern Region.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 0.94             | 0.82 | 1.40 | 1.00 | 63.1               | .431           | 2574               |
|                   | Local               | 0.91             | 1.00 | 1.31 | 0.98 | 71.6               | .565           |                    |
|                   | No. Obs.            | 619              | 353  | 272  | 1330 |                    |                |                    |
| 18                | MOS                 | 0.93             | 0.87 | 1.54 | 0.93 | 60.1               | .417           | 2549               |
|                   | Local               | 0.74             | 1.13 | 1.71 | 0.89 | 60.9               | .436           |                    |
|                   | No. Obs.            | 593              | 386  | 333  | 1237 |                    |                |                    |
| 24                | MOS                 | 1.05             | 1.01 | 1.53 | 0.87 | 61.3               | .419           | 2548               |
|                   | Local               | 0.85             | 1.37 | 1.84 | 0.83 | 58.7               | .394           |                    |
|                   | No. Obs.            | 692              | 301  | 251  | 1304 |                    |                |                    |

Table 5.4. Same as Table 5.2 except for 22 stations in the Southern Region.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 0.96             | 1.04 | 1.28 | 0.95 | 62.3               | .443           | 2851               |
|                   | Local               | 0.91             | 1.25 | 1.19 | 0.97 | 75.8               | .644           |                    |
|                   | No. Obs.            | 1246             | 314  | 310  | 981  |                    |                |                    |
| 18                | MOS                 | 0.98             | 0.83 | 1.51 | 0.90 | 57.1               | .405           | 2910               |
|                   | Local               | 0.90             | 1.19 | 1.52 | 0.78 | 58.1               | .428           |                    |
|                   | No. Obs.            | 1105             | 520  | 400  | 885  |                    |                |                    |
| 24                | MOS                 | 1.07             | 0.84 | 1.24 | 0.91 | 56.3               | .375           | 2921               |
|                   | Local               | 0.92             | 1.13 | 1.51 | 0.81 | 55.7               | .382           |                    |
|                   | No. Obs.            | 1211             | 571  | 339  | 800  |                    |                |                    |

Table 5.5. Same as Table 5.2 except for 26 stations in the Central Region.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 0.99             | 0.91 | 1.48 | 0.95 | 63.8               | .449           | 3014               |
|                   | Local               | 0.87             | 1.17 | 1.44 | 0.98 | 77.8               | .664           |                    |
|                   | No. Obs.            | 1029             | 343  | 237  | 1405 |                    |                |                    |
| 18                | MOS                 | 0.98             | 1.04 | 1.74 | 0.82 | 56.4               | .378           | 3008               |
|                   | Local               | 0.68             | 1.54 | 1.83 | 0.84 | 59.3               | .428           |                    |
|                   | No. Obs.            | 888              | 402  | 336  | 1382 |                    |                |                    |
| 24                | MOS                 | 1.04             | 0.96 | 1.72 | 0.83 | 55.8               | .369           | 2992               |
|                   | Local               | 0.72             | 1.41 | 1.99 | 0.82 | 55.9               | .384           |                    |
|                   | No. Obs.            | 880              | 466  | 296  | 1350 |                    |                |                    |

Table 5.6. Same as Table 5.2 except for 16 stations in the Western Region.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 1.08             | 1.01 | 1.54 | 0.81 | 61.1               | .431           | 1983               |
|                   | Local               | 0.90             | 1.15 | 1.45 | 0.94 | 74.0               | .618           |                    |
|                   | No. Obs.            | 709              | 219  | 197  | 858  |                    |                |                    |
| 18                | MOS                 | 0.99             | 1.06 | 2.03 | 0.68 | 52.6               | .352           | 1972               |
|                   | Local               | 0.88             | 1.13 | 2.08 | 0.72 | 55.3               | .388           |                    |
|                   | No. Obs.            | 591              | 282  | 252  | 847  |                    |                |                    |
| 24                | MOS                 | 0.91             | 1.20 | 2.04 | 0.62 | 48.6               | .315           | 1964               |
|                   | Local               | 0.87             | 1.07 | 2.11 | 0.68 | 50.1               | .332           |                    |
|                   | No. Obs.            | 580              | 347  | 266  | 771  |                    |                |                    |

Table 5.7. Comparative verification of MOS guidance and local forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 86 stations, 1200 GMT cycle.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 1.03             | 0.95 | 1.58 | 0.84 | 58.4               | .415           | 10083              |
|                   | Local               | 0.95             | 0.99 | 1.47 | 0.92 | 70.4               | .581           |                    |
|                   | No. Obs.            | 3248             | 1633 | 1128 | 4074 |                    |                |                    |
| 18                | MOS                 | 1.09             | 0.99 | 1.32 | 0.85 | 62.2               | .434           | 9962               |
|                   | Local               | 0.82             | 1.43 | 1.79 | 0.88 | 62.2               | .455           |                    |
|                   | No. Obs.            | 3865             | 1069 | 899  | 4129 |                    |                |                    |
| 24                | MOS                 | 1.10             | 0.95 | 1.28 | 0.87 | 60.1               | .409           | 9994               |
|                   | Local               | 0.84             | 1.37 | 1.75 | 0.87 | 58.2               | .402           |                    |
|                   | No. Obs.            | 3473             | 1167 | 975  | 4379 |                    |                |                    |

Table 5.8. Same as Table 5.7 except for 24 stations in the Eastern Region.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 1.00             | 1.10 | 1.43 | 0.89 | 63.6               | .452           | 2395               |
|                   | Local               | 0.91             | 1.06 | 1.54 | 0.93 | 71.5               | .569           |                    |
|                   | No. Obs.            | 645              | 278  | 245  | 1227 |                    |                |                    |
| 18                | MOS                 | 1.11             | 0.97 | 1.17 | 0.91 | 64.2               | .439           | 2424               |
|                   | Local               | 0.83             | 1.38 | 1.78 | 0.89 | 62.3               | .429           |                    |
|                   | No. Obs.            | 714              | 231  | 221  | 1258 |                    |                |                    |
| 24                | MOS                 | 1.05             | 0.91 | 1.36 | 0.93 | 60.8               | .403           | 2414               |
|                   | Local               | 0.93             | 1.18 | 1.67 | 0.85 | 58.6               | .388           |                    |
|                   | No. Obs.            | 597              | 318  | 251  | 1248 |                    |                |                    |

Table 5.9. Same as Table 5.7 except for 22 stations in the Southern Region.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 1.07             | 0.82 | 1.24 | 0.91 | 59.0               | .417           | 2906               |
|                   | Local               | 1.04             | 0.90 | 1.25 | 0.90 | 72.5               | .611           |                    |
|                   | No. Obs.            | 1181             | 566  | 360  | 799  |                    |                |                    |
| 18                | MOS                 | 1.06             | 0.83 | 1.08 | 0.94 | 64.6               | .443           | 2814               |
|                   | Local               | 0.86             | 1.36 | 1.60 | 0.91 | 63.7               | .462           |                    |
|                   | No. Obs.            | 1404             | 322  | 262  | 827  |                    |                |                    |
| 24                | MOS                 | 1.04             | 1.00 | 0.97 | 0.95 | 62.1               | .430           | 2808               |
|                   | Local               | 0.88             | 1.40 | 1.46 | 0.88 | 59.8               | .421           |                    |
|                   | No. Obs.            | 1223             | 316  | 300  | 969  |                    |                |                    |



Table 5.10. Same as Table 5.7 except for 24 stations in the Central Region.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 1.07             | 0.93 | 1.72 | 0.83 | 58.4               | .403           | 2825               |
|                   | Local               | 0.87             | 1.11 | 1.60 | 0.92 | 70.4               | .572           |                    |
|                   | No. Obs.            | 842              | 429  | 267  | 1287 |                    |                |                    |
| 18                | MOS                 | 1.12             | 1.06 | 1.54 | 0.80 | 60.4               | .404           | 2826               |
|                   | Local               | 0.78             | 1.69 | 1.77 | 0.89 | 63.3               | .461           |                    |
|                   | No. Obs.            | 1013             | 283  | 222  | 1308 |                    |                |                    |
| 24                | MOS                 | 1.19             | 0.94 | 1.39 | 0.81 | 59.4               | .389           | 2825               |
|                   | Local               | 0.79             | 1.60 | 1.91 | 0.85 | 58.9               | .405           |                    |
|                   | No. Obs.            | 947              | 319  | 228  | 1331 |                    |                |                    |

Table 5.11. Same as Table 5.7 except for 16 stations in the Western Region.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Percent<br>Correct | Skill<br>Score | Number<br>of Cases |
|-------------------|---------------------|------------------|------|------|------|--------------------|----------------|--------------------|
|                   |                     | 1                | 2    | 3    | 4    |                    |                |                    |
| 12                | MOS                 | 0.90             | 1.07 | 2.08 | 0.68 | 50.9               | .342           | 1957               |
|                   | Local               | 0.92             | 0.93 | 1.57 | 0.90 | 65.7               | .526           |                    |
|                   | No. Obs.            | 580              | 360  | 256  | 761  |                    |                |                    |
| 18                | MOS                 | 1.06             | 1.13 | 1.55 | 0.75 | 58.6               | .404           | 1898               |
|                   | Local               | 0.80             | 1.26 | 2.10 | 0.83 | 58.2               | .415           |                    |
|                   | No. Obs.            | 734              | 233  | 194  | 737  |                    |                |                    |
| 24                | MOS                 | 1.11             | 0.97 | 1.53 | 0.79 | 57.6               | .379           | 1947               |
|                   | Local               | 0.74             | 1.28 | 2.12 | 0.88 | 54.6               | .355           |                    |
|                   | No. Obs.            | 706              | 214  | 196  | 831  |                    |                |                    |

Table 6.1. Definitions of the categories used for verification of persistence, local, and guidance forecasts of ceiling height and visibility.

| Category | Ceiling (ft) | Visibility (mi) |
|----------|--------------|-----------------|
| 1        | $\leq 400$   | $< 1$           |
| 2        | 500-900      | 1-2 3/4         |
| 3        | 1000-2900    | 3-6             |
| 4        | $\geq 3000$  | $> 6$           |

Table 6.2. Comparative verification of MOS guidance, persistence, and local ceiling height forecasts for 93 stations, 0000 GMT cycle.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Log<br>Score | Percent<br>Correct | Skill<br>Score |
|-------------------|---------------------|------------------|------|------|------|--------------|--------------------|----------------|
|                   |                     | 1                | 2    | 3    | 4    |              |                    |                |
| 12                | MOS                 | 1.18             | 0.83 | 0.99 | 1.00 | 3.655        | 72.2               | .410           |
|                   | Local               | 0.84             | 0.89 | 1.10 | 1.01 | 2.202        | 81.1               | .597           |
|                   | Persistence         | 0.89             | 0.95 | 0.95 | 1.03 | 2.263        | 81.1               | .591           |
|                   | No. Obs.            | 849              | 847  | 1872 | 8425 |              |                    |                |
| 15                | Local               | 0.51             | 0.74 | 1.22 | 1.03 | 2.900        | 75.4               | .474           |
|                   | Persistence         | 0.94             | 0.83 | 0.93 | 1.04 | 3.193        | 74.4               | .449           |
|                   | No. Obs.            | 809              | 975  | 1938 | 8455 |              |                    |                |
| 18                | MOS                 | 1.16             | 0.83 | 1.03 | 1.00 | 3.131        | 72.4               | .393           |
|                   | Local               | 0.36             | 0.64 | 1.15 | 1.03 | 2.561        | 74.8               | .421           |
|                   | Persistence         | 1.54             | 0.97 | 0.84 | 1.01 | 3.551        | 70.9               | .358           |
|                   | No. Obs.            | 490              | 819  | 2111 | 8469 |              |                    |                |
| 24                | MOS                 | 1.25             | 0.77 | 0.95 | 1.02 | 2.618        | 77.1               | .380           |
|                   | Local               | 0.31             | 0.59 | 1.34 | 1.00 | 2.367        | 76.1               | .361           |
|                   | Persistence         | 1.92             | 1.22 | 1.10 | 0.93 | 4.071        | 68.3               | .240           |
|                   | No. Obs.            | 396              | 664  | 1624 | 9227 |              |                    |                |

Table 6.3. Same as Table 6.2 except for visibility, 0000 GMT cycle.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Log<br>Score | Percent<br>Correct | Skill<br>Score |
|-------------------|---------------------|------------------|------|------|------|--------------|--------------------|----------------|
|                   |                     | 1                | 2    | 3    | 4    |              |                    |                |
| 12                | MOS                 | 1.30             | 1.04 | 1.06 | 0.97 | 3.334        | 73.0               | .364           |
|                   | Local               | 0.84             | 0.83 | 1.30 | 0.97 | 2.066        | 79.7               | .518           |
|                   | Persistence         | 0.82             | 0.89 | 0.91 | 1.04 | 1.928        | 82.5               | .553           |
|                   | No. Obs.            | 536              | 753  | 1684 | 9016 |              |                    |                |
| 15                | Local               | 0.47             | 0.45 | 1.11 | 1.08 | 2.853        | 73.6               | .354           |
|                   | Persistence         | 0.81             | 0.64 | 0.89 | 1.08 | 3.025        | 73.9               | .366           |
|                   | No. Obs.            | 549              | 1076 | 1747 | 8789 |              |                    |                |
|                   |                     |                  |      |      |      |              |                    |                |
| 18                | MOS                 | 1.20             | 0.90 | 1.11 | 0.99 | 2.701        | 75.9               | .336           |
|                   | Local               | 0.33             | 0.42 | 1.11 | 1.06 | 2.215        | 78.4               | .326           |
|                   | Persistence         | 1.38             | 0.81 | 1.13 | 0.98 | 3.047        | 74.2               | .290           |
|                   | No. Obs.            | 319              | 817  | 1341 | 9420 |              |                    |                |
| 24                | MOS                 | 1.00             | 0.86 | 1.09 | 1.00 | 2.147        | 79.9               | .329           |
|                   | Local               | 0.28             | 0.43 | 1.10 | 1.04 | 1.888        | 81.3               | .312           |
|                   | Persistence         | 2.00             | 1.02 | 1.33 | 0.94 | 3.141        | 73.5               | .217           |
|                   | No. Obs.            | 218              | 657  | 1159 | 9887 |              |                    |                |

Table 6.4. Same as Table 6.2 except for ceiling height for 94 stations, 1200 GMT cycle.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Log<br>Score | Percent<br>Correct | Skill<br>Score |
|-------------------|---------------------|------------------|------|------|------|--------------|--------------------|----------------|
|                   |                     | 1                | 2    | 3    | 4    |              |                    |                |
| 12                | MOS                 | 1.38             | 0.72 | 0.98 | 1.01 | 2.528        | 77.7               | .399           |
|                   | Local               | 0.74             | 0.82 | 1.25 | 0.98 | 1.468        | 84.7               | .602           |
|                   | Persistence         | 0.93             | 0.98 | 1.19 | 0.97 | 1.569        | 84.1               | .591           |
|                   | No. Obs.            | 370              | 663  | 1609 | 9141 |              |                    |                |
| 15                | Local               | 0.65             | 0.90 | 1.24 | 0.98 | 1.981        | 80.6               | .510           |
|                   | Persistence         | 0.74             | 1.05 | 1.15 | 0.98 | 2.188        | 79.0               | .472           |
|                   | No. Obs.            | 464              | 638  | 1707 | 9187 |              |                    |                |
| 18                | MOS                 | 1.38             | 0.68 | 0.93 | 1.01 | 3.260        | 74.7               | .369           |
|                   | Local               | 0.64             | 0.87 | 1.32 | 0.97 | 2.538        | 76.5               | .437           |
|                   | Persistence         | 0.61             | 0.92 | 1.16 | 1.00 | 2.824        | 74.4               | .370           |
|                   | No. Obs.            | 546              | 708  | 1613 | 8737 |              |                    |                |
| 24                | MOS                 | 1.36             | 0.69 | 0.89 | 1.02 | 4.137        | 70.4               | .357           |
|                   | Local               | 0.56             | 0.99 | 1.31 | 0.98 | 3.607        | 69.7               | .359           |
|                   | Persistence         | 0.42             | 0.81 | 1.04 | 1.07 | 4.030        | 67.4               | .253           |
|                   | No. Obs.            | 811              | 808  | 1774 | 8175 |              |                    |                |

Table 6.5. Same as Table 6.2 except for visibility for 94 stations, 1200 GMT cycle.

| Projection<br>(h) | Type of<br>Forecast | Bias by Category |      |      |      | Log<br>Score | Percent<br>Correct | Skill<br>Score |
|-------------------|---------------------|------------------|------|------|------|--------------|--------------------|----------------|
|                   |                     | 1                | 2    | 3    | 4    |              |                    |                |
| 12                | MOS                 | 1.31             | 0.79 | 1.04 | 1.00 | 2.018        | 81.4               | .370           |
|                   | Local               | 0.91             | 0.69 | 1.35 | 0.98 | 1.240        | 86.5               | .560           |
|                   | Persistence         | 1.17             | 1.05 | 1.03 | 0.99 | 1.298        | 87.2               | .578           |
|                   | No. Obs.            | 203              | 646  | 1147 | 9778 |              |                    |                |
| 15                | Local               | 0.90             | 0.83 | 1.34 | 0.97 | 1.673        | 82.5               | .441           |
|                   | Persistence         | 1.14             | 1.24 | 0.97 | 0.99 | 1.824        | 82.7               | .431           |
|                   | No. Obs.            | 220              | 549  | 1246 | 9957 |              |                    |                |
| 18                | MOS                 | 1.30             | 0.83 | 1.02 | 1.00 | 2.523        | 78.8               | .335           |
|                   | Local               | 0.72             | 0.94 | 1.38 | 0.96 | 2.091        | 79.5               | .394           |
|                   | Persistence         | 0.78             | 1.25 | 0.91 | 1.01 | 2.306        | 79.7               | .354           |
|                   | No. Obs.            | 305              | 539  | 1278 | 9471 |              |                    |                |
| 24                | MOS                 | 1.51             | 0.91 | 0.99 | 0.98 | 3.772        | 71.3               | .306           |
|                   | Local               | 0.60             | 1.02 | 1.30 | 0.97 | 3.249        | 71.1               | .307           |
|                   | Persistence         | 0.47             | 0.93 | 0.73 | 1.09 | 3.514        | 71.6               | .213           |
|                   | No. Obs.            | 512              | 725  | 1573 | 8737 |              |                    |                |

Table 7.1. Verification of MOS guidance and local max/min temperature forecasts for 93 stations, 0000 GMT cycle.

| Forecast Projection  | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|----------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Today's Max          | MOS           | 12192           | 1.6                       | 3.9                      | 4.6                              | --                              | --                       |
|                      | Local         |                 | 0.6                       | 3.3                      | 2.4                              | --                              | --                       |
| Tonight's Min        | MOS           | 12061           | -2.6                      | 5.1                      | 10.1                             | 0.8                             | 0.5                      |
|                      | Local         |                 | -1.2                      | 4.2                      | 5.4                              | 0.7                             | 0.4                      |
| Tomorrow's Max       | MOS           | 12163           | 1.2                       | 4.7                      | 8.5                              | --                              | --                       |
|                      | Local         |                 | 0.3                       | 4.4                      | 7.0                              | --                              | --                       |
| Tomorrow Night's Min | MOS           | 12022           | -3.1                      | 5.9                      | 15.6                             | 0.7                             | 0.6                      |
|                      | Local         |                 | -2.0                      | 5.3                      | 11.8                             | 0.6                             | 0.6                      |

Table 7.2. Same as Table 7.1 except for 24 stations in the Eastern Region.

| Forecast Projection  | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|----------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Today's Max          | MOS           | 2796            | 1.3                       | 3.7                      | 3.6                              | --                              | --                       |
|                      | Local         |                 | 0.3                       | 3.3                      | 2.5                              | --                              | --                       |
| Tonight's Min        | MOS           | 2793            | -2.4                      | 5.1                      | 9.6                              | 0.7                             | 0.6                      |
|                      | Local         |                 | -0.9                      | 4.2                      | 4.8                              | 0.7                             | 0.5                      |
| Tomorrow's Max       | MOS           | 2789            | 0.6                       | 4.3                      | 6.7                              | --                              | --                       |
|                      | Local         |                 | -0.2                      | 4.2                      | 6.2                              | --                              | --                       |
| Tomorrow Night's Min | MOS           | 2788            | -2.9                      | 6.1                      | 16.3                             | 0.8                             | 0.6                      |
|                      | Local         |                 | -1.7                      | 5.4                      | 12.6                             | 0.6                             | 0.6                      |

Table 7.3. Same as Table 7.1 except for 24 stations in the Southern Region.

| Forecast Projection  | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|----------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Today's Max          | MOS           | 3362            | 1.4                       | 3.9                      | 5.7                              | --                              | --                       |
|                      | Local         |                 | 0.6                       | 3.4                      | 3.5                              | --                              | --                       |
| Tonight's Min        | MOS           | 3239            | -2.0                      | 4.6                      | 7.5                              | 0.7                             | 0.4                      |
|                      | Local         |                 | -1.0                      | 4.0                      | 4.1                              | 0.7                             | 0.4                      |
| Tomorrow's Max       | MOS           | 3352            | 1.1                       | 4.8                      | 10.0                             | --                              | --                       |
|                      | Local         |                 | 0.5                       | 4.5                      | 8.5                              | --                              | --                       |
| Tomorrow Night's Min | MOS           | 3232            | -2.6                      | 5.4                      | 12.4                             | 0.8                             | 0.5                      |
|                      | Local         |                 | -1.8                      | 5.1                      | 10.1                             | 0.7                             | 0.5                      |



Table 7.4. Same as Table 7.1 except for 28 stations in the Central Region.

| Forecast Projection  | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|----------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Today's Max          | MOS           | 3878            | 2.4                       | 4.3                      | 5.7                              | --                              | --                       |
|                      | Local         |                 | 0.9                       | 3.3                      | 2.1                              | --                              | --                       |
| Tonight's Min        | MOS           | 3879            | -2.9                      | 5.5                      | 13.3                             | 0.8                             | 0.5                      |
|                      | Local         |                 | -1.1                      | 4.4                      | 6.3                              | 0.7                             | 0.3                      |
| Tomorrow's Max       | MOS           | 3874            | 1.9                       | 5.2                      | 9.9                              | --                              | --                       |
|                      | Local         |                 | 0.7                       | 4.6                      | 7.5                              | --                              | --                       |
| Tomorrow Night's Min | MOS           | 3874            | -3.4                      | 6.4                      | 18.8                             | 0.6                             | 0.6                      |
|                      | Local         |                 | -2.0                      | 5.6                      | 13.6                             | 0.6                             | 0.6                      |

Table 7.5. Same as Table 7.1 except for 17 stations in the Western Region.

| Forecast Projection  | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|----------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Today's Max          | MOS           | 2156            | 0.9                       | 3.2                      | 2.6                              | --                              | --                       |
|                      | Local         |                 | 0.3                       | 3.0                      | 1.6                              | --                              | --                       |
| Tonight's Min        | MOS           | 2150            | -3.2                      | 4.8                      | 8.7                              | 0.9                             | 0.6                      |
|                      | Local         |                 | -2.3                      | 4.2                      | 6.6                              | 0.8                             | 0.6                      |
| Tomorrow's Max       | MOS           | 2148            | 0.6                       | 4.3                      | 6.0                              | --                              | --                       |
|                      | Local         |                 | 0.0                       | 3.9                      | 4.4                              | --                              | --                       |
| Tomorrow Night's Min | MOS           | 2128            | -3.6                      | 5.7                      | 13.9                             | 0.8                             | 0.7                      |
|                      | Local         |                 | -2.7                      | 5.1                      | 10.2                             | 0.7                             | 0.7                      |

Table 7.6. Verification of MOS guidance and local max/min temperature forecasts for 93 stations, 1200 GMT cycle.

| Forecast Projection      | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|--------------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Tonight's Min            | MOS           | 11845           | -2.9                      | 4.7                      | 7.9                              | 0.8                             | 0.5                      |
|                          | Local         |                 | -1.6                      | 3.7                      | 3.3                              | 0.8                             | 0.4                      |
| Tomorrow's Max           | MOS           | 11951           | 1.2                       | 4.4                      | 7.4                              | --                              | --                       |
|                          | Local         |                 | 0.2                       | 3.9                      | 4.4                              | --                              | --                       |
| Tomorrow Night's Min     | MOS           | 11823           | -2.9                      | 5.7                      | 14.3                             | 0.8                             | 0.6                      |
|                          | Local         |                 | -1.7                      | 4.8                      | 8.5                              | 0.7                             | 0.5                      |
| Day After Tomorrow's Max | MOS           | 11889           | 1.3                       | 5.4                      | 13.3                             | --                              | --                       |
|                          | Local         |                 | 0.4                       | 5.0                      | 10.4                             | --                              | --                       |

Table 7.7. Same as Table 7.6 except for 24 stations in the Eastern Region.

| Forecast Projection      | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|--------------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Tonight's Min            | MOS           | 2674            | -2.4                      | 4.6                      | 6.5                              | 0.8                             | 0.5                      |
|                          | Local         |                 | -1.2                      | 3.6                      | 2.8                              | 0.8                             | 0.4                      |
| Tomorrow's Max           | MOS           | 2657            | 0.5                       | 4.0                      | 5.2                              | --                              | --                       |
|                          | Local         |                 | -0.4                      | 4.0                      | 4.0                              | --                              | --                       |
| Tomorrow Night's Min     | MOS           | 2659            | -2.8                      | 5.9                      | 15.0                             | 0.9                             | 0.5                      |
|                          | Local         |                 | -1.2                      | 4.9                      | 8.8                              | 0.8                             | 0.4                      |
| Day After Tomorrow's Max | MOS           | 2639            | 0.4                       | 5.0                      | 10.7                             | --                              | --                       |
|                          | Local         |                 | -0.3                      | 4.7                      | 8.6                              | --                              | --                       |

Table 7.8. Same as Table 7.6 except for 24 stations in the Southern Region.

| Forecast Projection      | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|--------------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Tonight's Min            | MOS           | 3211            | -2.6                      | 4.4                      | 6.7                              | 0.8                             | 0.4                      |
|                          | Local         |                 | -1.6                      | 3.5                      | 2.5                              | 0.8                             | 0.3                      |
| Tomorrow's Max           | MOS           | 3329            | 1.0                       | 4.5                      | 8.6                              | --                              | --                       |
|                          | Local         |                 | 0.4                       | 4.0                      | 5.7                              | --                              | --                       |
| Tomorrow Night's Min     | MOS           | 3199            | -2.3                      | 5.2                      | 11.4                             | 0.7                             | 0.5                      |
|                          | Local         |                 | -1.4                      | 4.6                      | 7.0                              | 0.7                             | 0.4                      |
| Day After Tomorrow's Max | MOS           | 3317            | 0.8                       | 5.5                      | 13.1                             | --                              | --                       |
|                          | Local         |                 | 0.6                       | 5.2                      | 12.0                             | --                              | --                       |

Table 7.9. Same as Table 7.6 except for 28 stations in the Central Region.

| Forecast Projection      | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|--------------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Tonight's Min            | MOS           | 3776            | -3.2                      | 5.3                      | 11.0                             | 0.8                             | 0.5                      |
|                          | Local         |                 | -1.5                      | 3.9                      | 3.9                              | 0.8                             | 0.3                      |
| Tomorrow's Max           | MOS           | 3782            | 2.0                       | 4.8                      | 9.6                              | --                              | --                       |
|                          | Local         |                 | 0.5                       | 4.0                      | 4.4                              | --                              | --                       |
| Tomorrow Night's Min     | MOS           | 3783            | -3.4                      | 6.2                      | 17.9                             | 0.8                             | 0.6                      |
|                          | Local         |                 | -1.7                      | 5.1                      | 9.8                              | 0.7                             | 0.5                      |
| Day After Tomorrow's Max | MOS           | 3763            | 2.2                       | 6.1                      | 17.0                             | --                              | --                       |
|                          | Local         |                 | 0.9                       | 5.4                      | 12.3                             | --                              | --                       |

Table 7.10. Same as Table 7.6 except for 17 stations in the Western Region.

| Forecast Projection      | Forecast Type | Number of Cases | Mean Algebraic Error (°F) | Mean Absolute Error (°F) | Percent of Absolute Errors >10°F | Probability of Detection (32°F) | False Alarm Ratio (32°F) |
|--------------------------|---------------|-----------------|---------------------------|--------------------------|----------------------------------|---------------------------------|--------------------------|
| Tonight's Min            | MOS           | 2184            | -3.3                      | 4.5                      | 6.2                              | 0.8                             | 0.5                      |
|                          | Local         |                 | -2.4                      | 3.8                      | 3.7                              | 0.9                             | 0.5                      |
| Tomorrow's Max           | MOS           | 2183            | 1.0                       | 3.8                      | 4.2                              | --                              | --                       |
|                          | Local         |                 | 0.1                       | 3.4                      | 2.8                              | --                              | --                       |
| Tomorrow Night's Min     | MOS           | 2182            | -3.1                      | 5.2                      | 11.3                             | 0.8                             | 0.6                      |
|                          | Local         |                 | -2.5                      | 4.7                      | 8.1                              | 0.8                             | 0.6                      |
| Day After Tomorrow's Max | MOS           | 2170            | 1.4                       | 4.9                      | 10.0                             | --                              | --                       |
|                          | Local         |                 | 0.3                       | 4.3                      | 7.0                              | --                              | --                       |



