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AFOS-ERA VERIFICATION OF GUIDANCE AND LOCAL AVIATION/PUBLIC WEATHER FORECASTS--NO. 5 (OCTOBER 1985-MARCH 1986)

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1. INTRODUCTION

This is the fifth 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). In order to expedite the preparation and distribution of these reports, we've automated the preparation of tables which display the verification results. Although the formats have been revised slightly, we believe these changes will not impact the overall utility of either the document or the tables.

All of the forecasts (both local and guidance) and the verifying observations 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 national AFOS-era verification data processing system is described in detail by Dagostaro (1985). The local collection system is described by Ruth et al. (1985), while guidelines for the public/aviation forecast verification program are given in National Weather Service (1983).

Verification statistics are presented for the cool season months of October 1985 through March 1986 for probability of precipitation (PoP), precipitation type, snow amount, surface wind, cloud amount, ceiling height, visibility, and maximum/minimum (max/min) temperature. 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 verification were official forecasts obtained from the Coded City Forecast (FPUS4) bulletin. All of the local aviation weather forecasts except for cloud amount were obtained from NWS official terminal forecasts (FT's). The local 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 the verifying observations. For example, the local and guidance max/min temperature forecasts are now being verified by using max/min temperatures observed during approximately 12-h periods 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, we do not think it is meaningful to compare results for the 1985-86 cool season with statistics 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, 1980). 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, in day-to-day operations, surface observations at 0200 or 1400 GMT were used as input to the prediction equations about 90% of the time. The LFM model schedule makes this possible, and the guidance is available earlier than if the 0300 and 1500 GMT observations were used.

The forecasts were verified by computing Brier scores (Brier, 1950) for 93 of the 94 stations listed in Table 2.1. 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. 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 changes which were in the correct direction also were tabulated.

Tables 2.2 and 2.7 present the 1985-86 cool season 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.

3. PRECIPITATION TYPE

The objective conditional probability of precipitation type (PoPT) forecast system described in Technical Procedures Bulletin No. 319 (National Weather Service, 1982c) 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 which 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 is conditional and is available whether or not precipitation occurs.

Table 3.1 lists the 86 stations used for the precipitation type verification. The verification sample included only those cases in which precipitation actually occurred within ± 1 hour of the forecast valid time. If a combination of precipitation types occurred during the 2-h period, the verifying observation was considered as freezing if freezing precipitation was observed at any time, or frozen if frozen (but not freezing) precipitation occurred. 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.

Based on the three precipitation type categories, forecast-observed contingency tables were constructed. Bias by category,[1] probability of detection (POD),[2] false alarm ratio (FAR),[3] skill score,[4] and percent correct were calculated from contingency tables of precipitation type. Tables 3.2 and 3.3 show the verification results for 0000 and 1200 GMT, respectively. The number of freezing rain cases is small, and conclusions for that category must be drawn with caution.

4. SNOW AMOUNT

The objective probability of snow amount forecast system described in Technical Procedures Bulletin No. 318 (National Weather Service, 1982b) and by Bocchieri (1983) provides categorical forecasts for four categories of snow amount: <2, 2 or 3, 4 or 5, and ≥ 6 inches. Forecast equations based on LFM

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[1] In the discussion of precipitation type, snow amount, surface wind, cloud amount, 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.

[2] 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.

[3] 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.

[4] The skill score used throughout this report is the Heidke skill score (Panofsky and Brier, 1965).

model fields are used to produce conditional probabilities of snow amount for the three categories of ≥2, ≥4, and ≥6 inches. These conditional probabilities are converted to unconditional probability forecasts through the use of MOS PoP and probability of frozen precipitation forecasts. The unconditional probability forecasts are converted to categorical forecasts through the use of the threshold technique described in Technical Procedures Bulletin No. 318.

Verification scores were computed for both local and guidance forecasts for 80 of the 86 stations listed in Table 3.1. The local and guidance forecasts were verified for the 12-24 h period from both 0000 and 1200 GMT, since the guidance was provided for this projection only.

We constructed forecast-observed contingency tables for four categories of snow amount. These tables were used for computing several different scores: bias by category, percent correct, skill score, threat score,[5] POD, and FAR. The percent correct and skill score were calculated based on all four categories. The bias by category, threat score, POD and FAR were calculated separately for the three cumulative categories of ≥2, ≥4, and ≥6 inches. Table 4.1 shows comparative verification scores of snow amount forecasts for both cycles.

5. SURFACE WIND

The objective surface wind forecasts were generated by the cool season, LFM-based equations described in Technical Procedures Bulletin No. 347 (National Weather Service, 1984b). Prior to the 1983-84 cool season, the surface wind prediction equations were rederived to account for the latest avaiable data from the LFM model. 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.

We verified the 12-, 18-, and 24-h forecasts from both 0000 and 1200 GMT. 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 kt, the wind forecasts were verified in two ways. First, for those cases in which the speed forecasts from both the FT and MOS were ≥10 kt, the mean absolute error 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 were computed from contingency tables of wind speed. The definitions of the categories used in the contingency tables for wind speed and direction are given in Table 5.1. The threat score used here was calculated by combining events of the upper two categories (winds ≥28 kt). In addition, for all cases in which the wind speeds (forecasts or corresponding observations) were at least 10 kt, the skill score for the wind direction forecasts was computed from

[5]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.

contingency tables. The 93 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. Another point that needs to be considered is the nature of the wind forecast 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. Only the results based on the observation at the specific verification time are 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 the verification statistics.

The results for all 93 (93) stations combined for the 0000 (1200) GMT cycles are presented in Table 5.2 (Table 5.7). Tables 5.3-5.6 and 5.8-5.11 show scores for the NWS Eastern, Southern, Central, and Western Regions for 0000 and 1200 GMT, respectively.

In addition, 42-h forecasts of winds $\geq$23 kt were collected as part of the AFOS-era verification system. The local forecasts were manually entered by forecasters at the WSFO's. Since these forecasts specify the occurrence (or non-occurrence) of an operationally significant wind, they were verified against the highest observed sustained wind within $\pm$3 hours surrounding the forecast valid time. For purposes of comparison, and analogous to the development of the MOS prediction equations, another set of scores also were calculated by using the 1-min average wind at the forecast valid time as the verifying observation. The results are given in Tables 5.12 and 5.13 for the 0000 and 1200 GMT forecast cycles, respectively.

6. CLOUD AMOUNT

During the 1985-86 cool season, the objective cloud amount 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 0200 (1400) GMT surface observations to produce probability forecasts of the four categories of cloud amount shown in Table 6.1. We converted the probability estimates to "best category" forecasts by an algorithm that produced good bias characteristics (bias of approximately 1.0 for each category) on the developmental sample. The algorithm used to obtain the best category is also described in Technical Procedures Bulletin No. 303.

We compared the local forecasts with a matched sample of guidance forecasts for the 94 stations listed in Table 2.1 for the 12-, 18-, and 24-h projections from 0000 and 1200 GMT. The surface observations used for verification were converted to the cloud amount categories given in Table 6.1. 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. Prior to the 1983-84 cool season, opaque sky cover amounts from surface observations were used in determining the observed categories. However, the hourly surface reports from which the verifying observations are now being taken do not record total opaque sky cover as part of the observation; hence, thin clouds are also included. For example, a report of overcast with eight tenths opaque and two tenths thin, which previously was put into the broken category, now 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 statistics for both the guidance and local forecasts.

The results for all stations combined are shown in Tables 6.2 and 6.7 for the 0000 and 1200 GMT cycle forecasts, respectively. Tables 6.3-6.6 and Tables 6.8-6.11 show scores for the NWS Eastern, Southern, Central, and Western Regions, for the 0000 and 1200 GMT cycles, respectively.

7. CEILING AND VISIBILITY

During the 1985-86 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 0200 (1400) GMT surface observations.

Verification scores were computed for the local and guidance forecasts for 93 of the 94 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 general nature.

We constructed forecast-observed contingency tables for the four categories of ceiling and visibility given in Table 7.1. These categories were used for computing several different scores: bias by category, percent correct, skill score, and log score.[6] We have summarized the results in Tables 7.2-7.5. 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 for the 12-, 18-, and 24-h projections are actually 10-, 16-, and 22-h forecasts.

8. MAXIMUM/MINIMUM TEMPERATURE

Effective with the 1200 GMT cycle on November 25, 1985, the max/min temperature guidance was generated by a new set of LFM-based regression equations.

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[6] The log score 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.

These equations, described more completely in Technical Procedures Bulletin No. 356 (National Weather Service, 1985c), predict daytime max and nighttime min temperatures. During the cool season, daytime is defined as 9 a.m. to 7 p.m. Local Standard Time (LST), while nighttime extends from 7 p.m. to 9 a.m. LST. The guidance equations were 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 (Erickson and Dallavalle, 1986). The fall season is defined as September-November; the winter, as December-February; and the spring, as March-May. During the 0000 GMT cycle, the MOS max/min guidance is valid for periods corresponding to today's max, tonight's min, tomorrow's max, and tomorrow night's min. Similarly, for the 1200 GMT forecast cycle, guidance is produced for tonight's min, tomorrow's max, tomorrow night's min, and the day after tomorrow's max. Station observations at 0000 GMT (1200 GMT) are used as possible predictors only in the first period forecast of today's max (tonight's min). The valid periods of the guidance closely approximate those of the local forecaster who makes predictions of today's high, tonight's low, and so forth.

Note that prior to November 25, 1985, the MOS max/min guidance was valid for calendar day, rather than daytime/nighttime, periods. The LFM-based regression equations used are described in Technical Procedures Bulletin No. 344 (National Weather Service, 1984a). The calendar day guidance was not completely acceptable to the forecaster and so was replaced. We will not discuss the calendar day problem further in this report, except to emphasize that during the first third of the 1985-86 cool season the guidance was for the calendar day instead of the daytime/nighttime. The interested reader is referred to Dallavalle et al. (1980) for more details on the older MOS temperature forecast system.

In this publication, we present results for both guidance and local forecasts which were verified by using observations approximating the daytime high or nighttime low. Unfortunately, the max/min observations given in the synoptic and hourly reports do not correspond exactly to the daytime or nighttime periods. Thus, for example, while the min temperature reported at 1200 GMT is valid for the preceding 12-h period, this observation inadequately represents the overnight low. Even in the eastern United States, the min temperature during winter often occurs around sunrise and after 1200 GMT. This problem is exacerbated in the western United States where 1200 GMT corresponds to 0400 LST, a time preceding the normal occurrence of the overnight low. On the other hand, the 0000 GMT report of the max temperature, valid for the previous 12 hours, is a reasonable indicator of the daytime high.

To overcome these difficulties with the max/min observations, a procedure for deducing the daytime high and nighttime low from synoptic and hourly reports was implemented at the beginning of the 1984-85 cool season. In the local AFOS-era verification software (Ruth et al., 1985), daytime is defined as 7 a.m to 7 p.m. LST and nighttime as 7 p.m. to 8 a.m LST. The local program scans the synoptic and hourly reports to determine if the max/min observation adequately represents the daytime or nighttime period. If this observation is satisfactory, it is kept. If, however, the reported value is not representative of the day or night period, then an algorithm is used to deduce an appropriate value from available synoptic and hourly temperature observations. The local forecaster is also provided the option of replacing the estimated observation with the exact nighttime low or daytime high. It's important to note, then, that the verification observations used in this report correspond reasonably well to the local and guidance forecast periods.

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, percent of absolute errors >10°F, probability of detection[7] of min temperatures ≤32°F, and false alarm ratio[8] for min temperatures ≤32°F were computed for 93 stations in the conterminous United States (Table 2.1). At 0000 (1200) GMT, the local and guidance 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 and guidance min temperature forecasts are valid for nighttime periods ending about 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 8.1 and 8.6, respectively. A matched sample of approximately 15,000 cases per forecast projection was available. Similarly, Tables 8.2-8.5 give the 0000 GMT verification scores for the Eastern, Southern, Central, and Western Regions, respectively. Tables 8.7-8.10 show scores by NWS region for the 1200 GMT cycle.

9. SUMMARY

Highlights of the 1985-86 cool season verification results, summarized by general type of weather element, are:

- 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 and both forecast cycles show that the local forecasts were 9.3% better than the guidance for the first period, 5.0% better for the second period, and 3.9% better for the third period. Depending on the projection and cycle, the local forecasters deviated from the guidance about 56% of the time, while these changes were in the correct direction from 55% to 65% of the time. The percent improvement over climate scores for all three periods and both forecast cycles indicate that most of the local and guidance scores were slightly better than those for the previous cool season (Carter et al., 1985).

- Precipitation Type - Local and guidance forecasts for 85 (86) stations and projections of 18, 30, and 42 hours from 0000 (1200) GMT comprised the comparative verification. Only those cases for which the local PoP was ≥30% were verified, and surface observations within ±1 hour of the forecast valid time were used. Based on three-category (freezing rain, snow, rain) contingency tables, the results

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[7] Here, the probability of detection is defined to be the fraction of time the min temperature was correctly forecast to be ≤32°F when the previous day's min was ≥40°F.

[8] Here, the false alarm ratio is defined to be the fraction of forecasts of ≤32°F that failed to verify when the previous day's min was ≥40°F.

for all stations combined for all three projections and both cycles indicate that the guidance was slightly better than the locals in terms of percent correct and skill score. In terms of bias by category and probability of detection, the guidance forecasts of freezing rain were better than the locals; however, the false alarm ratios for the guidance were generally worse than the corresponding values for the local forecasts. The local and guidance forecasts of snow performed at about the same level of accuracy. Overall, the scores for all three categories were similar to those of the previous cool season, with two notable exceptions: (a) the false alarm ratios for the freezing rain category were generally better than those for the 1984-85 cool season for both the guidance and the local forecasts, and (b) the 1985-86 bias by category values for freezing rain were lower for both the guidance and local forecasts.

- Snow Amount - The snow amount verification involved 80 stations for the 12-24 h period from 0000 and 1200 GMT. In terms of skill score and threat score, the local forecasts were better than the guidance for all three categories for both cycles. In terms of bias by category, the local forecasts were better than the guidance for all three categories for the 0000 GMT cycle, while the opposite was true for the 1200 GMT. Although the local forecasts for the $\geq$2 inch category improved over the previous cool season, they were generally worse for the $\geq$4 and $\geq$6 inch categories. The guidance was usually worse than for the previous cool season for the $\geq$4 and $\geq$6 inch categories for 0000 GMT, and for all three categories during the 1200 GMT cycle.

- Surface Wind - The AFOS-era wind verification involved the comparison of surface wind speed and direction forecasts for 93 stations for projections of 12, 18, and 24 hours from 0000 and 1200 GMT. The statistics for all stations combined for wind direction and speed indicate the locals were able to improve upon MOS for the 12-h forecast projection from both 0000 and 1200 GMT, while MOS was better than the locals for the 18- and 24-h projections. The results are similar to those for the previous cool season, except for the threat score for winds $\geq$28 kt. During the 1984-85 and 1985-86 cool seasons, the MOS guidance significantly underforecast winds $\geq$18 kt. This appears to be directly related to the LFM's new surface stress profile which was implemented in January 1985 (National Weather Service, 1985b). We also verified 42-h forecasts of winds $\geq$23 kt and found that there was considerable difference in the characteristics of the MOS and local predictions. MOS forecast only about half as many strong winds as the observed 1-min average. On the other hand, the locals predicted three or four times as many strong winds as the observed 1-min average. The bias of the local forecasts was still high, but much less so, when the verifying observation was the 3-h maximum speed. The comparative accuracy and skill measures reflect the comparative biases of the MOS and local forecasts. For a rare event such as this, a low bias usually leads to a higher percent correct with lower skill and threat scores.

- Cloud Amount - The verification for cloud amount involved 94 stations and forecasts for projections of 12, 18, and 24 hours from 0000 and

1200 GMT. The skill scores and percents correct for all stations combined indicate both the 0000 and 1200 GMT cycle local forecasts were better than the corresponding guidance for the 12-h projection, while the guidance was better than the local forecasts for the 18- and 24-h projections. In terms of bias by category (clear, scattered, broken, and overcast), the results varied by category, cycle, and forecast projection, but overall, the guidance was better. The results indicate that both types of forecasts generally were less accurate than those for the previous cool season.

- Ceiling and Visibility - The verification involved the comparison of local forecasts, MOS guidance, and persistence for 93 stations for projections of 12, 15, 18, and 24 hours from 0000 and 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 10-, 16-, and 22-h forecasts for the guidance. For both forecast cycles combined, the log scores, percents correct, and skill scores show that the local forecasts of ceiling were about as accurate as persistence for the 12-h projection, but the local forecasts were better than persistence for all other projections. The local forecasts were better than the guidance for the 12-h and 18-h projections, but they were about the same as the guidance for the 24-h projection. The bias by category varied from projection to projection and cycle to cycle, with persistence clearly being better than the local forecasts for the first three categories at the 15-h projection only. For visibility, the log score, percent correct, and skill score for both cycles combined show that persistence was better than local and guidance forecasts for the 12-h projection, while the locals were better than persistence for the 15-h projection. Overall, the local forecasts were generally better than both persistence and the guidance for the 18-h and 24-h projections.

- 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 initial model time. As stated earlier, prior to November 25, 1985, the MOS guidance was valid for calendar day periods; however, on that date, a new MOS system to forecast max/min temperatures for the same projections as the local forecaster replaced the calendar day guidance. As verifying observations, max or min temperatures for daytime or nighttime intervals were used.

  For all stations and projections combined, we found the mean absolute errors of the local max and min temperature forecasts averaged 0.5°F and 0.4°F, respectively, less than those for the MOS guidance. In every region and for virtually all projections, the local forecasters were able to improve over the MOS guidance, both in terms of mean absolute error and the percentage of errors >10°F. A portion of this improvement is likely due to the inclusion of the older calendar day MOS guidance during the first third of the 1985-86 cool season. However, we think that most of the superiority in the local forecasts is related to the forecaster's ability to discern synoptic situations where the MOS guidance is deficient. Compared to the 1984-85 cool season verifications, the local forecasts improved by nearly 0.2°F mean absolute error for all stations and projections combined. Note, however, that most of the improvement was in the min forecasts. We do not know whether the change in the local forecasts from one season to the next is related to the improved objective guidance system, a change in the difficulty of specific forecasting situations, or the implementation of the new Regional Analysis and Forecast System (National Weather Service, 1985a). Note, too, that the MOS min guidance was more accurate by 0.7°F mean absolute error for all stations combined, when compared to the 1984-85 cool season results. Obviously, this improvement is due, in large part, to the new guidance system.

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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. TCC was not available during the 0000 GMT cycle for surface wind, ceiling height, and visibility. ELP was not available for surface wind, ceiling height, and visibility during the 1200 GMT cycle.

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	AVP	Scranton, Pennsylvania
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

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.0914		41.9			
(1st period)	LOCAL	0.0832	9.0	47.2	15205	8669	61.4
24-36	MOS	0.1036		35.4			
(2nd period)	LOCAL	0.0985	4.9	38.5	15032	8311	61.2
36-48	MOS	0.1152		27.9			
(3rd period)	LOCAL	0.1111	3.6	30.4	15181	8255	55.3

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.1056		46.6			
(1st period)	LOCAL	0.0986	6.6	50.2	3704	2329	64.6
24-36	MOS	0.1127		42.4			
(2nd period)	LOCAL	0.1091	3.2	44.3	3668	2180	61.5
36-48	MOS	0.1311		34.6			
(3rd period)	LOCAL	0.1257	4.1	37.3	3694	2122	57.1

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.0750		40.1			
(1st period)	LOCAL	0.0690	7.9	44.8	4013	2242	65.5
24-36	MOS	0.0829		33.4			
(2nd period)	LOCAL	0.0766	7.6	38.4	3876	2160	70.2
36-48	MOS	0.0926		25.1			
(3rd period)	LOCAL	0.0899	2.9	27.3	4013	2232	64.8

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.0945		39.5			
(1st period)	LOCAL	0.0840	11.2	46.3	4648	2623	54.3
24-36	MOS	0.1114		33.3			
(2nd period)	LOCAL	0.1077	3.3	35.5	4651	2471	53.5
36-48	MOS	0.1217		24.7			
(3rd period)	LOCAL	0.1193	1.9	26.1	4639	2461	44.1

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.0913		40.2			
(1st period)	LOCAL	0.0820	10.2	46.3	2840	1475	62.8
24-36	MOS	0.1075		29.6			
(2nd period)	LOCAL	0.0998	7.1	34.6	2837	1500	60.3
36-48	MOS	0.1157		24.9			
(3rd period)	LOCAL	0.1083	6.4	29.7	2835	1440	57.2

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.0955		40.9			
(1st period)	LOCAL	0.0863	9.7	46.6	14948	8478	64.6
24-36	MOS	0.1054		33.5			
(2nd period)	LOCAL	0.1000	5.1	36.9	15094	8359	55.8
36-48	MOS	0.1184		26.6			
(3rd period)	LOCAL	0.1133	4.3	29.7	14934	8495	60.6

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.1076		45.1			
(1st period)	LOCAL	0.0992	7.8	49.4	3649	2290	65.3
24-36	MOS	0.1199		39.7			
(2nd period)	LOCAL	0.1119	6.7	43.8	3668	2214	59.4
36-48	MOS	0.1300		33.5			
(3rd period)	LOCAL	0.1241	4.5	36.5	3645	2159	59.7

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.0747		41.0			
(1st period)	LOCAL	0.0681	8.8	46.2	3872	2216	72.2
24-36	MOS	0.0861		30.1			
(2nd period)	LOCAL	0.0823	4.4	33.2	4003	2162	61.2
36-48	MOS	0.0951		24.0			
(3rd period)	LOCAL	0.0884	7.0	29.3	3867	2371	68.8

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.1035		38.6			
(1st period)	LOCAL	0.0922	10.9	45.3	4611	2562	57.3
24-36	MOS	0.1121		29.7			
(2nd period)	LOCAL	0.1074	4.3	32.7	4607	2535	45.7
36-48	MOS	0.1304		23.5			
(3rd period)	LOCAL	0.1261	3.3	26.0	4607	2407	54.2

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

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	0.0955		37.8			
(1st period)	LOCAL	0.0849	11.0	44.6	2816	1410	65.0
24-36	MOS	0.1027		33.0			
(2nd period)	LOCAL	0.0974	5.2	36.5	2816	1448	59.7
36-48	MOS	0.1158		23.5			
(3rd period)	LOCAL	0.1127	2.7	25.5	2815	1558	58.9

Table 3.1. Eighty-six stations used for comparative verification of MOS guidance and local precipitation type forecasts. These same stations, except for MFR, PDX, PVD, SDF, SPI, and TCC were used for snow amount verification.

DCA	Washington	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	AVP	Scranton, Pennsylvania
PIT	Pittsburgh, Pennsylvania	ERI	Erie, Pennsylvania
CAE	Columbia, South Carolina	CHS	Charleston, South Carolina
CRW	Charleston, West Virginia	BKW	Berkely, 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	Detriot, 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	Settle-Tacoma, Washington	GEG	Spokane, Washington

Table 3.2. Comparative verification of MOS guidance and local forecasts of PoPT for 85 stations for the 0000 GMT cycle. Only cases where the local PoP was ≥30% were included. Data for TCC were not available for the 30- and 42-h projections. Data for ELP were not available for all projections. The long dash (----) indicated there were no forecasts of freezing rain.

Projection (h)	Region Number of Stations	Type of Forecast	Bias ZR	Bias S	Bias R	Percent Correct	Skill Score	POD ZR	POD S	FAR ZR	FAR S
18	Eastern 24	MOS	0.94	0.93	1.05	91.0	0.819	0.35	0.87	0.63	0.06
		LOCAL	0.53	0.95	1.05	90.6	0.810	0.24	0.87	0.56	0.08
		No. Obs.	17	287	431						
	Southern 21	MOS	0.40	0.91	1.02	96.0	0.765	0.40	0.74	0.00	0.19
		LOCAL	0.40	0.78	1.03	94.5	0.662	0.20	0.61	0.50	0.22
		No. Obs.	5	23	245						
	Central 28	MOS	0.55	0.98	1.07	90.9	0.831	0.41	0.91	0.25	0.07
		LOCAL	0.55	0.96	1.09	89.4	0.803	0.41	0.88	0.25	0.08
		No. Obs.	29	258	261						
	Western 12	MOS	0.43	0.99	1.03	91.4	0.830	0.14	0.90	0.67	0.09
		LOCAL	0.57	0.94	1.06	91.8	0.837	0.14	0.88	0.75	0.06
		No. Obs.	7	117	155						
	All Stations	MOS	0.64	0.96	1.05	91.8	0.834	0.36	0.89	0.43	0.07
		LOCAL	0.53	0.94	1.06	91.0	0.817	0.31	0.87	0.42	0.08
		No. Obs.	58	685	1092						
30	Eastern 24	MOS	0.97	0.99	1.01	89.9	0.807	0.45	0.89	0.54	0.11
		LOCAL	0.71	1.01	1.02	88.5	0.777	0.29	0.87	0.59	0.14
		No. Obs.	38	247	411						
	Southern 20	MOS	0.33	0.89	1.03	95.9	0.743	0.00	0.78	1.00	0.13
		LOCAL	0.83	0.67	1.03	94.2	0.634	0.50	0.50	0.40	0.25
		No. Obs.	6	18	218						
	Central 28	MOS	1.34	0.90	1.04	85.7	0.750	0.44	0.83	0.67	0.08
		LOCAL	0.54	1.02	1.05	85.4	0.734	0.24	0.86	0.55	0.15
		No. Obs.	41	268	279						
	Western 12	MOS	5.00	0.86	1.07	88.4	0.763	0.00	0.81	1.00	0.06
		LOCAL	5.00	0.95	1.01	90.5	0.808	0.00	0.87	1.00	0.08
		No. Obs.	1	100	140						
	All Stations	MOS	1.15	0.93	1.03	89.1	0.789	0.41	0.85	0.65	0.09
		LOCAL	0.69	1.00	1.03	88.5	0.774	0.28	0.86	0.59	0.14
		No. Obs.	86	633	1048						
42	Eastern 24	MOS	1.15	0.96	1.01	88.2	0.760	0.20	0.84	0.83	0.12
		LOCAL	0.50	1.00	1.02	87.5	0.740	0.15	0.85	0.70	0.15
		No. Obs.	20	223	403						
	Southern 20	MOS	0.00	0.75	1.04	95.7	0.690	0.00	0.69	----	0.08
		LOCAL	0.33	0.69	1.04	94.8	0.622	0.00	0.56	1.00	0.18
		No. Obs.	3	16	192						
	Central 28	MOS	1.37	0.86	1.10	85.7	0.736	0.42	0.81	0.69	0.05
		LOCAL	0.53	0.95	1.09	87.9	0.770	0.21	0.86	0.60	0.09
		No. Obs.	19	208	235						
	Western 12	MOS	0.43	0.88	1.11	84.3	0.678	0.29	0.74	0.33	0.15
		LOCAL	0.00	0.92	1.10	87.3	0.737	0.00	0.81	----	0.12
		No. Obs.	7	90	139						
	All Stations	MOS	1.06	0.90	1.05	87.9	0.750	0.29	0.81	0.73	0.10
		LOCAL	0.43	0.96	1.05	88.6	0.760	0.14	0.84	0.67	0.12
		No. Obs.	49	537	969						

Table 3.3. Same as Table 3.2 except for 86 stations for 1200 GMT cycle. Data for TCC were not available for the 18- and 42-h projections. Data for ELP were not available for the 30- and 42-h projections. Data for both LAS and ABQ were not available for the 42-h projection.

Projection (h)	Region Number of Stations	Type of Forecast	Bias			Percent Correct	Skill Score	POD		FAR	
			ZR	S	R			ZR	S	ZR	S
18	Eastern 24	MOS	1.14	0.95	1.02	89.5	0.798	0.46	0.87	0.60	0.08
		LOCAL	0.63	1.03	1.01	90.7	0.818	0.31	0.91	0.50	0.11
		No. Obs.	35	255	417						
	Southern 21	MOS	0.60	0.95	1.01	97.4	0.850	0.20	0.91	0.67	0.05
		LOCAL	0.20	0.95	1.02	95.8	0.755	0.00	0.82	1.00	0.14
		No. Obs.	5	22	237						
	Central 28	MOS	1.03	0.96	1.04	88.8	0.799	0.39	0.89	0.62	0.07
		LOCAL	0.84	0.97	1.06	88.0	0.783	0.39	0.88	0.53	0.09
		No. Obs.	38	306	282						
	Western 12	MOS	1.00	0.84	1.13	87.6	0.753	0.00	0.78	1.00	0.06
		LOCAL	1.50	0.95	1.03	87.6	0.757	0.25	0.84	0.83	0.11
		No. Obs.	4	116	147						
	All Stations	MOS	1.05	0.93	1.04	90.1	0.809	0.39	0.86	0.63	0.07
		LOCAL	0.74	0.99	1.03	90.1	0.806	0.33	0.88	0.56	0.10
		No. Obs.	82	699	1083						
30	Eastern 24	MOS	1.44	0.93	1.02	88.9	0.779	0.33	0.86	0.77	0.08
		LOCAL	0.61	1.00	1.02	89.2	0.782	0.33	0.88	0.45	0.12
		No. Obs.	18	244	385						
	Southern 21	MOS	0.50	1.06	1.00	96.3	0.773	0.25	0.83	0.50	0.21
		LOCAL	0.25	1.00	1.01	95.9	0.737	0.00	0.78	1.00	0.22
		No. Obs.	4	18	223						
	Central 28	MOS	1.24	0.93	1.04	88.4	0.790	0.56	0.88	0.55	0.06
		LOCAL	0.68	0.94	1.10	85.7	0.736	0.28	0.84	0.59	0.10
		No. Obs.	25	232	234						
	Western 12	MOS	0.25	0.90	1.10	87.8	0.754	0.00	0.82	1.00	0.09
		LOCAL	1.25	0.92	1.06	88.9	0.782	0.25	0.84	0.80	0.09
		No. Obs.	4	111	138						
	All Stations	MOS	1.18	0.93	1.03	89.7	0.794	0.41	0.86	0.65	0.08
		LOCAL	0.67	0.96	1.04	89.1	0.780	0.27	0.86	0.59	0.11
		No. Obs.	51	605	980						
42	Eastern 24	MOS	1.07	0.94	1.03	87.1	0.745	0.33	0.83	0.69	0.11
		LOCAL	0.47	1.02	1.03	86.7	0.731	0.13	0.86	0.71	0.16
		No. Obs.	30	222	393						
	Southern 19	MOS	0.33	0.75	1.03	96.5	0.704	0.00	0.67	1.00	0.11
		LOCAL	0.67	1.08	1.00	97.0	0.786	0.00	0.92	1.00	0.15
		No. Obs.	3	12	182						
	Central 28	MOS	1.87	0.86	1.02	83.2	0.707	0.47	0.78	0.75	0.10
		LOCAL	0.87	0.97	1.04	81.9	0.670	0.17	0.81	0.81	0.17
		No. Obs.	30	229	248						
	Western 11	MOS	2.00	0.79	1.14	86.8	0.723	0.00	0.73	1.00	0.07
		LOCAL	2.00	0.93	1.04	89.1	0.776	0.00	0.83	1.00	0.11
		No. Obs.	1	90	129						
	All Stations	MOS	1.42	0.88	1.04	87.0	0.743	0.38	0.79	0.74	0.10
		LOCAL	0.69	0.99	1.03	86.7	0.734	0.14	0.84	0.80	0.15
		No. Obs.	64	553	952						

Table 4.1. Comparative verification of MOS guidance and local forecasts of snow amount for 80 stations for 12-24 h projections.

Cycle (GMT)	Type of Forecast	Bias			Percent Correct	Skill Score	Threat Score			POD			FAR		
		≥2	≥4	≥6			≥2	≥4	≥6	≥2	≥4	≥6	≥2	≥4	≥6
0000	MOS	0.81	0.60	0.24	98.0	0.287	0.218	0.055	0.050	0.32	0.08	0.06	0.60	0.86	0.75
	LOCAL	1.10	0.69	0.41	97.8	0.339	0.275	0.110	0.091	0.45	0.17	0.12	0.59	0.76	0.71
	No. Obs.	194	48	17											
1200	MOS	0.93	0.72	0.56	97.3	0.265	0.215	0.120	0.087	0.34	0.18	0.13	0.63	0.74	0.78
	LOCAL	1.17	0.71	0.44	97.4	0.368	0.304	0.133	0.150	0.51	0.20	0.19	0.57	0.72	0.57
	No. Obs.	231	65	16											

Table 5.1. Definition of the categories used for MOS guidance, local forecasts, and surface observations of wind direction and speed.

Category	Direction (degrees)	Speed (kt)
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 5.2. Comparative verification of MOS guidance and local surface wind forecasts for 93 stations, 0000 GMT cycle.

Fcst Proj (h)	Type of Fcst.	Direction: Mean Abs. Error (Deg)	Direction: Skill Score	Direction: No. of Cases	Speed: Mean Abs. Error (Kts)	Speed: Mean Alg. Error (Kts)	Speed: No. of Cases	Contingency Table: Skill Score	Contingency Table: Percent Fcst. Correct	Contingency Table: Threat Score (>27 Kts)	Bias by Category: 1 No. Obs	Bias by Category: 2 No. Obs	Bias by Category: 3 No. Obs	Bias by Category: 4 No. Obs	Bias by Category: 5 No. Obs	Bias by Category: 6 No. Obs
12	MOS	20	0.555	3056	3.3	0.6	3071	0.386	86.7	0.06	1.03	0.84	0.82	0.59	0.38	0.00
	LOCAL	18	0.611		3.1	1.1		0.466	86.6	0.18	0.98	1.24	1.00	0.70	0.33	0.75
											13060	1479	391	81	24	4
18	MOS	23	0.517	5588	3.3	0.3	5624	0.379	75.8	0.09	1.07	0.81	0.80	0.70	0.47	0.30
	LOCAL	26	0.462		3.4	0.4		0.369	73.9	0.02	1.01	1.10	0.78	0.41	0.12	0.30
											11051	2821	874	233	43	10
24	MOS	26	0.479	3938	3.6	0.9	3960	0.324	81.7	0.00	1.03	0.91	0.68	0.58	0.15	0.00
	LOCAL	30	0.425		3.9	1.5		0.281	76.7	0.02	0.94	1.44	0.94	0.53	0.39	0.25
											12497	1847	536	110	33	8

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

Fcst Proj (h)	Type of Fcst.	Direction: Mean Abs. Error (Deg)	Direction: Skill Score	Direction: No. of Cases	Speed: Mean Abs. Error (Kts)	Speed: Mean Alg. Error (Kts)	Speed: No. of Cases	Contingency Table: Skill Score	Contingency Table: Percent Fcst. Correct	Contingency Table: Threat Score (>27 Kts)	Bias by Category: 1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	21	0.497	749	3.0	0.2	754	0.409	87.6	0.00	1.06	0.66	0.67	0.50	0.00	0.00
	LOCAL	19	0.540		2.9	1.0		0.471	86.1	0.33	0.98	1.20	1.03	0.56	0.50	1.00
											3186	419	78	16	4	1
18	MOS	23	0.446	1484	2.9	0.1	1490	0.405	77.0	0.08	1.11	0.69	0.80	0.54	0.63	0.00
	LOCAL	27	0.384		3.1	0.4		0.357	73.2	0.09	1.03	0.99	0.78	0.46	0.13	2.00
											2659	808	178	39	8	1
24	MOS	24	0.451	775	3.3	0.8	780	0.301	85.8	0.00	1.05	0.73	0.52	0.42	0.33	*
	LOCAL	30	0.337		3.8	1.9		0.267	79.2	0.00	0.93	1.56	1.11	0.83	0.33	*
											3206	393	84	12	3	0

* This category was neither forecast nor observed.

Table 5.4. Same as Table 5.2 except for 23 stations in the Southern Region.

		Direction			Speed												
								Contingency Table									
											Bias by Category						
Fcst Proj (h)	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)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	21	0.555	610	3.2	1.2	611	0.339	89.9	0.00	1.01	0.88	0.93	0.75	**	*
	LOCAL	16	0.639		3.0	1.6		0.428	89.8	0.00	0.98	1.30	1.07	1.00	**	*
											3536	268	57	8	0	0
18	MOS	23	0.527	1403	3.2	0.5	1411	0.327	76.2	0.00	1.07	0.80	0.77	0.63	1.00	*
	LOCAL	26	0.486		3.3	0.4		0.324	75.0	0.00	1.03	1.06	0.53	0.14	0.00	*
											2940	706	184	35	2	0
24	MOS	25	0.508	816	3.3	1.1	820	0.298	86.3	0.00	1.01	0.99	0.47	1.00	0.00	*
	LOCAL	29	0.453		3.7	1.7		0.236	81.2	0.00	0.94	1.63	0.78	0.67	0.00	*
											3427	346	85	6	3	0

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

Table 5.5. Same as Table 5.2 except for 28 stations in the Central Region.

		Direction			Speed											
								Contingency Table								
											Bias by Category					
Fcst Proj (h)	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)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	18	0.586	1293	3.3	0.2	1295	0.389	81.8	0.05	1.05	0.83	0.81	0.56	0.36	0.00
	LOCAL	16	0.646		3.0	0.8		0.459	81.3	0.20	0.96	1.28	1.02	0.73	0.36	0.67
											3740	624	188	48	14	3
18	MOS	20	0.568	2130	3.3	-0.1	2136	0.375	70.0	0.08	1.10	0.84	0.79	0.72	0.15	0.29
	LOCAL	23	0.497		3.4	0.1		0.371	67.6	0.00	0.98	1.19	0.93	0.38	0.11	0.14
											3012	1066	383	125	27	7
24	MOS	23	0.522	1473	3.6	0.3	1479	0.328	77.1	0.00	1.07	0.86	0.61	0.36	0.13	0.00
	LOCAL	26	0.479		4.0	1.2		0.279	70.4	0.03	0.93	1.42	0.98	0.36	0.60	0.50
											3561	738	241	66	15	4

Table 5.6. Same as Table 5.2 except for 18 stations in the Western Region.

Fcst Proj (h)	Type of Fcst.	Direction: Mean Abs. Error (Deg)	Direction: Skill Score	Direction: No. of Cases	Speed: Mean Abs. Error (Kts)	Speed: Mean Alg. Error (Kts)	Speed: No. of Cases	Contingency Table: Skill Score	Contingency Table: Percent Fcst. Correct	Contingency Table: Threat Score (>27 Kts)	Bias by Category: 1 No. Obs	Bias by Category: 2 No. Obs	Bias by Category: 3 No. Obs	Bias by Category: 4 No. Obs	Bias by Category: 5 No. Obs	Bias by Category: 6 No. Obs
12	MOS	28	0.444	404	4.3	1.8	411	0.364	89.2	0.14	0.99	1.18	0.94	0.78	0.33	*
	LOCAL	25	0.491		3.7	1.2		0.469	91.3	0.00	1.00	1.11	0.85	0.56	0.17	*
											2598	168	68	9	6	0
18	MOS	36	0.378	571	4.6	2.0	587	0.369	83.5	0.13	1.00	1.12	0.87	0.88	1.50	0.50
	LOCAL	37	0.355		4.5	1.3		0.355	83.7	0.00	1.01	1.12	0.74	0.74	0.17	0.00
											2440	241	129	34	6	2
24	MOS	35	0.346	874	4.1	1.8	881	0.326	77.5	0.00	0.98	1.13	1.06	1.12	0.17	0.00
	LOCAL	37	0.331		4.1	1.5		0.309	77.4	0.00	0.99	1.15	0.85	0.77	0.25	0.00
											2303	370	126	26	12	4

* This category was neither forecast nor observed.

Table 5.7. Comparative verification of MOS guidance and local surface wind forecasts for 93 stations, 1200 GMT cycle.

		Direction			Speed												
								Contingency Table									
											Bias by Category						
Fcst Proj (h)	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)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	23	0.515	4213	3.3	0.7	4220	0.370	82.5	0.08	1.03	0.90	0.76	0.77	0.35	0.25
	LOCAL	21	0.549		3.3	1.5		0.414	80.5	0.16	0.94 12493	1.39 1892	1.11 546	0.86 111	0.81 31	0.38 8
18	MOS	24	0.506	2967	3.6	1.0	2985	0.380	86.1	0.06	1.02	0.88	0.85	0.43	0.29	0.33
	LOCAL	26	0.470		3.7	0.9		0.342	84.0	0.12	1.00 12909	1.17 1500	0.72 398	0.27 95	0.33 21	0.50 6
24	MOS	25	0.482	2853	3.7	1.0	2874	0.356	86.1	0.00	1.03	0.84	0.76	0.49	0.23	0.00
	LOCAL	30	0.416		3.9	1.1		0.309	83.5	0.03	1.00 12961	1.16 1482	0.70 394	0.28 86	0.18 22	1.00 3

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

		Direction			Speed						Contingency Table						
											Bias by Category						
Fcst Proj (h)	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)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	22	0.487	822	3.1	0.6	822	0.335	86.0	0.00	1.05	0.71	0.62	1.00	0.33	**
	LOCAL	21	0.497		3.3	1.5		0.386	83.0	0.00	0.95 3189	1.43 399	0.92 91	1.25 12	0.67 3	* 0
18	MOS	23	0.468	676	3.1	0.8	679	0.392	87.9	0.00	1.05	0.69	0.80	0.23	0.50	0.00
	LOCAL	28	0.403		3.5	1.0		0.321	84.1	0.00	0.99 3215	1.16 380	0.58 81	0.46 13	1.00 2	2.00 1
24	MOS	24	0.440	691	3.4	0.7	695	0.411	87.4	0.00	1.05	0.70	0.75	0.56	0.25	0.00
	LOCAL	31	0.344		3.6	1.0		0.327	83.2	0.14	0.99 3169	1.16 409	0.67 81	0.22 18	0.25 4	2.00 1

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

Table 5.9. Same as Table 5.7 except for 23 stations in the Southern Region.

Fcst Proj (h)	Type of Fcst.	Direction			Speed												
								Contingency Table									
											Bias by Category						
		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)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	23	0.541	939	3.1	1.2	941	0.356	85.8	0.25	1.00	1.02	0.83	1.38	0.25	*
	LOCAL	21	0.566		3.2	1.8		0.372	83.1	0.14	0.93	1.63	0.98	1.50	0.50	***
											3366	370	93	8	4	0
18	MOS	24	0.524	638	3.6	1.5	640	0.348	88.2	0.00	1.00	0.97	1.13	0.86	0.00	0.00
	LOCAL	24	0.532		3.5	0.9		0.320	88.1	0.00	1.01	1.02	0.48	0.43	0.00	1.00
											3321	295	62	7	2	1
24	MOS	26	0.464	566	3.4	1.5	568	0.339	89.6	0.00	1.02	0.89	0.71	0.11	*	*
	LOCAL	27	0.428		3.7	1.3		0.245	87.3	0.00	1.00	1.09	0.53	0.11	*	**
											3370	276	58	9	0	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 5.10. Same as 5.7 except for 28 stations in the Central Region.

Fcst Proj (h)	Type of Fcst.	Direction: Mean Abs. Error (Deg)	Direction: Skill Score	No. of Cases	Speed: Mean Abs. Error (Kts)	Speed: Mean Alg. Error (Kts)	Speed: No. of Cases	Contingency Table: Skill Score	Contingency Table: Percent Fcst. Correct	Contingency Table: Threat Score (>27 Kts)	Bias by Category: 1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	21	0.555	1621	3.2	0.3	1624	0.385	78.5	0.14	1.06	0.87	0.71	0.60	0.43	0.25
	LOCAL	19	0.580		3.3	1.5		0.402	74.5	0.21	0.90	1.40	1.32	0.72	1.07	0.25
											3526	739	234	65	14	4
18	MOS	22	0.539	1206	3.5	0.6	1208	0.391	82.0	0.06	1.04	0.89	0.70	0.45	0.36	0.50
	LOCAL	25	0.478		3.7	0.7		0.363	78.9	0.07	0.98	1.27	0.81	0.22	0.18	0.00
											3716	597	198	55	11	2
24	MOS	22	0.522	1173	3.8	0.6	1178	0.331	80.3	0.00	1.05	0.84	0.74	0.47	0.23	0.00
	LOCAL	27	0.450		3.9	0.7		0.298	77.3	0.00	1.00	1.16	0.77	0.29	0.00	0.00
											3706	620	187	49	13	2

Table 5.11. Same as 5.7 except for 18 stations in the Western Region.

Fcst Proj (h)	Type of Fcst.	Direction: Mean Abs. Error (Deg)	Direction: Skill Score	Direction: No. of Cases	Speed: Mean Abs. Error (Kts)	Speed: Mean Alg. Error (Kts)	Speed: No. of Cases	Contingency Table: Skill Score	Contingency Table: Percent Fcst. Correct	Contingency Table: Threat Score (>27 Kts)	Bias by Category: 1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	30	0.383	831	3.8	0.9	833	0.364	79.9	0.00	1.00	1.05	0.91	0.92	0.30	0.00
	LOCAL	25	0.481		3.2	1.0		0.483	83.3	0.11	0.99	1.09	0.98	0.85	0.60	0.00
											2412	384	128	26	10	4
18	MOS	30	0.342	447	4.4	1.7	458	0.356	87.6	0.11	1.00	1.03	1.18	0.35	0.17	0.50
	LOCAL	33	0.366		4.5	1.4		0.299	86.6	0.38	1.00	1.10	0.86	0.25	0.50	0.00
											2657	228	57	20	6	2
24	MOS	34	0.353	423	4.6	2.2	433	0.320	88.9	0.00	1.00	1.10	0.87	0.80	0.20	*
	LOCAL	39	0.294		4.8	2.0		0.324	88.5	0.00	0.99	1.29	0.71	0.50	0.60	*
											2716	177	68	10	5	0

* This category was neither forecast nor observed.

Table 5.12. Comparative verification of MOS guidance and local 42-h surface wind speed forecasts for 94 stations, 0000 GMT cycle.

Type of Verifying Observation	Type of Forecast	Bias by Category ≤22 kt	Bias by Category >22 kt	Skill Score	Percent Forecast Correct	Threat Score >22 kt
1-min Avg	MOS	1.01	0.57	0.225	97.7	0.13
	LOCAL	0.97	2.70	0.179	94.4	0.11
	No. Obs.	14538	281			
3-h Max	MOS	1.04	0.22	0.188	95.3	0.11
	LOCAL	1.00	1.06	0.245	92.9	0.16
	No. Obs.	14081	717			

Table 5.13. Same as Table 5.12 except for 93 stations, 1200 GMT cycle.

Type of Verifying Observation	Type of Forecast	Bias by Category ≤22 kt	Bias by Category >22 kt	Skill Score	Percent Forecast Correct	Threat Score >22 kt
1-min Avg	MOS	1.01	0.38	0.056	98.9	0.03
	LOCAL	0.97	4.54	0.075	95.8	0.05
	No. Obs.	14485	120			
3-h Max	MOS	1.02	0.12	0.084	97.3	0.05
	LOCAL	0.99	1.42	0.147	94.8	0.09
	No. Obs.	14203	381			

Table 6.1. 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 6.2. Comparative verification of MOS guidance and local forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 94 stations, 0000 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	1.00	0.99	1.42	0.90	61.1	0.432
	LOCAL	0.77	1.32	1.60	0.95	69.2	0.559
	No. Obs.	5245	1891	1535	6436		
18	MOS	0.95	1.00	1.59	0.85	57.9	0.415
	LOCAL	0.60	1.50	2.00	0.80	53.3	0.372
	No. Obs.	4879	2353	1952	6026		
24	MOS	1.00	1.07	1.60	0.80	56.7	0.393
	LOCAL	0.63	1.57	2.14	0.78	50.6	0.335
	No. Obs.	5262	2391	1650	5921		

Table 6.3. Same as Table 6.2 except for 24 stations in the Eastern Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	0.98	0.84	1.41	0.96	59.7	0.398
	LOCAL	0.84	1.07	1.44	0.94	65.8	0.492
	No. Obs.	803	559	463	1856		
18	MOS	0.83	0.87	1.64	0.94	59.5	0.412
	LOCAL	0.53	1.32	1.94	0.86	55.1	0.366
	No. Obs.	857	561	496	1750		
24	MOS	0.90	1.08	1.65	0.92	61.4	0.426
	LOCAL	0.59	1.55	2.35	0.86	54.7	0.354
	No. Obs.	1106	446	339	1785		

Table 6.4. Same as Table 6.2 except for 24 stations in the Southern Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	0.95	0.99	1.42	0.95	62.4	0.448
	LOCAL	0.74	1.59	1.64	0.93	68.2	0.554
	No. Obs.	1703	472	403	1311		
18	MOS	0.99	0.82	1.40	0.92	59.8	0.444
	LOCAL	0.65	1.54	1.79	0.70	52.4	0.371
	No. Obs.	1524	738	611	1137		
24	MOS	1.00	0.93	1.33	0.89	57.7	0.399
	LOCAL	0.64	1.57	1.96	0.71	49.2	0.320
	No. Obs.	1718	803	482	1011		

Table 6.5. Same as Table 6.2 except for 28 stations in the Central Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	1.03	1.00	1.43	0.90	62.1	0.430
	LOCAL	0.69	1.40	1.92	0.97	69.2	0.549
	No. Obs.	1573	546	365	2136		
18	MOS	0.97	1.10	1.69	0.82	56.6	0.383
	LOCAL	0.47	1.67	2.43	0.83	50.7	0.328
	No. Obs.	1458	646	485	2032		
24	MOS	1.04	1.18	1.75	0.76	56.3	0.378
	LOCAL	0.56	1.76	2.42	0.78	49.2	0.304
	No. Obs.	1432	641	440	2112		

Table 6.6. Same as Table 6.2 except for 18 stations in the Western Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	1.06	1.22	1.41	0.77	59.4	0.408
	LOCAL	0.86	1.21	1.39	0.98	74.9	0.634
	No. Obs.	1166	314	304	1133		
18	MOS	0.98	1.32	1.72	0.67	55.5	0.388
	LOCAL	0.78	1.38	1.88	0.78	56.4	0.404
	No. Obs.	1040	408	360	1107		
24	MOS	1.05	1.16	1.71	0.59	49.7	0.318
	LOCAL	0.78	1.34	1.86	0.72	49.6	0.325
	No. Obs.	1006	501	389	1013		

Table 6.7. Comparative verification of MOS guidance and local forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 94 stations, 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	1.00	1.01	1.60	0.83	57.8	0.407
	LOCAL	0.77	1.20	1.77	0.91	64.9	0.513
	No. Obs.	5221	2390	1617	5893		
18	MOS	1.09	0.99	1.29	0.84	61.8	0.426
	LOCAL	0.66	1.70	2.15	0.89	57.3	0.401
	No. Obs.	6001	1643	1329	5995		
24	MOS	1.12	0.94	1.23	0.86	59.6	0.405
	LOCAL	0.67	1.57	2.01	0.87	53.2	0.346
	No. Obs.	5215	1865	1495	6412		

Table 6.8. Same as Table 6.7 except for 24 stations in the Eastern Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	0.82	1.09	1.79	0.94	60.5	0.414
	LOCAL	0.70	1.30	1.86	0.95	67.2	0.516
	No. Obs.	1089	443	329	1753		
18	MOS	1.00	1.11	1.34	0.92	63.5	0.437
	LOCAL	0.62	1.78	2.21	0.88	59.6	0.409
	No. Obs.	1160	334	319	1799		
24	MOS	1.12	0.94	1.27	0.90	57.9	0.376
	LOCAL	0.78	1.24	1.73	0.85	55.1	0.351
	No. Obs.	806	533	444	1821		

Table 6.9. Same as Table 6.7 except for 24 stations in the Southern Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	1.03	0.89	1.31	0.88	58.7	0.413
	LOCAL	0.77	1.29	1.62	0.87	62.5	0.486
	No. Obs.	1687	800	480	1043		
18	MOS	1.03	0.88	1.05	0.98	64.3	0.435
	LOCAL	0.64	1.96	2.02	0.92	54.3	0.361
	No. Obs.	1991	449	364	1052		
24	MOS	1.02	0.87	1.13	0.99	62.3	0.436
	LOCAL	0.67	1.79	1.96	0.85	51.2	0.329
	No. Obs.	1694	482	398	1305		

Table 6.10. Same as Table 6.7 except for 28 stations in the Central Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	1.01	1.14	1.68	0.81	58.4	0.404
	LOCAL	0.72	1.21	2.05	0.91	65.9	0.513
	No. Obs.	1431	640	428	2077		
18	MOS	1.18	0.96	1.44	0.79	60.8	0.407
	LOCAL	0.62	1.73	2.49	0.88	56.6	0.382
	No. Obs.	1645	493	349	2091		
24	MOS	1.21	0.90	1.32	0.82	60.4	0.403
	LOCAL	0.57	1.76	2.60	0.85	51.8	0.320
	No. Obs.	1539	543	352	2140		

Table 6.11. Same as Table 6.7 except for 18 stations in the Western Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score
12	MOS	1.11	0.97	1.71	0.64	52.4	0.347
	LOCAL	0.93	0.97	1.56	0.87	64.1	0.505
	No. Obs.	1014	507	380	1020		
18	MOS	1.18	1.04	1.36	0.68	57.7	0.379
	LOCAL	0.80	1.26	1.84	0.90	59.5	0.428
	No. Obs.	1205	367	297	1053		
24	MOS	1.16	1.13	1.22	0.74	57.0	0.361
	LOCAL	0.73	1.44	1.82	0.94	55.6	0.368
	No. Obs.	1176	307	301	1146		

Table 7.1. 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 7.2. Comparative verification of MOS guidance, persistence, and local ceiling height forecasts for 93 stations, 0000 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Log Score	Percent Correct	Skill Score
12	MOS	1.16	0.80	0.96	1.01	3.661	72.6	0.394
	LOCAL	0.87	0.93	1.08	1.00	2.178	81.7	0.595
	PERSISTENCE	0.87	0.92	0.96	1.03	2.105	82.7	0.610
	No. Obs.	1139	979	2140	10827			
15	LOCAL	0.59	0.74	1.22	1.02	2.783	76.1	0.465
	PERSISTENCE	1.01	0.79	0.95	1.03	2.973	75.9	0.458
	No. Obs.	989	1136	2198	10820			
18	MOS	1.05	0.81	1.09	0.99	2.814	74.8	0.416
	LOCAL	0.46	0.66	1.06	1.05	2.384	77.0	0.433
	PERSISTENCE	1.58	0.99	0.83	1.01	3.230	73.4	0.381
	No. Obs.	628	903	2477	11026			
24	MOS	1.02	0.73	1.03	1.01	2.264	79.5	0.399
	LOCAL	0.37	0.69	1.27	1.00	2.121	79.2	0.395
	PERSISTENCE	2.12	1.23	1.10	0.93	3.608	71.6	0.273
	No. Obs.	468	724	1876	11972			

Table 7.3. Same as Table 7.2 except for visibility, 0000 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Log Score	Percent Correct	Skill Score
12	MOS	1.43	1.01	1.16	0.95	3.362	72.5	0.361
	LOCAL	0.89	0.75	1.29	0.98	1.882	81.4	0.548
	PERSISTENCE	0.83	0.82	0.92	1.04	1.805	83.4	0.566
	No. Obs.	716	966	1971	11416			
15	LOCAL	0.48	0.50	1.05	1.08	2.610	76.0	0.385
	PERSISTENCE	0.85	0.68	0.87	1.07	2.828	75.5	0.382
	No. Obs.	701	1176	2085	11166			
18	MOS	1.05	0.90	1.33	0.96	2.442	77.0	0.355
	LOCAL	0.41	0.42	1.04	1.06	2.041	80.1	0.337
	PERSISTENCE	1.46	0.83	1.14	0.98	2.892	75.5	0.297
	No. Obs.	405	954	1577	12087			
24	MOS	1.13	0.74	1.27	0.98	1.921	81.4	0.368
	LOCAL	0.30	0.46	1.08	1.04	1.717	82.7	0.331
	PERSISTENCE	2.47	0.99	1.29	0.94	2.994	75.1	0.232
	No. Obs.	240	799	1387	12596			

Table 7.4. Same as Table 7.2 except for ceiling height for 93 stations, 1200 GMT cycle. Data for TCC were not available for the 18-h projection.

Projection (h)	Type of Forecast	Bias by Category				Log Score	Percent Correct	Skill Score
		1	2	3	4			
12	MOS	1.32	0.78	0.99	1.00	2.309	79.7	0.415
	LOCAL	0.78	0.93	1.16	0.99	1.324	86.3	0.612
	PERSISTENCE	0.96	1.05	1.16	0.97	1.407	85.7	0.604
	No. Obs.	466	728	1893	11983			
15	LOCAL	0.68	0.89	1.25	0.99	1.912	81.9	0.512
	PERSISTENCE	0.71	0.97	1.19	0.99	2.015	80.9	0.485
	No. Obs.	634	793	1859	11987			
18	MOS	1.40	0.63	0.96	1.01	3.181	76.0	0.389
	LOCAL	0.69	1.00	1.28	0.97	2.479	77.8	0.454
	PERSISTENCE	0.56	0.91	1.15	1.01	2.626	77.1	0.410
	No. Obs.	798	834	1898	11383			
24	MOS	1.48	0.72	0.89	1.00	4.131	71.3	0.376
	LOCAL	0.66	1.12	1.28	0.97	3.543	71.0	0.382
	PERSISTENCE	0.39	0.79	1.02	1.08	3.837	70.1	0.290
	No. Obs.	1139	970	2150	10673			

Table 7.5. Same as Table 7.2 except for visibility for 93 stations, 1200 GMT cycle. Data for TCC were not available for the 18-h projection.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Log Score	Percent Correct	Skill Score
12	MOS	1.45	0.68	1.11	1.00	1.949	82.0	0.374
	LOCAL	0.83	0.75	1.21	1.00	1.220	87.0	0.549
	PERSISTENCE	1.19	1.05	1.01	0.99	1.264	87.5	0.572
	No. Obs.	246	801	1400	12603			
15	LOCAL	0.93	0.90	1.19	0.98	1.577	83.8	0.454
	PERSISTENCE	1.07	1.22	0.93	0.99	1.709	84.0	0.451
	No. Obs.	274	695	1528	12761			
18	MOS	1.55	0.92	1.14	0.97	2.669	78.0	0.351
	LOCAL	0.80	0.94	1.32	0.97	2.102	79.9	0.404
	PERSISTENCE	0.70	1.16	0.88	1.02	2.260	80.1	0.358
	No. Obs.	420	724	1602	12155			
24	MOS	1.96	1.00	1.01	0.94	4.118	70.1	0.322
	LOCAL	0.71	0.95	1.32	0.97	3.128	72.2	0.342
	PERSISTENCE	0.40	0.87	0.72	1.10	3.422	72.3	0.223
	No. Obs.	729	969	1970	11250			

Table 8.1. 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		0.8	3.7	4.2	--	--
	LOCAL	15058	0.2	3.1	2.0	--	--
Tonight's Min	MOS		-0.9	4.2	5.4	0.62	0.33
	LOCAL	14880	-0.3	3.8	3.8	0.60	0.27
Tomorrow's Max	MOS		0.5	4.6	8.7	--	--
	LOCAL	15069	0.0	4.2	6.4	--	--
Tomorrow Night's Min	MOS		-0.8	5.2	11.1	0.48	0.47
	LOCAL	14808	-0.6	4.9	10.0	0.43	0.45

Table 8.2. Same as Table 8.1 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	MOS		0.5	3.5	3.1	--	--
Max	LOCAL	3736	0.0	3.2	1.7	--	--
Tonight's	MOS		-1.6	4.1	4.4	0.71	0.42
Min	LOCAL	3586	-0.7	3.8	3.2	0.67	0.34
Tomorrow's	MOS		-0.1	4.3	6.5	--	--
Max	LOCAL	3740	-0.6	4.2	5.5	--	--
Tomorrow	MOS		-1.9	4.9	8.2	0.59	0.50
Night's Min	LOCAL	3566	-1.4	4.8	8.7	0.56	0.46

Table 8.3. Same as Table 8.1 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	MOS		0.4	3.4	3.6	--	--
Max	LOCAL	3866	0.1	2.9	1.7	--	--
Tonight's	MOS		-0.5	4.0	3.9	0.57	0.28
Min	LOCAL	3862	-0.1	3.5	2.4	0.61	0.25
Tomorrow's	MOS		-0.2	4.4	7.7	--	--
Max	LOCAL	3867	-0.3	3.9	5.9	--	--
Tomorrow	MOS		-0.8	5.0	9.5	0.42	0.43
Night's Min	LOCAL	3848	-0.6	4.7	7.7	0.42	0.43

Table 8.4. Same as Table 8.1 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		1.4	4.3	6.3	--	--
	LOCAL	4632	0.4	3.4	2.6	--	--
Tonight's Min	MOS		-0.7	4.6	6.9	0.68	0.28
	LOCAL	4614	0.0	4.2	5.4	0.61	0.24
Tomorrow's Max	MOS		1.6	5.3	11.3	--	--
	LOCAL	4637	0.6	4.7	8.6	--	--
Tomorrow Night's Min	MOS		-0.2	5.7	14.4	0.47	0.45
	LOCAL	4591	0.1	5.5	13.6	0.38	0.47

Table 8.5. Same as Table 8.1 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		0.7	3.5	3.3	--	--
	LOCAL	2824	0.2	2.9	1.6	--	--
Tonight's Min	MOS		-0.8	4.2	6.2	0.46	0.36
	LOCAL	2818	-0.3	3.6	4.1	0.43	0.26
Tomorrow's Max	MOS		0.7	4.4	8.5	--	--
	LOCAL	2825	0.0	3.8	4.5	--	--
Tomorrow Night's Min	MOS		-0.4	5.1	11.5	0.51	0.49
	LOCAL	2803	-0.6	4.4	8.8	0.40	0.46

Table 8.6. 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		-1.2	4.1	4.7	0.65	0.34
	LOCAL	14868	-0.7	3.4	2.7	0.65	0.25
Tomorrow's Max	MOS		0.4	4.5	7.5	--	--
	LOCAL	15066	-0.3	3.8	4.2	--	--
Tomorrow Night's Min	MOS		-0.8	4.8	8.9	0.58	0.42
	LOCAL	14838	-0.5	4.4	6.9	0.58	0.35
Day After Tomorrow's	MOS		0.5	5.3	12.3	--	--
	LOCAL	15010	-0.1	4.8	9.7	--	--

Table 8.7. Same as Table 8.6 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		-1.9	4.1	4.6	0.76	0.43
	LOCAL	3580	-1.2	3.5	2.5	0.76	0.31
Tomorrow's Max	MOS		-0.2	4.1	5.1	--	--
	LOCAL	3738	-0.8	3.9	4.4	--	--
Tomorrow Night's Min	MOS		-2.0	4.7	7.5	0.67	0.52
	LOCAL	3577	-1.2	4.4	6.0	0.69	0.42
Day After Tomorrow's	MOS		-0.5	4.8	9.4	--	--
	LOCAL	3725	-0.8	4.7	8.8	--	--

Table 8.8. Same as Table 8.6 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		-1.0	3.9	3.5	0.54	0.32
	LOCAL	3867	-0.5	3.2	1.9	0.66	0.22
Tomorrow's Max	MOS		-0.5	4.2	6.4	--	--
	LOCAL	3873	-0.5	3.6	3.5	--	--
Tomorrow Night's Min	MOS		-0.9	4.6	6.9	0.49	0.41
	LOCAL	3862	-0.5	4.1	4.8	0.54	0.34
Day After Tomorrow's	MOS		-0.7	5.0	10.5	--	--
	LOCAL	3858	-0.7	4.7	9.4	--	--

Table 8.9. Same as Table 8.6 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	MOS		-1.1	4.3	6.0	0.77	0.30
Min	LOCAL	4600	-0.6	3.7	3.6	0.64	0.27
Tomorrow's	MOS		1.5	5.2	11.2	--	--
Max	LOCAL	4626	0.3	4.3	5.6	--	--
Tomorrow	MOS		-0.2	5.3	11.5	0.67	0.38
Night's Min	LOCAL	4589	0.1	4.9	9.3	0.57	0.36
Day After	MOS		2.0	6.1	17.3	--	--
Tomorrow's	LOCAL	4613	1.0	5.5	12.9	--	--

Table 8.10. Same as Table 8.6 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	MOS		-0.6	3.7	4.3	0.57	0.30
Min	LOCAL	2821	-0.4	3.1	2.4	0.47	0.19
Tomorrow's	MOS		0.8	4.0	6.1	--	--
Max	LOCAL	2829	-0.1	3.3	2.6	--	--
Tomorrow	MOS		-0.2	4.6	9.3	0.54	0.30
Night's Min	LOCAL	2810	-0.4	4.0	6.7	0.54	0.22
Day After	MOS		1.1	4.9	10.2	--	--
Tomorrow's	LOCAL	2814	0.1	4.2	6.2	--	--