NWS-TDL-ON-87-1

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

TDL OFFICE NOTE 87-1

AFOS-ERA VERIFICATION OF GUIDANCE AND LOCAL AVIATION/PUBLIC WEATHER FORECASTS--NO. 7 (OCTOBER 1986-MARCH 1987)

Valery J. Dagostaro, Gary M. Carter, and J. Paul Dallavalle

June 1987

AFOS-ERA VERIFICATION OF GUIDANCE AND LOCAL AVIATION/PUBLIC WEATHER FORECASTS--NO. 7 (OCTOBER 1986-MARCH 1987)

Valery J. Dagostaro, Gary M. Carter, and J. Paul Dallavalle

1. INTRODUCTION

This is the seventh in a 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). Verification statistics are presented for the cool season months of October 1986 through March 1987 for probability of precipitation (PoP), precipitation type, snow amount, surface wind, cloud amount, ceiling height, visibility, and maximum/minimum (max/min) temperature. Due to a change in the issuance time of the NWS official terminal forecasts (FT's), the aviation weather elements (ceiling height, visibility, and wind speed and direction) no longer have matching local and guidance forecasts and the corresponding observations. Hence, for those elements, only statistics for the guidance will be presented. 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 guidance forecasts and the verifying observations for the aviation elements were archived centrally by TDL. For the remaining weather elements, including the 42-h significant wind, 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).

The local PoP and max/min forecasts used for verification were official public weather forecasts obtained from the Coded City Forecast (FPUS4) bulletin. The local cloud amount, precipitation type, snow amount, and the local 42-h significant wind 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). 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. Hence, we do not think it is meaningful to compare results for the 1986-87 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 (or even 0100 or 1300 GMT) were used as input to the prediction equations nearly all the time. The LFM model schedule makes this necessary, 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 by at least 20% and the percent of changes which were in the correct direction also were tabulated.

Tables 2.2 and 2.7 present the 1986-87 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: freezing (freezing rain or drizzle), frozen (snow or ice pellets), 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 freezing, frozen, and liquid categories will be referred to as freezing rain, snow, 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 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 ≥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. In particular, forecast equations based on LFM model fields are used to produce conditional probabilities of snow

---

[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).

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 81 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 for the 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, 1984). Prior to the 1983-84 cool season, the surface wind prediction equations were rederived to account for the latest available 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 guidance forecasts from both 0000 and 1200 GMT. Although we did not verify local forecasts for these projections, we continued to use the same method of verification as in previous seasons. First, for those cases in which the speed forecasts from MOS were ≥10 kt, the mean absolute error and the mean algebraic error (forecast minus observed wind speed) 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 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 speed forecasts were at least 10 kt, the skill score for the wind direction forecasts was computed from contingency tables. The 94 stations used in the verification are listed in Table 2.1.

---

[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.

The results for all 94 stations combined for the 0000 and 1200 GMT cycles are presented in Table 5.2 and Table 5.7 respectively. 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. 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 was calculated by using the 1-min average wind observed at the exact forecast valid time. The results for all 94 (93) stations combined for both the guidance and the locals are given in Table 5.12 (Table 5.13) for the 0000 (1200) GMT forecast cycle.

6. CLOUD AMOUNT

During the 1986-87 cool season, the objective cloud amount forecasts were produced by the prediction equations described in Technical Procedures Bulletin No. 303 (National Weather Service, 1981). These regional, generalized-operator equations used LFM model output and either 0100 or 0200 (1300 or 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 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 1986-87 cool season, the ceiling and visibility guidance was produced by the prediction equations described in Technical Procedures Bulletin No. 303 (National Weather Service, 1981). Operationally, the guidance was based primarily on LFM model output and either 0100 or 0200 (1300 or 1400) GMT surface observations.

Verification scores were computed for the guidance only for the 94 stations listed in Table 2.1. 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 and persistence forecasts were verified for the 12-, 18-, and 24-h projections from 0000 and 1200 GMT.

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 forecasts for the 12-, 18-, and 24-h projections are actually 3-, 9-, and 15-h forecasts, respectively, from the latest available surface observation, and in this sense, the guidance forecasts are usually 10-, 16-, and 22-h forecasts.

8. MAXIMUM/MINIMUM TEMPERATURE

Throughout the 1986-87 cool season, the max/min temperature guidance was generated by the prediction equations described in Technical Procedures Bulletin No. 356 (National Weather Service, 1985b). These equations forecast 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.

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. For 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

---

[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.

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 (see 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. However, it should be noted that the local forecasters occasionally may not have put much effort into making the 60-h min forecasts from 0000 GMT, especially during severe weather events.

For all stations combined, the results for 0000 and 1200 GMT are shown in Tables 8.1 and 8.6, respectively. 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 1986-87 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 combined show that the local forecasts were 8.0% better than the guidance for the first period, 4.9% better for the second period, and 5.0% better for the third period. Depending on the projection and cycle, the local forecasters deviated by 20% or more from the guidance about 11% of the time, while these changes were in

---

[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.

the correct direction from 59% to 66% of the time. The percent improvement over climate scores for all three periods and both forecast cycles indicate that the local and guidance scores were better than those for the previous cool season (Dagostaro et al., 1986).

- 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 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 scores for all stations combined for all three projections and both cycles indicate that the local and guidance forecasts performed at about the same level of accuracy. Overall, the scores for all three categories were generally worse than those for the previous cool season.

- Snow Amount - The snow amount verification involved 81 stations for the 12-24 h period from 0000 and 1200 GMT. In terms of skill score and threat score, the local forecasts were almost always better than the guidance for all three categories for both cycles. In terms of bias by category, POD, and FAR, neither the local forecasts nor the guidance was clearly better for the lower two categories. However, for the ≥ 6 inch category, the locals were generally as good as or better than the guidance. Both the local forecasts and the guidance generally improved over the previous cool season, especially for the ≥ 4 and ≥6 inch categories.

- Surface Wind - Statistics were computed for guidance forecasts of surface wind speed and direction for 94 stations for projections of 12, 18, and 24 hours from 0000 and 1200 GMT. The results are similar to those for the previous cool season, except for the threat score for winds ≥28 kt which was considerably better this year for the 0000 GMT cycle and worse for the 1200 GMT cycle. During the past three cool seasons, the MOS guidance significantly underforecast the number of winds ≥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, 1985a).

  The 42-h significant wind verification involved the comparison of local and guidance forecasts of winds ≥23 kt for 94 (93) stations for the 42-h projection from 0000 (1200) GMT. In terms of bias by category, the guidance was considerably better than the local forecasts when the verifying observation was the 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 accuracy and skill measures reflect the respective 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, the guidance was better than the local forecasts for the clear, scattered, and broken categories. The local forecasts were generally better than the guidance for the overcast category. Overall, the results were similar to those for the previous cool season.

- o Ceiling and Visibility - The verification involved the comparison of MOS guidance and persistence for 93 (94) stations for projections of 12, 18, and 24 hours from 0000 (1200) GMT. These are actually 3-, 9-, and 15-h forecasts from the latest available surface observations for persistence, and in this sense, they are usually 10-, 16-, and 22-h forecasts for the guidance. For both forecast cycles combined, the log scores, percents correct, and skill scores for ceiling show that persistence was better than the guidance for the 12-h projection, while the guidance was generally better for the 18- and 24-h projections. The bias by category results varied from projection to projection and cycle to cycle. For visibility, the log score, percent correct, and skill score for both cycles combined show that persistence was better than the guidance for the 12-h projection. In terms of bias by category, the guidance was generally as good as or better than persistence for all cycles and projections. The results for ceiling and visibility were similar to those for the previous cool season.

- 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 ending approximately 24 (36) and 48 (60) hours after 0000 or 1200 GMT, while the minimum temperature forecasts were valid for nighttime periods ending approximately 36 (24) and 60 (48) hours after initial model time. The valid periods of the guidance closely approximate those of the local forecasts. 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 were 0.3°F and 0.2°F, respectively, more accurate 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. Compared to the 1985-86 cool season verifications, the MOS guidance improved by 0.5°F mean absolute error for all stations and projections combined, while the local forecasts improved by over 0.2°F. Most of the improvement occurred in the min forecasts. We think the improvement from one season to the next is related in part to the new objective guidance system for temperature which was implemented in November 1985. We do not know whether a change in the difficulty of specific forecasting situations also contributed to the improved forecasts.

10. ACKNOWLEDGMENTS

We are grateful to Fred Marshall and Eston Pennington for assistance in archiving the data, and to Belinda Howard for typing the text.

REFERENCES

Bocchieri, J. R., 1983: Automated guidance for forecasting snow amount. Mon. Wea. Rev., 111, 2097-2109.

_____, J. R., and G. J. Maglaras, 1983: An improved operational system for forecasting precipitation type. Mon. Wea. Rev., 111, 405-419.

Brier, G. W., 1950: Verification of forecasts expressed in terms of probability. Mon. Wea. Rev., 78, 1-3.

Carter, G. M., J. P. Dallavalle, G. W. Hollenbaugh, G. J. Maglaras, and B. E. Schwartz, 1983: Comparative verification of guidance and local aviation/public weather forecasts--No. 15 (October 1982-March 1983). TDL Office Note 83-16, National Weather Service, NOAA, U.S. Department of Commerce, 76 pp.

Dagostaro, V. J., 1985: The national AFOS-era verification data processing system. TDL Office Note 85-9, National Weather Service, NOAA, U.S. Department of Commerce, 47 pp.

_____, G. M. Carter, J. P. Dallavalle, and G. W. Hollenbaugh, 1986: AFOS-era verification of guidance and local aviation/public weather forecasts--No. 5 (October 1985-March 1986). TDL Office Note 86-2, National Weather Service, NOAA, U.S. Department of Commerce, 54 pp.

Erickson, M. C., and J. P. Dallavalle, 1986: Objectively forecasting the short-range maximum/minimum temperature - A new look. Preprints Eleventh Conference on Weather Forecasting and Analysis, Kansas City, Amer. Meteor. Soc., 33-38.

Gerrity, J. P., Jr., 1977: The LFM model--1976: A documentation. NOAA Technical Memorandum NWS NMC-60, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 68 pp.

Glahn, H. R., and D. A. Lowry, 1972: The use of Model Output Statistics (MOS) in objective weather forecasting. J. Appl. Meteor., 11, 1203-1211.

Jorgensen, D. L., 1967: Climatological probabilities of precipitation for the conterminous United States. ESSA Tech. Report WB-5, Environmental Science Services Administration, U.S. Department of Commerce, 60 pp.

Klein, W. H., B. M. Lewis, and I. Enger, 1959: Objective prediction of five-day mean temperatures during winter. J. Meteor., 16, 672-682.

National Weather Service, 1980: The use of Model Output Statistics for predicting probability of precipitation. NWS Technical Procedures Bulletin No. 289, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 13 pp.

_____, 1981: The use of Model Output Statistics for predicting ceiling, visibility, cloud amount, and obstructions to vision. NWS Technical Procedures Bulletin No. 303, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 11 pp.

_____, 1982a: National Verification Plan. National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 81 pp.

_____, 1982b: The use of Model Output Statistics for predicting snow amount. NWS Technical Procedures Bulletin No. 318, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 14 pp.

_____, 1982c: Operational probability of precipitation type forecasts based on Model Output Statistics. NWS Technical Procedures Bulletin No. 319, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 14 pp.

_____, 1983: Public/aviation forecast verification. NWS Operations Manual, Chapter C-73, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 18 pp.

_____, 1984: The use of Model Output Statistics for predicting surface wind. NWS Technical Procedures Bulletin No. 347, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 11 pp.

_____, 1985a: New surface stress formulation for the LFM. NWS Technical Procedures Bulletin No. 348, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 6 pp.

_____, 1985b: Automated daytime maximum, nighttime minimum, 3-hourly surface temperature, and 3-hourly surface dew point guidance. NWS Technical Procedures Bulletin No. 356, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 14 pp.

Newell, J. E., and D. G. Deaven, 1981: The LFM-II model--1980. NOAA Technical Memorandum NWS NMC-66, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 20 pp.

Panofsky, H. A., and G. W. Brier, 1965: Some Applications of Statistics to Meteorology. Pennsylvania State University, University Park, 224 pp.

Ruth, D. P., R. L. Miller, and M. M. Heffernan, 1985: AFOS-era forecast verification. NOAA Techniques Development Laboratory Computer Program NWS TDL CP 85-3, National Weather Service, NOAA, U.S. Department of Commerce, 47 pp.

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 1200 GMT cycle for 42-h significant wind.

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. Only local deviations from guidance of at least 20% are included in the changes to guidance.

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	0.0825		47.8			
(1st period)	LOCAL	0.0754	8.7	52.3	16015	1865	66.4
24-36	MOS	0.0946		41.1			
(2nd period)	LOCAL	0.0904	4.5	43.7	15818	1601	59.9
36-48	MOS	0.1070		32.5			
(3rd period)	LOCAL	0.1013	5.4	36.2	15914	1780	59.6

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	0.0858		54.5			
(1st period)	LOCAL	0.0785	8.5	58.4	4013	531	63.8
24-36	MOS	0.0985		47.5			
(2nd period)	LOCAL	0.0922	6.4	50.9	4008	463	61.3
36-48	MOS	0.1143		39.1			
(3rd period)	LOCAL	0.1062	7.0	43.4	3984	523	59.7

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	0.0894		46.2			
(1st period)	LOCAL	0.0823	7.9	50.4	4177	584	66.6
24-36	MOS	0.0991		40.0			
(2nd period)	LOCAL	0.0968	2.3	41.4	4024	506	58.1
36-48	MOS	0.1123		32.4			
(3rd period)	LOCAL	0.1070	4.7	35.6	4152	573	63.4

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	0.0744		47.7			
(1st period)	LOCAL	0.0679	8.8	52.3	4875	509	65.6
24-36	MOS	0.0903		41.0			
(2nd period)	LOCAL	0.0866	4.2	43.4	4848	403	59.8
36-48	MOS	0.1006		30.7			
(3rd period)	LOCAL	0.0965	4.0	33.5	4846	429	51.3

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	0.0815		37.5			
(1st period)	LOCAL	0.0735	9.8	43.6	2950	241	73.0
24-36	MOS	0.0902		30.3			
(2nd period)	LOCAL	0.0855	5.2	33.9	2938	229	61.1
36-48	MOS	0.1003		23.4			
(3rd period)	LOCAL	0.0943	6.0	28.0	2932	255	65.1

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	0.0844		47.3			
(1st period)	LOCAL	0.0783	7.3	51.1	15876	1850	65.2
24-36	MOS	0.0951		39.5			
(2nd period)	LOCAL	0.0900	5.3	42.7	15983	1756	59.2
36-48	MOS	0.1080		32.4			
(3rd period)	LOCAL	0.1030	4.6	35.6	15774	1875	63.7

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	0.0862		54.2			
(1st period)	LOCAL	0.0816	5.3	56.6	4043	540	63.7
24-36	MOS	0.0960		48.8			
(2nd period)	LOCAL	0.0903	6.0	51.9	4028	476	59.9
36-48	MOS	0.1117		40.6			
(3rd period)	LOCAL	0.1054	5.6	43.9	4009	569	60.8

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	0.0894		46.0			
(1st period)	LOCAL	0.0818	8.5	50.6	4039	545	65.1
24-36	MOS	0.1045		36.0			
(2nd period)	LOCAL	0.0970	7.1	40.6	4166	542	58.1
36-48	MOS	0.1165		29.0			
(3rd period)	LOCAL	0.1089	6.5	33.7	4013	605	68.6

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	0.0817		46.0			
(1st period)	LOCAL	0.0754	7.7	50.2	4819	525	67.0
24-36	MOS	0.0895		37.5			
(2nd period)	LOCAL	0.0860	3.9	39.9	4815	476	58.6
36-48	MOS	0.1043		31.0			
(3rd period)	LOCAL	0.1011	3.1	33.2	4795	450	61.6

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	0.0797		38.0			
(1st period)	LOCAL	0.0736	7.7	42.8	2975	240	65.0
24-36	MOS	0.0897		31.2			
(2nd period)	LOCAL	0.0863	3.9	33.8	2974	262	61.5
36-48	MOS	0.0976		25.2			
(3rd period)	LOCAL	0.0950	2.6	27.1	2957	251	62.2

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, and TCC were also used for snow amount verification.

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
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. Comparative verification of MOS guidance and local forecasts of PoPT for 86 stations for the 0000 GMT cycle. Only cases where the local PoP was ≥ 30% were included.

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	MOS	0.71	0.95	1.04	90.1	0.792	0.43	0.84	0.40	0.11
	24	LOCAL	0.79	0.93	1.04	89.7	0.783	0.14	0.84	0.82	0.10
		No. Obs.	14	256	450						
	Southern	MOS	0.40	1.14	1.00	95.5	0.747	0.30	0.79	0.25	0.31
	22	LOCAL	0.90	0.62	1.04	94.9	0.668	0.60	0.52	0.33	0.15
		No. Obs.	10	42	479						
	Central	MOS	0.40	0.98	1.04	91.9	0.841	0.10	0.91	0.75	0.07
	28	LOCAL	1.00	0.92	1.08	88.8	0.783	0.40	0.86	0.60	0.07
		No. Obs.	10	304	303						
	Western	MOS	0.33	0.92	1.06	90.9	0.807	0.33	0.84	0.00	0.09
	12	LOCAL	0.67	0.80	1.13	89.1	0.763	0.33	0.76	0.50	0.05
		No. Obs.	3	99	163						
	All	MOS	0.51	0.97	1.03	92.1	0.826	0.30	0.87	0.42	0.10
	Stations	LOCAL	0.86	0.89	1.06	90.7	0.793	0.35	0.82	0.59	0.08
		No. Obs.	37	701	1395						
30	Eastern	MOS	1.05	0.94	1.03	91.2	0.813	0.36	0.87	0.65	0.08
	24	LOCAL	0.36	1.11	0.98	91.7	0.827	0.23	0.94	0.38	0.15
		No. Obs.	22	227	452						
	Southern	MOS	1.88	0.68	1.00	94.1	0.576	0.50	0.50	0.73	0.26
	22	LOCAL	1.13	0.71	1.02	95.0	0.610	0.38	0.50	0.67	0.30
		No. Obs.	8	28	441						
	Central	MOS	0.75	1.00	1.02	84.9	0.719	0.21	0.86	0.71	0.15
	28	LOCAL	0.36	1.09	0.97	86.2	0.741	0.11	0.91	0.70	0.17
		No. Obs.	28	274	293						
	Western	MOS	****	0.86	1.06	90.5	0.775	****	0.79	1.00	0.08
	12	LOCAL	****	1.00	0.99	85.5	0.670	****	0.77	1.00	0.23
		No. Obs.	0	71	150						
	All	MOS	1.03	0.95	1.02	89.9	0.778	0.31	0.84	0.70	0.12
	Stations	LOCAL	0.48	1.07	0.99	90.2	0.785	0.19	0.89	0.61	0.17
		No. Obs.	58	600	1336						
42	Eastern	MOS	1.92	1.02	0.96	87.0	0.730	0.62	0.84	0.68	0.17
	24	LOCAL	0.85	1.04	0.98	86.6	0.715	0.15	0.84	0.82	0.20
		No. Obs.	13	228	443						
	Southern	MOS	1.50	0.88	1.00	94.1	0.633	0.38	0.61	0.75	0.31
	22	LOCAL	0.38	0.61	1.04	94.1	0.538	0.25	0.42	0.33	0.30
		No. Obs.	8	33	431						
	Central	MOS	2.45	1.01	0.93	83.2	0.684	0.36	0.86	0.85	0.15
	28	LOCAL	0.27	1.01	1.02	87.1	0.748	0.18	0.87	0.33	0.14
		No. Obs.	11	251	272						
	Western	MOS	1.00	0.96	1.02	85.5	0.699	0.00	0.81	1.00	0.16
	12	LOCAL	0.33	0.91	1.07	90.8	0.804	0.33	0.84	0.00	0.08
		No. Obs.	3	85	140						
	All	MOS	1.91	1.00	0.98	87.5	0.730	0.43	0.83	0.78	0.17
	Stations	LOCAL	0.51	0.99	1.02	89.1	0.754	0.20	0.83	0.61	0.16
		No. Obs.	35	597	1286						

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

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

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	1.23	0.93	1.03	91.5	0.825	0.41	0.87	0.67	0.06
		LOCAL	0.68	1.07	0.98	90.8	0.812	0.32	0.93	0.53	0.13
		No. Obs.	22	245	452						
	Southern 22	MOS	1.13	0.87	1.01	94.6	0.607	0.38	0.57	0.67	0.35
		LOCAL	0.75	0.67	1.03	94.6	0.556	0.50	0.43	0.33	0.35
		No. Obs.	8	30	466						
	Central 28	MOS	0.74	0.98	1.04	88.5	0.786	0.26	0.88	0.65	0.11
		LOCAL	0.70	0.99	1.04	87.7	0.770	0.26	0.88	0.63	0.12
		No. Obs.	27	280	295						
	Western 12	MOS	****	0.95	1.02	92.8	0.834	****	0.87	1.00	0.08
		LOCAL	***	0.96	1.02	90.3	0.774	***	0.83	***	0.14
		No. Obs.	0	76	160						
	All Stations	MOS	1.00	0.95	1.02	91.6	0.815	0.33	0.86	0.67	0.10
		LOCAL	0.70	1.00	1.01	90.8	0.798	0.32	0.87	0.55	0.13
		No. Obs.	57	631	1373						
30	Eastern 24	MOS	2.23	0.98	0.97	87.3	0.747	0.46	0.85	0.79	0.13
		LOCAL	1.31	1.01	0.98	85.4	0.704	0.31	0.82	0.76	0.19
		No. Obs.	13	267	439						
	Southern 22	MOS	1.56	1.13	0.98	93.9	0.684	0.22	0.79	0.86	0.30
		LOCAL	0.78	0.74	1.03	94.1	0.620	0.33	0.53	0.57	0.29
		No. Obs.	9	38	448						
	Central 28	MOS	2.50	0.98	0.96	86.3	0.742	0.40	0.88	0.84	0.11
		LOCAL	1.20	0.95	1.05	86.2	0.734	0.20	0.84	0.83	0.11
		No. Obs.	10	275	264						
	Western 12	MOS	0.67	0.89	1.08	91.2	0.815	0.33	0.83	0.50	0.06
		LOCAL	0.00	0.91	1.08	89.6	0.779	0.00	0.82	**	0.09
		No. Obs.	3	96	150						
	All Stations	MOS	2.00	0.98	0.99	89.2	0.773	0.37	0.86	0.81	0.12
		LOCAL	1.03	0.96	1.02	88.3	0.747	0.26	0.81	0.75	0.15
		No. Obs.	35	676	1301						
42	Eastern 24	MOS	1.95	0.90	1.01	88.8	0.772	0.37	0.82	0.81	0.08
		LOCAL	0.53	1.09	0.97	86.6	0.726	0.11	0.87	0.80	0.21
		No. Obs.	19	225	414						
	Southern 22	MOS	3.00	0.65	0.99	92.8	0.507	0.57	0.42	0.81	0.35
		LOCAL	0.86	1.12	1.00	92.2	0.435	0.00	0.46	1.00	0.59
		No. Obs.	7	26	426						
	Central 28	MOS	1.78	0.96	0.96	82.1	0.682	0.37	0.83	0.79	0.14
		LOCAL	0.37	1.09	0.98	86.5	0.747	0.07	0.92	0.80	0.16
		No. Obs.	27	256	265						
	Western 12	MOS	****	0.98	1.00	89.6	0.752	****	0.83	1.00	0.16
		LOCAL	***	1.02	0.99	87.2	0.696	***	0.79	***	0.22
		No. Obs.	0	63	148						
	All Stations	MOS	2.02	0.92	0.99	87.9	0.743	0.40	0.81	0.80	0.13
		LOCAL	0.49	1.08	0.98	88.0	0.740	0.08	0.86	0.85	0.20
		No. Obs.	53	570	1253						

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

Table 4.1. Comparative verification of MOS guidance and local forecasts of snow amount for 81 stations for 12-24 h projection.

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	1.05	1.25	0.96	98.1	0.328	0.295	0.267	0.225	0.47	0.47	0.36	0.55	0.62	0.63
	LOCAL	1.20	1.23	0.72	98.1	0.358	0.307	0.309	0.265	0.52	0.53	0.36	0.57	0.57	0.50
	No. Obs.	182	57	25											
1200	MOS	1.18	1.28	0.39	97.9	0.324	0.279	0.257	0.143	0.47	0.47	0.17	0.60	0.64	0.56
	LOCAL	1.19	1.33	1.35	97.9	0.335	0.296	0.250	0.317	0.50	0.47	0.57	0.58	0.65	0.58
	No. Obs.	194	58	23											

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

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

Table 5.2. Verification of MOS guidance surface wind forecasts for 94 stations, 0000 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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	23	0.541	3428	3.4	1.2	3452	0.410	88.9	0.20	1.02 14700	0.82 1455	0.84 332	0.67 75	0.46 13	0.00 5
18	MOS	25	0.499	6028	3.3	0.6	6050	0.388	79.0	0.10	1.07 12836	0.79 2838	0.80 780	0.71 170	0.56 36	0.33 9
24	MOS	28	0.464	4609	3.6	1.3	4623	0.352	83.8	0.00	1.03 14233	0.87 1933	0.81 485	0.89 99	0.46 24	0.50 4

Table 5.3. Same as Table 5.2 except for 24 stations in the Eastern 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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	22	0.521	933	3.2	0.9	937	0.393	88.2	0.25	1.03 3770	0.73 422	0.89 76	0.75 20	0.33 3	0.00 1
18	MOS	26	0.449	1738	3.0	0.6	1739	0.387	77.8	0.17	1.08 3177	0.74 841	0.77 198	1.14 22	1.33 3	* 0
24	MOS	26	0.453	1062	3.3	1.2	1066	0.379	86.1	0.00	1.03 3692	0.85 451	0.74 107	1.05 19	1.00 2	* 0

* This category was neither forecast nor observed.

Table 5.4. Same as Table 5.2 except for 24 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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	26	0.459	775	3.7	2.0	783	0.353	90.4	0.33	1.00 3791	1.01 270	1.09 44	0.64 11	2.00 1	0.00 1
18	MOS	26	0.478	1508	3.3	1.1	1515	0.377	80.3	0.10	1.04 3399	0.84 655	0.97 161	0.53 32	2.00 3	1.00 1
24	MOS	30	0.427	1071	3.6	1.7	1072	0.327	86.6	0.00	1.01 3799	0.95 376	1.09 79	0.63 19	0.00 5	1.00 1

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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	18	0.622	1264	3.1	0.5	1265	0.459	86.5	0.18	1.05 4214	0.75 605	0.82 153	0.76 34	0.38 8	0.00 2
18	MOS	21	0.566	2084	3.2	-0.1	2086	0.395	74.5	0.11	1.11 3470	0.75 1079	0.78 312	0.76 83	0.29 24	0.29 7
24	MOS	23	0.534	1440	3.4	0.7	1440	0.370	81.9	0.00	1.05 4074	0.76 689	0.71 197	0.95 41	0.78 9	0.50 2

Table 5.6. Same as Table 5.2 except for 18 stations in the Western 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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	32	0.391	456	4.3	2.2	467	0.356	91.9	0.00	1.01 2925	0.96 158	0.66 59	0.20 10	0.00 1	0.00 1
18	MOS.	37	0.404	698	4.4	1.6	710	0.334	85.8	0.00	1.03 2790	0.95 263	0.65 109	0.45 33	0.50 6	0.00 1
24	MOS	35	0.370	1036	4.0	1.7	1045	0.310	80.2	0.00	1.01 2668	1.00 417	0.86 102	0.85 20	0.25 8	0.00 1

Table 5.7. Verification of MOS guidance surface wind forecasts for 94 stations, 1200 GMT cycle.

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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	25	0.490	4727	3.4	1.0	4745	0.391	84.7	0.05	1.02 14301	0.88 1947	0.85 485	0.71 99	0.67 24	0.00 4
18	MOS	25	0.497	3547	3.8	1.4	3580	0.349	87.1	0.00	1.02 14629	0.86 1502	0.79 389	0.66 62	0.36 11	0.00 5
24	MOS	26	0.485	3407	3.9	1.6	3453	0.350	87.6	0.05	1.02 14677	0.82 1469	0.88 339	0.72 75	0.23 13	0.20 5

Table 5.8. Same as Table 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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	24	0.487	1022	3.1	0.7	1027	0.413	87.5	0.00	1.04 3712	0.74 451	0.71 107	0.74 19	2.00 2	* 0
18	MOS	22	0.498	967	3.5	1.0	971	0.354	86.2	0.00	1.03 3726	0.83 431	0.68 116	1.40 10	0.00 4	* 0
24	MOS	24	0.443	959	3.5	1.4	965	0.366	87.0	0.00	1.03 3756	0.72 431	1.15 82	1.10 20	0.33 3	0.00 1

* This category was neither forecast nor observed.

Table 5.9. Same as Table 5.7 except for 24 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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	27	0.464	1097	3.6	1.7	1104	0.358	86.7	0.00	1.00 3813	1.03 385	1.05 79	0.68 19	0.00 5	0.00 1
18	MOS	27	0.462	879	4.1	2.5	890	0.331	88.7	0.00	0.98 3744	1.26 259	1.03 72	1.60 5	0.00 2	0.00 1
24	MOS	31	0.412	785	4.1	2.4	799	0.280	89.3	0.00	1.00 3785	1.03 273	0.96 45	0.45 11	0.00 1	0.00 1

Table 5.10. Same as Table 5.7 except for 28 stations in the Central 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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	20	0.564	1556	3.2	0.6	1557	0.409	82.6	0.06	1.04 4095	0.83 691	0.80 197	0.71 41	0.89 9	0.00 2
18	MOS	21	0.534	1198	3.5	0.6	1208	0.370	84.6	0.00	1.06 4199	0.69 620	0.74 155	0.50 34	0.67 3	0.00 4
24	MOS	21	0.570	1220	3.6	0.9	1226	0.383	84.4	0.08	1.04 4212	0.76 607	0.86 153	0.79 34	0.25 8	0.50 2

Table 5.11. Same as Table 5.7 except for 18 stations in the Western 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 (kt)	Mean Alg. Error (kt)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 kt)	1 No. Obs	2 No. Obs	3 No. Obs	4 No. Obs	5 No. Obs	6 No. Obs
12	MOS	32	0.366	1052	3.7	1.3	1057	0.362	81.7	0.08	1.01 2681	0.97 420	0.93 102	0.70 20	0.50 8	0.00 1
18	MOS	35	0.378	503	4.4	2.4	511	0.296	90.1	0.00	1.01 2960	0.95 192	0.89 46	0.15 13	1.00 2	* 0
24	MOS	36	0.366	443	4.8	2.5	463	0.283	91.1	0.00	1.01 2924	0.99 158	0.51 59	0.00 10	0.00 1	0.00 1

* 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		Skill Score	Percent Forecast Correct	Threat Score >22 kt
		≤22 kt	>22 kt			
1-min Avg	MOS	1.00	0.78	0.192	98.1	0.11
	LOCAL	0.96	3.76	0.134	94.7	0.08
	No. Obs.	15514	207			
±3-h Max	MOS	1.02	0.30	0.188	96.5	0.11
	LOCAL	0.98	1.45	0.220	93.7	0.14
	No. Obs.	15172	536			

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		Skill Score	Percent Forecast Correct	Threat Score >22 kt
		≤22 kt	>22 kt			
1-min Avg	MOS	1.00	0.52	0.048	99.3	0.03
	LOCAL	0.97	7.70	0.054	96.0	0.03
	No. Obs.	15570	77			
±3-h Max	MOS	1.02	0.14	0.090	98.2	0.05
	LOCAL	0.98	2.13	0.126	95.2	0.08
	No. Obs.	15352	278			

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				Percent Correct	Skill Score
		1	2	3	4		
12	MOS	1.00	1.11	1.44	0.88	61.9	0.437
	LOCAL	0.76	1.43	1.68	0.94	70.1	0.566
	No. Obs.	5654	1760	1426	6850		
18	MOS	1.07	0.96	1.64	0.78	56.0	0.385
	LOCAL	0.61	1.55	2.05	0.79	53.6	0.372
	No. Obs.	4974	2436	1877	6558		
24	MOS	1.11	1.05	1.49	0.76	56.3	0.385
	LOCAL	0.62	1.59	2.22	0.76	50.2	0.331
	No. Obs.	5316	2502	1695	6328		

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	1.03	1.00	1.46	0.88	61.6	0.437
	LOCAL	0.79	1.21	1.58	0.94	67.1	0.517
	No. Obs.	1102	522	423	1896		
18	MOS	1.09	0.86	1.57	0.82	56.9	0.394
	LOCAL	0.59	1.44	1.92	0.81	55.0	0.383
	No. Obs.	1045	622	520	1732		
24	MOS	1.15	1.07	1.33	0.80	58.8	0.401
	LOCAL	0.69	1.66	2.15	0.78	53.0	0.349
	No. Obs.	1262	500	394	1766		

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	0.89	1.04	1.40	0.99	62.3	0.444
	LOCAL	0.67	1.55	1.72	0.95	68.6	0.552
	No. Obs.	1415	473	409	1757		
18	MOS	1.04	0.81	1.48	0.89	58.6	0.421
	LOCAL	0.57	1.47	1.90	0.81	54.3	0.384
	No. Obs.	1187	702	570	1713		
24	MOS	1.06	1.00	1.22	0.88	58.3	0.416
	LOCAL	0.54	1.59	1.96	0.81	48.9	0.318
	No. Obs.	1345	711	531	1588		

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	1.02	1.31	1.48	0.85	62.2	0.423
	LOCAL	0.73	1.77	1.82	0.95	71.5	0.576
	No. Obs.	1859	436	336	2191		
18	MOS	1.10	1.16	1.66	0.73	54.4	0.350
	LOCAL	0.49	2.03	2.29	0.79	51.7	0.345
	No. Obs.	1609	623	479	2108		
24	MOS	1.16	1.09	1.64	0.71	54.7	0.354
	LOCAL	0.49	1.82	2.74	0.77	47.9	0.298
	No. Obs.	1635	723	405	2052		

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	1.07	1.10	1.45	0.76	61.4	0.422
	LOCAL	0.89	1.19	1.59	0.93	73.9	0.617
	No. Obs.	1278	329	258	1006		
18	MOS	1.04	1.04	2.01	0.62	54.1	0.363
	LOCAL	0.82	1.19	2.20	0.74	53.6	0.367
	No. Obs.	1133	489	308	1005		
24	MOS	1.05	1.03	1.87	0.58	52.4	0.352
	LOCAL	0.83	1.22	2.12	0.63	52.2	0.362
	No. Obs.	1074	568	365	922		

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	1.09	0.94	1.58	0.79	58.8	0.419
	LOCAL	0.79	1.16	1.73	0.92	65.5	0.518
	No. Obs.	5378	2535	1701	6337		
18	MOS	1.09	1.07	1.41	0.81	62.9	0.437
	LOCAL	0.66	1.74	2.49	0.88	57.9	0.406
	No. Obs.	6555	1604	1227	6409		
24	MOS	1.12	0.99	1.37	0.83	59.7	0.401
	LOCAL	0.64	1.75	2.24	0.85	53.2	0.345
	No. Obs.	5716	1749	1416	6802		

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	1.07	0.99	1.61	0.82	61.8	0.446
	LOCAL	0.77	1.26	1.75	0.92	66.8	0.522
	No. Obs.	1261	501	392	1784		
18	MOS	1.16	0.97	1.41	0.82	65.8	0.473
	LOCAL	0.71	1.71	2.42	0.86	62.6	0.456
	No. Obs.	1420	357	296	1860		
24	MOS	1.21	1.01	1.34	0.80	59.2	0.405
	LOCAL	0.77	1.46	1.97	0.80	55.1	0.365
	No. Obs.	1100	513	419	1893		

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	1.07	0.89	1.32	0.89	59.1	0.426
	LOCAL	0.76	1.19	1.56	0.93	66.1	0.533
	No. Obs.	1349	714	525	1581		
18	MOS	1.02	0.90	1.22	0.96	63.7	0.454
	LOCAL	0.61	1.60	2.24	0.95	56.6	0.397
	No. Obs.	1667	462	365	1526		
24	MOS	0.98	0.97	1.19	0.98	61.4	0.426
	LOCAL	0.59	1.74	2.01	0.90	54.0	0.358
	No. Obs.	1437	465	404	1719		

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	1.13	0.94	1.67	0.79	58.6	0.404
	LOCAL	0.72	1.22	2.12	0.92	65.0	0.504
	No. Obs.	1624	718	399	2027		
18	MOS	1.11	1.28	1.66	0.76	62.4	0.414
	LOCAL	0.57	2.39	3.23	0.86	55.8	0.372
	No. Obs.	2003	379	279	2099		
24	MOS	1.15	1.02	1.61	0.78	58.9	0.370
	LOCAL	0.52	2.33	2.93	0.85	50.1	0.301
	No. Obs.	1833	429	327	2147		

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	1.09	0.97	1.81	0.58	55.0	0.382
	LOCAL	0.94	0.98	1.53	0.87	63.7	0.500
	No. Obs.	1144	602	385	945		
18	MOS	1.09	1.14	1.40	0.68	59.0	0.381
	LOCAL	0.77	1.33	2.15	0.86	56.7	0.387
	No. Obs.	1465	406	287	924		
24	MOS	1.16	0.96	1.36	0.71	59.5	0.383
	LOCAL	0.75	1.48	2.14	0.88	54.5	0.356
	No. Obs.	1346	342	266	1043		

Table 7.1. Definitions of the categories used for verification of persistence and guidance forecasts of ceiling height and visibility.

Category	Ceiling (ft)	Visibility (mi)
1	≤400	<1
2	500-900	1-2 3/4
3	1000-2900	3-6
4	≥3000	>6

Table 7.2. Comparative verification of MOS guidance and persistence 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
	MOS	1.24	0.82	0.93	1.01	3.574	73.4	0.401
12	PERSISTENCE	0.87	0.88	0.95	1.03	1.971	83.6	0.619
	No. Obs.	1080	1051	2280	11567			
	MOS	1.24	0.78	0.99	1.01	2.933	74.6	0.407
18	PERSISTENCE	1.54	0.91	0.82	1.02	3.174	74.1	0.393
	No. Obs.	615	1008	2599	11468			
	MOS	1.42	0.79	0.80	1.03	2.423	79.0	0.375
24	PERSISTENCE	2.09	1.27	1.03	0.94	3.634	71.5	0.265
	No. Obs.	457	734	2103	12554			

Table 7.3. Same as Table 7.2 except for 94 stations, 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Log Score	Percent Correct	Skill Score
	MOS	1.54	0.89	0.86	1.01	2.320	79.6	0.410
12	PERSISTENCE	0.95	1.19	1.12	0.97	1.352	86.2	0.624
	No. Obs.	462	738	2123	12755			
	MOS	1.62	0.70	0.89	1.00	3.144	76.2	0.381
18	PERSISTENCE	0.59	0.97	1.18	1.00	2.616	76.9	0.396
	No. Obs.	748	897	2010	12327			
	MOS	1.67	0.73	0.82	1.00	4.153	71.3	0.361
24	PERSISTENCE	0.40	0.82	1.04	1.06	3.803	69.9	0.275
	No. Obs.	1073	1057	2263	11554			

Table 7.4. 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	1.62	1.09	1.00	0.96	3.386	72.0	0.334
	PERSISTENCE	0.79	0.81	0.87	1.05	1.708	83.8	0.568
	No. Obs.	626	932	2373	12263			
18	MOS	1.28	1.01	1.08	0.98	2.475	76.8	0.337
	PERSISTENCE	1.47	0.80	1.10	0.99	2.776	75.3	0.285
	No. Obs.	344	954	1868	12894			
24	MOS	1.28	1.00	1.04	0.99	1.925	81.6	0.345
	PERSISTENCE	2.23	1.12	1.30	0.94	2.825	75.5	0.220
	No. Obs.	229	688	1600	13733			

Table 7.5. Same as Table 7.2 except for visibility for 94 stations, 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Log Score	Percent Correct	Skill Score
12	MOS	1.27	1.02	0.98	1.00	1.799	82.7	0.370
	PERSISTENCE	1.03	1.16	0.97	0.99	1.157	88.0	0.564
	No. Obs.	233	687	1608	13928			
18	MOS	1.59	1.10	1.00	0.98	2.441	79.2	0.354
	PERSISTENCE	0.64	1.24	0.83	1.02	2.087	80.6	0.344
	No. Obs.	373	644	1857	13322			
24	MOS	2.11	1.07	0.96	0.95	3.954	70.2	0.307
	PERSISTENCE	0.37	0.85	0.65	1.11	3.195	72.5	0.204
	No. Obs.	627	933	2369	12256			

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		-0.2	3.5	2.5	--	--
	LOCAL	15844	-0.1	3.1	1.6	--	--
Tonight's Min	MOS		-1.0	3.7	3.2	0.64	0.36
	LOCAL	15692	-0.5	3.4	2.2	0.63	0.27
Tomorrow's Max	MOS		-0.4	4.2	6.4	--	--
	LOCAL	15807	-0.5	4.0	5.1	--	--
Tomorrow Night's Min	MOS		-0.6	4.5	7.1	0.51	0.44
	LOCAL	15614	-0.7	4.4	6.2	0.49	0.40

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 Max	MOS		0.1	3.3	2.3	--	--
	LOCAL	4018	0.0	3.0	1.3	--	--
Tonight's Min	MOS		-0.9	3.6	2.4	0.67	0.23
	LOCAL	3972	-0.6	3.4	1.8	0.67	0.23
Tomorrow's Max	MOS		-0.4	3.8	4.3	--	--
	LOCAL	4013	-0.6	3.7	3.8	--	--
Tomorrow Night's Min	MOS		-1.0	4.4	6.0	0.58	0.29
	LOCAL	3946	-1.0	4.4	5.8	0.54	0.29

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 Max	MOS		0.3	3.5	3.1	--	--
	LOCAL	4030	0.2	3.2	2.2	--	--
Tonight's Min	MOS		-0.4	3.3	1.7	0.55	0.44
	LOCAL	4022	-0.2	3.2	1.4	0.56	0.29
Tomorrow's Max	MOS		0.6	4.4	7.0	--	--
	LOCAL	4023	0.1	4.1	6.1	--	--
Tomorrow Night's Min	MOS		0.1	4.2	5.7	0.43	0.51
	LOCAL	4014	-0.2	4.2	5.4	0.47	0.45

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		-0.3	3.7	2.8	--	--
	LOCAL	4864	-0.2	3.2	1.7	--	--
Tonight's Min	MOS		-1.7	4.1	4.8	0.70	0.42
	LOCAL	4830	-0.9	3.8	3.1	0.67	0.34
Tomorrow's Max	MOS		-1.0	4.7	8.6	--	--
	LOCAL	4852	-1.0	4.4	6.6	--	--
Tomorrow Night's Min	MOS		-1.2	5.1	10.1	0.49	0.55
	LOCAL	4811	-1.1	4.8	7.9	0.47	0.49

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		-1.1	3.3	1.6	--	--
	LOCAL	2932	-0.4	2.9	1.0	--	--
Tonight's Min	MOS		-0.8	3.6	3.7	0.65	0.36
	LOCAL	2868	-0.2	3.3	2.5	0.58	0.17
Tomorrow's Max	MOS		-0.8	3.9	4.6	--	--
	LOCAL	2919	-0.6	3.6	3.0	--	--
Tomorrow Night's Min	MOS		0.0	4.2	5.2	0.49	0.41
	LOCAL	2843	-0.1	4.0	5.0	0.47	0.37

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		-0.9	3.4	2.3	0.63	0.25
	LOCAL	15770	-0.6	3.1	1.4	0.65	0.22
Tomorrow's Max	MOS		-0.4	4.2	6.0	--	--
	LOCAL	15831	-0.5	3.7	3.7	--	--
Tomorrow Night's Min	MOS		-0.9	4.1	5.4	0.59	0.40
	LOCAL	15640	-0.7	3.9	4.2	0.58	0.34
Day After Tomorrow's Max	MOS		-0.4	4.8	9.4	--	--
	LOCAL	15764	-0.6	4.6	7.9	--	--

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		-0.8	3.4	1.5	0.67	0.22
	LOCAL	4016	-0.8	3.1	1.4	0.71	0.17
Tomorrow's Max	MOS		0.0	3.7	3.9	--	--
	LOCAL	4043	-0.5	3.5	3.1	--	--
Tomorrow Night's Min	MOS		-0.9	4.0	4.4	0.63	0.23
	LOCAL	3982	-0.8	3.9	3.9	0.59	0.21
Day After Tomorrow's Max	MOS		-0.3	4.1	5.7	--	--
	LOCAL	4030	-0.6	4.1	5.8	--	--

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		-0.5	3.1	1.2	0.52	0.34
	LOCAL	4036	-0.4	2.8	0.6	0.60	0.32
Tomorrow's Max	MOS		0.3	4.4	7.0	--	--
	LOCAL	4027	0.0	3.9	4.6	--	--
Tomorrow Night's Min	MOS		-0.4	3.8	3.9	0.54	0.52
	LOCAL	4010	-0.4	3.6	2.9	0.57	0.41
Day After Tomorrow's Max	MOS		0.3	4.8	10.1	--	--
	LOCAL	4014	0.1	4.7	9.2	--	--

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 Min	MOS		-1.3	3.8	3.5	0.67	0.24
	LOCAL	4807	-0.7	3.4	2.0	0.63	0.25
Tomorrow's Max	MOS		-0.8	4.7	8.0	--	--
	LOCAL	4808	-0.8	3.9	4.4	--	--
Tomorrow Night's Min	MOS		-1.6	4.7	7.7	0.61	0.44
	LOCAL	4776	-1.1	4.3	5.9	0.58	0.40
Day After Tomorrow's Max	MOS		-0.8	5.6	13.8	--	--
	LOCAL	4779	-0.9	5.1	10.6	--	--

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 Min	MOS		-1.0	3.3	2.7	0.67	0.20
	LOCAL	2911	-0.5	3.0	1.7	0.65	0.11
Tomorrow's Max	MOS		-1.4	3.9	4.3	--	--
	LOCAL	2953	-0.9	3.4	2.0	--	--
Tomorrow Night's Min	MOS		-0.5	3.9	4.9	0.53	0.41
	LOCAL	2872	-0.4	3.6	3.6	0.58	0.35
Day After Tomorrow's Max	MOS		-0.8	4.3	6.3	--	--
	LOCAL	2941	-0.8	4.1	4.9	--	--