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AFOS-ERA VERIFICATION OF GUIDANCE AND LOCAL AVIATION/PUBLIC WEATHER FORECASTS--NO. 4 (APRIL 1985-SEPTEMBER 1985)

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1. INTRODUCTION

This is the fourth 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). For this particular report, the format was streamlined to allow for more timely preparation and distribution. Specifically, the text was reduced by omitting the discussion of the results displayed in each table. In addition, a couple of the more detailed contingency tables for surface wind were eliminated. We believe these changes will not impact the overall utility of the document.

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 Miller et al. (1984), while guidelines for the public/aviation forecast verification program are given in National Weather Service (1983).

Verification statistics are presented for the warm season months of April through September 1985 for probability of precipitation (PoP), 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, 1982).

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, 1981b). 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 (except for PoP) 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, except for the PoP forecasts, we do not think it is meaningful to compare results for the 1985 warm season with statistics based on the pre-AFOS verification system (e.g., Maglaras et al., 1984).

2. PROBABILITY OF PRECIPITATION

MOS PoP forecasts were produced by the warm season prediction equations described in Technical Procedures Bulletin No. 299 (National Weather Service, 1981a). 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 warm 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. In addition, Fig. 2.1 shows (for all stations combined) the trend in percent improvement over climate for the 0000 GMT cycle local and LFM-based guidance forecasts for the first and third periods. Note that the warm season of 1978 marked the implementation of a complete, LFM-based MOS package.

3. SURFACE WIND

The objective surface wind forecasts were generated by the warm season, LFM-based equations described in Technical Procedures Bulletin No. 347 (National Weather Service, 1984b). Prior to the 1984 warm 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 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,[1] percent correct, bias by category,[2] and the threat score[3] 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 3.1. 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 contingency tables. The 94 stations used in the verification are listed in Table 2.1.

In addition, 42-h forecasts of winds ≥22 knots were collected as part of the AFOS-era verification system. The local forecasts were manually entered by forecasters at the WSFO's. However, for the warm season, the sample of 42-h forecasts was insufficient to provide a meaningful comparative verification.

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. Because of this, an additional comparison was made between the objective and local forecasts by using as the verifying value the highest observed wind within ±3 hours surrounding the valid time. Since the comparative results were similar to those based on the observation at the specific verification time, they are not presented here. Due to these and other possible differences between the MOS forecasts and local forecasts as obtained

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

[2]In the discussion of 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.

[3]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.

from the FT's, only conclusions of a general nature should be drawn from the verification statistics.

The results for all 93 (94) stations combined for the 0000 (1200) GMT cycles are presented in Table 3.2 (Table 3.7). Tables 3.3-3.6 and 3.8-3.11 show scores for the NWS Eastern, Southern, Central, and Western Regions for 0000 and 1200 GMT, respectively. Fig. 3.1 is a comparison of the overall bias values for MOS winds ≥18 kt for the 18-h projection from 0000 GMT during the 1984 and 1985 warm seasons. This diagram is included to show the impact of the LFM's new surface stress profile. Note that the surface stress profile was modified in the operational version of the LFM model on January 10, 1985 (National Weather Service, 1985a).

4. CLOUD AMOUNT

During the 1985 warm season, the objective cloud amount forecasts were produced by the prediction equations described in Technical Procedures Bulletin No. 303 (National Weather Service, 1981c). 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 4.1. 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 local forecasts and surface observations used for verification were converted to the cloud amount categories given in Table 4.1. 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 4.2 and 4.7 for the 0000 and 1200 GMT cycle forecasts, respectively. Tables 4.3-4.6 and Tables 4.8-4.11 show scores for the NWS Eastern, Southern, Central, and Western Regions, for the 0000 and 1200 GMT cycles, respectively.

5. CEILING AND VISIBILITY

During the 1984 warm season, the ceiling and visibility guidance was produced by the prediction equations described in Technical Procedures Bulletin No. 303

(National Weather Service, 1981c). 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 the stations listed in Table 2.1. The local forecasts were obtained from the FT's. Persistence based on an observation taken at 0900 (2100) GMT for the 0000 (1200) GMT forecast cycle was used as a standard of comparison. The objective forecasts were verified for both cycles for 12-, 18-, and 24-h projections. The local and persistence forecasts were verified for 12-, 15-, 18-, and 24-h projections from 0000 and 1200 GMT. On station, the guidance and persistence observations usually were available in time for preparation of the local forecasts. As was the case for surface wind, the local ceiling and visibility forecasts from the FT's are not given for a specific valid time. Hence, any comparisons with the results for the objective forecasts must be of a general nature.

We constructed forecast-observed contingency tables for the four categories of ceiling and visibility given in Table 5.1. These categories were used for computing several different scores: bias by category, percent correct, skill score, and log score.[4] We have summarized the results in Tables 5.2-5.5. 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.

6. MAXIMUM/MINIMUM TEMPERATURE

The max/min temperature guidance for the 1985 warm season was generated by the LFM-based regression equations described in Technical Procedures Bulletin No. 344 (National Weather Service, 1984a). The guidance was based on equations developed by stratifying archived LFM model forecasts, station observations, and the first two harmonics of the day of the year into seasons of 3-mo duration (Dallavalle et al., 1980). We defined spring as March-May, summer as June-August, and fall as September-November. Since the MOS max/min guidance is valid for the local calendar day, the first period (approximately 24-h) objective forecast of the max based on 0000 GMT model data is for the calendar day starting at the subsequent midnight. The max/min guidance for the other periods (projections of approximately 36, 48, and 60 hours) also correspond to specific calendar days.

In contrast, the local forecasts are for daytime max and nighttime min. Thus, the first period subjective max forecast from 0000 GMT data is for today's high. The second period forecast is for tonight's low and so forth. A similar procedure is followed for the 1200 GMT cycle, except the first period is tonight's min. For the local forecast, daytime is defined to be approximately from 1200 to 0000 GMT. Nighttime then extends approximately from 0000 to 1200 GMT except in the western parts of the Central and Southern Regions and throughout the entire Western Region where nighttime may go to nearly 1800 GMT.

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[4]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.

In this report, we present results for both guidance and local forecasts which were verified by using observations approximating the daytime high or nighttime low. Note that the max/min observations given in the synoptic or hourly reports do not correspond exactly to the daytime or nighttime periods. Thus, 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 during the winter, the low often occurs around sunrise and after 1200 GMT. This problem is obviously 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 new 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 (Miller et al., 1984), daytime is defined as 0700-1900 LST and nighttime as 1900-0800 LST. The local program scans the synoptic and hourly reports to determine if the synoptic observation adequately represents the nighttime or daytime period. If so, this observation is used. On the other hand, if the synoptic report is not representative of the appropriate period, then an algorithm is used to deduce an appropriate value from available synoptic and hourly temperature observations. Also, the local forecaster is provided the option of replacing the calculated observation with the exact nighttime low or daytime high. It's important to note, then, that the observations used for verification in this report correspond to the local forecast times and not to the calendar day periods for which the guidance is valid.

Because the local forecaster would be provided with more useful guidance if the MOS forecasts were valid for daytime highs and nighttime lows instead of the calendar day values, we've derived new equations to predict the nighttime low and the daytime high. This new system was implemented in November 1985 (National Weather Service, 1985b) and should provide the forecasters with better guidance.

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[5] of min temperatures ≤32°F, and false alarm ratio[6] for min temperatures ≤32°F were computed for 93 stations in the conterminous United States (Table 2.1). At 0000 (1200) GMT, the local max temperature forecasts are valid for daytime periods ending approximately 24 (36) and 48 (60) hours after 0000 (1200) GMT. Similarly, at 0000 (1200) GMT, the local min temperature forecasts are valid for nighttime periods ending approximately 36 (24) and 60 (48) hours after 0000 (1200) GMT.

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[5]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.

[6]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, the results for 0000 and 1200 GMT are shown in Tables 6.1 and 6.6, respectively. A matched sample of approximately 15,400 cases per forecast projection was available. Similarly, Tables 6.2-6.5 give the 0000 GMT verification scores for the Eastern, Southern, Central, and Western Regions, respectively. Tables 6.7-6.10 show analogous scores by NWS region for the 1200 GMT cycle.

7. SUMMARY

Highlights of the 1985 warm 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 3.6% better than the guidance for the first period, 1.4% better for the second period, and at about the same level of accuracy as the guidance 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 47% to 55% 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 slightly better than those for the previous warm season (Carter et al., 1985). Also, as shown in Fig. 2.1, the overall skill of 0000 GMT cycle first- and third-period guidance and local forecasts has remained about the same since 1978 when LFM-based MOS forecasts were introduced.

- Surface Wind - The AFOS-era wind verification involved the comparison of surface wind speed and direction forecasts for 93 (94) stations for projections of 12, 18, and 24 hours from 0000 (1200) GMT. For purposes of verification, the local forecasts were obtained from NWS official terminal forecasts (FT's). Several fundamental differences exist between the MOS wind forecasts and those in the FT's. For example, the FT's are not as precise in regard to valid time as are the objective forecasts. Due to these differences, only conclusions of a general nature can be drawn from the results. The 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. During the 1985 warm season, the MOS guidance significantly underforecast winds $\geq$ 18 kt as depicted by the results in Fig. 3.1. This appears to be directly related to the LFM's new surface stress profile which was implemented in January 1985.

- 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. These 1985 results indicate that both types of forecasts generally were less accurate than those for the previous warm season (Carter et al., 1985).

- Ceiling and Visibility - The verification involved the comparison of local forecasts, MOS guidance, and persistence for 93 (94) stations for projections of 12, 15, 18, and 24 hours from 0000 (1200) GMT. Direct comparison of local, MOS, and persistence forecasts was possible for the 12-, 18-, and 24-h projections. These are actually 3-, 9-, and 15-h forecasts from the latest available surface observations for the locals and persistence, and in this sense, they are 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 usually were better than persistence and the guidance for all projections, while the guidance was better than persistence for the 18- and 24-h projections. In terms of bias by category, the guidance was better overall than the locals and persistence. For visibility, the log score, percent correct, and skill score varied considerably from projection to projection and cycle to cycle. Overall, persistence was better than local and guidance forecasts for the 12-h projection, while the locals and persistence were about the same for the 15-h projection. The local forecasts were better than persistence and the guidance for the 18-h and 24-h projections. However, in terms of bias by category, the guidance was slightly better overall than the local and persistence forecasts.

- 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. In contrast, the MOS guidance was valid for calendar day periods. As verifying observations, we used the max or min temperatures for daytime (0700-1900 LST) or nighttime (1900-0800 LST) intervals. The observations were deduced from synoptic and hourly reports by the local AFOS-era verification software. For all stations and projections combined, we found that the mean absolute error of the local max and min temperature forecasts both averaged 0.2°F less than that for the MOS guidance. In every region and for nearly 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. The size and sign of the MOS mean algebraic errors indicate that part of the inaccuracy in the MOS guidance is attributable to the verifying observation. Since the MOS max/min guidance is valid for a calendar day period, the MOS max (min) temperatures have a warm (cold) bias when verified against the daytime (nighttime) report. Note that for all stations and max (min) projections combined, the MOS guidance averaged 1.0°F (0.7°F) too warm (cold). Nevertheless, part of the improvement in the local forecasts is due to the ability of the forecaster to recognize synoptic patterns when the MOS guidance is deficient. The forecaster is also able to use the latest observational data, such as radar and satellite reports, in making the public forecasts. Compared to the 1984 warm season verifications (Carter et al., 1985), the scores for the 1985 warm season reveal an average improvement in both the local forecasts and the guidance of over 0.1°F mean absolute error for all stations and projections combined.

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REFERENCES

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

Carter, G. M., V. J. Dagostaro, J. P. Dallavalle, N. S. Foat, G. W. Hollenbaugh, and G. J. Maglaras, 1985: AFOS-era verification of guidance and local aviation/public weather forecasts--No. 2 (April 1984-September 1984). TDL Office Note 85-2, National Weather Service, NOAA, U.S. Department of Commerce, 52 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.

Dallavalle, J. P., J. S. Jensenius, Jr., and W. H. Klein, 1980: Improved surface temperature guidance from the limited-area fine mesh model. Preprints Eighth Conference on Weather Forecasting and Analysis, Denver, Amer. Meteor. Soc., 1-8.

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.

Maglaras, G. J., G. M. Carter, J. P. Dallavalle, G. W. Hollenbaugh, and B. E. Schwartz, 1984: Comparative verification of guidance and local aviation/public weather forecasts--No. 16 (April 1983-September 1983). TDL Office Note 84-4, National Weather Service, NOAA, U.S. Department of Commerce, 69 pp.

Miller, R. L., M. M. Heffernan, and D. P. Ruth, 1984: AFOS-era forecast verification. NOAA Techniques Development Laboratory Computer Program NWS TDL CP 84-3, National Weather Service, NOAA, U.S. Department of Commerce, 44 pp.

National Weather Service, 1981a: The use of Model Output Statistics for predicting probability of precipitation (PoP). NWS Technical Procedures Bulletin No. 299, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 12 pp.

_____, 1981b: More efficient LFM by applying fourth order operators. NWS Technical Procedures Bulletin No. 300, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 9 pp.

_____, 1981c: 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.

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

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

_____, 1984a: Automated maximum/minimum temperature, 3-hourly surface temperature, and 3-hourly surface dew point guidance. NWS Technical Procedures Bulletin No. 344, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 13 pp.

_____, 1984b: 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.

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.

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	Scrantan, 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	.1009		29.8			
(1st period)	Local	.0976	3.3	32.1	15465	8975	53.6
24-36	MOS	.1087		23.8			
(2nd period)	Local	.1069	1.6	25.1	15312	8359	53.1
36-48	MOS	.1160		19.3			
(3rd period)	Local	.1163	-0.2	19.1	15450	8496	46.8

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	.1157		33.9			
(1st period)	Local	.1125	2.7	35.7	3685	2284	56.3
24-36	MOS	.1239		27.2			
(2nd period)	Local	.1211	2.3	28.8	3668	2106	57.5
36-48	MOS	.1339		23.3			
(3rd period)	Local	.1324	1.1	24.2	3679	2224	52.0

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	.1063		25.6			
(1st period)	Local	.1073	-0.9	24.9	4122	2563	49.2
24-36	MOS	.1040		18.1			
(2nd period)	Local	.1045	-0.5	17.6	3978	2465	50.8
36-48	MOS	.1210		15.7			
(3rd period)	Local	.1222	-0.9	14.9	4118	2504	47.2

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	.1102		30.5			
(1st period)	Local	.1042	5.4	34.2	4798	2673	53.5
24-36	MOS	.1233		26.1			
(2nd period)	Local	.1206	2.2	27.7	4801	2391	55.4
36-48	MOS	.1266		20.0			
(3rd period)	Local	.1288	-1.7	18.6	4796	2323	42.7

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	.0585		26.7			
(1st period)	Local	.0531	9.2	33.5	2860	1455	57.3
24-36	MOS	.0712		19.8			
(2nd period)	Local	.0691	3.0	22.1	2865	1397	46.7
36-48	MOS	.0679		14.9			
(3rd period)	Local	.0660	2.8	17.3	2857	1445	45.0

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	.1036		28.6			
(1st period)	Local	.0996	3.9	31.5	15268	8699	55.1
24-36	MOS	.1104		24.7			
(2nd period)	Local	.1091	1.2	25.6	15392	8431	48.6
36-48	MOS	.1181		18.7			
(3rd period)	Local	.1174	0.5	19.1	15244	8304	54.6

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 (1st period)	MOS Local	.1197 .1144	4.4	30.2 33.3	3650	2223	57.7
24-36 (2nd period)	MOS Local	.1273 .1255	1.4	28.0 29.0	3646	2134	56.9
36-48 (3rd period)	MOS Local	.1359 .1362	-0.2	22.6 22.5	3646	2103	57.8

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 (1st period)	MOS Local	.1024 .0983	4.0	23.6 26.6	3973	2478	52.3
24-36 (2nd period)	MOS Local	.1179 .1154	2.1	22.1 23.8	4109	2540	49.4
36-48 (3rd period)	MOS Local	.1091 .1088	0.2	18.0 18.2	3964	2449	53.8

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	.1144		32.1			
(1st period)	Local	.1102	3.6	34.5	4789	2646	57.9
24-36	MOS	.1211		23.9			
(2nd period)	Local	.1206	0.4	24.3	4784	2425	43.2
36-48	MOS	.1379		17.3			
(3rd period)	Local	.1356	1.7	18.7	4781	2242	57.9

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	.0668		24.7			
(1st period)	Local	.0644	3.5	27.3	2856	1352	50.8
24-36	MOS	.0601		24.6			
(2nd period)	Local	.0598	0.5	25.0	2853	1332	43.3
36-48	MOS	.0746		14.7			
(3rd period)	Local	.0750	-0.6	14.2	2853	1510	46.6

Table 3.1. 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 3.2. Comparative verification of MOS guidance and local surface wind forecasts for 93 stations, 0000 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 (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)	No. of Cases
12	MOS	22	.545	2016	3.2	1.2	2046	.366	92.4	.00	1.01	1.00	0.59	0.67	0.29	0.00	15589
	Local	20	.562		3.0	1.4		.393	92.1	.21	0.99 (14558)	1.24 (822)	0.59 (169)	0.60 (30)	0.71 (7)	0.67 (3)	
18	MOS	25	.472	5131	3.1	0.4	5176	.373	79.5	.02	1.07	0.78	0.78	0.56	0.33	0.25	15561
	Local	28	.421		3.2	0.5		.351	77.7	.07	1.03 (12155)	1.01 (2635)	0.60 (631)	0.24 (108)	0.46 (24)	0.13 (8)	
24	MOS	28	.452	4171	3.4	0.9	4215	.331	81.2	.09	1.05	0.80	0.79	0.58	0.47	0.00	15573
	Local	31	.400		3.5	1.0		.297	78.6	.04	1.01 (12758)	1.07 (2145)	0.74 (556)	0.32 (96)	0.47 (15)	1.33 (3)	

Table 3.3. Same as Table 3.2 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)	No. of Cases
12	MOS	22	.510	474	3.0	0.9	496	.374	92.5	.00	1.02	0.83	0.45	0.57	0.00	0.00	3840
	Local	19	.566		2.8	0.9		.386	92.0	.25	1.01 (3562)	1.00 (227)	0.40 (42)	0.57 (7)	2.00 (1)	1.00 (1)	
18	MOS	25	.418	1406	2.7	0.6	1440	.357	79.8	.14	1.05	0.81	0.73	0.46	0.33	0.33	3832
	Local	30	.368		3.0	0.5		.293	77.3	.13	1.04 (3031)	0.94 (669)	0.46 (113)	0.15 (13)	1.00 (3)	0.00 (3)	
24	MOS	28	.402	627	3.2	1.5	654	.270	90.0	.50	1.02	0.73	1.30	0.17	1.00	0.00	3851
	Local	31	.342		3.7	2.2		.205	85.4	.00	0.97 (3521)	1.33 (302)	1.95 (20)	0.50 (6)	2.00 (1)	2.00 (1)	

Table 3.4. Same as Table 3.2 except for 23 stations in the Southern 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)	No. of Cases
12	MOS	23	.488	343	3.5	1.7	345	.302	94.8	.00	1.00	1.20	0.57	4.00	0.00	0.00	3984
	Local	20	.547		3.3	1.8		.334	94.6	.50	0.99 (3836)	1.42 (117)	0.50 (28)	4.00 (1)	0.00 (1)	1.00 (1)	
18	MOS	24	.473	1153	2.9	0.9	1156	.374	84.0	.00	1.04	0.76	1.05	0.42	0.33	**	3970
	Local	26	.430		3.0	0.8		.346	82.9	.00	1.03 (3326)	0.93 (538)	0.51 (91)	0.17 (12)	0.33 (3)	** (0)	
24	MOS	24	.493	842	3.3	1.5	849	.328	85.9	.00	1.02	0.90	0.90	0.40	0.33	*	3969
	Local	28	.395		3.4	1.3		.289	84.8	.00	1.01 (3478)	1.02 (406)	0.51 (72)	0.20 (10)	0.33 (3)	*** (0)	

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

Table 3.5. Same as Table 3.2 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 (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)	No. of Cases
12	MOS	20	.585	883	3.1	1.1	885	.365	89.4	.00	1.01	0.94	0.64	0.75	0.50	0.00	4779
	Local	20	.567		3.0	1.4		.401	88.4	.14	0.98 (4317)	1.34 (368)	0.75 (73)	0.38 (16)	0.75 (4)	0.00 (1)	
18	MOS	23	.513	2001	3.1	-0.1	2007	.358	72.3	.00	1.13	0.74	0.74	0.62	0.31	0.00	4777
	Local	26	.453		3.2	0.2		.347	69.8	.08	1.02 (3260)	1.09 (1114)	0.67 (321)	0.25 (61)	0.38 (16)	0.00 (5)	
24	MOS	29	.458	1513	3.3	0.0	1518	.291	76.0	.09	1.12	0.69	0.50	0.30	0.43	0.00	4788
	Local	32	.410		3.5	0.7		.266	71.2	.09	1.00 (3611)	1.13 (883)	0.71 (241)	0.27 (44)	0.43 (7)	0.00 (2)	

Table 3.6. Same as Table 3.2 except for 18 stations in the Western 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)	No. of Cases
12	MOS	25	.468	316	3.5	1.7	320	.402	94.1	.00	0.99	1.32	0.69	0.00	0.00	*	2986
	Local	23	.492		3.2	1.5		.409	94.5	.00	1.00 (2843)	1.18 (110)	0.54 (26)	0.67 (6)	0.00 (1)	* (0)	
18	MOS	33	.364	571	3.9	1.0	573	.377	84.9	.00	1.03	0.88	0.72	0.50	0.50	*	2982
	Local	36	.328		3.8	0.8		.357	84.1	.00	1.02 (2538)	0.99 (314)	0.64 (106)	0.32 (22)	0.50 (2)	* (0)	
24	MOS	30	.330	1189	3.5	1.4	1194	.349	71.9	.00	1.01	0.97	1.01	1.06	0.50	*	2965
	Local	33	.325		3.4	0.7		.341	73.5	.00	1.07 (2148)	0.87 (554)	0.72 (223)	0.39 (36)	0.25 (4)	* (0)	

* This category was neither forecast nor observed.

Table 3.7. Comparative verification of MOS guidance and local 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 (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)	No. of Cases
12	MOS	25	.473	4466	3.1	0.7	4497	.368	81.9	.10	1.04	0.86	0.73	0.64	0.25	0.00	15631
	Local	23	.512		3.0	1.0		.399	80.8	.13	0.98 (12786)	1.20 (2161)	0.79 (570)	0.53 (95)	0.44 (16)	0.33 (3)	
18	MOS	25	.482	1945	3.4	1.5	1966	.299	91.2	.00	1.01	0.86	0.72	0.19	0.33	0.00	15488
	Local	28	.441		3.6	1.7		.246	89.1	.00	0.99 (14356)	1.21 (960)	0.74 (137)	0.29 (31)	0.00 (3)	2.00 (1)	
24	MOS	27	.516	1597	3.5	1.4	1626	.297	92.6	.00	1.02	0.76	0.46	0.31	0.14	0.00	15587
	Local	32	.404		3.7	1.6		.244	90.4	.14	0.99 (14572)	1.24 (818)	0.42 (161)	0.27 (26)	0.14 (7)	1.67 (3)	

Table 3.8. Same as Table 3.7 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 (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)	No. of Cases
12	MOS	27	.422	701	3.2	1.5	722	.346	90.2	.50	1.01	0.85	1.39	0.80	1.00	0.00	3849
	Local	24	.462		3.3	2.2		.334	86.9	.25	0.95 (3519)	1.51 (300)	2.09 (23)	1.20 (5)	2.00 (1)	1.00 (1)	
18	MOS	24	.440	361	3.3	1.9	370	.311	93.9	.00	1.01	0.85	0.95	1.00	**	*	3870
	Local	29	.388		3.6	2.1		.240	91.5	.00	0.98 (3680)	1.46 (163)	1.09 (22)	0.60 (5)	* (0)	** (0)	
24	MOS	25	.463	415	3.3	1.4	437	.334	92.5	.00	1.02	0.68	0.70	1.00	1.00	0.00	3835
	Local	32	.333		3.6	1.4		.240	90.1	.25	1.00 (3564)	1.06 (222)	0.49 (43)	0.50 (4)	1.00 (1)	2.00 (1)	

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

Table 3.9. Same as Table 3.7 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 (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)	No. of Cases
12	MOS	23	.477	890	2.9	1.2	895	.364	86.3	.00	1.02	0.86	0.92	0.50	0.00	*	4006
	Local	23	.471		2.8	1.1		.379	85.9	.00	1.00 (3487)	1.08 (431)	0.55 (77)	0.25 (8)	0.00 (3)	* (0)	
18	MOS	25	.458	423	3.7	2.1	430	.365	93.1	.00	0.99	1.19	0.93	0.17	*	*	3846
	Local	27	.437		3.6	1.8		.341	93.0	.00	0.99 (3639)	1.25 (171)	0.33 (30)	0.17 (6)	* (0)	** (0)	
24	MOS	31	.482	319	3.9	2.4	321	.260	94.5	.00	1.00	1.20	0.41	0.00	0.00	0.00	3993
	Local	35	.428		3.9	2.6		.296	94.0	.25	0.99 (3843)	1.63 (120)	0.26 (27)	1.00 (1)	0.00 (1)	3.00 (1)	

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

Table 3.10. Same as Table 3.7 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)	No. of Cases
12	MOS	26	.489	1637	3.1	0.0	1640	.315	76.2	.10	1.10	0.76	0.50	0.44	0.29	0.00	4772
	Local	23	.531		3.2	1.0		.374	73.7	.17	0.94 (3593)	1.31 (881)	0.81 (246)	0.60 (43)	0.71 (7)	0.00 (2)	
18	MOS	25	.491	787	3.3	1.1	791	.285	88.3	.00	1.04	0.72	0.52	0.00	0.00	*	4762
	Local	28	.446		3.7	1.7		.218	84.2	.00	0.98 (4261)	1.21 (429)	0.78 (58)	0.45 (11)	0.00 (3)	* (0)	
24	MOS	25	.548	626	3.3	0.8	628	.284	90.2	.00	1.05	0.63	0.29	0.27	0.00	0.00	4757
	Local	31	.434		3.7	1.3		.224	86.2	.00	0.99 (4312)	1.24 (359)	0.44 (66)	0.27 (15)	0.00 (4)	0.00 (1)	

* This category was neither forecast nor observed.

Table 3.11. Same as Table 3.7 except for 18 stations in the Western 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)	No. of Cases
12	MOS	24	.368	1238	3.2	0.8	1240	.395	74.3	.00	1.01	1.04	0.84	0.87	0.20	*	3004
	Local	23	.473		2.8	0.2		.440	77.4	.00	1.06 (2187)	0.93 (549)	0.71 (224)	0.41 (39)	0.00 (5)	* (0)	
18	MOS	26	.425	374	3.3	1.3	375	.234	89.8	.00	1.01	0.89	0.70	0.00	*	0.00	3010
	Local	28	.388		3.5	1.4		.196	88.7	.00	1.01 (2776)	1.00 (197)	0.81 (27)	0.00 (9)	* (0)	0.00 (1)	
24	MOS	28	.471	237	3.7	1.6	240	.300	94.1	.00	1.01	0.86	0.56	0.00	0.00	*	3002
	Local	34	.306		3.7	1.5		.217	92.5	.00	1.00 (2853)	1.20 (117)	0.40 (25)	0.00 (6)	0.00 (1)	* (0)	

* This category was neither forecast nor observed.

Table 4.1. 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 4.2. 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	Number of Cases
		1	2	3	4			
	MOS	0.77	1.66	1.23	0.74	50.3	.328	
12	Local	0.79	1.30	1.44	0.86	61.0	.471	15487
	No. Obs.	5979	3082	2112	4314			
	MOS	0.74	1.43	1.10	0.69	51.7	.347	
18	Local	0.60	1.34	1.55	0.60	48.5	.311	15518
	No. Obs.	4491	4476	3024	3527			
	MOS	0.78	1.46	1.15	0.64	47.0	.284	
24	Local	0.68	1.31	1.67	0.57	43.9	.253	15531
	No. Obs.	4938	4291	2654	3648			

Table 4.3. Same as Table 4.2 except for 24 stations in the Eastern Region.

Projection (h)	Type of Forecast	Bias by Category				Percent Correct	Skill Score	Number of Cases
		1	2	3	4			
	MOS	0.64	1.66	1.45	0.82	48.6	.312	
12	Local	0.75	1.41	1.51	0.82	55.8	.404	3706
	No. Obs.	1212	665	518	1311			
	MOS	0.57	1.30	1.17	0.80	52.0	.342	
18	Local	0.63	1.10	1.54	0.66	49.1	.309	3721
	No. Obs.	650	1168	871	1032			
	MOS	0.64	1.59	1.20	0.79	47.1	.293	
24	Local	0.65	1.27	1.83	0.70	44.0	.262	3727
	No. Obs.	1106	900	577	1144			

Table 4.4. Same as Table 4.2 except for 24 stations in the Southern Region.

Projection (h)	Type of Forecast	Bias by Category				Percent Correct	Skill Score	Number of Cases
		1	2	3	4			
	MOS	0.71	1.75	1.04	0.63	46.9	.283	
12	Local	0.71	1.33	1.38	0.83	56.8	.421	4105
	No. Obs.	1507	1001	692	905			
	MOS	0.61	1.47	1.01	0.58	52.1	.327	
18	Local	0.46	1.38	1.41	0.45	46.8	.255	4124
	No. Obs.	1021	1444	956	703			
	MOS	0.73	1.46	1.10	0.54	47.2	.269	
24	Local	0.62	1.34	1.66	0.36	41.7	.203	4123
	No. Obs.	1180	1362	763	818			

Table 4.5. Same as Table 4.2 except for 28 stations in the Central Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
	MOS	0.66	1.75	1.34	0.77	48.5	.310	
12	Local	0.79	1.28	1.51	0.86	61.5	.478	4745
	No. Obs.	1731	945	612	1457			
	MOS	0.66	1.58	1.19	0.68	47.9	.303	
18	Local	0.47	1.52	1.73	0.60	44.3	.265	4750
	No. Obs.	1373	1255	813	1309			
	MOS	0.70	1.55	1.22	0.61	44.4	.254	
24	Local	0.58	1.36	1.75	0.59	41.5	.226	4758
	No. Obs.	1388	1303	829	1238			

Table 4.6. Same as Table 4.2 except for 18 stations in the Western Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
	MOS	1.04	1.28	1.06	0.68	60.1	.378	
12	Local	0.91	1.16	1.30	0.95	72.6	.586	2931
	No. Obs.	1529	471	290	641			
	MOS	1.00	1.31	0.95	0.66	56.7	.348	
18	Local	0.81	1.38	1.51	0.67	56.9	.381	2923
	No. Obs.	1447	609	384	483			
	MOS	1.06	1.15	1.08	0.51	50.9	.288	
24	Local	0.87	1.22	1.34	0.62	50.9	.308	2923
	No. Obs.	1264	726	485	448			

Table 4.7. 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				Percent Correct	Skill Score	Number of Cases
		1	2	3	4			
	MOS	0.88	1.36	1.11	0.66	50.0	.323	
12	Local	0.82	1.12	1.49	0.75	56.1	.412	15483
	No. Obs.	4907	4274	2627	3675			
	MOS	0.93	1.51	0.94	0.83	54.7	.335	
18	Local	0.71	1.66	2.03	0.69	49.3	.300	15351
	No. Obs.	7435	2495	1641	3780			
	MOS	0.90	1.52	1.02	0.75	49.0	.301	
24	Local	0.80	1.43	1.61	0.66	46.8	.285	15443
	No. Obs.	5884	3123	2109	4327			

Table 4.8. Same as Table 4.7 except for 24 stations in the Eastern Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
	MOS	0.74	1.42	1.37	0.74	49.1	.320	
12	Local	0.78	1.12	1.71	0.77	53.0	.376	3676
	No. Obs.	1079	894	558	1145			
	MOS	0.83	1.78	1.02	0.89	52.8	.336	
18	Local	0.69	1.82	2.00	0.71	49.0	.312	3694
	No. Obs.	1557	496	423	1218			
	MOS	0.72	1.65	1.18	0.85	46.9	.282	
24	Local	0.73	1.54	1.77	0.66	45.0	.271	3665
	No. Obs.	1174	663	518	1310			

Table 4.9. Same as Table 4.7 except for 24 stations in the Southern Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
	MOS	0.87	1.34	1.04	0.58	50.1	.310	
12	Local	0.77	1.14	1.54	0.60	53.7	.372	4116
	No. Obs.	1172	1361	759	824			
	MOS	0.90	1.57	0.89	0.75	53.9	.306	
18	Local	0.60	1.78	2.23	0.56	43.8	.227	3960
	No. Obs.	2059	767	431	703			
	MOS	0.80	1.63	0.89	0.69	45.4	.257	
24	Local	0.77	1.41	1.49	0.54	42.8	.231	4091
	No. Obs.	1464	1020	685	922			

Table 4.10. Same as Table 4.7 except for 28 stations in the Central Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
12	MOS	0.87	1.40	1.04	0.70	48.8	.311	4755
	Local	0.78	1.13	1.42	0.84	56.7	.423	
	No. Obs.	1391	1287	821	1256			
18	MOS	0.96	1.52	0.97	0.80	54.7	.334	4753
	Local	0.70	1.72	2.07	0.75	49.3	.303	
	No. Obs.	2240	707	467	1339			
24	MOS	0.94	1.50	1.11	0.69	47.0	.276	4743
	Local	0.80	1.43	1.63	0.68	45.9	.273	
	No. Obs.	1724	973	604	1442			

Table 4.11. Same as Table 4.7 except for 18 stations in the Western Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
12	MOS	1.00	1.27	1.04	0.51	53.0	.323	2936
	Local	0.97	1.05	1.29	0.70	62.1	.460	
	No. Obs.	1265	732	489	450			
18	MOS	1.02	1.14	0.88	0.88	58.3	.341	2944
	Local	0.87	1.27	1.75	0.66	56.7	.352	
	No. Obs.	1579	525	320	520			
24	MOS	1.08	1.14	0.83	0.79	59.9	.368	2944
	Local	0.88	1.33	1.53	0.79	56.3	.353	
	No. Obs.	1522	467	302	653			

Table 5.1. Definitions of the categories used for verification of persistence, local, and guidance forecasts of ceiling height and visibility.

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

Table 5.2. 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				Log Score	Percent Correct	Skill Score
		1	2	3	4			
12	MOS	1.13	0.75	0.91	1.02	2.309	82.9	.345
	Local	0.71	0.75	1.07	1.02	1.472	87.9	.532
	Persistence	0.74	0.72	0.91	1.03	1.428	88.4	.534
	No. Obs.	493	630	1239	13229			
15	Local	0.39	0.50	0.85	1.05	1.463	84.6	.401
	Persistence	1.70	0.78	0.63	1.05	1.729	84.3	.400
	No. Obs.	217	589	1811	13044			
18	MOS	0.77	0.69	0.89	1.02	1.095	86.4	.356
	Local	0.31	0.38	0.69	1.05	0.980	87.5	.335
	Persistence	4.75	1.70	0.70	1.00	1.716	84.0	.298
	No. Obs.	77	269	1616	13607			
24	MOS	0.89	0.58	0.80	1.02	0.744	92.4	.279
	Local	0.22	0.43	1.09	1.01	0.706	92.0	.281
	Persistence	4.34	2.29	1.64	0.93	1.802	85.0	.150
	No. Obs.	85	201	687	14616			

Table 5.3. Same as Table 5.2 except for visibility, 0000 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category				Log Score	Percent Correct	Skill Score
		1	2	3	4			
12	MOS	1.14	1.08	0.94	1.00	2.695	74.3	.339
	Local	0.58	0.47	1.22	1.01	1.728	80.6	.493
	Persistence	0.60	0.42	0.79	1.10	1.695	81.9	.466
	No. Obs.	344	896	2448	11886			
15	Local	0.43	0.28	0.97	1.03	1.284	83.8	.383
	Persistence	2.70	0.89	0.94	1.00	1.629	82.5	.380
	No. Obs.	77	428	2071	13067			
18	MOS	0.63	0.85	1.09	0.99	1.052	86.2	.293
	Local	0.23	0.18	0.84	1.03	0.873	88.2	.298
	Persistence	5.83	1.82	1.40	0.94	1.607	82.9	.284
	No. Obs.	35	209	1392	13919			
24	MOS	0.80	0.70	1.16	0.99	0.986	87.3	.306
	Local	0.17	0.18	0.74	1.04	0.853	88.8	.244
	Persistence	5.89	1.72	1.57	0.93	1.713	81.8	.218
	No. Obs.	35	220	1243	14084			

Table 5.4. Same as Table 5.2 except for ceiling height 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	1.03	0.65	0.92	1.01	0.758	92.2	.311
12	Local	0.58	0.65	1.30	0.99	0.528	93.6	.493
12	Persistence	0.79	0.94	1.47	0.98	0.593	92.9	.482
12	No. Obs.	86	207	701	14641			
15	Local	0.51	0.67	1.34	0.99	0.765	91.7	.400
15	Persistence	0.52	0.71	1.45	0.99	0.849	90.6	.349
15	No. Obs.	131	270	715	14701			
18	MOS	1.25	0.72	0.93	1.01	1.429	88.4	.314
18	Local	0.47	0.69	1.38	0.99	1.177	88.6	.362
18	Persistence	0.29	0.52	1.19	1.01	1.200	88.1	.275
18	No. Obs.	228	362	860	14018			
24	MOS	1.52	0.78	0.94	1.00	2.710	81.3	.317
24	Local	0.43	0.80	1.42	0.99	2.190	81.6	.330
24	Persistence	0.13	0.31	0.83	1.08	2.141	82.2	.175
24	No. Obs.	500	624	1238	13215			

Table 5.5. Same as Table 5.2 except for visibility for 94 stations, 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category				Log Score	Percent Correct	Skill Score
		1	2	3	4			
12	MOS	1.62	1.05	1.19	0.98	1.032	87.5	.339
	Local	0.59	0.37	1.06	1.01	0.609	91.9	.522
	Persistence	0.88	0.86	0.98	1.00	0.587	92.8	.580
	No. Obs.	34	222	1228	14137			
15	Local	0.64	0.58	1.17	0.99	0.767	89.8	.433
	Persistence	0.74	1.08	0.95	1.00	0.749	90.6	.451
	No. Obs.	39	177	1284	14301			
18	MOS	2.26	1.27	1.00	0.99	1.441	85.3	.337
	Local	0.54	0.74	1.26	0.98	1.134	86.1	.380
	Persistence	0.31	0.83	0.81	1.03	1.047	87.8	.358
	No. Obs.	97	227	1484	13647			
24	MOS	2.03	1.23	1.06	0.94	3.143	72.7	.349
	Local	0.37	0.56	1.24	1.00	2.372	75.5	.359
	Persistence	0.09	0.21	0.49	1.19	2.456	76.0	.181
	No. Obs.	346	909	2420	11882			

Table 6.1. 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	MOS		1.3	3.1	2.6	--	--
Max	Local	15506	0.6	2.8	1.8	--	--
Tonight's	MOS		-0.4	3.1	1.4	0.39	0.43
Min	Local	15412	0.1	2.9	1.1	0.24	0.47
Tomorrow's	MOS		1.0	3.6	4.5	--	--
Max	Local	15496	0.7	3.5	4.4	--	--
Tomorrow	MOS		-0.5	3.7	3.2	0.16	0.72
Night's Min	Local	15360	-0.2	3.6	3.3	0.17	0.65

Table 6.2. Same as Table 6.1 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		0.7	3.0	2.2	--	--
Max	Local	3847	0.4	2.9	1.8	--	--
Tonight's	MOS		-0.7	3.2	1.4	0.41	0.31
Min	Local	3780	-0.1	2.9	1.0	0.27	0.40
Tomorrow's	MOS		0.2	3.4	3.0	--	--
Max	Local	3852	0.1	3.4	3.6	--	--
Tomorrow	MOS		-1.1	3.8	4.0	0.17	0.76
Night's Min	Local	3768	-0.8	3.8	4.0	0.13	0.81

Table 6.3. Same as Table 6.1 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		1.3	2.8	1.6	--	--
Max	Local	3989	0.7	2.4	1.1	--	--
Tonight's	MOS		0.5	2.7	0.4	*	1.00
Min	Local	4002	0.5	2.5	0.6	*	1.00
Tomorrow's	MOS		1.1	3.2	2.8	--	--
Max	Local	3984	1.0	3.0	2.5	--	--
Tomorrow	MOS		0.4	3.0	1.2	*	**
Night's Min	Local	3986	0.5	3.0	2.1	*	1.00

*No events of ≤ 32°F were observed.
**No forecasts of ≤32°F were made.

Table 6.4. Same as Table 6.1 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		1.5	3.5	3.5	--	--
	Local	4809	0.9	3.2	2.5	--	--
Tonight's Min	MOS		-0.5	3.5	1.9	0.36	0.44
	Local	4777	0.2	3.2	1.4	0.20	0.50
Tomorrow's Max	MOS		1.5	4.2	7.2	--	--
	Local	4803	1.2	4.1	6.8	--	--
Tomorrow Night's Min	MOS		-0.3	4.1	4.6	0.12	0.73
	Local	4766	-0.0	4.0	4.3	0.16	0.43

Table 6.5. Same as Table 6.1 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		1.5	3.1	2.9	--	--
	Local	2861	0.5	2.7	1.7	--	--
Tonight's Min	MOS		-1.1	3.1	1.9	0.39	0.47
	Local	2853	-0.5	2.9	1.3	0.26	0.45
Tomorrow's Max	MOS		0.9	3.7	4.4	--	--
	Local	2857	0.3	3.6	4.2	--	--
Tomorrow Night's Min	MOS		-1.2	3.6	3.0	0.18	0.64
	Local	2840	-0.8	3.4	2.5	0.23	0.50

Table 6.6. 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	MOS		-1.5	3.2	1.7	0.49	0.48
Min	Local	15353	-0.7	2.8	0.9	0.34	0.48
Tomorrow's	MOS		0.5	3.5	3.7	--	--
Max	Local	15423	0.2	3.2	3.2	--	--
Tomorrow	MOS		-0.5	3.5	2.4	0.22	0.57
Night's Min	Local	15317	-0.2	3.3	2.1	0.22	0.48
Day After	MOS		1.1	4.1	6.9	--	--
Tomorrow's Max	Local	15398	0.9	4.0	6.3	--	--

Table 6.7. Same as Table 6.6 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		-1.7	3.3	2.1	0.67	0.48
	Local	3744	-0.8	2.8	1.1	0.33	0.56
Tomorrow's Max	MOS		-0.2	3.4	2.9	--	--
	Local	3814	-0.3	3.3	3.0	--	--
Tomorrow Night's Min	MOS		-1.1	3.5	2.7	0.32	0.63
	Local	3736	-0.5	3.3	2.4	0.27	0.57
Day After Tomorrow's Max	MOS		0.0	3.8	5.0	--	--
	Local	3816	0.2	3.9	5.5	--	--

Table 6.8. Same as Table 6.6 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	2.5	0.6	*	**
	Local	3986	-0.2	2.3	0.5	*	1.00
Tomorrow's Max	MOS		0.3	3.0	2.2	--	--
	Local	3969	0.4	2.7	2.2	--	--
Tomorrow Night's Min	MOS		0.4	2.9	0.8	*	**
	Local	3982	0.4	2.8	1.0	*	**
Day After Tomorrow's Max	MOS		1.1	3.4	4.0	--	--
	Local	3959	1.0	3.3	3.6	--	--

*No events of ≤ 32°F were observed.
**No forecasts of ≤32°F were made.

Table 6.9. Same as Table 6.6 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		-1.7	3.6	2.0	0.36	0.53
	Local	4776	-0.7	3.0	0.9	0.40	0.44
Tomorrow's Max	MOS		1.1	3.9	5.7	--	--
	Local	4789	0.7	3.6	4.7	--	--
Tomorrow Night's Min	MOS		-0.4	3.9	3.3	0.24	0.40
	Local	4758	-0.0	3.7	2.6	0.24	0.25
Day After Tomorrow's Max	MOS		1.8	4.8	10.6	--	--
	Local	4782	1.5	4.7	9.7	--	--

Table 6.10. Same as Table 6.6 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		-2.2	3.4	2.4	0.46	0.45
	Local	2847	-1.1	2.8	1.0	0.29	0.36
Tomorrow's Max	MOS		0.5	3.4	3.4	--	--
	Local	2851	0.1	3.1	2.1	--	--
Tomorrow Night's Min	MOS		-1.3	3.5	2.9	0.12	0.63
	Local	2841	-0.9	3.2	2.1	0.16	0.56
Day After Tomorrow's Max	MOS		1.3	4.3	7.1	--	--
	Local	2841	0.5	4.0	5.7	--	--

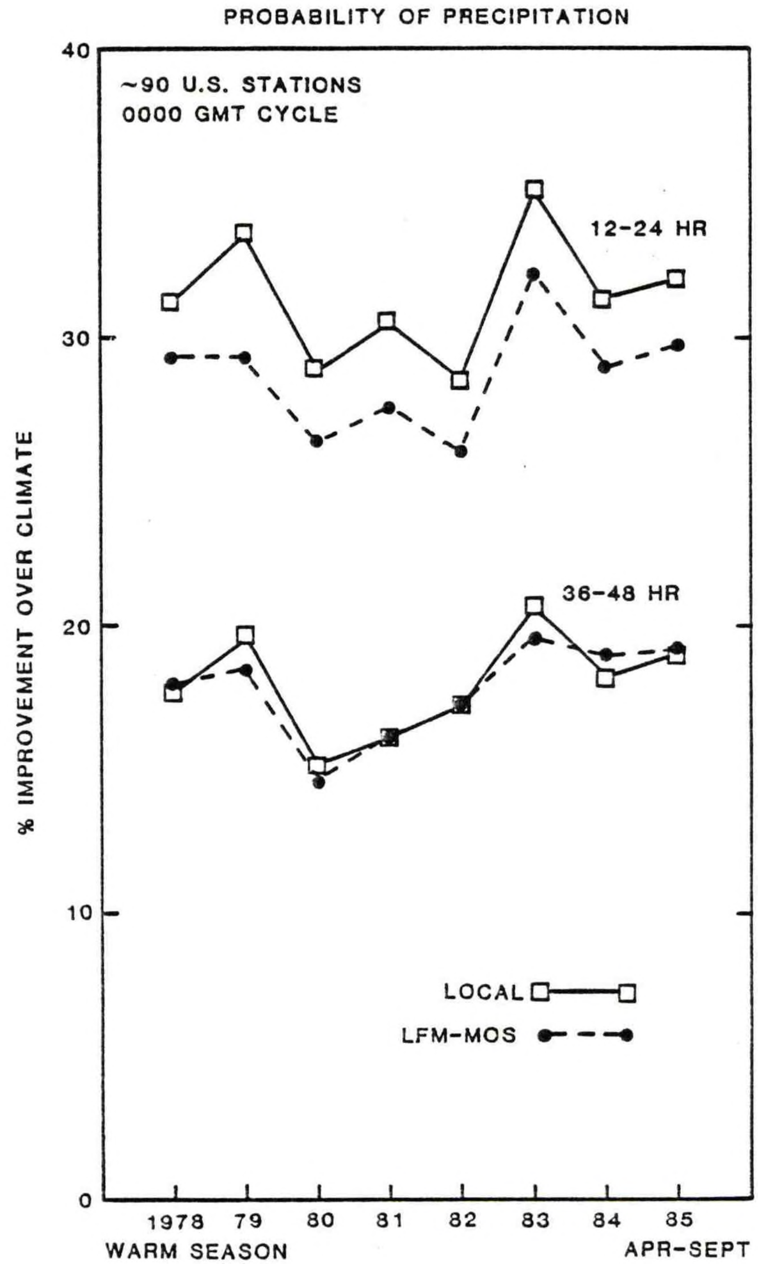

Figure 2.1. Percent improvement over climate in the Brier score of the local and guidance PoP forecasts.

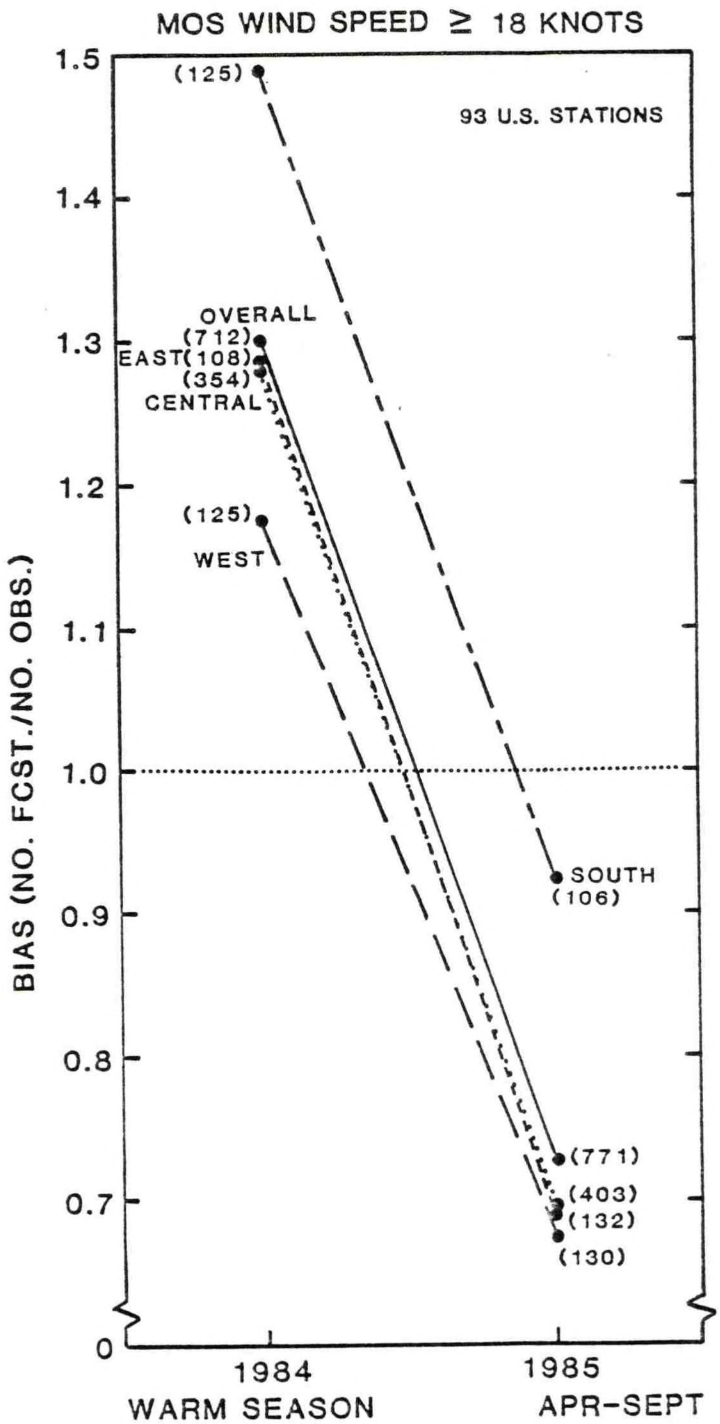

Figure 3.1. Biases for MOS surface wind speed forecasts of 18 knots or greater for the 18-h projection from 0000 GMT before and after the surface stress profile change to the LFM model. National and regional scores are shown. The number of observations for each sample point is given in parentheses.