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

TDL Office Note 80-8

COMPARATIVE VERIFICATION OF GUIDANCE AND LOCAL AVIATION/PUBLIC WEATHER FORECASTS--No. 8
(April 1979 - September 1979)

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December 1980

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1. INTRODUCTION

This is the eighth in the series of Techniques Development Laboratory (TDL) office notes which compare the performance of TDL's automated guidance forecasts with National Weather Service (NWS) local forecasts made at Weather Service Forecast Offices (WSFO's). The local forecasts, which are produced subjectively, may or may not be based on the automated guidance. We present verification statistics for the warm season months of April through September 1979 for probability of precipitation, surface wind, opaque sky cover, ceiling height, visibility, and maximum/minimum (max/min) temperature.

The objective guidance is based on equations developed through the Model Output Statistics (MOS) technique (Glahn and Lowry, 1972). We derived these prediction equations by using archived surface observations and forecast fields from the Limited-area Fine Mesh (LFM) model (National Weather Service, 1971), the Trajectory (TJ) model (Reap, 1972), and/or the 6-layer coarse mesh Primitive Equation (6LPE) model (Shuman and Hovermale, 1968). In operations, however, forecast fields from the LFM-II (National Weather Service, 1977a) and the 7-layer PE (7LPE) model (National Weather Service, 1977b) are employed in the MOS guidance equations when LFM or PE data, respectively, are required. Unless indicated otherwise, we usually refer to MOS forecasts based on the LFM-II as "early" guidance; "final" guidance indicates that the objective forecasts were dependent on the 7LPE. Also, the observation times of surface weather elements used as predictors in the early and final guidance generally differ.

The local forecasts from the WSFO's were collected by the Technical Procedures Branch of the Office of Meteorology and Oceanography for the purposes of the NWS combined aviation/public weather verification system (National Weather Service, 1973). These forecasts were recorded for verification according to the direction that they be "...not inconsistent with..." the official weather prognosis. Surface observations as late as 2 hours before the first valid forecast time may have been used in the preparation of the local forecasts. We obtained the observed verification data from the National Climatic Center in Asheville, North Carolina.

2. PROBABILITY OF PRECIPITATION (PoP)

The objective PoP forecasts were produced by the warm season prediction equations described in Technical Procedures Bulletin No.233 (National Weather Service, 1978a). Guidance was available for the first, second, and third periods, which correspond to 12-24 hours, 24-36 hours, and 36-48 hours, respectively, after the model input data time (0000 or 1200 GMT). The predictors for the first period equations were forecast fields from the LFM-II model and surface variables observed at the forecast site 3 hours after the initial model time.

Both early and final objective guidance were produced for the second and third periods while only early guidance was available for the first period. All of the early automated forecasts were based on the LFM-II model forecasts. The final guidance for the second period was based on fields from the LFM-II, 7LPE, and TJ models. Third period final guidance equations used 7LPE predictors only.

We verified the forecasts by computing the Brier score (Brier, 1950) for the 87 stations shown in Table 2.1. Please note that we used the standard NWS Brier score which is one-half the original score defined by Brier. Brier scores will naturally 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 climatology, that is, the percent improvement of the Brier scores obtained from the local or guidance forecasts over the Brier scores produced by climatic forecasts. The latter are defined as relative frequencies of precipitation by month and by station determined from a 15-year sample (Jorgensen, 1967).

Table 2.2 shows the results for all 87 stations for 0000 GMT forecasts made during the period April through September 1979. Tables 2.3 through 2.6 show scores for the NWS Eastern, Southern, Central, and Western Regions, respectively; the second and third period verifications are a three-way comparison between the early guidance, final guidance, and the subjective local forecasts.

In contrast to last warm season (Dallavalle et al., 1979), NWS forecasters were able to register small improvements upon the early guidance for the second and third periods. Only in the Central Region for the third period and in the Western Region for the second period were the guidance forecasts slightly better than the local forecasts. The local forecasts also continue to be superior to the guidance for the first period, except in the Eastern Region where the local forecasts were only slightly better.

The early guidance continued to be more accurate than the final guidance for both the second and third periods. Furthermore, this superiority was evident in all the NWS regions, including the Western Region where final guidance forecasts were better in previous years.

Fig. 2.1 shows the trend since 1971 in the accuracy (expressed in terms of percent improvement over climatology) of the first and third period 0000 GMT PoP forecasts for all 87 stations. During the 1979 warm season, the local forecasts were more accurate for both the first and third periods than the previous year. In contrast, the guidance forecasts showed no improvement. Recall that starting with the warm season of 1977 the final and early guidance have been identical in the first period. Several "long term" trends are evident. First, the accuracy of both the guidance and local forecasts has increased since the 1975 season. Undoubtedly, much of this improvement has resulted from better numerical models which furnish the MOS predictors. Secondly, since 1975, the 12-24 h forecasts have improved about as much as the 36-48 h forecasts. This is an interesting observation since Charba and Klein (1980) show the third period local forecasts improving more than the first period forecasts for the period 1966-1975. Note that results for the 1974 and 1976 seasons were unavailable because of missing data.

3. SURFACE WIND

The objective surface wind forecasts were generated by LFM-based (early) equations valid for the warm season (National Weather Service, 1979). In addition to LFM model forecasts, predictors in the equations included the sine and cosine of the day of the year and twice the day of the year. Surface weather observations are not included. Wind guidance produced by PE-based (final) equations was terminated in May 1979, so the final guidance was not verified for the 1979 warm season. We only verified the 18-, 30-, and 42-h forecast projections from 0000 GMT. Note that the definition of the objective surface wind forecast is the same as that of the observed wind: the one-minute average direction and speed for a specific time.

Since the local forecasts were recorded as calm if the wind speed was expected to be less than 8 knots, we verified the wind forecasts in two ways. First, for all those cases in which both the local and objective wind speed forecasts were at least 8 knots, the mean absolute error (MAE) of speed was computed. Secondly, for all cases where both local and automated forecasts were available, Heidke skill score, percent correct, and bias by category[1] were computed from contingency tables of wind speed. The seven categories in the tables were: less than 8, 8-12, 13-17, 18-22, 23-27, 28-32, and greater than 32 knots. Table 3.1 lists the 94 stations used in the verification. Tables 3.2-3.12 show comparative verification scores (0000 GMT cycle only) for the 18-, 30-, and 42-h projections. Note that all the objective forecasts of wind speed were adjusted by an "inflation" equation (Klein et al., 1959) involving the multiple correlation coefficient and the mean value of wind speed for a particular station and forecast valid time.

The results for all 94 stations combined are shown in Tables 3.2 and 3.3. The MAE`s for the direction reveal an advantage for the guidance that was approximately 4° for all three forecast projections. Overall, the MAE`s, skill scores, and percent correct for the wind speed were generally better for the objective guidance. The biases by category in Table 3.2 and the contingency tables in Table 3.3 indicate that both the guidance and the local forecasts generally underestimated winds stronger than 22 knots (i.e., categories 5, 6, and 7). Overall, the scores were very similar to those for the 1978 summer season.

Tables 3.4-3.7 show scores for the NWS Eastern, Southern, Central, and Western Regions, respectively. The regional values usually had the same general characteristics as those for the entire group of stations, except the advantage of the guidance over the local forecasts varied in magnitude from region to region. Note also that in the Eastern, Southern, and Central Regions, there were instances where the mean absolute error of the wind speed forecasts was less for the local forecasts than for the objective guidance.

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[1]In the discussion of surface wind, opaque sky cover, ceiling, and visibility, bias by category refers to the number of forecasts of a category divided by the number of observations of that category. A value of 1.0 means unbiased forecasts of that category.

Table 3.8 shows the distribution of wind direction absolute errors by categories--0-30°, 40-60°, 70-90°, 100-120°, 130-150°, and 160-180° --for all 94 stations combined. For all three projections, we see that the early guidance had about 6% fewer errors of 40° or more than did the local forecasts.

Distributions of direction errors for the individual regions are given in Tables 3.9-3.12. In general, these results are much like those in Table 3.8 except, once again, the advantage of the guidance over local forecasts differed in magnitude from region to region.

A comparison of the overall MAE`s and skill scores during the past 6 warm seasons for the 18- and 42-h guidance and local forecasts is presented in Figs. 3.1-3.3. In general, the verification data throughout this period were relatively homogeneous since the number of stations varied only slightly from season to season while the basic set of verification stations remained the same. Since the final (PE-based) guidance was abandoned during the 1979 warm season, Figs. 3.1-3.3 do not show verification results of the final guidance forecasts after 1978.

The MAE`s for direction are shown in Fig. 3.1. Except for a slight increase in some of the MAE`s during the 1975 warm season, the guidance and local forecasts for both projections have generally improved over the span of the 6 seasons.

In contrast, the MAE`s in Fig. 3.2 indicate a decrease in accuracy for the final forecasts of wind speed. This was caused by the introduction of inflation in July of 1975. We realized that inflation would have this effect; however, previous wind speed verifications indicated that the bias values of inflated forecasts were somewhat closer to 1.0 compared to the bias values of uninflated forecasts (Carter and Hollenbaugh, 1976). Despite the inflation technique, the MAE`s for the guidance were generally as good as, or better than, those for the local forecasts. Note that the 18-h early guidance MAE`s have approached the pre-inflated levels since the forecasts became operational in 1977.

Fig. 3.3 is a comparison of guidance and local skill scores computed on five (instead of seven) categories; the fifth category included all speeds greater than 22 knots. Here we see that the skill of the guidance at both projections remained relatively constant from 1974 to 1979 despite the use of inflation. Of particular note in Fig. 3.3 is the superiority in skill of the guidance over the local forecasts for both projections.

The 18- and 42-h early guidance MAE and skill scores in Figs. 3.1-3.3 reveal the consistent superiority of the early guidance over the final guidance. Because of this, we stopped disseminating the final guidance surface wind forecasts.

4. OPAQUE SKY COVER

The operational prediction equation set used in forecasting opaque sky cover was unchanged for the 1979 warm season. The early guidance equations used LFM-II model output and 0300 (1500) GMT surface observations to produce forecasts at 6-h intervals from 6 to 48 hours after 0000 (1200) GMT. The final guidance equations used LFM-II and 7LPE model output and 0600 (1800) GMT surface observations to produce forecasts at 6-h intervals from 12 to 48 hours after 0000 (1200) GMT.

These regionalized equations produced probability forecasts of four categories of opaque sky cover, more commonly known as cloud amount, as shown in Table 4.1. For both the early and final guidance packages, we converted the probability estimates to a single "best category" forecast in a manner which produced good bias characteristics, that is, a bias value of approximately 1.0 for each category. For more details about our cloud amount forecast system, see Technical Procedures Bulletin No. 234 (National Weather Service, 1978b).

We compared the local forecasts at the 94 stations listed in Table 3.1 with a matched sample of early and final objective forecasts. The comparison was conducted for 18-, 30-, and 42-h forecasts from the 0000 GMT cycle only. The local forecasts and the surface observations used for verification were converted from opaque sky cover amount to the categories in Table 4.1. Four-category, forecast-observed contingency tables were prepared from the transformed local and best-category objective predictions. Using these tables, we computed the percent correct, Heidke skill score, and bias by category.

The results for all stations combined are shown in Table 4.2. At all projections, the percent correct and skill scores for final guidance were better than those for the early guidance. Also, it is clear that in terms of percent correct and skill scores, both early and final guidance were superior to the local forecasts. In all categories but the 42-h forecast of broken sky cover, where the local bias was better than the early guidance, bias-by-category scores of the early and final guidance forecasts were better (closer to 1.0) than those of the local forecasts.

The verification scores for stations in the NWS Eastern, Southern, Central, and Western Regions are given in Tables 4.3 through 4.6, respectively. In each case, the differences in performance between the early and final guidance were generally small at all projections. The Western Region, at the 18- and 30-h projections, provided the only instances where the local forecasts equalled or exceeded that of the guidance forecasts in terms of skill score. In general, the guidance bias scores for the clear, scattered, and overcast categories were superior to the locals at each projection. The opposite was frequently true for the broken category.

The percent correct and skill scores over the past 5 warm seasons are shown in Figs. 4.1 and 4.2, respectively, for the 18- and 42-h projections. These figures show that the guidance has improved steadily with time and that the relative superiority of the guidance over the local forecasts is generally increasing.

Figs. 4.3 and 4.4 show the biases for categories 1 and 2, respectively, for the 18- and 42-h projections. These figures show that the bias characteristics of the guidance have remained superior to those of the local forecasts. The local forecasts underforecast the clear category (category 1) and overforecast the scattered category (category 2).

5. CEILING AND VISIBILITY

For the 1979 warm season, we used the same ceiling and visibility prediction equations as were used during the previous warm season. Operationally, the early guidance set was driven by LFM-II model output and used 0300 (1500) GMT surface observations. The final guidance set used both LFM-II and 7LPE model output and the 0600 (1800) GMT surface observations. The early guidance consisted of forecasts at 6-h intervals from 6 to 48 hours after cycle time; the final guidance, from 12 to 48 hours after cycle time. For details concerning the ceiling and visibility forecast system see Technical Procedures Bulletin No. 234 (National Weather Service, 1978b).

Our ceiling and visibility verification procedure continued to track the performance of a number of scores for both subjective local forecasts and objective guidance forecasts. In each case, a persistence observation (taken at 0900 GMT for the 0000 GMT cycle and at 2100 or 2200 GMT for the 1200 GMT cycle) provided a comparison. Early and final guidance forecasts were verified for both cycles at the 12-, 18-, 24-, 36-, and 48-h projections and local forecasts at the 12-,15-, and 21-h projections. The guidance forecasts and the persistence observation were usually available to the local forecaster.

We constructed six-category (Table 5.1) forecast-observed contingency tables for all the forecasts involved in the comparative verification. These categories were then used for computing several different scores: bias-by-category, percent correct, and Heidke skill score. We then collapsed the tables to two categories (categories 1 and 2 combined versus categories 3 through 6 combined) and calculated the bias and threat score for categories 1 and 2 combined and the Heidke skill score and percent correct for the reduced tables. We have summarized the results in Tables 5.2 - 5.9. The Heidke skill score and bias for categories 1 and 2 combined are also given in Figs. 5.1 - 5.8 for selected projections for the last 4 warm seasons.

Tables 5.2 - 5.5 present the verification for the six-category ceiling and visibility forecasts. At the 12-h projection for both cycles, the persistence forecast had the highest skill score for both ceiling and visibility, the local subjective forecast had somewhat lower skill, and the guidance forecasts had significantly lower skill. The final guidance 12-h forecasts which used an observation 6 hours after cycle time, always had a higher skill score than the early guidance, which used an observation 3 hours after cycle time. With the exception of visibility forecasts at the 15-h projection (where the difference was quite small), the local forecasts outperformed persistence at the 15- and 21-h projections for both ceiling and visibility. There was little difference in skill between the early and final guidance at the 18-, 24-, 36-, and 48-h projections. However, the final guidance generally had slightly higher skill scores at these longer-range projections.

The bias-by-category characteristics of the guidance were generally better (i.e., closer to 1.0) than either the local or persistence forecasts. The biases of the 36-h persistence forecasts (actually a 27-h projection) should be about the same as those of 12-h persistence (actually a 3-h projection). Tables 5.2 - 5.5 show this to be true.

Tables 5.6 - 5.9 contain the comparative verification for the reduced two-category ceiling and visibility forecasts. The relative frequency of ceiling less than 500 feet ranged from .007 to .052 and of visibility less than 1 mile from .003 to .037, indicating that these events are relatively rare and, hence, are difficult to forecast. The difficulty was reflected in the lower skill scores. At the 12-h projection, the persistence forecast for ceiling and visibility had the highest skill score although the skill score for the local ceiling forecast was only slightly less than that of persistence. As in the six-category case, the final guidance skill score was always superior to the early guidance skill score, but both are much less than the persistence and local skill scores. At the 15-h projection, the persistence skill score was higher than that of the local forecasts except for visibility on the 1200 GMT cycle. However, at the 21-h projection, the skill score for the local forecasts was significantly higher than that of persistence. Guidance forecasts for the 18-, 24-, 36-, and 48-h projections were generally more skillful than persistence, the exception being the 18-h visibility for the 0000 GMT cycle. Final guidance ceiling forecasts were generally better than the early guidance for both cycles. The 1200 GMT cycle final visibility forecasts were somewhat less skillful than the early guidance, with the reverse being true for the 0000 GMT cycle. Beyond the 12-h projection, the two-category bias characteristics for the guidance forecasts were clearly superior to those of both persistence and local forecasts except for the 36-h projection where the persistence forecasts were better than the early guidance.

Figs. 5.1 - 5.8 present the trend graphs for bias and skill score for selected projections for the 0000 GMT cycle two-category ceiling and visibility forecasts. In general, these data show that the guidance bias characteristics for the difficult-to-forecast low categories improved significantly with the adoption of the threshold technique for category selection in 1977. However, we also note a general decrease in the guidance skill scores between 1978 and 1979.

6. MAX/MIN TEMPERATURE

The objective max/min guidance for April through September of 1979 was generated by several different sets of regression equations. However, the predictand for both the early and final guidance was the local calendar day max or min valid approximately 24, 36, 48, and 60 hours after initial model time (0000 or 1200 GMT). The final automated forecasts were based on equations developed by stratifying archived 6LPE and TJ model output, station observations, and the first two harmonics of the day of the year into seasons of 3-month duration (Hammons et al., 1976). We used spring (March-May), summer (June-August), and fall (September-November) equations to produce the final guidance during the appropriate months of the 1979 warm season. Operationally, the equations employed output from the 7LPE and the TJ models as predictors. Station observations taken 6 hours after the initial model time also were used in the final guidance equations for the first two projections.

In contrast, the early guidance system depended on prediction equations (Carter et al., 1979) derived from LFM model output, station observations available 3 hours after initial model time, and the first two harmonics of the day of the year. For the first projection, forecast equations were available for 3-month seasons: spring (April-June) and summer (July-September). After the first projection, however, we had enough data only for 6-month season equations. Thus, the early guidance for the second, third, and fourth projections relied on warm season (April-September) equations. In operations, forecast fields from the LFM-II were employed as predictors in the LFM-derived equations. Surface observations at 3 hours after the initial model time were often used as input to many of the forecasts for the first two periods.

The objective guidance--both early and final--is available on the FOUS22 teletype bulletin while the local forecasts are on the FPUS4 teletype message. As mentioned earlier, the automated max/min forecasts are for the local calendar day. Thus, for example, the first period objective forecasts of the max based on 0000 GMT model data are valid for the calendar day that starts at midnight following 0000 GMT and that ends 24 hours later. However, the valid period of the local max/min forecast does not correspond to the calendar day. Rather, the local forecaster predicts a max for the 1200 to 0000 GMT interval and a min that is generally valid from 0000 to 1200 GMT. This latter time, however, is extended to 1800 GMT for forecasters in the Western Region and for many others in the western parts of the Central and Southern Regions. Hence, caution is necessary in comparing verification scores for the local forecasts and the objective guidance.

We verified local and objective forecasts from the 0000 GMT cycle, using calendar day max and min temperatures obtained from the National Climatic Center as the verifying observations. Mean algebraic error (forecast minus observed temperature), mean absolute error, and the number of absolute errors greater than or equal to 10°F were computed for 87 stations (Table 2.1) in the conterminous United States. Four forecast projections of approximately 24(max), 36(min), 48(max), and 60(min) hours after 0000 GMT were verified.

Verification results are shown in Table 6.1 for all stations combined. It is evident that the early and final guidance are nearly equal in forecast skill at all four projections. In fact, the mean absolute errors of the early and the final guidance differ by no more than 0.1°F at any projection. Moreover, noticeable differences between the early and final guidance in terms of both the magnitude of the mean algebraic error (or bias) and the number of large absolute errors ($\geq$ 10°F) appear only in the 48-h max. During the 1979 warm season, the final MOS forecasts were better guidance for the 48-h max, but the early MOS forecasts were more accurate for the 60-h min. This is an exact reversal of the 1978 warm season verification (Dallavalle et al., 1979). Also, note that, in terms of algebraic error, the early and final guidance had opposite biases for the 24- and 48-h max with the early guidance having a warm bias (positive algebraic error) while the final guidance had a cold bias (negative algebraic error). Finally, observe that the 48-h MOS guidance for the max was less accurate than the 60-h min guidance. As noted before (Hammons et al., 1976), the max is more difficult than the min to forecast during the warm season.

For the first time in our comparative verifications, the differences in accuracy between the MOS guidance and the local forecasts favored the objective forecasts. In fact, the local forecasts improved on the early guidance in terms of mean absolute error and number of large errors only for the 48-h max. For the other projections, the MOS early guidance was more accurate than the subjective forecasts.

Analogous verification scores are shown in Tables 6.2 - 6.5 for the Eastern, Southern, Central, and Western Regions, respectively. In general, the trends are similar to those seen for all 87 stations combined. However, in the Eastern Region, the final was marginally more accurate (by 0.1°F mean absolute error) than the early for the 36-, 48-, and 60-h projections. In the Southern and Central Regions, the early guidance was generally more accurate than the final in terms of mean absolute error for all projections but the 48-h max. In the Western Region, the early guidance was superior to the final guidance except for the 36-h min. The largest differences in accuracy between the early and final guidance occurred for the 48-h max in the Western Region where a large cold bias in the final guidance contributed to a mean absolute error 0.7°F greater than that for the early guidance.

The performance of the local forecasters with respect to the automated guidance varied little from region to region. Generally, the local forecasts were unable to improve upon the early guidance at any projection except for the 48-h max. For that forecast projection, the local forecasts were more accurate than the early guidance (but not the final) in the Eastern, Southern, and Central Regions. In the Western Region, the local forecasts improved by 0.5°F mean absolute error over the final guidance but were still less accurate than the early guidance.

The mean absolute errors (0000 GMT cycle only) during the last 9 warm seasons are given in Fig. 6.1 for the max forecasts. Although the curves are irregular, the final guidance for both the 24- and 48-h max has tended to improve since 1971. Of course, the natural variability in the max and the difficulty of predicting that quantity during the warm season are important in understanding these curves. Note that the local forecasts have also improved slightly over this period, although the improvement is not as dramatic as with the objective guidance. The final automated forecasts had substantial increases in accuracy in 1974 when MOS equations were first operational for an entire warm season (Klein and Hammons, 1975) and in 1976 when the 3-month MOS equations were used (Hammons et al., 1976). Finally, after the introduction of LFM-based equations in 1978, the 24-h early guidance improved to the point where it was as accurate as the subjective forecasts. This trend in the early guidance is not evident at the 48-h projection.

An analogous time series is shown in Fig. 6.2 for the min forecasts. Verifications for the 60-h projection are available for the last 4 seasons. For the 36-h projection, there has been an overall improvement in both the objective and local forecasts since 1971. The greatest increase in accuracy of the 36-h min came in 1974 and again in 1976, as discussed for the objective max guidance. Note that for both the 36- and 60-h projections the objective guidance--both early and final--was more accurate than the subjective forecasts.

7. CONCLUSION

This verification showed that, generally, both the guidance and local forecasts did at least as well as they did last year and, in many cases, showed improvement. The most notable exceptions were the ceiling and visibility guidance forecasts. For the most part, verification scores for these two guidance products showed an overall degradation over the previous year. The skill scores for the local forecasts also lost some ground over last year's forecasts at the 12- and 15-h projections for ceiling and the 15-h projection for visibility.

The local PoP forecasts for the 1979 warm season were superior to the guidance in almost every case in terms of Brier score and percent improvement over guidance. The only instances where early guidance was slightly better than the locals occurred for the third period in the Central Region and the second period in the Western Region. The trend for percent improvement in P-score over climatology showed virtually no change from 1978 for the guidance while the locals continued to improve.

The MOS guidance wind speed and direction forecasts were generally more accurate than the local forecasts in both the regional and national verifications. Both the guidance and local forecasts tended to underestimate wind speeds stronger than 22 knots, as they have for the previous 5 warm seasons. Due to the introduction of the inflation technique in 1975, the MAE of the wind speed guidance generally increased for the 18- and 42-h projections. For both projections, the guidance skill scores have remained superior to those of the local forecasts for the entire 6 year verification period.

Both the early and the final opaque sky cover guidance were generally more accurate than the local forecasts in terms of percent correct and skill score for all projections verified. In the Western Region, however, the local forecasts showed greater skill in terms of skill score than the early guidance at both the 18- and 30-h projections. Overall, the final guidance was more accurate than the early guidance for each projection. This superiority of final over early guidance was also evident on a region by region basis. Only in the Southern Region at 18-h and Western Region at 42-h was the reverse true.

A direct comparison between local, MOS, and persistence forecasts of ceiling and visibility was possible only for the 12-h projection. For that projection, local forecasts were superior to the guidance for both elements while persistence generally outperformed the locals. At most projections, the bias characteristics of the guidance forecasts were generally better than either persistence or the locals. In particular, the locals underforecast the occurrence of the lower-category events.

For the max/min temperature, the early guidance was more accurate than the final for the 24-, 36-, and 60-h projections. In contrast, for the 48-h max, the final guidance had lower mean absolute errors. However, all differences in accuracy between the two types of objective guidance were small. These same trends were generally evident in the four NWS regions discussed in this report. Though comparisons between the objective guidance and the local max/min forecasts are difficult to make because of the different forecast periods involved, we found that the local forecasts and the early guidance had approximately equal mean absolute errors for the 24-, 36-, and 48-h projections. For the 60-h min, the early guidance was more accurate than the subjective forecasts.

ACKNOWLEDGMENTS

We wish to thank the Technical Procedures Branch of the Office of Meteorology and Oceanography for providing us with the local forecasts, and especially Dean Dubofsky of the Branch who processed the data. We are also grateful to Fred Marshall and Tim Chambers of the Techniques Development Laboratory for assistance in archiving the guidance forecasts and error checking the observations used for verification. Additional thanks are extended to Cheryl Shaw, Susanne Mayo, and Mercedes Bakon for typing the text and the many tables shown in this report.

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Table 2.1. Eighty-seven stations used for comparative verification of automated and local PoP and max/min temperature forecasts.

AVL	Asheville, North Carolina	DFW	Dallas-Ft. Worth, Texas
RDU	Raleigh-Durham, North Carolina	JAN	Jackson, Mississippi
ORF	Norfolk, Virginia	MIA	Miami, Florida
PHL	Philadelphia, Pennsylvania	ORL	Orlando, Florida
RIC	Richmond, Virginia	TPA	Tampa, Florida
DCA	Washington, D.C.	MSY	New Orleans, Louisiana
CRW	Charleston, West Virginia	BRO	Brownsville, Texas
CHS	Charleston, South Carolina	SAT	San Antonio, Texas
CLT	Charlotte, North Carolina	IAH	Houston, Texas
CAE	Columbia, South Carolina	ATL	Atlanta, Georgia
LGA	New York (Laguardia), New York	BHM	Birmingham, Alabama
BUF	Buffalo, New York	JAX	Jacksonville, Florida
ALB	Albany, New York	MEM	Memphis, Tennessee
BOS	Boston, Massachusetts	SHV	Shreveport, Louisiana
BDL	Hartford, Connecticut	AUS	Austin, Texas
BTV	Burlington, Vermont	LIT	Little Rock, Arkansas
PWM	Portland, Maine	OKC	Oklahoma City, Oklahoma
PVD	Providence, Rhode Island	TUL	Tulsa, Oklahoma
SYR	Syracuse, New York	MAF	Midland, Texas
CLE	Cleveland, Ohio	ELP	El Paso, Texas
CMH	Columbus, Ohio	AMA	Amarillo, Texas
BWI	Baltimore, Maryland	ABQ	Albuquerque, New Mexico
ACY	Atlantic City, New Jersey	FLG	Flagstaff, Arizona
CVG	Cincinnati, Ohio	TUS	Tucson, Arizona
DAY	Dayton, Ohio	LAS	Las Vegas, Nevada
PIT	Pittsburgh, Pennsylvania	LAX	Los Angeles, California
ICT	Wichita, Kansas	RNO	Reno, Nevada
MCI	Kansas City, Missouri	SAN	San Diego, California
STL	St. Louis, Missouri	SFO	San Francisco, California
MDW	Chicago (Midway), Illinois	BIL	Billings, Montana
MKE	Milwaukee, Wisconsin	SLC	Salt Lake City, Utah
SSM	Sault Ste Marie, Michigan	BOI	Boise, Idaho
DLH	Duluth, Minnesota	HLN	Helena, Montana
FAR	Fargo, North Dakota	GEG	Spokane, Washington
MSP	Minneapolis, Minnesota	PDX	Portland, Oregon
DSM	Des Moines, Iowa	SEA	Seattle-Tacoma, Washington
OMA	Omaha, Nebraska	CPR	Casper, Wyoming
FSD	Sioux Falls, South Dakota	RAP	Rapid City, South Dakota
DEN	Denver, Colorado	IND	Indianapolis, Indiana
BIS	Bismarck, North Dakota	SDF	Louisville, Kentucky
CYS	Cheyenne, Wyoming	DTW	Detroit, Michigan
LBF	North Platte, Nebraska	PHX	Phoenix, Arizona
BNA	Nashville, Tennessee	GTF	Great Falls, Montana
TOP	Topeka, Kansas		

Table 2.2. Comparative verification of early and final guidance and local PoP forecasts for 87 stations, 0000 GMT cycle.

Projection	Type of Forecast	Brier Score	Improvement Over Guidance (%)	Improvement Over Climatology (%)	Number of Cases
12-24 h (1st period)	Early/Final Local	.1082 .1024	5.6	29.4 33.7	10367
24-36 h (2nd period)	Early Final Local	.1201 .1251 .1189	0.9[1] (4.8)	22.3 19.2 23.0	10397
36-48 h (3rd period)	Early Final Local	.1247 .1273 .1236	1.1[1] (3.1)	18.6 16.9 19.6	10394

[1]This is the percent improvement of the locals over the early guidance; the figure in parentheses is the percent improvement of the locals over the final guidance.

Table 2.3. Same as Table 2.2 except for 26 stations in the Eastern Region.

Projection	Type of Forecast	Brier Score	Improvement Over Guidance (%)	Improvement Over Climatology (%)	Number of Cases
12-24 h (1st period)	Early/Final	.1162		42.3	2978
	Local	.1152	0.9	42.8	
24-36 h (2nd period)	Early	.1363		29.3	2996
	Final	.1444		25.4	
	Local	.1345	1.3[1] (6.7)	30.3	
36-48 h (3rd period)	Early	.1411		29.2	2992
	Final	.1449		27.1	
	Local	.1399	0.8[1] (3.5)	29.8	

[1]This is the percent improvement of the locals over the early guidance; the figure in parentheses is the percent improvement of the locals over the final guidance.

Table 2.4. Same as Table 2.2 except for 23 stations in the Southern Region.

Projection	Type of Forecast	Brier Score	Improvement Over Guidance (%)	Improvement Over Climatology (%)	Number of Cases
12-24 h (1st period)	Early/Final	.1222		25.7	2910
	Local	.1123	8.1	31.8	
24-36 h (2nd period)	Early	.1191		20.9	2911
	Final	.1227		18.5	
	Local	.1181	0.8[1] (3.8)	21.6	
36-48 h (3rd period)	Early	.1355		15.6	2916
	Final	.1372		14.5	
	Local	.1341	1.0[1] (2.2)	16.5	

[1]This is the percent improvement of the locals over the early guidance; the figure in parentheses is the percent improvement of the locals over the final guidance.

Table 2.5. Same as Table 2.2 except for 22 stations in the Central Region.

Projection	Type of Forecast	Brier Score	Improvement Over Guidance (%)	Improvement Over Climatology (%)	Number of Cases
12-24 h (1st period)	Early/Final	.1122		28.6	2717
	Local	.1062	5.3	32.4	
24-36 h (2nd period)	Early	.1368		20.1	2728
	Final	.1408		17.8	
	Local	.1352	1.2[1] (4.0)	21.1	
36-48 h (3rd period)	Early	.1316		15.7	2727
	Final	.1351		13.5	
	Local	.1322	-0.5[1] (2.1)	15.3	

[1]This is the percent improvement of the locals over the early guidance; the figure in parentheses is the percent improvement of the locals over the final guidance.

Table 2.6. Same as Table 2.2 except for 16 stations in the Western Region.

Projection	Type of Forecast	Brier Score	Improvement Over Guidance (%)	Improvement Over Climatology (%)	Number of Cases
12-24 h (1st period)	Early/Final	.0652		15.0	1762
	Local	.0587	10.0	23.5	
24-36 h (2nd period)	Early	.0684		16.1	1762
	Final	.0717		11.8	
	Local	.0685	-0.2[1] (4.4)	15.9	
36-48 h (3rd period)	Early	.0682		10.2	1759
	Final	.0691		8.7	
	Local	.0652	4.4[1] (5.6)	14.1	

[1]This is the percent improvement of the locals over the early guidance; the figure in parentheses is the percent improvement of the locals over the final guidance.

Table 3.1. Ninety-four stations used for comparative verification of guidance and local sky cover, surface wind, ceiling, and visibility forecasts.

PWM	Portland, Maine
BTV	Burlington, Vermont
CON	Concord, New Hampshire
BOS	Boston, Massachusetts
PVD	Providence, Rhode Island
BUF	Buffalo, New York
SYR	Syracuse, New York
ALB	Albany, New York
JFK	New York (Kennedy), New York
EWR	Newark, New Jersey
ERI	Erie, Pennsylvania
AVP	Scranton, Pennsylvania
PIT	Pittsburgh, Pennsylvania
PHL	Philadelphia, Pennsylvania
CLE	Cleveland, Ohio
CMH	Columbus, Ohio
HTS	Huntington, West Virginia
CRW	Charleston, West Virginia
DCA	Washington, D.C.
ORF	Norfolk, Virginia
RDU	Raleigh-Durham, North Carolina
CLT	Charlotte, North Carolina
CHS	Charleston, South Carolina
CAE	Columbia, South Carolina
ATL	Atlanta, Georgia
SAV	Savannah, Georgia
MIA	Miami, Florida
JAX	Jacksonville, Florida
BHM	Birmingham, Alabama
MOB	Mobile, Alabama
TYS	Knoxville, Tennessee
MEM	Memphis, Tennessee
MEI	Meridian, Mississippi
JAN	Jackson, Mississippi
MSY	New Orleans, Louisiana
SHV	Shreveport, Louisiana
IAH	Houston, Texas
SAT	San Antonio, Texas
DFW	Dallas-Fort Worth, Texas
ABI	Abilene, Texas
LBB	Lubbock, Texas
ELP	El Paso, Texas
LIT	Little Rock, Arkansas
FSM	Fort Smith, Arkansas
TUL	Tulsa, Oklahoma
OKC	Oklahoma City, Oklahoma
ABQ	Albuquerque, New Mexico
GTF	Great Falls, Montana
TCC	Tucumcari, New Mexico
APN	Alpena, Michigan
DTW	Detroit, Michigan
SBN	South Bend, Indiana
IND	Indianapolis, Indiana
LEX	Lexington, Kentucky
SDF	Louisville, Kentucky
MSN	Madison, Wisconsin
MKE	Milwaukee, Wisconsin
ORD	Chicago (O'Hare), Illinois
SPI	Springfield, Illinois
STL	St. Louis, Missouri
MCI	Kansas City, Missouri
TOP	Topeka, Kansas
DDC	Dodge City, Kansas
DEN	Denver, Colorado
GJT	Grand Junction, Colorado
SHR	Sheridan, Wyoming
CYS	Cheyenne, Wyoming
BIS	Bismarck, North Dakota
FAR	Fargo, North Dakota
RAP	Rapid City, South Dakota
FSD	Sioux Falls, South Dakota
BFF	Scottsbluff, Nebraska
OMA	Omaha, Nebraska
MSP	Minneapolis, Minnesota
DSM	Des Moines, Iowa
BRL	Burlington, Iowa
INL	International Falls, Minnesota
FLG	Flagstaff, Arizona
PHX	Phoenix, Arizona
CDC	Cedar City, Utah
SLC	Salt Lake City, Utah
LAS	Las Vegas, Nevada
RNO	Reno, Nevada
SAN	San Diego, California
LAX	Los Angeles, California
FAT	Fresno, California
SFO	San Francisco, California
PDX	Portland, Oregon
PDT	Pendleton, Oregon
SEA	Seattle (Tacoma), Washington
GEG	Spokane, Washington
BOI	Boise, Idaho
PIH	Pocatello, Idaho
MSO	Missoula, Montana

Table 3.2 Comparative verification of MOS (early) and local surface wind forecasts for 94 stations, 0000 GMT cycle only, for the period April through September of 1979.

FCST PROJ (HOURS)	TYPE OF FCST	DIRECTION: MEAN ABS ERROR (DEG)	DIRECTION: NO. OF CASES	SPEED: MEAN ABS ERROR (KTS)	SPEED: MEAN FCST (KTS)	SPEED: MEAN OBS (KTS)	SPEED: NO. OF CASES	CONTINGENCY TABLE: SKILL SCORE	CONTINGENCY TABLE: PERCENT FCST CORRECT	BIAS-NO. FCST/NO. OBS: CAT1 (NO. OBS)	CAT2 (NO. OBS)	CAT3 (NO. OBS)	CAT4 (NO. OBS)	CAT5 (NO. OBS)	CAT6 (NO. OBS)	CAT7 (NO. OBS)	NO. OF CASES
18	EARLY	27	4843	2.9	11.8	11.8	4859	0.29	56	1.26	0.89	0.68	0.55	0.88	0.40	0.0	13691
	LOCAL	31		3.1	12.6			0.26	53	0.93 (5597)	1.12 (5583)	0.95 (2027)	0.72 (399)	0.44 (68)	0.93 (15)	4.00 (2)	
30	EARLY	31	1742	3.5	11.5	10.3	1767	0.32	70	1.06	0.89	0.81	0.48	0.55	0.33	0.0	13174
	LOCAL	34		3.6	11.8			0.26	65	0.95 (9105)	1.20 (3219)	0.78 (693)	0.80 (129)	0.35 (20)	2.67 (3)	1.60 (5)	
42	EARLY	37	4193	3.6	12.7	11.5	4222	0.22	50	1.13	0.92	0.86	0.99	1.24	0.81	3.00	12929
	LOCAL	43		3.6	12.4			0.17	48	0.93 (5272)	1.16 (5277)	0.86 (1906)	0.59 (390)	0.30 (66)	0.31 (16)	2.00 (2)	

le 3.3. Contingency tables for guidance (early) and local surface wind speed forecasts for 94 stations, 0000 GMT ycle only, for the period April through September of 1979.

18-h Forecasts

GUIDANCE

		1	2	3	4	5	6	7	T
	1	4295	1199	95	6	1	0	0	5597
	2	2453	2631	463	32	4	0	0	5583
	3	277	1026	613	91	20	0	0	2027
	4	15	112	136	69	15	2	0	399
	5	2	11	23	16	14	2	0	68
	6	0	1	3	4	5	2	0	15
	7	0	0	1	0	1	0	0	2
	T	7043	4980	1384	218	60	6	0	13691

LOCAL

		1	2	3	4	5	6	7	T
	1	3287	2087	203	15	0	2	3	5597
	2	1678	3087	765	46	4	1	2	5583
	3	208	948	744	122	4	0	1	2027
OBS	4	14	94	198	80	11	1	1	399
	5	2	9	22	21	6	7	1	68
	6	0	3	2	3	5	2	0	15
	7	0	0	1	0	0	1	0	2
	T	5159	6228	1935	287	30	14	8	13691

30-h Forecasts

GUIDANCE

		1	2	3	4	5	6	7	T
	1	7771	1208	118	8	0	0	0	9105
	2	1661	1298	236	21	3	0	0	3219
	3	209	303	157	21	2	1	0	693
OBS	4	28	52	40	6	3	0	0	129
	5	2	4	6	6	2	0	0	20
	6	0	0	3	0	0	0	0	3
	7	2	1	1	0	1	0	0	5
	T	9673	2866	561	62	11	1	0	13174

LOCAL

		1	2	3	4	5	6	7	T
	1	6988	1951	139	20	2	3	2	9105
	2	1483	1463	228	36	2	3	4	3219
	3	156	376	128	29	1	1	2	693
OBS	4	25	57	38	8	0	1	0	129
	5	1	5	5	7	2	0	0	20
	6	0	0	1	2	0	0	0	3
	7	2	1	1	1	0	0	0	5
	T	8655	3853	540	103	7	8	8	13174

42-h Forecasts

GUIDANCE

		1	2	3	4	5	6	7	T
	1	3452	1551	239	25	4	1	0	5272
	2	2165	2320	673	104	14	1	0	5277
	3	305	857	559	153	26	5	1	1906
OBS	4	32	106	141	87	22	2	0	390
	5	5	14	16	14	13	2	2	66
	6	0	2	4	3	3	1	3	16
	7	0	0	0	1	0	1	0	2
	T	5959	4850	1632	337	82	13	6	12929

LOCAL

		1	2	3	4	5	6	7	T
	1	2816	2191	249	12	2	0	0	5272
	2	1737	2775	683	76	4	0	2	5277
	3	325	969	519	84	7	0	2	1906
OBS	4	42	137	165	42	2	2	0	390
	5	4	24	21	13	2	2	0	66
	6	0	5	2	5	3	1	0	16
	7	0	0	2	0	0	0	0	2
	T	4926	6101	1641	232	20	5	4	12929

Table 3.4 Same as Table 3.2 except for 24 stations in the Eastern Region.

FCST PROJ (HOURS)	TYPE OF FCST	DIRECTION: MEAN ABS ERROR (DEG)	DIRECTION: NO. OF CASES	SPEED: MEAN ABS ERROR (KTS)	SPEED: MEAN FCST (KTS)	SPEED: MEAN OBS (KTS)	SPEED: NO. OF CASES	CONTINGENCY TABLE: SKILL SCORE	CONTINGENCY TABLE: PERCENT FCST CORRECT	BIAS-NO. FCST/NO. OBS: CAT1 (NO. OBS)	CAT2 (NO. OBS)	CAT3 (NO. OBS)	CAT4 (NO. OBS)	CAT5 (NO. OBS)	CAT6 (NO. OBS)	CAT7 (NO. OBS)	NO. OF CASES
18	EARLY	28	1296	2.7	11.7	11.6	1298	0.30	56	1.22	0.92	0.72	0.58	1.60	0.67	0.0	3361
	LOCAL	32		2.8	12.5			0.26	53	1.00 (1291)	1.02 (1463)	0.95 (519)	0.82 (74)	0.90 (10)	1.33 (3)	2.00 (1)	
30	EARLY	31	380	3.5	11.1	9.9	385	0.32	75	1.08	0.80	0.64	0.46	0.25	0.0	0.0	3291
	LOCAL	35		3.8	11.9			0.25	69	0.95 (2453)	1.20 (675)	0.95 (132)	1.08 (24)	0.25 (4)	1.00 (2)	2.00 (1)	
42	EARLY	36	1085	3.2	12.1	11.5	1091	0.23	51	1.21	0.89	0.81	0.86	0.80	1.00	0.0	3187
	LOCAL	43		3.1	12.4			0.17	48	1.03 (1224)	1.05 (1375)	0.81 (497)	0.84 (77)	0.60 (10)	1.00 (3)	0.0 (1)	

Table 3.5 Same as Table 3.2 except for 24 stations in the Southern Region.

		DIRECTION		SPEED														
								CONTINGENCY TABLE										
										BIAS-NO. FCST/NO. OBS								
FCST PROJ (HOURS)	TYPE OF FCST	MEAN ABS ERROR (DEG)	NO. OF CASES	MEAN ABS ERROR (KTS)	MEAN FCST (KTS)	MEAN OBS (KTS)	NO. OF CASES	SKILL SCORE	PERCENT FCST CORRECT	CAT1 (NO. OBS)	CAT2 (NO. OBS)	CAT3 (NO. OBS)	CAT4 (NO. OBS)	CAT5 (NO. OBS)	CAT6 (NO. OBS)	CAT7 (NO. OBS)	NO. OF CASES
18	EARLY	28	1201	3.0	11.7	11.3	1207	0.28	56	1.26	0.86	0.65	0.75	1.00	0.50	*	3630
	LOCAL	31		3.1	12.4			0.24	53	0.83	1.21	0.95	0.69	0.38	2.00	****	
										(1538)	(1519)	(483)	(75)	(13)	(2)	(0)	
30	EARLY	29	356	3.6	11.6	10.3	367	0.32	73	1.05	0.90	0.85	0.29	0.60	*	*	3583
	LOCAL	33		3.5	11.4			0.28	69	0.97	1.21	0.65	0.45	0.80	***	*	
										(2607)	(770)	(170)	(31)	(5)	(0)	(0)	
42	EARLY	37	1019	3.5	12.0	10.9	1028	0.20	50	1.16	0.90	0.81	0.96	1.09	0.50	*	3407
	LOCAL	43		3.5	12.1			0.14	47	0.83	1.24	0.83	0.74	0.27	0.0	**	
										(1454)	(1424)	(446)	(70)	(11)	(2)	(0)	

* This category was neither forecast nor observed.
** This category was forecast once but never observed.
*** This category was forecast twice but never observed.
**** This category was forecast 3 times but never observed.

Table 3.6 Same as Table 3.2 except for 28 stations in the Central Region.

FCST PROJ (HOURS)	TYPE OF FCST	DIRECTION MEAN ABS ERROR (DEG)	DIRECTION NO. OF CASES	SPEED MEAN ABS ERROR (KTS)	SPEED MEAN FCST (KTS)	SPEED MEAN OBS (KTS)	SPEED NO. OF CASES	CONTINGENCY TABLE SKILL SCORE	CONTINGENCY TABLE PERCENT FCST CORRECT	BIAS-NO. FCST/NO. OBS CAT1 (NO. OBS)	CAT2 (NO. OBS)	CAT3 (NO. OBS)	CAT4 (NO. OBS)	CAT5 (NO. OBS)	CAT6 (NO. OBS)	CAT7 (NO. OBS)	NO. OF CASES
18	EARLY	25	1745	2.9	12.0	12.4	1750	0.27	52	1.47	0.85	0.67	0.53	0.87	0.33	0.0	4169
	LOCAL	29		3.1	12.9			0.26	51	0.92 (1339)	1.10 (1843)	0.99 (768)	0.69 (179)	0.40 (30)	0.56 (9)	3.00 (1)	
30	EARLY	32	677	3.5	11.8	10.3	683	0.26	67	1.08	0.84	0.87	0.79	1.17	1.00	0.0	4132
	LOCAL	36		3.7	12.2			0.23	59	0.86 (2699)	1.37 (1107)	0.89 (268)	1.06 (48)	0.33 (6)	2.00 (1)	1.67 (3)	
42	EARLY	38	1597	3.8	13.6	12.0	1607	0.20	46	1.22	0.86	0.88	1.22	1.83	0.90	6.00	3937
	LOCAL	42		3.7	12.7			0.18	46	0.91 (1239)	1.14 (1764)	0.97 (721)	0.53 (172)	0.30 (30)	0.20 (10)	2.00 (1)	

Table 3.7 Same as Table 3.2 except for 18 stations in the Western Region.

FCST PROJ (HOURS)	TYPE OF FCST	DIRECTION: MEAN ABS ERROR (DEG)	DIRECTION: NO. OF CASES	SPEED: MEAN ABS ERROR (KTS)	SPEED: MEAN FCST (KTS)	SPEED: MEAN OBS (KTS)	SPEED: NO. OF CASES	CONTINGENCY TABLE: SKILL SCORE	CONTINGENCY TABLE: PERCENT FCST CORRECT	BIAS-NO. FCST/NO. OBS: CAT1 (NO. OBS)	CAT2 (NO. OBS)	CAT3 (NO. OBS)	CAT4 (NO. OBS)	CAT5 (NO. OBS)	CAT6 (NO. OBS)	CAT7 (NO. OBS)	NO. OF CASES
18	EARLY	32	601	3,3	11.5	11.6	604	0.30	61	1.10	0.99	0.71	0.35	0.33	0.0	*	2531
	LOCAL	36		3.5	12.4			0.22	55	0.97 (1429)	1.14 (758)	0.87 (257)	0.70 (71)	0.27 (15)	1.00 (1)	* (0)	
30	EARLY	29	329	3.2	10.9	10.6	332	0.30	64	1.01	1.05	0.80	0.15	0.00	*	**	2168
	LOCAL	31		3.4	11.3			0.28	65	1.11 (1346)	0.90 (667)	0.54 (123)	0.46 (26)	0.00 (5)	*** (0)	1.00 (1)	
42	EARLY	39	492	4.0	12.2	11.2	496	0.20	54	0.94	1.16	0.97	0.63	0.47	0.0	*	2398
	LOCAL	44		4.2	12.1			0.15	51	0.98 (1355)	1.22 (714)	0.71 (242)	0.32 (71)	0.13 (15)	0.0 (1)	** (0)	

* This category was neither forecast nor observed.
** This category was forecast once but never observed.
*** This category was forecast twice but never observed.

Table 3.8 Distribution of absolute errors associated with guidance (early) and local forecasts of surface wind direction for 94 stations, 0000 GMT cycle only, for the period April through September of 1979.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	PERCENTAGE FREQUENCY OF ABSOLUTE ERRORS BY CATEGORY					
		0-30°	40-60°	70-90°	100-120°	130-150°	160-180°
18	EARLY	75.1	15.8	4.8	2.0	1.3	0.9
	LOCAL	69.2	19.4	5.9	2.6	1.7	1.3
30	EARLY	71.0	17.2	5.3	3.0	2.0	1.6
	LOCAL	66.6	18.7	6.8	4.1	2.4	1.3
42	EARLY	63.1	19.8	7.4	4.4	3.1	2.1
	LOCAL	56.9	21.6	9.6	4.9	4.3	2.7

Table 3.9 Same as Table 3.8 except for 24 stations in the Eastern Region.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	PERCENTAGE FREQUENCY OF ABSOLUTE ERRORS BY CATEGORY					
		0-30°	40-60°	70-90°	100-120°	130-150°	160-180°
18	EARLY	74.3	16.7	4.9	1.9	1.0	1.2
	LOCAL	68.2	20.6	5.3	2.4	1.7	1.8
30	EARLY	68.7	20.5	6.3	1.6	1.6	1.3
	LOCAL	62.3	24.7	6.8	2.9	1.8	1.3
42	EARLY	64.1	20.3	6.8	4.2	2.9	1.8
	LOCAL	56.5	22.4	8.9	5.5	5.2	1.5

Table 3.10 Same as Table 3.8 except for 24 stations in the Southern Region.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	PERCENTAGE FREQUENCY OF ABSOLUTE ERRORS BY CATEGORY					
		0-30°	40-60°	70-90°	100-120°	130-150°	160-180°
18	EARLY	74.4	16.7	4.8	2.2	1.1	0.7
	LOCAL	68.7	19.6	6.7	2.6	1.7	0.8
30	EARLY	72.5	16.3	4.2	3.9	1.7	1.4
	LOCAL	68.3	16.6	7.0	5.3	1.7	1.1
42	EARLY	62.8	20.0	8.5	4.3	2.6	1.8
	LOCAL	55.8	23.0	9.9	5.0	3.5	2.7

Table 3.11 Same as Table 3.8 except for 28 stations in the Central Region.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	PERCENTAGE FREQUENCY OF ABSOLUTE ERRORS BY CATEGORY					
		0-30°	40-60°	70-90°	100-120°	130-150°	160-180°
18	EARLY	77.9	14.8	4.0	1.5	1.3	0.5
	LOCAL	71.5	19.4	4.9	2.4	1.1	0.6
30	EARLY	70.6	15.8	6.6	2.7	2.2	2.1
	LOCAL	66.5	17.6	7.7	3.2	3.2	1.8
42	EARLY	62.7	19.8	7.5	4.3	3.2	2.4
	LOCAL	57.1	21.8	10.0	4.4	3.5	3.2

Table 3.12 Same as Table 3.8 except for 18 stations in the Western Region.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	PERCENTAGE FREQUENCY OF ABSOLUTE ERRORS BY CATEGORY					
		0-30°	40-60°	70-90°	100-120°	130-150°	160-180°
18	EARLY	70.4	14.8	7.2	3.5	2.5	1.7
	LOCAL	65.2	16.5	8.7	3.7	3.0	3.0
30	EARLY	72.6	17.0	2.4	4.6	2.1	1.2
	LOCAL	70.2	16.4	4.9	5.8	2.1	0.6
42	EARLY	63.0	18.5	5.9	4.9	4.7	3.0
	LOCAL	59.6	16.3	9.1	5.1	6.3	3.7

Table 4.1. Definitions of the categories used for guidance forecasts of cloud amount.

Category	Cloud Amount (Opaque Sky Cover in tenths)
1	0-1
2	2-5
3	6-9
4	10

able 4.2. Comparative verification of early and final guidance and local forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 94 stations, 0000 GMT cycle, for the 1979 warm season.

PROJECTION (HRS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT3 (No. Obs)	CAT4 (No. Obs.)			
18	EARLY	0.99	1.16	0.96	0.85	51.9	.351	13167
	FINAL	0.97	1.17	0.91	0.91	52.4	.358	
	LOCAL	0.68	1.48	1.15	0.64	49.6	.321	
		(3913)	(3652)	(2982)	(2620)			
30	EARLY	1.02	1.46	0.61	0.84	51.3	.290	12452
	FINAL	1.00	1.43	0.52	0.95	53.0	.315	
	LOCAL	0.66	2.05	1.57	0.56	44.6	.252	
		(5668)	(2195)	(1611)	(2978)			
42	EARLY	1.07	1.20	0.78	0.86	46.1	.271	12729
	FINAL	0.98	1.08	1.01	0.90	47.1	.288	
	LOCAL	0.59	1.76	1.10	0.44	41.8	.213	
		(3775)	(3528)	(2865)	(2561)			

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

PROJECTION (HRS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT3 (No. Obs)	CAT4 (No. Obs.)			
18	EARLY	0.82	0.88	1.29	0.98	49.5	.319	3206
	FINAL	0.68	0.95	1.19	1.07	51.7	.344	
	LOCAL	0.63 (567)	1.32 (901)	1.33 (791)	0.64 (947)	47.5	.289	
30	EARLY	1.27	0.84	0.84	0.90	50.4	.296	3113
	FINAL	1.04	0.92	0.90	1.04	50.8	.302	
	LOCAL	0.73 (990)	1.91 (508)	1.67 (445)	0.58 (1170)	43.6	.257	
42	EARLY	1.26	0.86	0.93	1.04	44.9	.260	3095
	FINAL	1.00	0.71	1.33	1.01	45.1	.262	
	LOCAL	0.59 (535)	1.57 (873)	1.24 (756)	0.50 (931)	41.6	.208	

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

ROJECTION (HRS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT3 (No. Obs)	CAT4 (No. Obs.)			
18	EARLY	0.90	1.31	0.83	0.88	53.1	.363	3493
	FINAL	0.88	1.37	0.80	0.86	52.6	.356	
	LOCAL	0.67 (954)	1.53 (1037)	1.03 (902)	0.57 (600)	49.2	.303	
30	EARLY	0.99	1.56	0.51	0.82	53.0	.293	3458
	FINAL	0.99	1.68	0.33	0.82	54.1	.309	
	LOCAL	0.70 (1717)	1.99 (630)	1.43 (445)	0.55 (666)	46.9	.260	
42	EARLY	1.02	1.33	0.76	0.76	46.4	.269	3395
	FINAL	0.81	1.32	0.98	0.80	47.7	.289	
	LOCAL	0.56 (957)	1.79 (995)	1.03 (860)	0.34 (583)	41.9	.200	

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

PROJECTION (HRS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT3 (No. Obs)	CAT4 (No. Obs.)			
18	EARLY	0.96	1.28	1.01	0.65	48.2	.298	4092
	FINAL	0.99	1.26	0.95	0.71	48.3	.299	
	LOCAL	0.59 (1203)	1.57 (1174)	1.12 (892)	0.66 (823)	47.5	.291	
30	EARLY	1.03	1.60	0.50	0.75	49.5	.252	3851
	FINAL	1.05	1.50	0.36	0.87	51.5	.275	
	LOCAL	0.54 (1818)	2.32 (672)	1.71 (490)	0.53 (871)	39.5	.197	
42	EARLY	1.10	1.31	0.77	0.67	42.9	.223	3939
	FINAL	1.10	1.11	0.94	0.77	45.3	.260	
	LOCAL	0.50 (1159)	1.86 (1118)	1.10 (862)	0.41 (800)	39.0	.172	

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

PROJECTION (HRS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT3 (No. Obs)	CAT4 (No. Obs.)			
18	EARLY	1.16	1.05	0.49	0.96	59.6	.361	2376
	FINAL	1.17	0.98	0.48	1.08	60.0	.367	
	LOCAL	0.80 (1189)	1.45 (540)	1.15 (397)	0.74 (250)	56.7	.367	
30	EARLY	0.84	1.83	0.56	0.89	53.4	.278	2030
	FINAL	0.87	1.57	0.47	1.17	57.3	.332	
	LOCAL	0.73 (1143)	1.86 (385)	1.37 (231)	0.59 (271)	51.8	.283	
42	EARLY	1.00	1.30	0.56	1.03	52.7	.285	2300
	FINAL	0.99	1.22	0.62	1.18	52.2	.281	
	LOCAL	0.72 (1124)	1.82 (542)	0.97 (387)	0.54 (247)	47.0	.236	

Table 5.1. Definitions of the categories used for guidance forecasts of ceiling and visibility.

Category	Ceiling (ft)	Visibility (mi)
1	< 200	< 1/2
2	200–400	1/2 - 7/8
3	500–900	1 - 2 1/2
4	1000–2900	3–4
5	3000–7500	5–6
6	> 7500	> 6

Table 5.2. Comparative verification of early and final guidance, persistence, and local ceiling forecasts for 94 stations, 0000 GMT cycle, 1979 warm season.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	5	6	Percent Correct	Heidke Skill Score
12	Early	0.51	0.75	0.68	0.87	1.10	1.05	70.3	.345
	Final	0.45	0.84	0.85	0.92	1.02	1.04	72.1	.392
	Local	0.36	0.85	0.79	1.21	1.08	1.00	76.0	.495
	Persistence	0.79	0.78	0.81	0.92	1.06	1.03	77.8	.519
	No. Obs.	187	503	732	1164	1309	9430		
15	Local	0.21	0.46	0.52	0.95	1.37	1.02	71.7	.400
	Persistence	5.43	1.54	0.83	0.61	1.20	1.04	70.6	.372
	No. Obs.	28	272	800	1951	1269	10048		
18	Early	0.00	0.59	0.74	0.66	1.09	1.06	70.4	.344
	Final	0.20	0.57	0.83	0.70	1.08	1.06	70.7	.356
	Persistence	30.60	3.66	1.71	0.59	0.79	1.05	66.9	.289
	No. Obs.	5	111	364	1901	1830	9668		
21	Local	0.00	0.38	0.42	0.99	1.05	1.01	70.1	.314
	Persistence	57.00	4.27	2.13	0.96	0.65	1.00	65.3	.228
	No. Obs.	3	98	314	1235	2349	10439		
24	Early	0.26	0.52	0.63	0.78	1.12	1.01	76.2	.333
	Final	0.42	0.69	0.65	0.86	1.06	1.02	76.4	.337
	Persistence	8.05	3.27	2.17	1.36	0.82	0.93	66.9	.191
	No. Obs.	19	124	286	828	1752	10869		
36	Early	0.45	0.65	0.90	0.97	0.99	1.04	66.7	.270
	Final	0.63	1.10	1.15	1.02	1.03	0.99	65.4	.283
	Persistence	0.74	0.80	0.84	0.92	1.06	1.03	61.6	.169
	No. Obs.	200	508	735	1216	1356	9779		
48	Early	0.42	0.94	1.50	0.80	0.91	1.02	73.0	.244
	Final	0.95	0.66	1.62	0.77	0.96	1.01	72.5	.237
	Persistence	7.84	3.23	2.23	1.40	0.81	0.93	62.6	.086
	No. Obs.	19	125	278	804	1765	10807		

Table 5.3. Same as Table 5.2 except for visibility.

Projection (b)	Type of Forecast	Bias by Category 1	2	3	4	5	6	Percent Correct	Heidke Skill Score
12	Early	0.55	0.99	1.01	0.90	1.22	1.00	66.4	.321
	Final	0.59	0.71	1.09	0.92	1.15	0.99	68.1	.357
	Local	0.39	1.03	0.50	1.51	1.31	0.98	70.6	.415
	Persistence	0.63	0.69	0.48	0.84	0.89	1.12	74.2	.417
	No. Obs.	286	176	1151	1097	1251	8937		
15	Local	0.10	0.52	0.28	1.08	1.19	1.02	74.7	.323
	Persistence	6.52	2.06	0.85	0.99	0.84	1.01	74.2	.325
	No. Obs.	29	63	704	985	1433	10853		
18	Early	0.50	0.87	0.88	0.99	1.14	0.99	77.6	.275
	Final	0.50	0.39	0.85	1.03	1.12	0.99	78.1	.290
	Persistence	23.75	4.16	1.65	1.38	0.96	0.94	74.4	.260
	No. Obs.	8	31	359	709	1240	11300		
21	Local	0.00	0.41	0.26	0.77	1.17	1.02	81.9	.266
	Persistence	38.40	4.03	2.01	1.72	1.11	0.91	74.7	.219
	No. Obs.	5	32	299	576	1103	12029		
24	Early	0.11	0.92	0.88	1.09	1.06	0.99	79.9	.274
	Final	0.17	0.82	0.92	1.20	1.06	0.99	79.8	.282
	Persistence	10.56	3.39	1.77	1.56	1.11	0.91	74.0	.218
	No. Obs.	18	38	335	627	1068	11561		
36	Early	0.41	0.63	0.72	0.96	1.17	1.04	64.7	.264
	Final	0.85	1.13	1.36	1.24	1.09	0.91	62.0	.291
	Persistence	0.61	0.65	0.48	0.83	0.89	1.13	64.1	.195
	No. Obs.	304	195	1236	1162	1324	9359		
48	Early	0.76	1.38	1.25	1.15	1.08	0.98	77.5	.217
	Final	0.53	0.71	1.14	1.21	1.22	0.97	77.3	.228
	Persistence	10.82	3.71	1.73	1.52	1.14	0.91	71.4	.136
	No. Obs.	17	34	340	634	1034	11514		

Table 5.4. Same as Table 5.2 except 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	5	6	Percent Correct	[illegible] Skill Score
12	Early	0.59	0.97	0.78	0.93	0.98	1.01	76.8	.345
	Final	0.53	0.85	0.87	0.87	1.02	1.01	77.4	.363
	Local	0.35	0.64	0.85	1.47	1.17	0.95	78.4	.449
	Persistence	0.24	0.76	1.00	1.35	1.21	0.94	78.6	.456
	No. Obs.	17	106	259	791	1672	10437		
15	Local	0.23	0.60	0.78	1.64	0.98	0.97	77.0	.398
	Persistence	0.17	0.55	0.86	1.42	1.31	0.94	73.2	.330
	No. Obs.	35	176	353	847	1724	11410		
18	Early	1.16	0.98	0.82	0.85	1.00	1.02	75.5	.348
	Final	0.73	0.88	0.76	0.88	1.02	1.02	75.5	.347
	Persistence	0.08	0.36	0.67	1.23	1.43	0.95	70.1	.268
	No. Obs.	79	246	414	912	1456	10519		
21	Local	0.16	0.47	0.75	1.58	0.85	1.00	70.9	.342
	Persistence	0.02	0.24	0.50	1.02	1.45	1.00	66.0	.228
	No. Obs.	154	393	603	1156	1505	10314		
24	Early	0.56	0.69	0.84	0.94	1.14	1.02	69.1	.323
	Final	0.40	0.75	0.76	0.99	1.13	1.03	69.3	.326
	Persistence	0.03	0.18	0.38	0.95	1.60	1.03	63.7	.191
	No. Obs.	203	503	724	1185	1329	9894		
36	Early	0.94	0.92	0.72	0.93	0.96	1.02	74.6	.272
	Final	0.71	0.77	0.61	0.80	1.00	1.03	74.8	.264
	Persistence	0.35	0.70	1.03	1.42	1.22	0.94	65.8	.129
	No. Obs.	17	128	271	794	1747	11005		
48	Early	0.49	0.80	0.84	1.06	1.04	1.02	65.9	.255
	Final	0.59	0.82	1.02	1.01	0.96	1.02	66.1	.259
	Persistence	0.03	0.18	0.36	0.95	1.59	1.03	58.5	.076
	No. Obs.	201	492	733	1177	1336	9900		

Table 5.5. Same as Table 5.3 except for 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	5	6	Percent Correct	Heidke Skill Score
12	Early	0.54	1.19	1.13	1.11	1.06	0.99	82.4	.341
	Final	0.54	0.59	0.99	0.94	1.12	0.99	84.8	.418
	Local	0.46	0.59	0.49	1.21	1.37	0.97	86.1	.495
	Persistence	0.46	0.91	0.92	0.89	1.09	1.00	88.2	.541
	No. Obs.	13	32	291	570	957	11187		
15	Local	0.25	1.42	.78	1.47	1.49	0.94	83.1	.390
	Persistence	0.22	0.97	1.19	0.88	1.17	0.99	85.6	.414
	No. Obs.	32	31	251	621	950	12462		
18	Early	0.81	0.82	0.96	1.08	1.05	0.99	79.5	.308
	Final	0.71	0.74	0.83	0.88	1.18	1.00	80.6	.332
	Persistence	0.09	0.47	0.81	0.76	1.15	1.02	81.1	.323
	No. Obs.	89	72	360	719	967	11234		
21	Local	0.19	0.96	0.95	1.68	1.25	0.93	73.1	.312
	Persistence	0.04	0.26	0.56	0.59	1.03	1.08	76.9	.250
	No. Obs.	182	110	534	937	1083	11121		
24	Early	0.78	0.80	1.07	1.23	1.07	0.96	65.3	.317
	Final	0.64	0.73	1.08	1.15	1.16	0.97	65.3	.317
	Persistence	0.03	0.18	0.23	0.48	0.86	1.23	67.7	.183
	No. Obs.	303	193	1255	1143	1295	9467		
36	Early	1.20	1.21	1.10	1.27	1.17	0.97	78.3	.238
	Final	0.30	0.94	0.97	1.19	1.14	0.98	79.5	.260
	Persistence	0.45	1.03	0.87	0.90	1.10	1.00	79.1	.202
	No. Obs.	20	33	339	612	1012	11757		
48	Early	0.82	0.63	1.26	1.22	1.00	0.95	63.2	.280
	Final	0.87	0.98	1.36	1.23	1.01	0.93	62.3	.280
	Persistence	0.03	0.17	0.24	0.48	0.86	1.23	65.1	.113
	No. Obs.	300	198	1237	1137	1298	9487		

Table 5.6. Comparative verification of early and final guidance, persistence, and local ceiling forecasts for 94 stations, 0000 GMT cycle, during the 1979 warm season. Scores are computed from two-category contingency tables.

Projection	Type of Forecast	Rel Freq Cats. 1&2 combined	Bias Cats. 1&2 combined	Percent Correct	Heidke Skill Score	Threat Score
12	Early Final Local Persistence	.052	0.69 0.74 0.72 0.78	93.4 94.0 95.3 95.6	.214 .298 .445 .504	.141 .197 .307 .357
15	Local Persistence	.021	0.43 1.90	97.5 95.4	.157 .220	.091 .137
18	Early Final Persistence	.008	0.56 0.55 4.82	98.9 98.9 95.8	.161 .173 .130	.090 .098 .077
21	Local Persistence	.007	0.37 5.65	99.2 95.7	.127 .069	.070 .042
24	Early Final Persistence	.010	0.49 0.65 3.91	98.7 98.7 95.5	.126 .214 .105	.070 .124 .064
36	Early Final Persistence	.051	0.59 0.97 0.78	93.2 92.4 92.2	.136 .202 .109	.092 .138 .081
48	Early Final Persistence	.010	0.87 0.69 3.84	98.4 98.6 95.4	.155 .206 .068	.089 .119 .043

Table 5.7. Same as Table 5.6 except for visibility.

Projection	Type of Forecast	Rel Freq Cats. 1&2 combined	Bias Cats. 1&2 combined	Percent Correct	Heidke Skill Score	Threat Score
12	Early	.036	0.71	95.1	.185	.117
	Final		0.64	96.0	.306	.194
	Local		0.63	97.0	.467	.318
	Persistence		0.65	97.1	.502	.347
15	Local	.007	0.39	99.1	.043	.024
	Persistence		3.47	97.5	.132	.076
18	Early	.003	0.79	99.5	-.003	.000
	Final		0.41	99.6	-.002	.000
	Persistence		8.18	97.4	.017	.011
21	Local	.003	0.35	99.7	.039	.020
	Persistence		8.68	97.5	.012	.008
24	Early	.004	0.66	99.3	.040	.022
	Final		0.61	99.4	.086	.047
	Persistence		5.70	97.4	.047	.027
36	Early	.037	0.50	95.3	.131	.083
	Final		0.96	94.2.	.160	.105
	Persistence		0.62	95.0	.129	.083
48	Early	.004	1.18	99.3	.104	.057
	Final		0.65	99.4	.069	.037
	Persistence		6.08	97.4	.033	.020

Table 5.8. Same as Table 5.6 except for 1200 GMT cycle.

Projection	Type of Forecast	Rel Freq Cats. 1&2 combined	Bias Cats. 1&2 combined	Percent Correct	Heidke Skill Score	Threat Score
12	Early Final Local Persistence	.009	0.92 0.80 0.60 0.69	98.7 98.9 99.2 99.2	.239 .310 .484 .487	.140 .187 .322 .325
15	Local Persistence	.039	0.38 0.18	98.5 98.6	.308 .339	.187 .208
18	Early Final Persistence	.024	1.02 0.85 0.29	96.4 96.8 97.7	.237 .250 .230	.146 .154 .135
21	Local Persistence	.015	0.54 0.48	95.8 96.0	.197 .120	.120 .070
24	Early Final Persistence	.051	0.66 0.65 0.14	93.0 93.2 94.7	.136 .160 .076	.094 .108 .046
36	Early Final Persistence	.010	0.92 0.77 0.66	98.4 98.6 98.6	.200 .227 .159	.116 .133 .090
48	Early Final Persistence	.050	0.71 0.76 0.14	92.8 92.9 94.5	.130 .156 .031	.091 .106 .022

Table 5.9. Same as Table 5.7 except for 1200 GMT cycle.

Projection	Type of Forecast	Rel Freq Cats. 1&2 combined	Bias Cats. 1&2 combined	Percent Correct	Heidke Skill Score	Threat Score
12	Early	.003	1.00	99.4	.086	.047
	Final		0.58	99.5	.110	.060
	Local		0.56	99.6	.227	.129
	Persistence		0.78	99.6	.273	.159
15	Local	.004	0.83	99.3	.083	.045
	Persistence		0.59	99.4	.077	.042
18	Early	.012	0.81	98.2	.141	.081
	Final		0.72	98.2	.121	.069
	Persistence		0.26	98.6	.064	.036
21	Local	.021	0.48	97.5	.183	.107
	Persistence		0.12	97.7	.014	.009
24	Early	.036	0.79	94.8	.170	.109
	Final		0.68	95.0	.151	.096
	Persistence		0.09	96.1	.013	.009
36	Early	.004	1.21	99.2	.064	.035
	Final		0.70	99.4	.019	.011
	Persistence		0.81	99.3	.038	.021
48	Early	.036	0.75	94.7	.141	.092
	Final		0.92	94.2	.144	.095
	Persistence		0.09	96.1	.013	.009

Table 6.1. Comparative verification of early and final guidance and local max/min temperature forecasts for 87 stations (0000 GMT cycle only) for April through September of 1979.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	MEAN ALGEBRAIC ERROR (°F)	MEAN ABSOLUTE ERROR (°F)	NUMBER (%) OF ABSOLUTE ERRORS ≥ 10°	NUMBER OF CASES
24 (MAX)	EARLY	0.4	2.9	257 (2.6)	10008
	FINAL	-0.5	3.0	245 (2.4)	
	LOCAL	0.1	2.9	312 (3.1)	
36 (MIN)	EARLY	0.1	2.9	152 (1.5)	9998
	FINAL	0.2	2.9	158 (1.6)	
	LOCAL	0.4	3.0	252 (2.5)	
48 (MAX)	EARLY	0.8	3.9	711 (7.1)	9999
	FINAL	-0.4	3.8	574 (5.7)	
	LOCAL	0.4	3.8	632 (6.3)	
60 (MIN)	EARLY	0.2	3.4	338 (3.4)	10002
	FINAL	0.6	3.5	361 (3.6)	
	LOCAL	0.4	3.6	460 (4.6)	

Table 6.2. Same as Table 6.1 except for 26 stations in the Eastern Region.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	MEAN ALGEBRAIC ERROR (°F)	MEAN ABSOLUTE ERROR (°F)	NUMBER (%) OF ABSOLUTE ERRORS ≥ 10°	NUMBER OF CASES
24 (MAX)	EARLY	0.4	2.9	75 (2.5)	2951
	FINAL	-0.5	3.1	71 (2.4)	
	LOCAL	0.1	3.0	88 (3.0)	
36 (MIN)	EARLY	-0.2	3.0	41 (1.4)	2947
	FINAL	0.3	2.9	40 (1.4)	
	LOCAL	0.5	3.0	80 (2.7)	
48 (MAX)	EARLY	0.9	3.7	180 (6.1)	2946
	FINAL	-0.1	3.6	132 (4.5)	
	LOCAL	0.6	3.6	167 (5.7)	
60 (MIN)	EARLY	0.1	3.7	126 (4.3)	2949
	FINAL	0.9	3.6	114 (3.9)	
	LOCAL	0.6	3.9	164 (5.6)	

Table 6.3. Same as Table 6.1 except for 23 stations in the Southern Region.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	MEAN ALGEBRAIC ERROR (°F)	MEAN ABSOLUTE ERROR (°F)	NUMBER (%) OF ABSOLUTE ERRORS ≥ 10°	NUMBER OF CASES
24 (MAX)	EARLY	0.4	2.5	60 (2.2)	2781
	FINAL	-0.4	2.7	47 (1.7)	
	LOCAL	0.1	2.5	73 (2.6)	
36 (MIN)	EARLY	-0.2	2.7	30 (1.1)	2778
	FINAL	0.3	2.7	30 (1.1)	
	LOCAL	0.2	2.8	61 (2.2)	
48 (MAX)	EARLY	0.7	3.3	159 (5.7)	2779
	FINAL	-0.1	3.2	97 (3.5)	
	LOCAL	0.4	3.2	109 (3.9)	
60 (MIN)	EARLY	-0.1	2.9	53 (1.9)	2779
	FINAL	0.5	3.3	84 (3.0)	
	LOCAL	0.2	3.3	101 (3.6)	

Table 6.4. Same as Table 6.1 except for 22 stations in the Central Region.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	MEAN ALGEBRAIC ERROR (°F)	MEAN ABSOLUTE ERROR (°F)	NUMBER (%) OF ABSOLUTE ERRORS ≥ 10°	NUMBER OF CASES
24 (MAX)	EARLY	0.5	3.4	79 (3.0)	2591
	FINAL	0.0	3.3	83 (3.2)	
	LOCAL	0.3	3.3	86 (3.3)	
36 (MIN)	EARLY	0.4	3.2	53 (2.0)	2590
	FINAL	0.3	3.2	61 (2.4)	
	LOCAL	0.8	3.3	77 (3.0)	
48 (MAX)	EARLY	1.9	4.6	265 (10.2)	2588
	FINAL	0.3	4.3	215 (8.3)	
	LOCAL	0.9	4.3	224 (8.7)	
60 (MIN)	EARLY	0.8	3.7	129 (5.0)	2591
	FINAL	0.9	3.9	122 (4.7)	
	LOCAL	0.8	3.9	149 (5.8)	

Table 6.5. Same as Table 6.1 except for 16 stations in the Western Region.

FORECAST PROJECTION (HOURS)	TYPE OF FORECAST	MEAN ALGEBRAIC ERROR (°F)	MEAN ABSOLUTE ERROR (°F)	NUMBER (%) OF ABSOLUTE ERRORS ≥ 10°	NUMBER OF CASES
24 (MAX)	EARLY	0.1	2.9	43 (2.6)	1685
	FINAL	-1.3	3.2	44 (2.6)	
	LOCAL	-0.0	3.1	65 (3.9)	
36 (MIN)	EARLY	0.2	2.8	28 (1.7)	1683
	FINAL	-0.3	2.6	27 (1.6)	
	LOCAL	0.2	2.8	34 (2.0)	
48 (MAX)	EARLY	-0.8	3.8	107 (6.3)	1686
	FINAL	-2.5	4.5	130 (7.7)	
	LOCAL	-0.6	4.0	132 (7.8)	
60 (MIN)	EARLY	-0.1	3.0	30 (1.8)	1683
	FINAL	-0.4	3.1	41 (2.4)	
	LOCAL	-0.1	3.1	46 (2.7)	

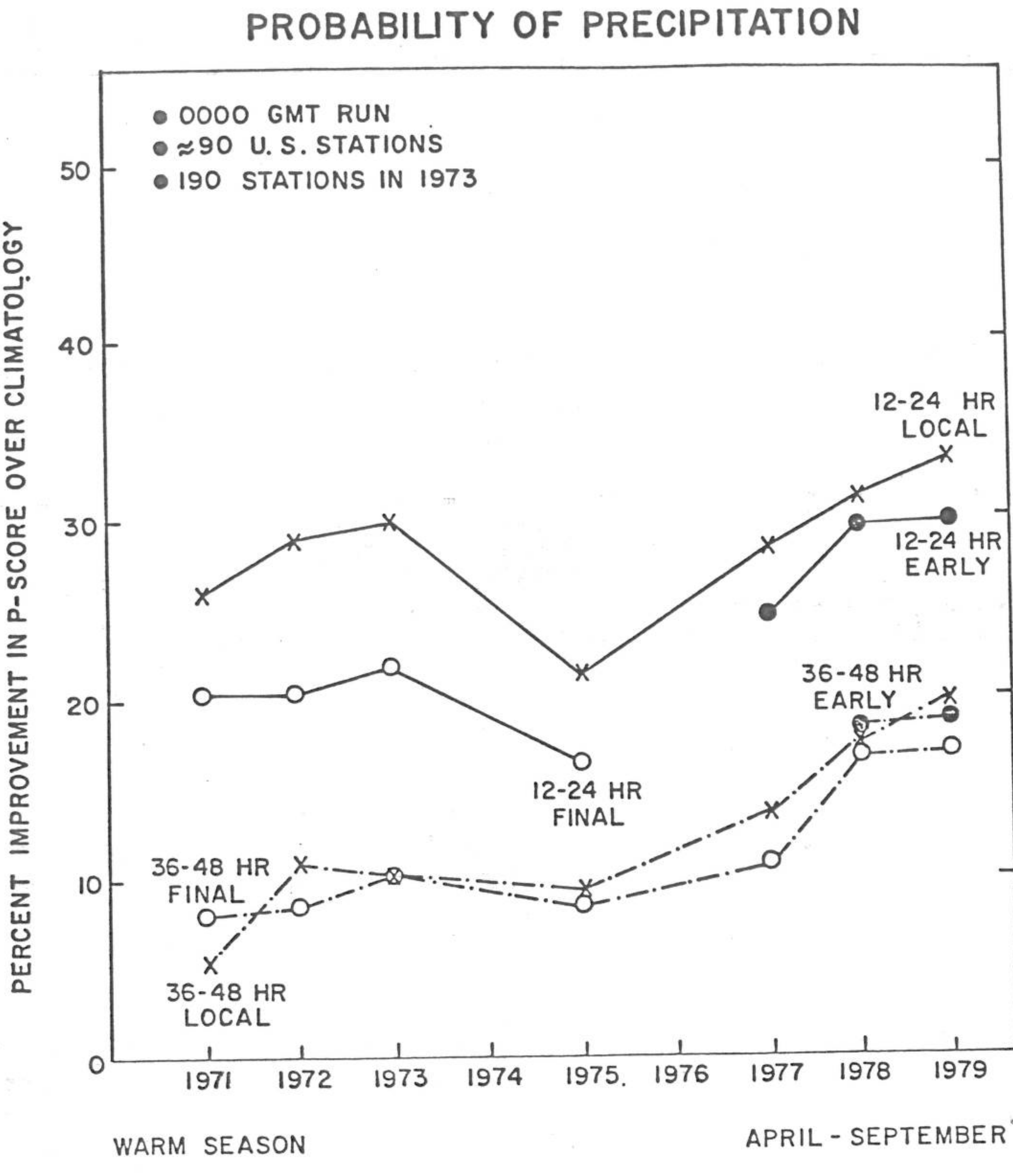


Figure 2.1. Percent improvement over climatology in the Brier score (P-score) of the local and the automated early and final PoP forecasts for the warm season. Results during 1974 and 1976 were unavailable due to missing data.

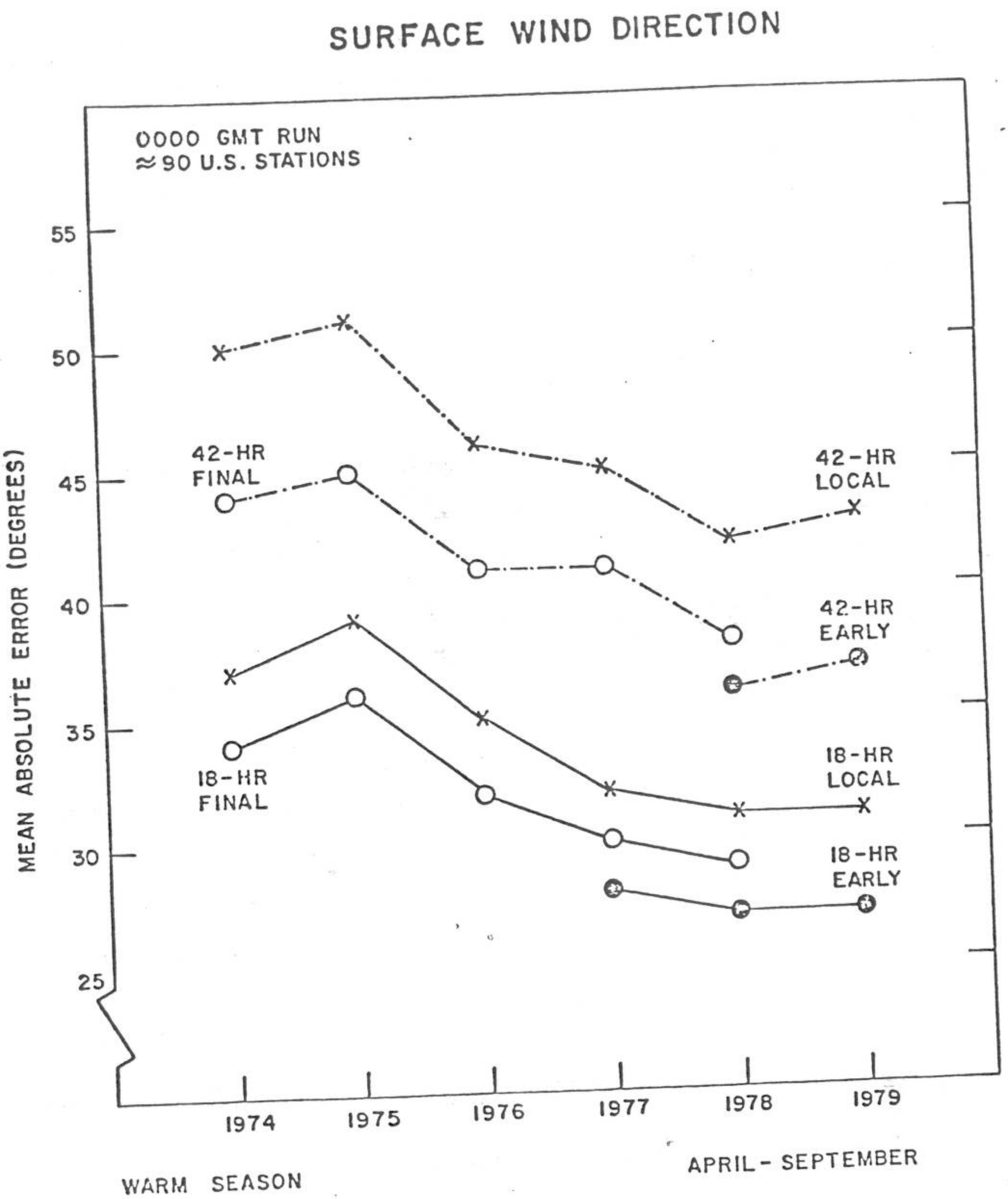


Figure 3.1. Mean absolute errors for subjective local and objective (early and final) surface wind direction forecasts. Since the final guidance was terminated during the 1979 warm season, it does not appear on the graph after 1978.

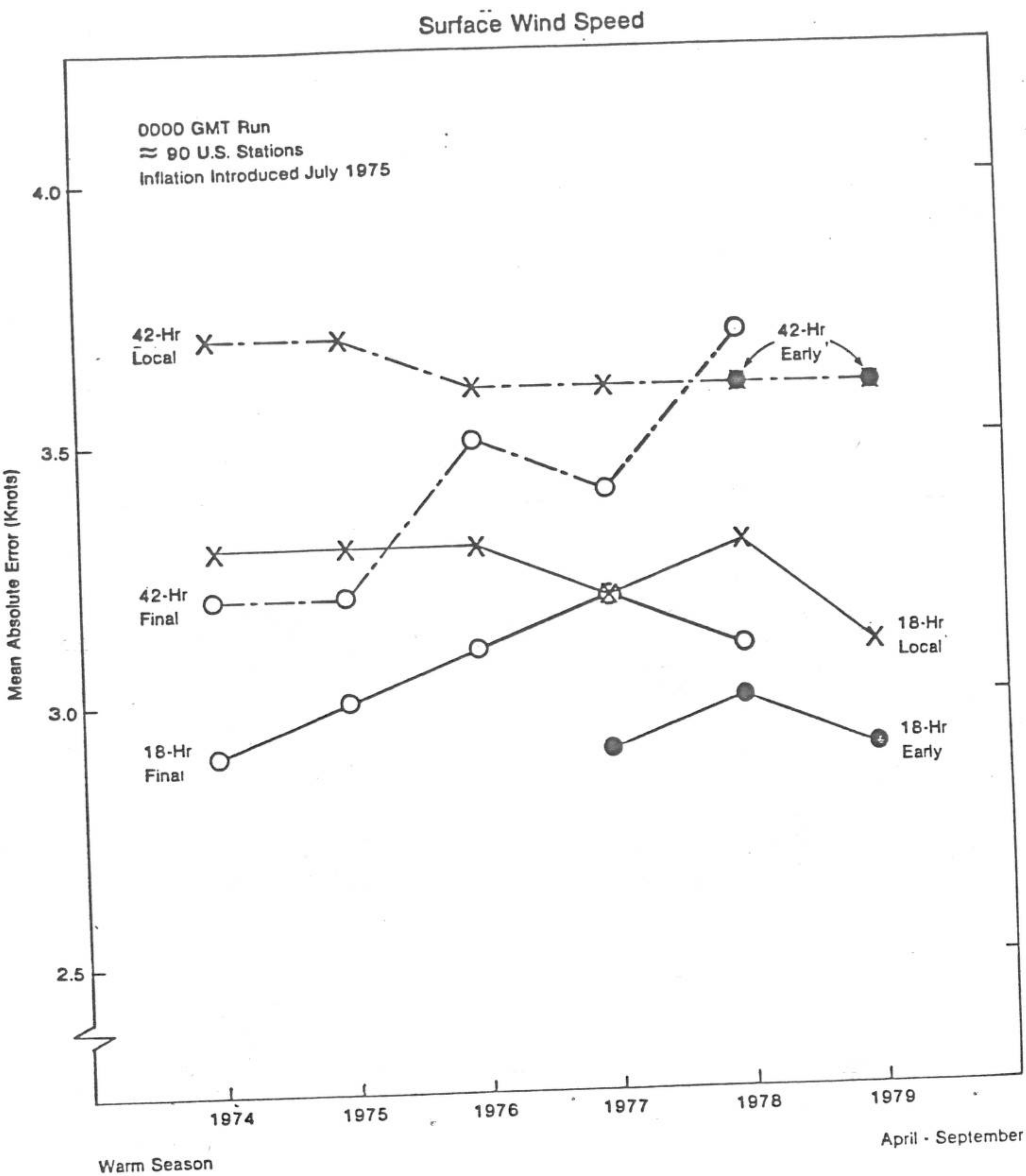


Figure 3.2. Same as Fig. 3.1 except for wind speed forecasts.

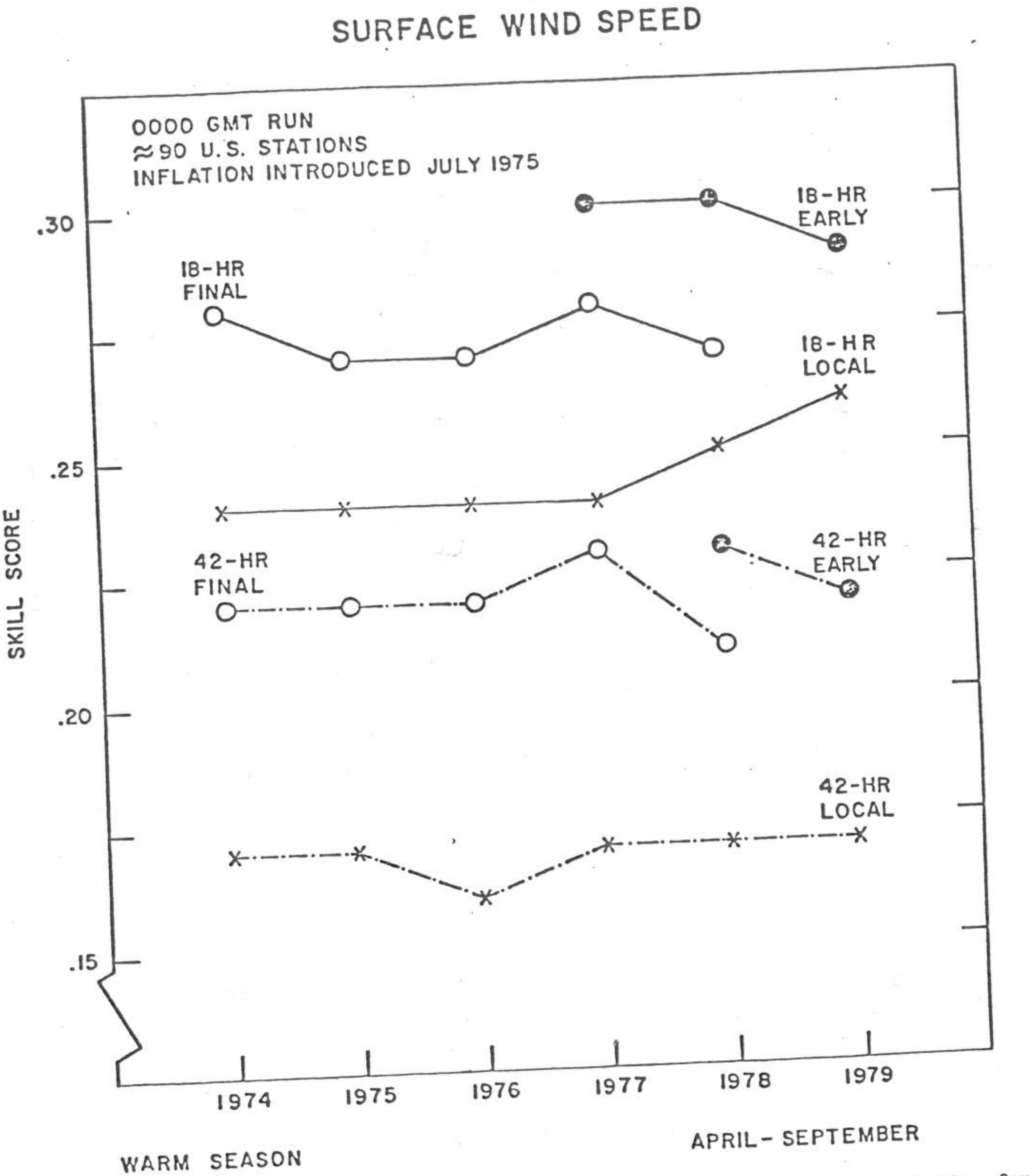


Figure 3.3. Skill scores computed from five-category contingency tables for subjective local and objective (early and final) surface wind speed forecasts. Since the final guidance was terminated during the 1979 warm season, it does not appear on the graph after 1978.

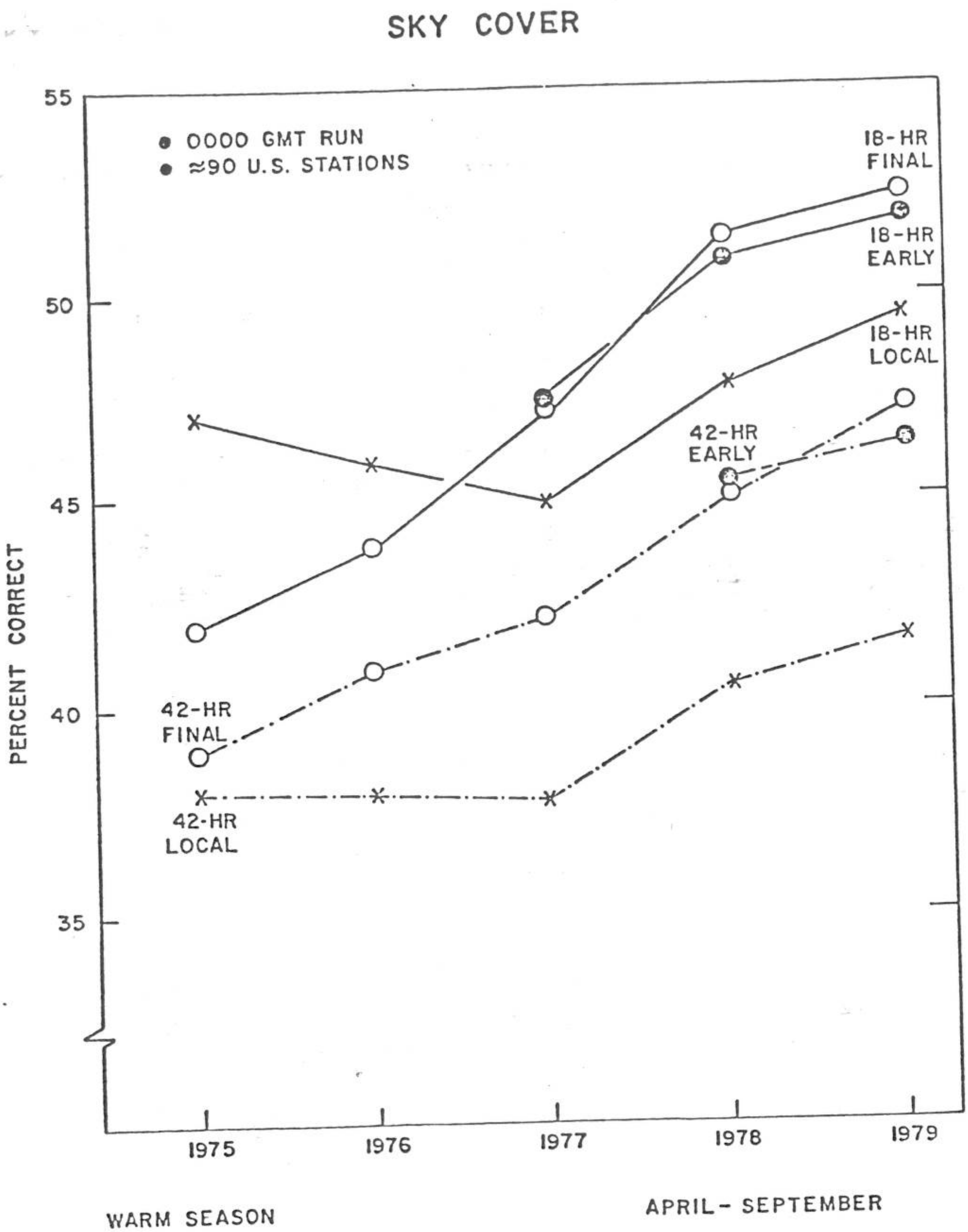


Figure 4.1. Percent correct for local and guidance cloud amount forecasts for 94 stations, 0000 GMT cycle.

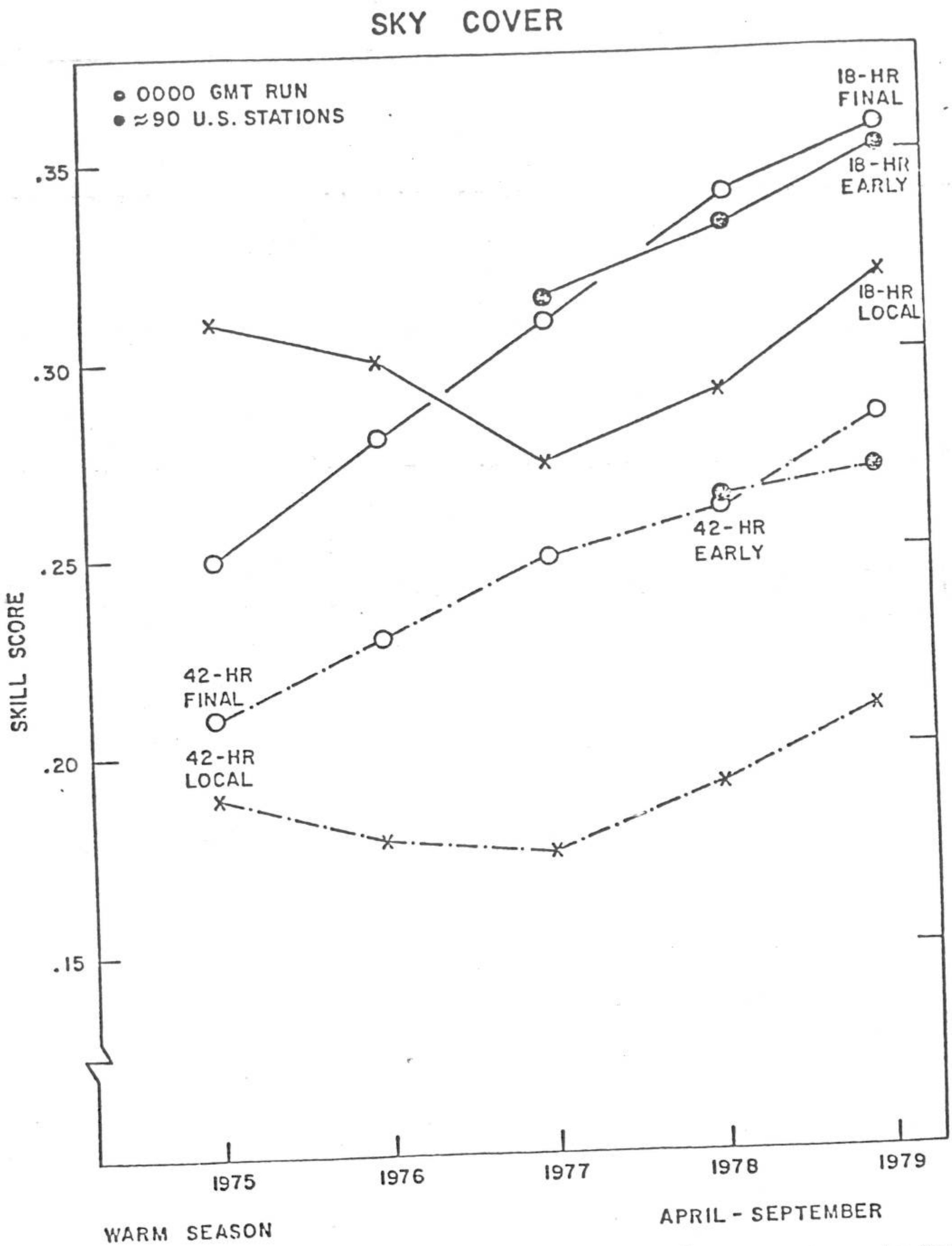


Figure 4.2. Skill score for local and guidance cloud amount forecasts for 94 stations, 0000 GMT cycle.

SKY COVER

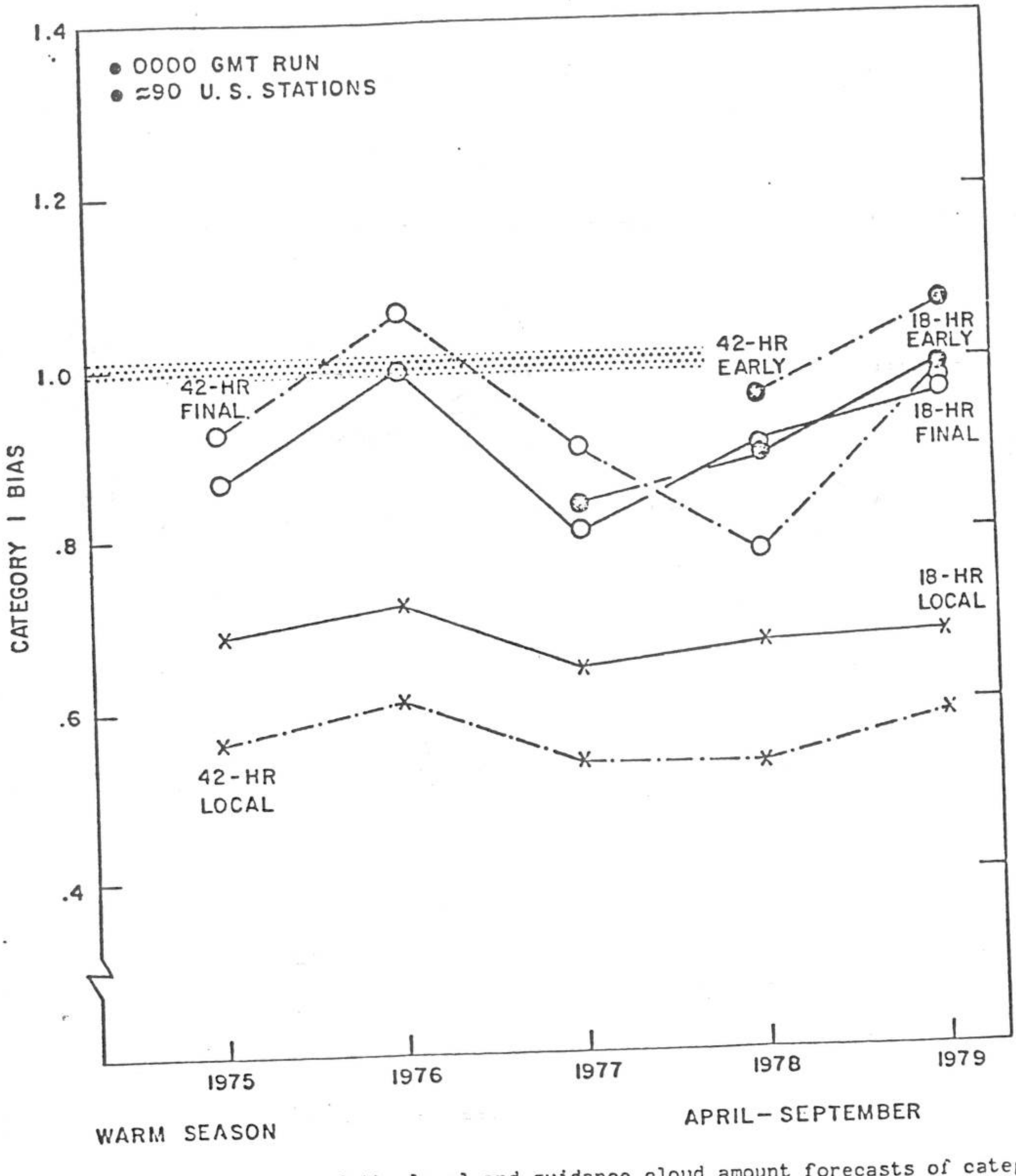


Figure 4.3. Bias of the local and guidance cloud amount forecasts of category 1 for 94 stations, 0000 GMT cycle.

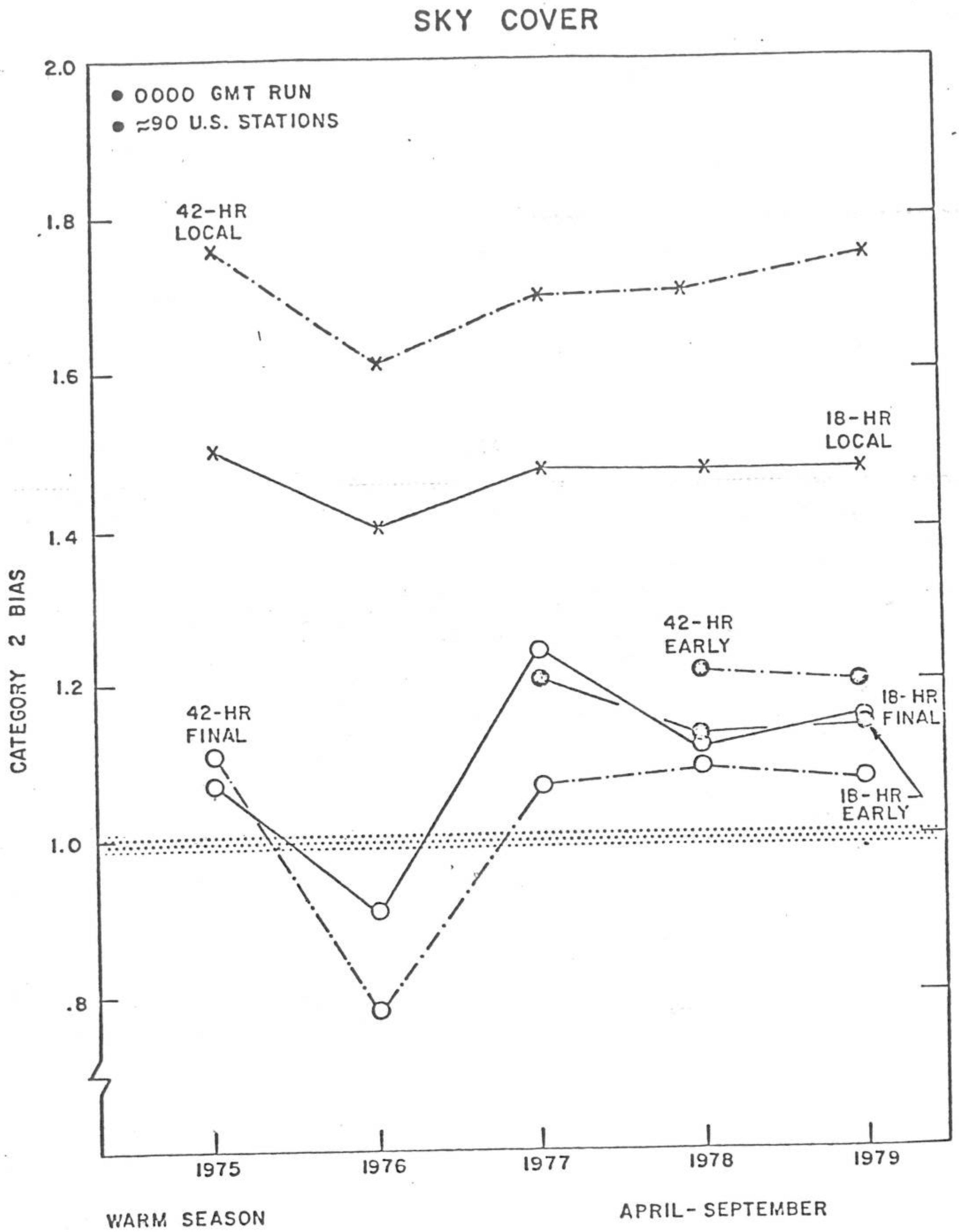


Figure 4.4. Same as Fig. 4.3 except for category 2 bias.

CEILING

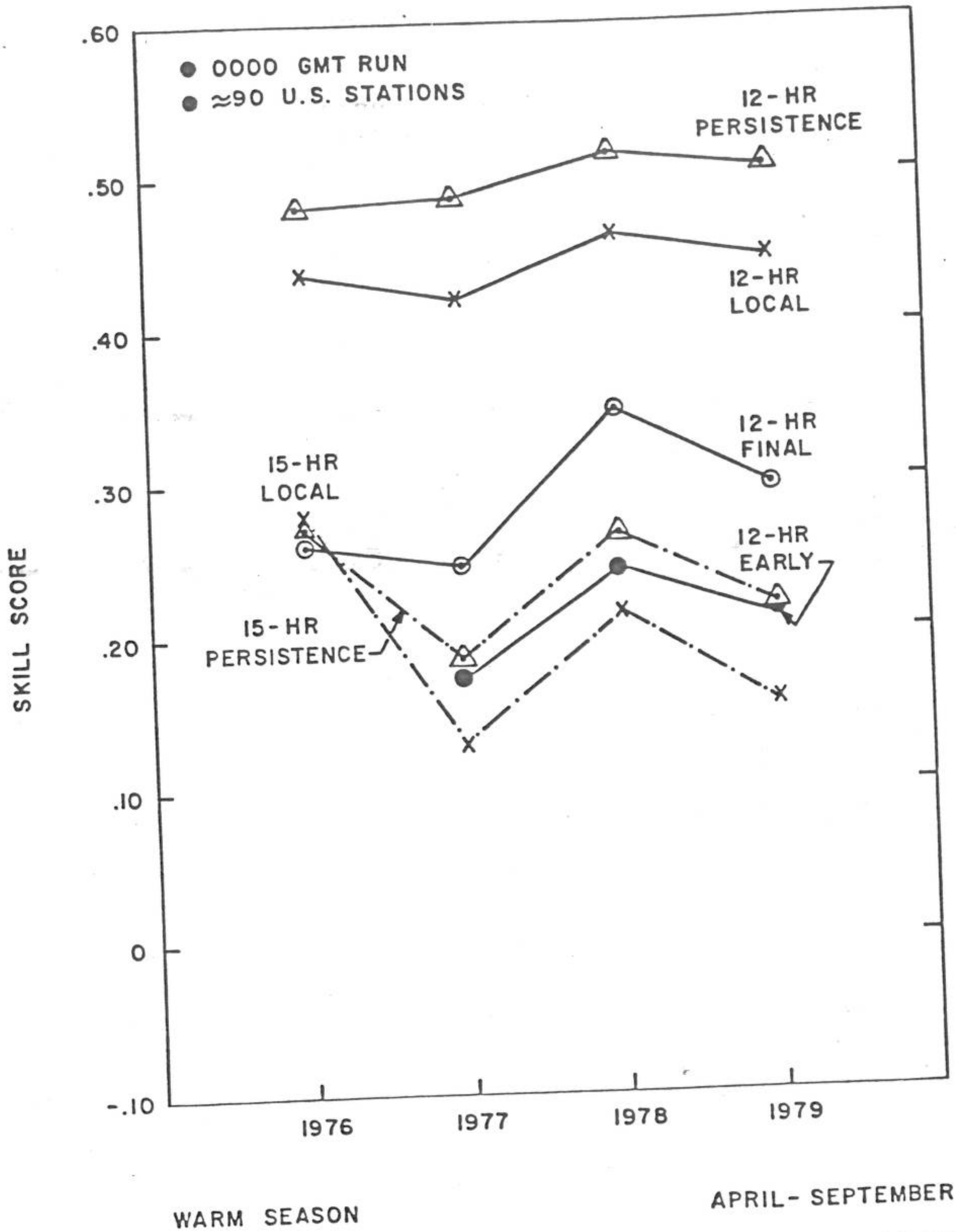


Figure 5.1. Skill score computed from two-category contingency tables for guidance, locals, and persistence ceiling forecasts for 94 stations, 0000 GMT cycle.

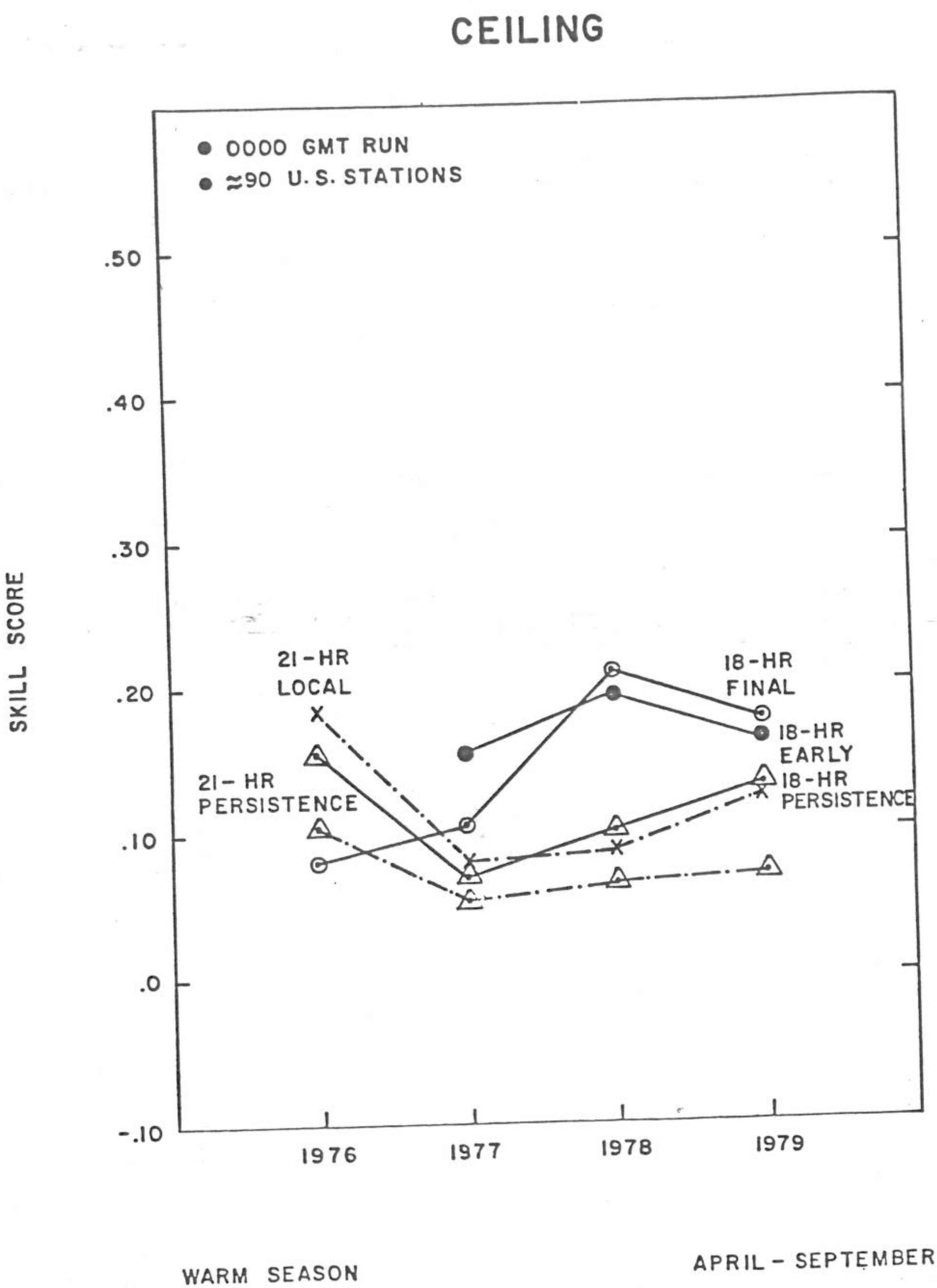


Figure 5.2. Same as Fig. 5.1.

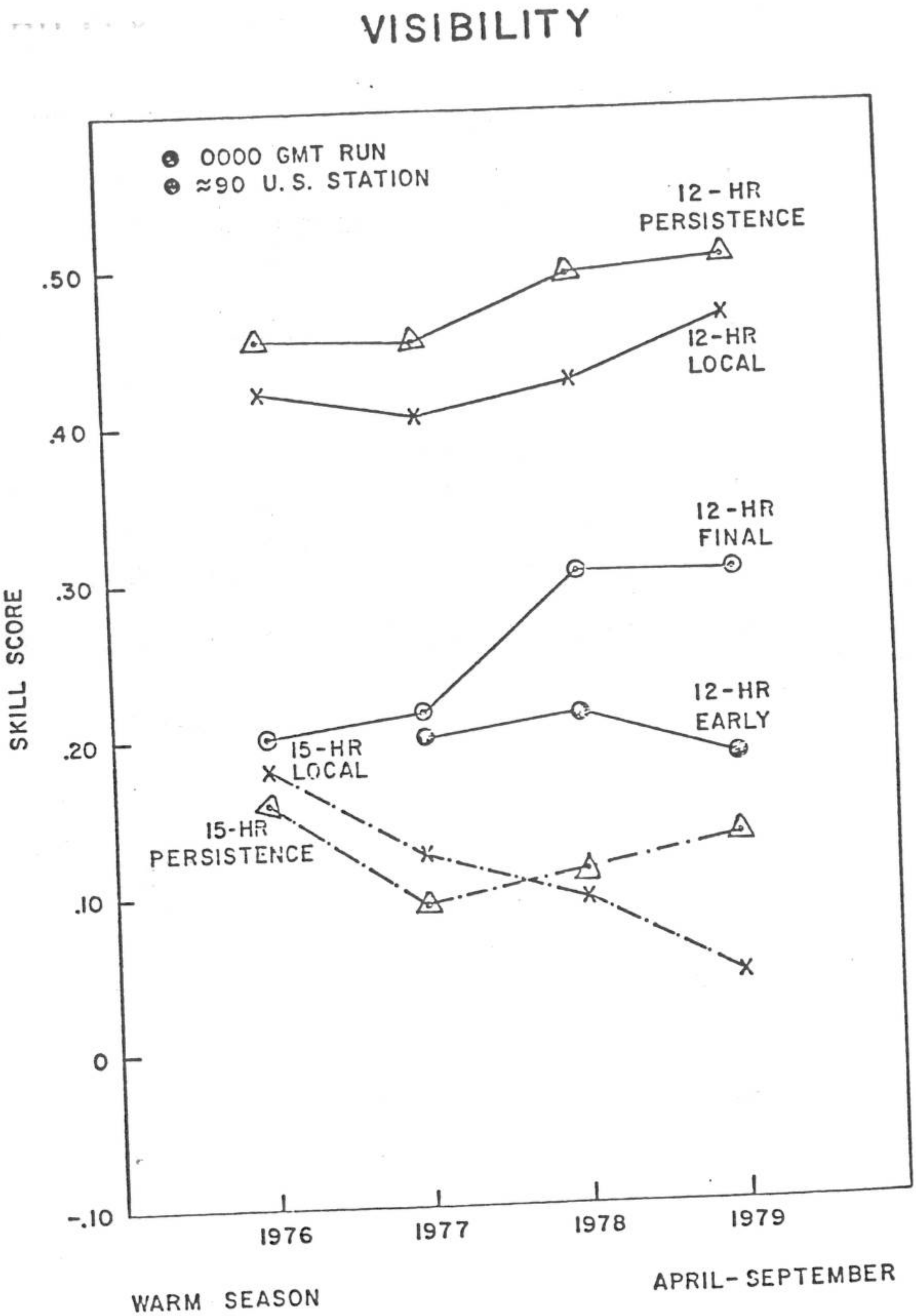


Figure 5.3. Same as Fig. 5.1 except for visibility forecasts.

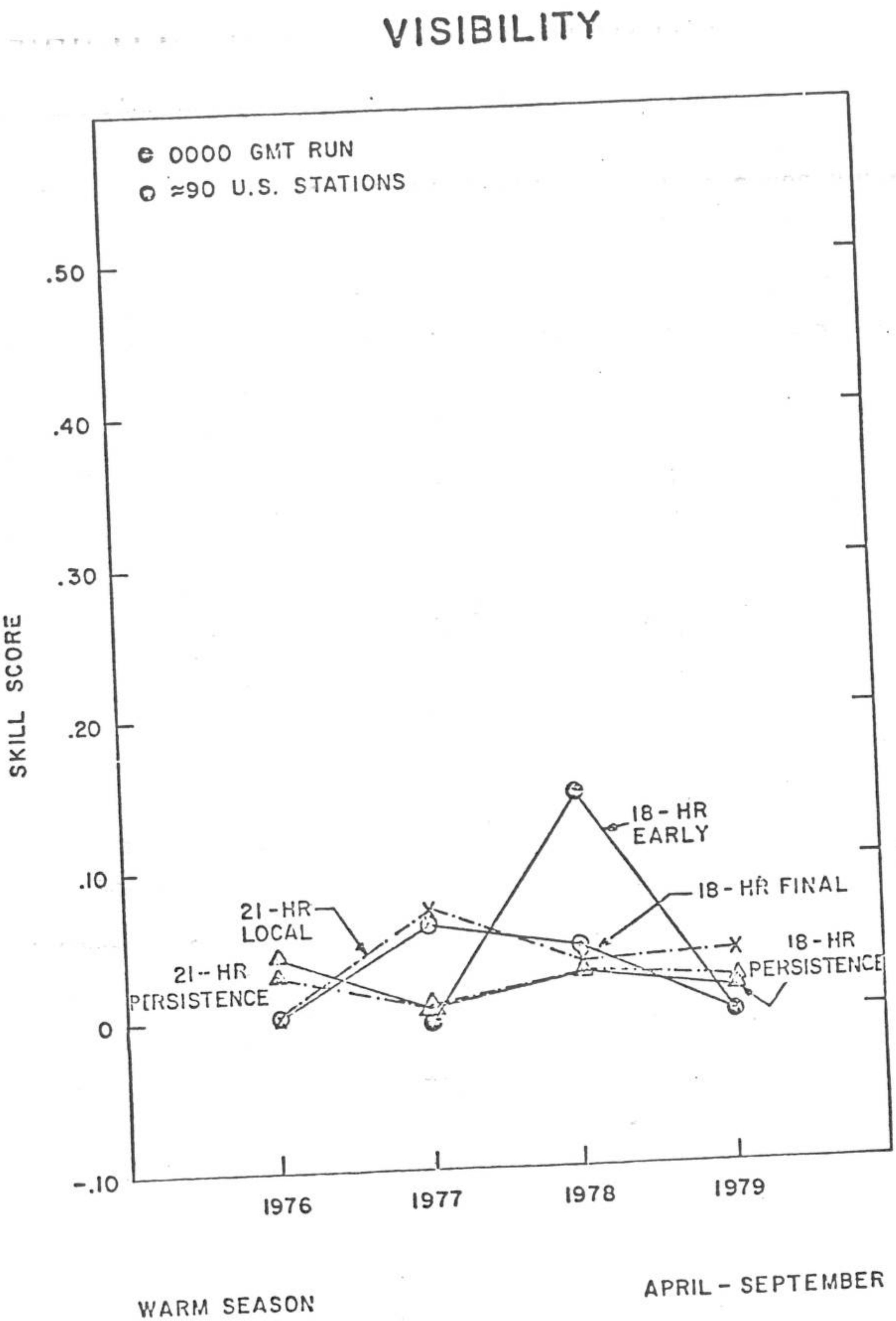


Figure 5.4. Same as Fig. 5.3.

CEILING

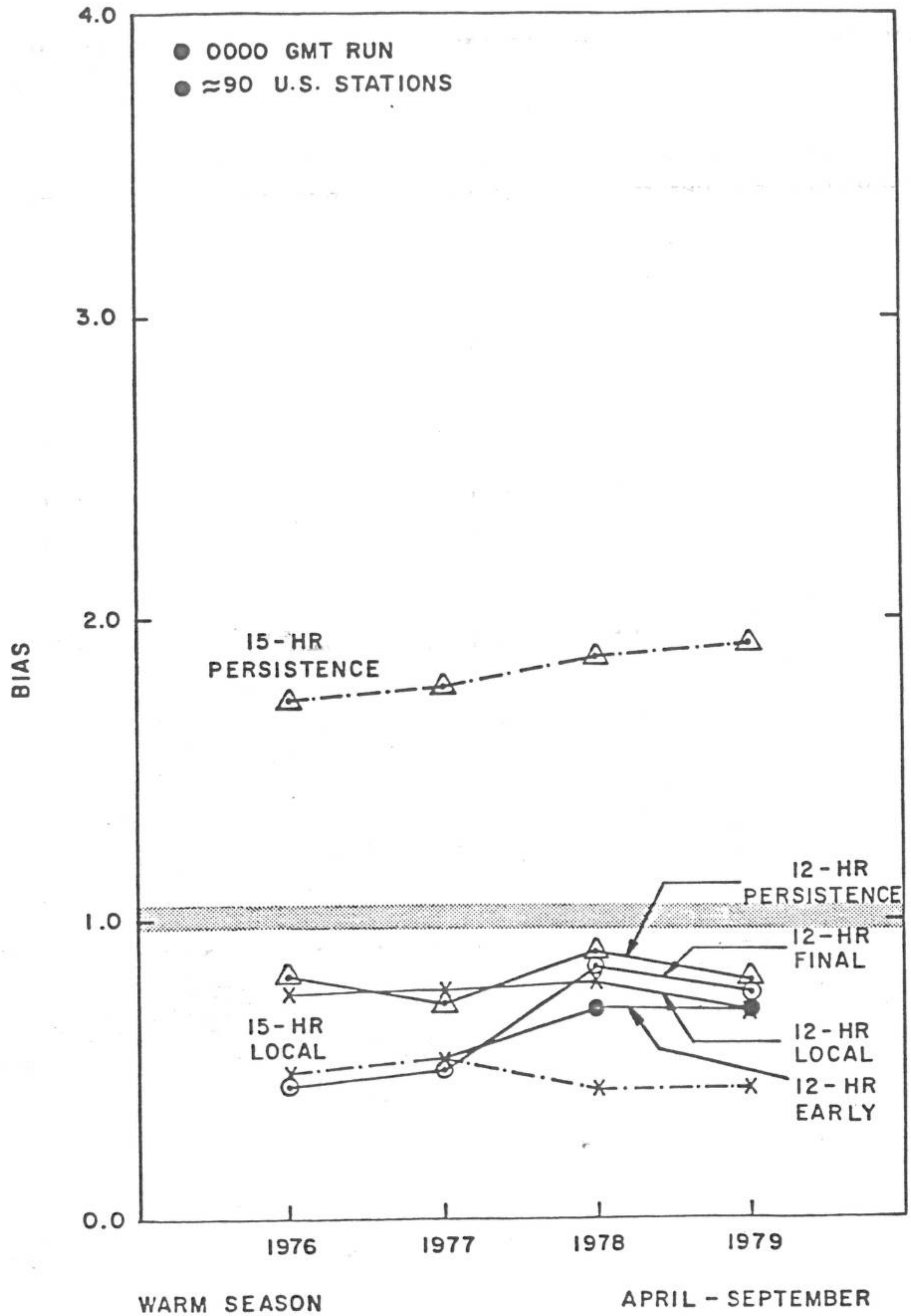
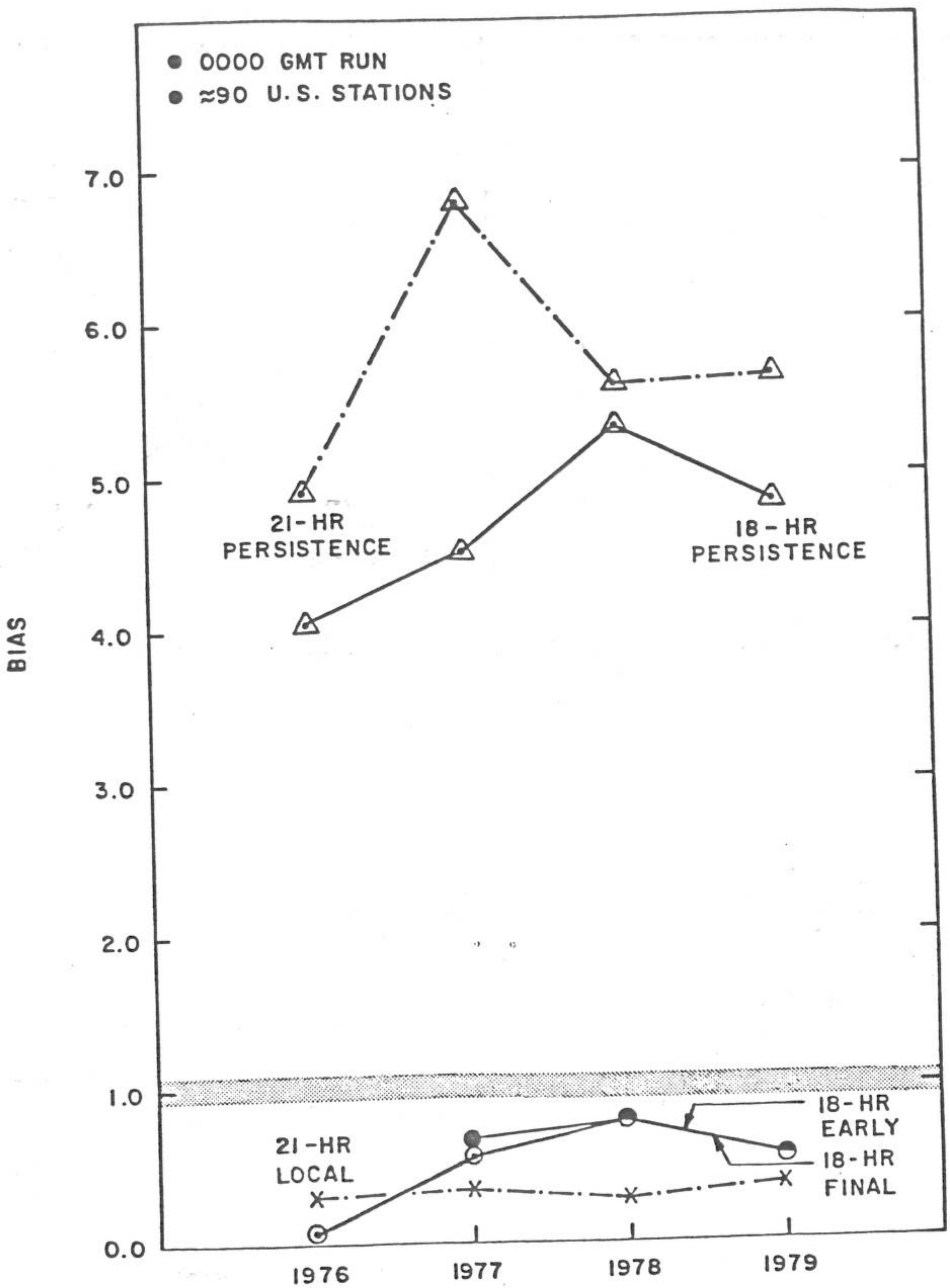


Figure 5.5. Bias for categories 1 and 2 combined for guidance, local, and persistence ceiling forecasts for 94 stations, 0000 GMT cycle.

CEILING



WARM SEASON APRIL - SEPTEMBER

Figure 5.6. Same as Fig. 5.5.

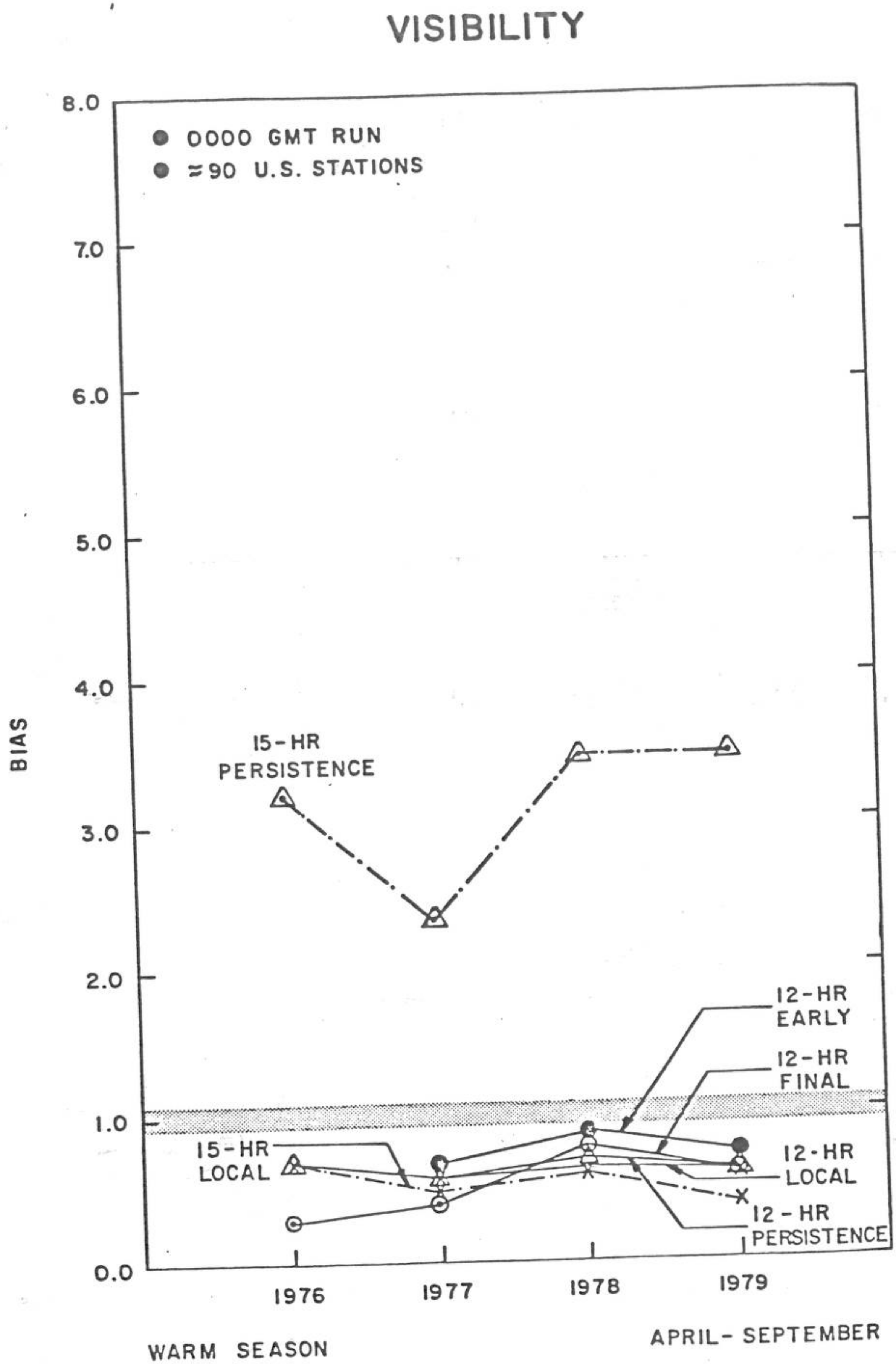


Figure 5.7. Same as Fig. 5.5 except for visibility forecasts.

VISIBILITY

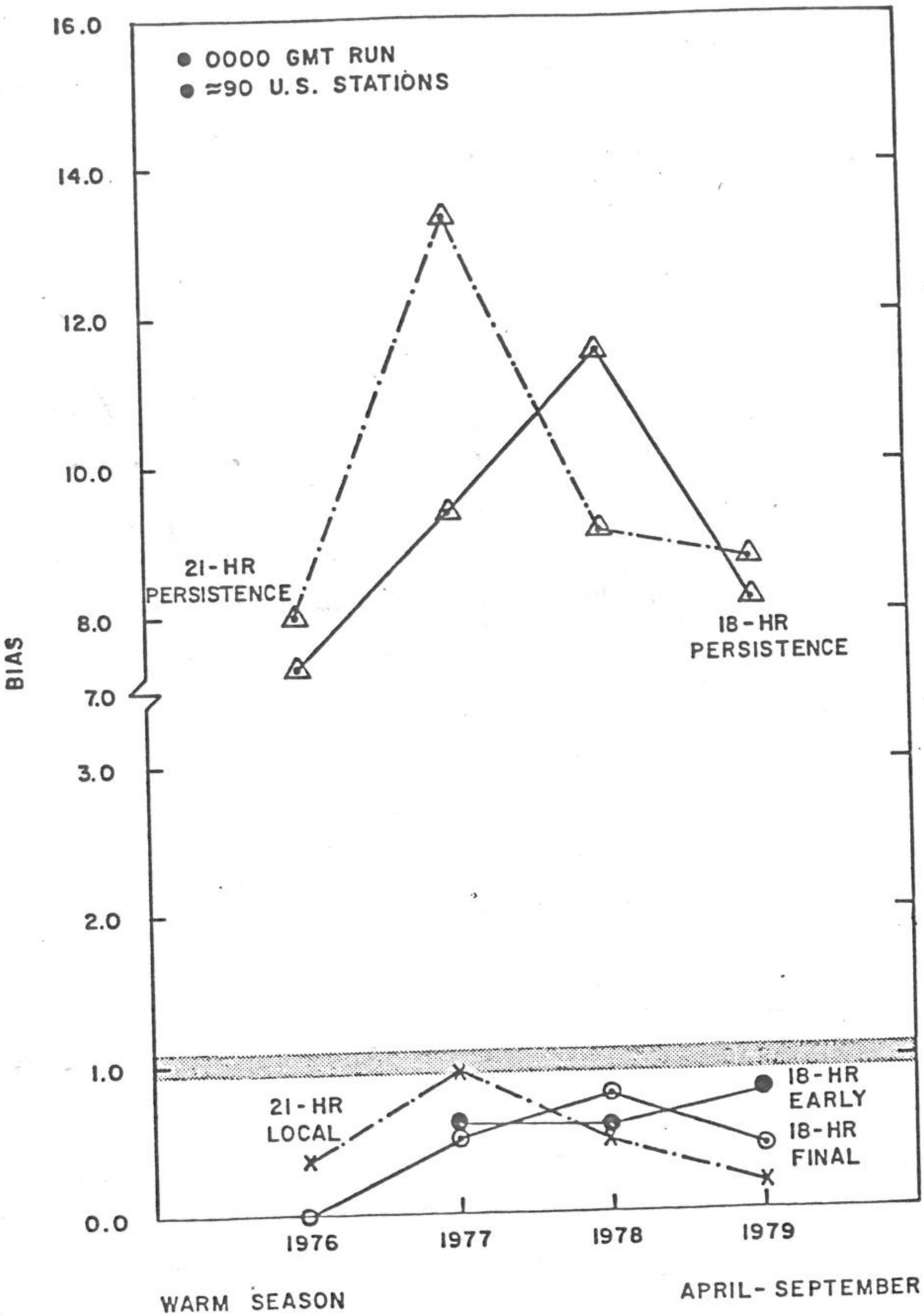


Figure 5.8. Same as Fig. 5.7.

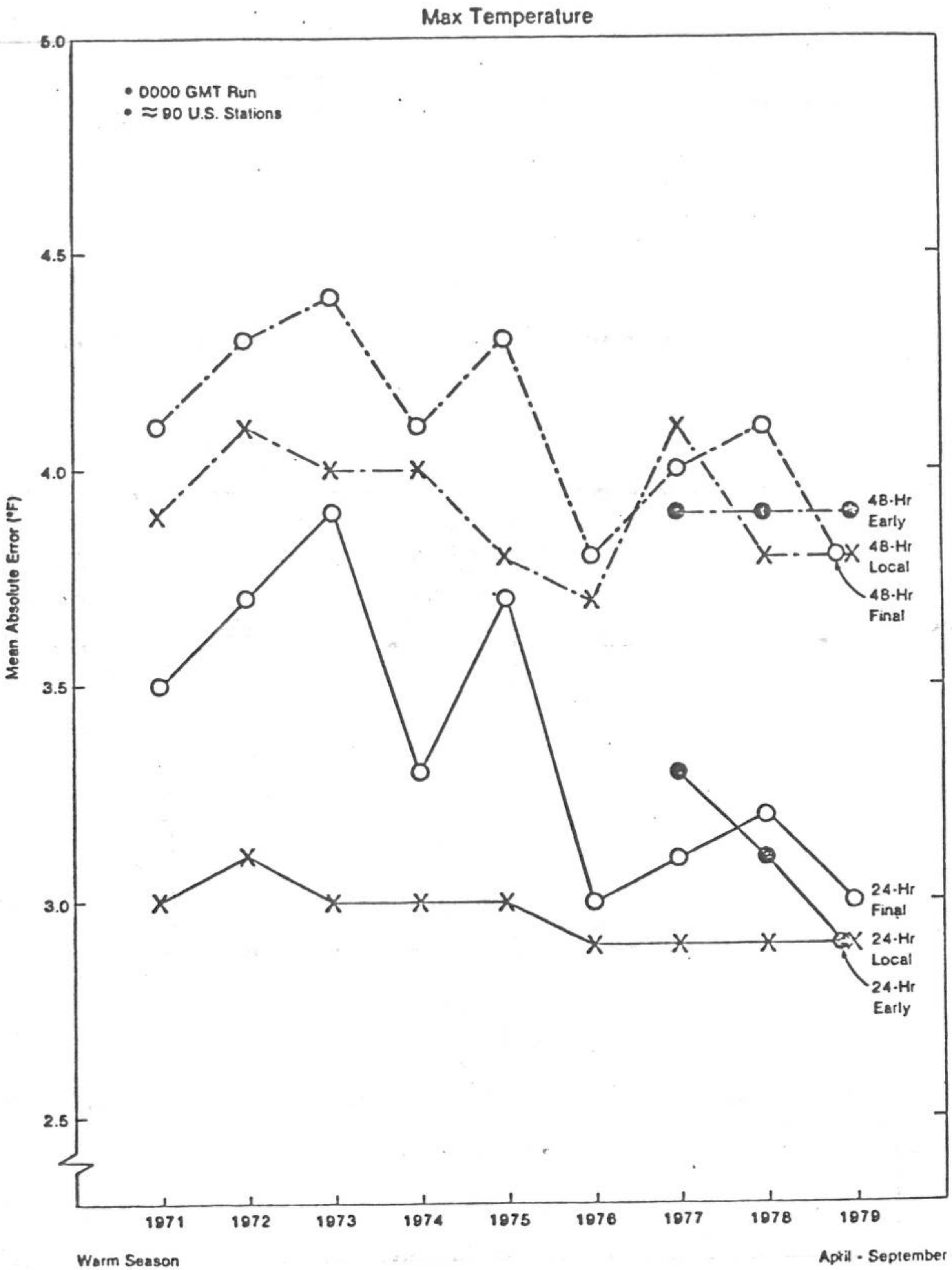


Figure 6.1. Mean absolute errors of the local and objective max temperature forecasts during the warm (April–September) season.

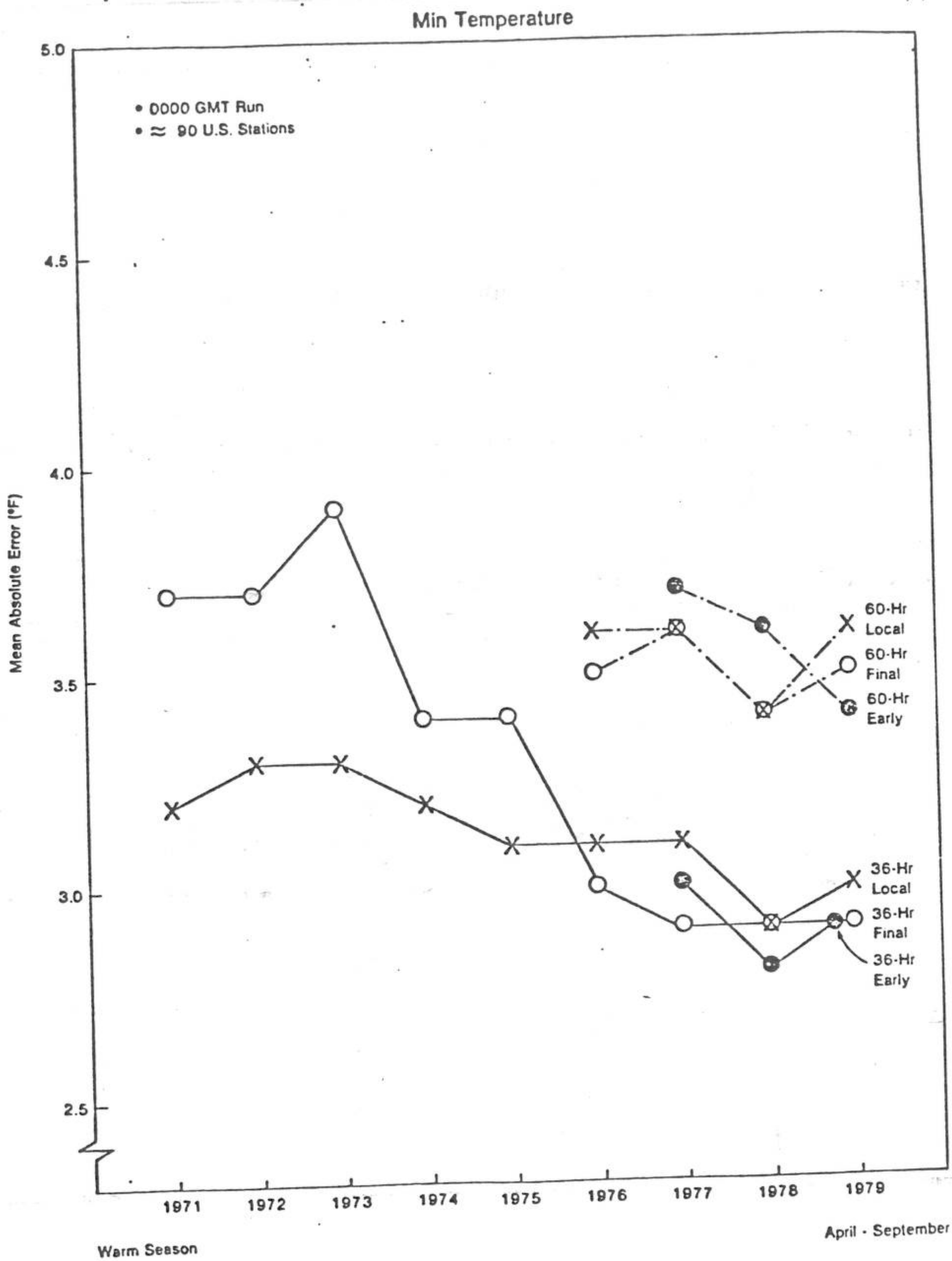


Figure 6.2. Same as Figure 6.1 except for the min temperature forecasts.