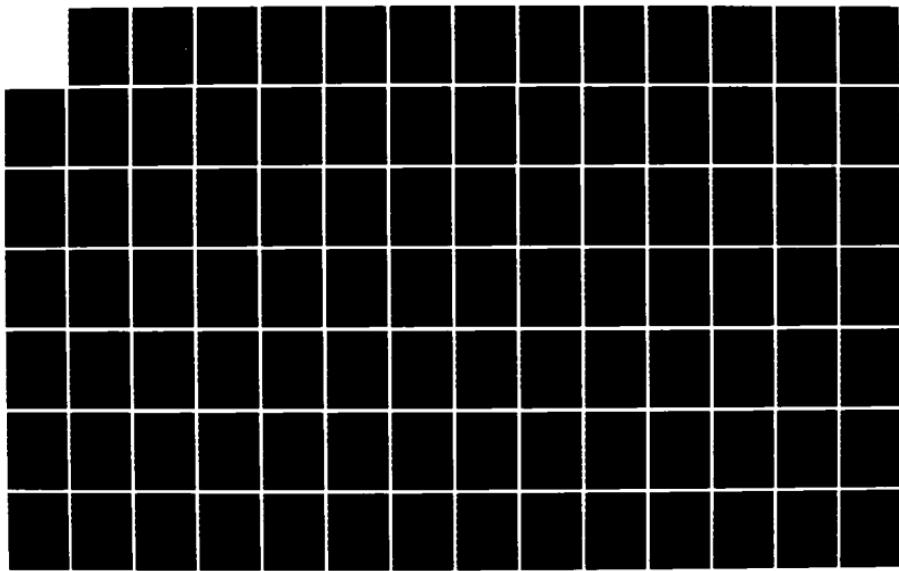
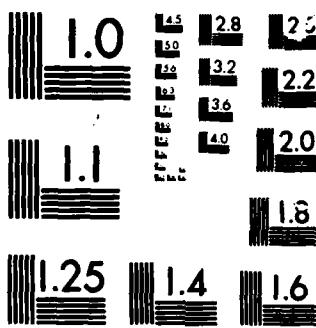


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Program Engineering
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Washington, D.C. 20591

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**Very Short Range Statistical
Forecasting of Automated Weather
Observations**

AD-A167 049

Robert G. Miller, Ph. D.

March 1986
Interim Report

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16. Abstract A procedure is developed for providing weather forecasting guidance over the short period of 10, 20, 30, ... 60 minutes. It uses automated surface observation elements as predictors and predictands. The model is founded on Markov assumption and utilizes multivariate linear regression as the statistical operator. Details are given on how the Generalized Equivalent Markov (GEM) model is constructed and how it compares with other objective methods such as climatology and persistence. Tests are performed on an independent data sample. Overall, GEM succeeds in bettering persistence and does so uniformly over the 6 projection periods of 10, 20, 30, ... 60 minutes.			
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1. INTRODUCTION

A recent analysis of rotorcraft operations (Taylor and Adams, 1985) indicates that the "typical flight mission consists of Point A to Point B flights that average 22 minutes in length, incorporating 5 interim stops for a total round-robin flight averaging 1 hour 48 minutes." The granularity (geographic and time) of weather information for rotorcraft operations is very small in comparison with what is required for fixed wing operations. Thus, the rotorcraft pilot has little interest in mid-range (4-6 hours) weather forecasts. What is needed is short range (10-120 minutes) forecasts for short range distances. The unique characteristics of rotorcraft allow them to land at places where airplanes can not. Many of these landing areas have low density traffic which does not justify a weather observer much less a forecaster. The rotorcraft community is extremely interested in an automatic weather sensor and an associated system for short term weather forecasting. It is for this reason that the FAA is sponsoring the NWS effort described in this report.

A statistical technique for predicting the probability distribution of all surface weather elements inside one hour is called GEM for a Generalized Equivalent Markov model. It uses only the current local automated surface weather conditions as predictors. From these probability distributions, categorical predictions are made for each automated surface weather element. The technique is a Markov procedure which is briefly described in the following quotation from William Feller (1950):

"In stochastic processes the future is never uniquely determined, but we have at least probability relations enabling us to make predictions The term "Markov process" is applied to a very large and important class of stochastic processes Conceptually, a Markov process is the probabilistic analogue of the processes of classical mechanics, where the future development is completely determined by the present state and is independent of the way in which the present state has developed ... in contrast to processes ... where the whole past history of the system influences its future."

GEM is a multivariate linear regression system in which all variables, both predictors and predictands, are zero-one. It is Markovian in that it uses only the most recent observation of the automated surface weather elements to predict the probability distribution of those same automated weather elements. In the original hourly GEM approach, an iterative scheme was employed. For such short time projections as one minute, the iteration scheme has been replaced by equations which predict directly to the desired projection time of interest.

The mathematical model is given in Section 2. Section 3 presents results comparing GEM with persistence. Section 4 gives a summary and discusses future plans.

2. TECHNIQUE DEVELOPMENT

This section describes the procedure from the mathematical model, through data preparation and statistical analyses, to a discussion of a nonlinear prediction method. The reader is referred to a NOAA Technical Report for further details (Miller, 1981).

2.1. Mathematical Model

Assumed given are measurements on a set of Z_1, Z_2, \dots, Z_p predictor variables and a set of $Y_{1,t}, Y_{2,t}, \dots, Y_{q,t}$ predictand variables at projection time t for a group of N observations. The problem of multivariate regression is to construct a set of Q linear functions

$$\begin{aligned}\hat{Y}_{1,t} &= a_{1,0,t} + a_{1,1,t}Z_1 + a_{1,2,t}Z_2 + \dots + a_{1,p,t}Z_p + \dots + a_{1,p,t}Z_p \\ \hat{Y}_{2,t} &= a_{2,0,t} + a_{2,1,t}Z_1 + a_{2,2,t}Z_2 + \dots + a_{2,p,t}Z_p + \dots + a_{2,p,t}Z_p \\ &\vdots \\ \hat{Y}_{q,t} &= a_{q,0,t} + a_{q,1,t}Z_1 + a_{q,2,t}Z_2 + \dots + a_{q,p,t}Z_p + \dots + a_{q,p,t}Z_p \\ &\vdots \\ \hat{Y}_{Q,t} &= a_{Q,0,t} + a_{Q,1,t}Z_1 + a_{Q,2,t}Z_2 + \dots + a_{Q,p,t}Z_p + \dots + a_{Q,p,t}Z_p\end{aligned}\quad (1)$$

which have the property that the sum of the squares of the errors

$$\epsilon_{q,t}^2 = \sum_{i=1}^N (Y_{i,q,t} - \hat{Y}_{i,q,t})^2 = \sum_{i=1}^N (Y_{i,q,t} - a_{q,0,t} - a_{q,1,t}Z_{i,1} - \dots - a_{q,p,t}Z_{i,p})^2 \quad (q=1, 2, \dots, Q) \quad (2)$$

are as small as possible. That is, the problem is to determine values of the $a_{q,p,t}$'s ($q = 1, 2, \dots, Q$; $p = 1, 2, \dots, P$) which minimize the quantities

$$\epsilon_q^2 \quad (q=1, 2, \dots, Q; t=10, 20, \dots, 60)$$

This is done by taking the partial derivatives of Eq. (2) with respect to the unknown a 's, setting each derivative equal to zero, and then solving for the a 's. The process yields a set of normal equations which can be written in matrix notation as (underlining signifies a matrix or vector):

$$\underline{A}_t = (\underline{Z}'\underline{Z})^{-1}(\underline{Z}'\underline{Y}_t) \quad (t = 10, 20, \dots, 60) \quad (3)$$

Expressed statistically this is the multivariate linear regression of the Y 's on the Z 's (Tatsuoka, 1971, pp. 26-38). In GEM, the Y values are advanced by 10, 20, 30, 40, 50, and 60 minutes from the corresponding Z values. Thus

$$Y_{i+t,q} = Z_{i,q}$$

and

$$Y_{i+t,p} = Z_{i,p} \quad (i=1,2, \dots, N; q=1,2, \dots, Q; p=1,2, \dots, P; \\ t = 10, 20, \dots, 60).$$

Once the A_t 's have been determined, they can then be used to estimate the value of \hat{y}_t at each 10-minute time step, given a set of z values at a zero time step (lower case values denote new forecast \hat{Y} based on new observation Z):

$$\hat{y}_t = z_0 A_t \quad (t = 10, 20, \dots, 60) \quad (4)$$

2.2. Data Preparation

Data collection began at the National Weather Service's Techniques Development and Test Branch location at Sterling, Virginia, in April 1984. The following weather elements are observed once a minute by equipment similar to the FAA's Automated Weather Observing System (AWOS). The elements are:

- o Lowest cloud hit
- o Second cloud hit
- o Third cloud hit
- o Fourth cloud hit
- o Visibility
- o Station pressure
- o Temperature
- o Dew point temperature
- o Wind speed
- o Wind direction
- o Precipitation amount in one minute
- o Precipitation occurrence
- o Frozen precipitation occurrence (when successfully measured)
- o Date of the observation

The elements were transformed into categories, and dummy predictors and predictands were created. Table 1 in columns 3 and 4 shows the specific categories defined for each zero-one dummy predictor. Column 1 indicates the dummy variable number while column 4 gives the index of that variable. One dummy variable must be "left-out" because of mathematical redundancy.

2.3. Statistical Analyses

The statistical analyses which are performed on these data result from the processing of crossproduct matrices. The actual steps are as follows:

Step 1. Compute the $Z'Z$ and $Z'Y_t$ crossproduct matrices from the data matrices Z and Y_t .

Step 2. Solve for A_t from $A_t = (Z'Z)^{-1}(Z'Y_t)$ where A_t is the matrix of regression coefficients for making a t -minute forecast.

Step. 3. Solve for the threshold probabilities p^* for making categorical forecasts.

Derivation of the two crossproduct matrices $Z'Z$ and $Z'Y$, in step 1, was accomplished by using a pointer system which saved a considerable amount of computer time. This efficiency is made possible because of the zero-one nature of the observations.

For the labeled predictors in Table 2, Column 4 gives the sum row of the $Z'Z$ matrix and Column 5 the lowest cloud hit row of the $Z'Y$ matrix where $t = 10$ minutes. This column gives the products between the Y variable for lowest ceiling hit times each of the 88 predictors over the sample N.

We solved for the regression coefficient matrix A_t in step 2 using the Crout method (Crout, 1941). This method does not require solving for the inverse matrix, $(Z'Z)^{-1}$, but instead derives the regression coefficients by first a forward and then a backward solution. Avoided are many of the computational instabilities encountered by inverting large matrices. The Crout method yields an 88×87 matrix--88 predictor coefficients for each of 87 predictands.

The lowest cloud hit equation for the A_t matrix at $t = 10$ minutes appears as Column 6 in Table 2.

2.4. Nonlinear Prediction Approach

Meteorologists have desired forecast guidance that is capable of predicting changes in the weather, such as frontal passages and their attendant weather variations, onset and discontinuation of severe weather (types and intensities), wind shifts and wind speed variations, as well as ceiling and visibility changes of a critical nature for aviation. Classical statistical approaches like regression have not succeeded in completely satisfying this desire, partly due to the additive nature of the statistical model currently employed. What seems to be needed is a model which will act in a multiplicative fashion--one capable of completely shutting down the prediction of an event when the antecedent conditions warrant. For example, when it rains, it is "never" preceded 1 minute before by a clear sky. However, a statistical-regression operator will fail to turn off the chance of rain fully if there are other antecedent conditions, say, easterly wind, high humidity, fog, and low visibility--conditions which are usually associated with future occurrences of rain. Regression would tend to increase the probability of rain because of each of these elements. In general with regression, the lack of any clouds would not be enough to negate completely the effect of these other elements.

Fortunately, there is a statistical model or operator which possesses this necessary capability. The discrete likelihood function (DLF) approach is fairly new (see Miller, 1979), but the basis for its existence is founded on the work of the eminent statistician, Sir Ronald A. Fisher, whose own work and

ideas on this subject were derived from the inverse probability notions of Bayes in the mid-eighteenth century. Basically, the concept is this: given that we observe a set of current conditions of the weather, the question to be asked is "What is the likelihood that these current conditions are those that would be the conditions preceding rain and, conversely, what is the likelihood that these current conditions are those that would be the conditions preceding no rain?" The two likelihoods are obtained by multiplying the conditional probabilities of each antecedent condition thus getting the joint probability of the entire observation. It should be emphasized that the presence of any antecedent condition which is incongruous with an event of interest (say, rain) will have a dramatic effect on that likelihood: it will force the likelihood to zero. Such a nonlinear system would seem to conform with meteorologists' desires. Should the usual conditional probabilities (posteriors) be of interest, they can be gotten directly from Bayes' theorem and the climatological frequencies of the possible events (priors). The linearly independent likelihoods are obtained from a set of regression estimated probabilities (REEP) (see Miller, 1964). Empirical evidence has shown that rarely if ever is a REEP probability of an event < 0 when the event occurs and > 1.0 when it does not occur. Certainly the situations arise when REEP forecasts $P < 0$ and $P > 1$. However, truncating these REEP forecasts to 0 and 1.0, respectively, does not seem to invalidate the reliability of the estimates.

When nonlinearity of the type just discussed is present in the data, an alternative approach may be more practical. It goes as follows:

- o Test for the equality of the predictand-group covariance matrices Σ_g using Bartlett's multivariate test (see Morrison, 1967).
- o If the test suggests inequality among the Σ 's, then proceed to test logical (boolean) combinations of predictor pairs. When certain pairs show predictive information over and above the basic set of predictors, include them into the GEM model.
- o All of the usual GEM manipulations follow as before, such as solving for the coefficient matrix A and determining the threshold probabilities for making categorical forecasts.

3. VERIFICATION RESULTS

To demonstrate the ability of the GEM equations to predict at a 10-minute projection, Brier scores (residual variances) have been computed on the developmental sample for climatology, persistence, and GEM for each of the predictands of interest. These are given in Table 3 for the specified dummy variables. The Brier score for persistence as defined here uses only that dummy element corresponding to the specific predictand dummy. A greater reduction (lower values are better) in Brier score for persistence could have been achieved if all dummies of the predictand element were used as

predictors. All dummies of a predictand element were not used as predictors in computing persistence's Brier score for two reasons: a) the procedure is so complex that it would severely strain the resources available to this project, and b) more importantly, persistence's function is as a simple, readily-available "no skill" statistical control. The more complex procedure is neither "readily available" nor simple, but a full-blown statistical forecasting procedure unto itself. The development of such a procedure is beyond the scope of this project.

3.1. Comparative Verification on Independent Data

In May 1985, independent data predictions were begun on 12 weather elements 10, 20, ..., 60 minutes in advance. A one full year of data (April 1984-April 1985) represented the developmental sample. A complete display of the roughly 100,000 forecasts made on data from May through August 1985 is given in the Appendix including:

- o Contingency tables,
GEM versus actual
Persistence versus actual
 - o Biases,
 - o Percentage correct,
 - o Heidke skill score,
 - o χ^2 goodness of fit on the margins, and
 - o Threat score (critical success index)
- for all six projections.

A summarization of these scores is given in Table 4. For each weather element and each projection, the score values are compared between GEM and persistence. The better score received a "G" if it belonged to GEM or a "P" if it belonged to persistence. A "T" signifies a tie. The frequencies of these designations are totaled to give the overall comparison.

4. SUMMARY AND PLANS

4.1 Summary

Overall GEM succeeds in bettering persistence (84 to 42) and does so uniformly over the six projection periods of 10, 20, ..., 60 minutes. GEM manages to accomplish this through consistent superiority in the threat score--an important measure of the skill of a procedure to predict rare events. GEM, however, seems to lack the balance (predicted frequency equaling observed frequency) for doing as well in the Heidke skill score. Such a characteristic seems correctable with a more appropriate threshold or loss function. A

successful improvement here could produce comparisons that would be even better than at present without any new predictive information being added. In particular, GEM's categorical wind direction forecasts do not realize the advantage they possess over persistence as demonstrated in the Brier score.

4.2 Plans

- Processing FAA data on a microcomputer has been successful. However, the raw data reside on 400 floppy disks. In the future all of these data will be stored on a single 20 megabyte hard disk.
- A new software architecture is planned to store the data as bits (since GEM's variables are all 0-1). Processing can be accomplished very efficiently using logical operations on integers.
- Computer experience with the Kaypro 10 micros has been exceptionally good. They have run 24 hours a day, seven days a week without a computer failure at Sterling, Virginia. Similar reliability has been achieved with the FAA's two research Kaypro 10's.
- It is advisable to institute a quality control of the input data at the time it is being collected; one that will provide an alert for erroneous or missing (instrument malfunction) information at the source.
- As things stand, the anticipated collection of Atlantic City and Indianapolis data will not be sensor-variable compatible with Sterling, Virginia. For example, cloud hits are taken 4 times each minute at Sterling, Virginia but are taken only 2 times each minute at Atlantic City, New Jersey.
- Further installations at Atlantic City and Indianapolis will permit us to test whether the GEM equations can be made general so as to apply at any location without the need to collect 2 years of weather observations first.
- We will embark on a full fledged AWOS system to predict 10, 20, ..., 60 minutes after the observation as against our previous efforts to predict sensor variables.
- Efforts will continue to verify forecasts based upon independent data.

- A rigorous investigation is planned to uncover and utilize nonlinear predictive information. Such an effort requires a computer upgrade, the new software architecture, and the Pascal language.
- In conjunction with this, the National Weather Service plans to upgrade from Kaypro 10's to Kaypro 286i's.
- A method will be developed for converting GEM's probability forecasts into categorical forecasts in a more optimal fashion than what beta thresholds have provided.

REFERENCES

- Crout, P. D., 1941: A short method for evaluating determinants and solving systems of linear equations with real and complex coefficients. Trans. AIEE, 60, 1235-1241.
- Feller, W., 1950: An Introduction to Probability Theory and its Applications. John Wiley and Sons, New York, 419 pp.
- Miller, Robert G., 1964: Regression estimation of event probabilities. Tech. Report No. 1, Contract CWB-10704, The Travelers Research Center, Inc., Hartford, Conn., 153 pp.
- _____, 1979: Estimating event probabilities by discrete likelihood functions. Proceedings Sixth Conference on Probability and Statistics in Atmospheric Sciences, Banff, Amer. Meteor. Soc., 93-97.
- _____, 1981: GEM: A statistical weather forecasting procedure. NOAA Technical Report NWS-28, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 103 pp.
- Morrison, D. F., 1967: Multivariate Statistical Methods. McGraw-Hill Company, New York, pp. 252-253.
- Tatsuoka, M. M., 1971: Multivariate Analysis: Techniques for Educational and Psychological Research. John Wiley and Sons, New York, 310 pp.
- Taylor, F. R., and R. J. Adams, 1985: Investigation of hazards of helicopter operations and root causes of helicopter accidents. DOT/FAA/PM-85/25.

APPENDIX

This appendix has two parts. The first part consists of tables which are referred to in the text as Tables 1-4. The second part contains the actual contingency tables and scores computed from the comparative verification between GEM and persistence. These verification statistics are arranged with GEM's results for 10, 20, 30, 40, 50, and 60-minute projections followed by persistence results for 10, 20, 30, 40, 50, and 60-minute projections.

The verification statistics are presented for the following elements:

- Lowest cloud hit
- Second cloud hit
- Third cloud hit
- Fourth cloud hit
- Visibility (miles)
- Station pressure (inches of Hg)
- Temperature ($^{\circ}$ F)
- Dew point depression ($^{\circ}$ F)
- Wind speed (kt)
- Wind direction (deg)
- Precipitation amount (inches)

for the following scores:

- Contingency table
- Biases (raw total/column total)
- Percentage correct (hits/total number of forecasts)
- Heidke skill score (hits-chance hits)/(total-chance hits)
- Chi-square goodness of fit on margins [(predicted totals-observed totals)²/observed totals].
- Threat score or critical success index [hits/(number of forecast + number of observed-hits)]

During the period of the present verification, May 1985-August 1985, there were no yes/no precipitation measurements. The instrument was found to have been inoperative. As a result, all of the yes/no precipitation comparative verifications should be disregarded. Apparently, the tipping bucket precipitation amount measurements were not affected.

Table 1. Predictor and predictand categories which specify the dummy variables used in GEM. Shown under the index column are the left-out categories not included because of redundancy.

Number	Weather Element	Category	Index
1	(Always unity)		1
2	Lowest cloud hit (00')	0 - 1	2
3		2 - 4	3
4		5 - 9	4
5		10 - 29	5
6		30 - 60	6
7		61 - UNL	Left out
8	Second cloud hit (00')	0 - 1	7
9		2 - 4	8
10		5 - 9	9
11		10 - 29	10
12		30 - 60	11
13		61 - UNL	Left out
14	Third cloud hit (00')	0 - 1	12
15		2 - 4	13
16		5 - 9	14
17		10 - 29	15
18		30 - 60	16
19		61 - UNL	Left out
20	Fourth cloud hit (00')	0 - 1	17
21		2 - 4	18
22		5 - 9	19
23		10 - 29	20
24		30 - 60	21
25		61 - UNL	Left out
26	Visibility (miles)	0 - 31/64	22
27		1/2 - 63/64	23
28		1 - 2 63/64	24
29		3 - 4 64/64	25
30		5 - 6 63/64	26
31		7 - 100	Left out
32	Station pressure (inches of Hg)	0 - 29.235	27
33		29.236 - 29.530	28
34		29.531 - 29.677	29
35		29.678 - 29.825	30
36		29.826 - 29.973	31
37		29.974 - 30.120	32
38		30.121 - 30.268	33
39		30.269 - 30.563	34
40		30.564 - 35.000	Left out
41	Temperature (°F)	- ∞ - 4	35
42		5 - 14	36
43		15 - 24	37
44		25 - 34	38

Table 1. Continued.

Number	Weather Element	Category	Index
45		35 - 39	39
46		40 - 44	40
47		45 - 49	41
48		50 - 54	42
49		55 - 59	43
50		60 - 64	44
51		65 - 74	45
52		75 - 84	46
53		85 - 94	47
54		95 - 110	Left out
55	Dew point depression (°F)	0 - 1	48
56		2 - 7	49
57		8 - 15	50
58		16 - 25	51
59		26 - 99	Left out
60	Wind speed (kt)	0 - 1	52
61		2 - 9	53
62		10 - 19	54
63		20 - 29	55
64		30 - 99	Left out
65	Wind direction (deg)	00 - 44	56
66		45 - 89	57
67		90 - 134	58
68		135 - 179	59
69		180 - 224	60
70		225 - 269	61
71		270 - 314	62
72		315 - 359	Left out
73	Precipitation amount (inches)	.002 - .100	63
74		.001 - .0019	64
75		.000 - .0009	Left out
76	Precipitation occurrence (Y or N)	Yes	65
77		No	Left out
78	Frozen precipitation (Y or N) (when successfully measured)	Yes	66
79		No	Left out
80	Month	January	67
81		February	68
82		March	69
83		April	70
84		May	71
85		June	72
86		July	73
87		August	74
88		September	75

Table 1. Continued.

Number	Weather Element	Category	Index
89		October	76
90		November	77
91		December	Left out
92	Hour (LST)	00 - 01	78
93		02 - 03	79
94		04 - 05	80
95		06 - 07	81
96		08 - 09	82
97		10 - 11	83
98		12 - 13	84
99		14 - 15	85
100		16 - 17	86
101		18 - 19	87
102		20 - 21	88
103		22 - 23	Left out

Table 2. Quantities derived for the designated dummy variables; the number of times each category occurred in the sample (ΣZ), the number of times each predictor occurred when it was followed by the lowest cloud hit ten minutes later (ΣYZ), and the regression coefficient for each predictor when lowest cloud hit was the predictand (A).

Index	Element	Category	ΣZ	ΣYZ	A ₁₀
1	(Always unity)		421803	8348	.04607
2	Lowest cloud hit (00')	0 - 1	8463	2300	.08631
3		2 - 4	21522	1097	-.01161
4		5 - 9	15660	223	-.00709
5		10 - 29	33872	244	-.00107
6		30 - 60	37845	209	-.00032
7	Second cloud hit (00')	0 - 1	2371	1512	.38899
8		2 - 4	12675	1266	.04696
9		5 - 9	10855	168	.01115
10		10 - 29	28144	191	.00779
11		30 - 60	32221	149	-.00246
12	Third cloud hit (00')	0 - 1	1312	911	.13030
13		2 - 4	11141	1435	.02128
14		5 - 9	10146	174	.00469
15		10 - 29	25915	182	-.00176
16		30 - 60	28200	108	-.00049
17	Fourth cloud hit (00')	0 - 1	635	446	.02371
18		2 - 4	9535	1457	-.00402
19		5 - 9	9629	180	-.03725
20		10 - 29	23260	177	-.00953
21		30 - 60	23923	81	-.00051
22	Visibility (Miles)	0 - 31/64	2254	346	.08842
23		1/2 - 63/64	2975	647	.10000
24		1 - 2 63/64	16285	2150	.05339
25		3 - 4 63/64	29549	882	.00551
26		5 - 6 63/64	28667	474	.00879
27	Station pressure (inches of Hg)	0 - 29.235	253	2	-.00512
28		29.236 - 29.530	5327	49	-.00526
29		29.531 - 29.677	10827	135	-.00421
30		29.678 - 29.825	47564	945	.00268
31		29.826 - 29.973	95658	2435	.00072
32		29.974 - 30.120	114484	2451	-.00737
33		30.121 - 30.268	87028	1491	-.00424
34		30.269 - 30.563	57127	792	-.00235
35	Temperature (°F)	-∞ - 4	1017	18	-.02170
36		5 - 14	3611	58	-.02073
37		15 - 24	24504	285	-.02695
38		25 - 34	53098	1014	-.02727
39		35 - 39	31961	1058	-.02200
40		40 - 44	31784	831	-.02483
41		45 - 49	37271	864	-.02842
42		50 - 54	36040	644	-.02838
43		55 - 59	35556	608	-.02789
44		60 - 64	39191	872	-.02590

Table 2. Continued.

Index	Element	Category	ΣZ	ΣZY	A10
45	Temperature ($^{\circ}$ F) cont.	65 - 74	72758	1291	-.02615
46		75 - 84	41673	606	-.02352
47		85 - 94	13241	195	-.02291
48	Dew point depression ($^{\circ}$ F)	0 - 1	35160	3078	.01576
49		2 - 7	158036	2631	-.00596
50		8 - 15	123263	1319	-.00516
51		16 - 25	80188	966	-.00755
52	Wind speed (kt)	0 - 1	18824	515	-.00059
53		2 - 9	336487	7027	.00002
54		10 - 19	61939	757	.00786
55		20 - 29	4497	49	.00863
56	Wind direction (deg)	00 - 44	33661	908	.00732
57		45 - 89	20748	405	-.00231
58		90 - 134	30569	475	-.00842
59		135 - 179	52449	1330	.00084
60		180 - 224	77072	1639	-.00207
61		225 - 269	33438	556	-.00027
62		270 - 314	95727	1475	-.00166
63	Precipitation amount (inches)	.002 - .100	60	1	-.05164
64		.001 - .0019	1001	35	-.01552
65	Precipitation occurrence (Y,N)	Yes	17977	728	-.00049
66	Frozen precipitation (Y,N) (when successfully measured)	Yes	0	0	.00000
67	Month	January	41688	827	-.00622
68		February	37552	724	-.00061
69		March	41750	493	-.00561
70		April	46108	646	-.00416
71		May	25387	506	.00000
72		June	30418	598	-.00455
73		July	28260	451	-.00761
74		August	16613	268	-.00082
75		September	35484	492	-.00524
76		October	37036	1023	-.00028
77		November	40638	788	-.00592
78	Hour (LST)	00 - 00	34956	765	-.00519
79		02 - 03	34553	860	-.00930
80		04 - 05	30464	769	-.00292
81		06 - 07	34371	892	-.00599
82		08 - 09	35620	896	.00209
83		10 - 11	35667	544	-.00026
84		12 - 13	35739	431	-.00680
85		14 - 15	36019	514	-.00312
86		16 - 17	36549	648	-.00340
87		18 - 19	36459	673	.00004
88		20 - 21	36137	639	-.00078

Table 3. Brier scores for a 10-minute forecast of each specified predictand using the global climatological probability, the conditional persistence probability, and GEM based on the developmental sample of 468408 cases. Dashes denote inapplicability.

Index	Element	Category	Climatology	Persistence	GEM
1	(Always unity)				
2	Lowest cloud hit (00')	0 - 1	.01940	.01810	.01657
3		2 - 4	.04848	.03827	.03075
4		5 - 9	.03551	.02896	.02547
5		10 - 29	.07399	.04296	.03680
6		30 - 60	.08152	.04617	.04139
7	Second cloud hit (00')	0 - 1	.05442	.04379	.04131
8		2 - 4	.02923	.01349	.01254
9		5 - 9	.02495	.01571	.01410
10		10 - 29	.06237	.02857	.02549
11		30 - 60	.07045	.03622	.03229
12	Third cloud hit (00')	0 - 1	.02962	.02614	.02474
13		2 - 4	.02575	.01134	.00963
14		5 - 9	.02342	.01435	.01273
15		10 - 29	.05769	.02610	.02327
16		30 - 60	.06244	.03164	.02820
17	Fourth cloud hit (00')	0 - 1	.00143	.00134	.00128
18		2 - 4	.02208	.01004	.00877
19		5 - 9	.02225	.01338	.01206
20		10 - 29	.05226	.02445	.02207
21		30 - 60	.05344	.02811	.02561
22	Visibility (Miles)	0 - 31/64	.05010	.03554	.03419
23		1/2 - 63/64	.07108	.05299	.05018
24		1 - 2 63/64	.03714	.01902	.01774
25		3 - 4 63/64	.06538	.03551	.03262
26		5 - 6 63/64	.06322	.04045	.03885
27	Station pressure (inches of Hg)	0 - 29.235	.00056	.00013	.00013
28		29.236 - 29.530	.01247	.00065	.00064
29		29.531 - 29.677	.02501	.01842	.01830
30		29.678 - 29.825	.09997	.06048	.06009
31		29.826 - 29.973	.01754	.01035	.01029
32		29.974 - 30.120	.01977	.01104	.01099
33		30.121 - 30.268	.01637	.09078	.09041
34		30.269 - 30.563	.11714	.00417	.00415
35	Temperature (°F)	-∞ - 4	.00241	.00008	.00008
36		5 - 14	.00847	.00131	.00130
37		15 - 24	.05462	.00840	.00822
38		25 - 34	.11007	.01693	.01641
39		35 - 39	.07000	.01897	.01850
40		40 - 44	.06987	.02013	.01950
41		45 - 49	.08046	.02240	.02161
42	Temperature (°F) cont.	50 - 54	.07818	.02308	.02230
43		55 - 59	.07711	.02287	.02214
44		60 - 64	.08436	.02350	.02290

Table 3. Continued.

Index	Element	Category	Climatology	Persistence	GEM
45		65 - 74	.14279	.02181	.02122
46		75 - 84	.08891	.01359	.01332
47		85 - 94	.03042	.00423	.00412
48	Dew point depression (°F)	0 - 1	.07640	.03393	.03126
49		2 - 7	.23428	.07114	.06557
50		8 - 15	.20686	.06386	.06252
51		16 - 25	.15397	.03901	.03787
52	Wind speed (kt)	0 - 1	.04304	.03518	.03385
53		2 - 9	.16165	.09348	.08612
54		10 - 19	.12539	.06327	.05878
55		20 - 29	.01047	.00775	.00744
56	Wind direction (deg)	00 - 44	.07360	.05026	.04757
57		45 - 89	.04668	.03327	.03202
58		90 - 134	.06719	.04270	.04116
59		135 - 179	.10876	.06754	.06411
60		180 - 224	.14962	.07513	.06896
61		225 - 269	.07313	.05558	.05391
62		270 - 314	.17534	.09554	.08856
63	Precipitation amount (inches)	.002 - .100	.00011	.00011	.00011
64		.001 - .0019	.00238	.00232	.00226
65	Precipitation Occurrence (Y,N)	Yes	.04088	.01804	.01773
66	Frozen precipitation (Y,N) (when successfully measured)	Yes	-	-	-
67	Month	January	-	-	-
68		February	-	-	-
69		March	-	-	-
70		April	-	-	-
71		May	-	-	-
72		June	-	-	-
73		July	-	-	-
74		August	-	-	-
75		September	-	-	-
76		October	-	-	-
77		November	-	-	-
78	Hour (LST)	00 - 00	-	-	-
79		02 - 03	-	-	-
80		04 - 05	-	-	-
81		06 - 07	-	-	-
82		08 - 09	-	-	-
83		10 - 11	-	-	-
84		12 - 13	-	-	-
85		14 - 15	-	-	-
86		16 - 17	-	-	-
87		18 - 19	-	-	-
88		20 - 21	-	-	-

Table 4. A summarization of the comparative skill between GEM, "G", and persistence, "P", (ties are denoted by "T") for appropriate scores at projections of 10, 20, ..., 60 minutes with a tally for each. Percent correct (PC), Heidke skill score (H), and threat score (T) are shown for the predictands listed in section 2.2, except precipitation occurrence. The actual data from which this table was constructed is shown on pages 19-91.

		10	20	30	40	50	60	
H_1	PC	G	G	G	G	G	G	
	H	G	G	G	G	G	G	
	T	G	G	G	G	G	G	
H_2	PC	G	G	G	G	G	G	
	H	P	P	P	P	P	P	
	T	G	G	G	G	G	G	
H_3	PC	G	P	G	P	P	P	
	H	G	P	P	P	P	P	
	T	G	G	G	G	G	G	
H_4	PC	P	P	P	P	P	P	
	H	P	P	P	P	P	P	
	T	G	G	P	G	G	G	
V	PC	T	G	G	G	G	G	
	H	T	G	G	G	G	G	
	T	T	T	T	T	T	T	
P	PC	T	T	T	T	T	T	
	G	T	T	T	T	T	T	
	T	T	T	T	T	T	T	
T	PC	T	T	G	G	G	G	
	H	T	T	G	G	G	G	
	DPD	PC	T	P	G	G	G	
WS	PC	T	G	G	G	G	G	
	H	T	G	G	G	G	G	
	WD	PC	T	P	P	P	P	
PA	PC	T	T	T	G	G	G	
	H	T	T	T	G	P	P	
	Total	G	9	11	15	17	16	84
	P	3	9	7	7	8	8	42
	T	15	7	5	3	3	3	36

GEM Results

GFM VERSUS VERIFYING OBSERVATION AT 10 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	0 - 1	193	74	3	1	2	78
FORECAST	2 - 4	90	942	218	32	18	85
	5 - 9	10	262	823	195	47	163
	10 - 29	22	125	402	3658	196	726
	30 - 60	31	91	79	449	2723	1072
	61 - UNL	1349	2530	1777	2738	2146	78962
COLUMN TOTALS:		1695	4024	3302	7073	5132	81086
BIASFS:		.21	.34	.45	.73	.87	1.10
							102312

PERCENT CORRECT: 85.33

HEIDKE SKILL SCORE: .5109

CHI-SQUARE: 5279.56

THREAT SCORE: .2110

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	0 - 1	75	47	0	0	0	90
FORECAST	2 - 4	62	824	221	34	8	78
	5 - 9	8	196	784	215	34	164
	10 - 29	0	57	262	3415	224	882
	30 - 60	4	35	48	337	2288	1063
	61 - UNL	65	172	300	1104	1340	87876
COLUMN TOTALS:		214	1331	1615	5105	3894	90153
BIASFS:		.99	.92	.87	.95	.97	1.01
							102312

PERCENT CORRECT: 93.11

HEIDKE SKILL SCORE: .6770

CHI-SQUARE: 59.39

THREAT SCORE: .5101

THIRD CLOUD HIT ('00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	25	51	0	0	0	74	150
2 - 4	29	700	222	31	8	86	1076
5 - 9	1	137	755	206	21	202	1322
GEM FORECAST	10 - 29	0	29	186	3074	221	968
	30 - 60	2	17	28	213	1874	1011
	61 - UNL	33	92	206	945	1021	89844
COLUMN TOTALS:		90	1026	1397	4469	3145	92185
BIASES:		1.67	1.05	.95	1.00	1.00	1.00

PERCENT CORRECT: 94.10

HEIDKE SKILL SCORE: .6816

CHI-SQUARE: 46.50

THREAT SCORE: .5237

FOURTH CLOUD HIT ('00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	2	24	1	0	0	63	90
2 - 4	8	535	243	29	3	114	932
5 - 9	0	110	636	140	12	267	1165
GEM FORECAST	10 - 29	0	18	188	2310	195	983
	30 - 60	0	12	26	222	1291	986
	61 - UNL	6	59	165	858	869	91937
COLUMN TOTALS:		16	758	1259	3559	2370	94350
BIASES:		5.63	1.23	.93	1.04	1.07	1.00

PERCENT CORRECT: 94.53

HEIDKE SKILL SCORE: .6390

CHI-SQUARE: 408.30

THREAT SCORE: .4637

VISIBILITY (MILES)

VERIFICATION: OBSERVATION

	0 -	31/64	1/2 -	63/64	1 -	2	63/64	3 -	4	63/64	5 -	6	63/64	7 -	100	ROW TOTALS
0 -	31/64	345		89		109		65		35		40		683		683
1/2 -	63/64	94		127		167		75		21		39		523		523
GFM	1 -	2	63/64	95		186		2963		1047		166		4574		4574
FORECAST	3 -	4	63/64	63		67		981		4040		1147		6747		6747
	5 -	6	63/64	37		28		186		1142		3449		1738		6580
	7 -	100		39		25		137		396		1788		80820		83205
COLUMN TOTALS:		673		522		4543		6765		6606		83203		102312		102312
BIASES:		1.02		1.00		1.01		1.00		1.00		1.00		1.00		1.00

PERCENT CORRECT: 89.67
 HEIDKE SKILL SCORE: .6852
 CHI-SQUARE: .51
 THRETFAT SCORE: .3751

STATION PRESSURE (INCHES OF HG)

PERCENT CORRECT: 98.25
HEIDKE SKILL. SCORE: .9749
CHI-SQUARE: .11

TEMPERATURE (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION											ROW TOTALS			
-30 - 4	5 - 14	15 - 24	25 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	65 - 74	75 - 84	85 - 94	95 - 110	
-30 - 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 - 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 - 34	0	0	0	0	59	10	0	0	0	0	0	0	0	69
35 - 39	0	0	0	2	60	24	0	0	0	0	0	0	0	86
40 - 44	0	0	0	0	13	674	162	0	0	0	0	0	0	849
GEM FORECAST	45 - 49	0	0	0	0	170	2684	312	0	0	0	0	0	3166
50 - 54	0	0	0	0	0	296	3799	574	0	0	0	0	0	4669
55 - 59	0	0	0	0	0	0	554	7663	773	0	0	0	0	8990
60 - 64	0	0	0	0	0	0	0	7	744	14230	1394	0	0	16375
65 - 74	0	0	0	0	0	0	0	0	3	1340	31245	1176	0	33764
75 - 84	0	0	0	0	0	0	0	0	0	1181	24358	711	0	26250
85 - 94	0	0	0	0	0	0	0	0	0	2	706	7352	15	8075
95 - 110	0	0	0	0	0	0	0	0	0	0	0	15	4	19
COLUMN TOTALS:	0	0	0	61	83	868	3142	4672	8984	16343	33822	26240	8078	19
BIASES:	99.99	99.99	99.99	1.13	1.04	.98	1.01	1.00	1.00	1.00	1.00	1.00	1.00	102312

PERCENT CORRECT: 90.05
 HEIDKE SKILL SCORE: .8728
 CHI-SQUARE: 1.93

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION							ROW TOTALS
0 - 1	2 - 7	8 - 15	16 - 25	26 - 99	0 - 1	2 - 7	
0 - 1	7211	2813	0	0	0	0	10024
2 - 7	2825	34155	1687	0	0	0	38667
GEM FORECAST	8 - 15	0	1728	23654	1416	0	26798
16 - 25	0	1	1416	18641	512	0	20570
26 - 99	0	0	0	526	5727	0	6253
COLUMN TOTALS:	10036	38697	26757	20583	6239	0	102312
BIASES:	1.00	1.00	1.00	1.00	1.00	0	

PERCENT CORRECT: 87.37%
 HEIDKE SKILL SCORE: .8281
 CHI-SQUARE: .14

		WIND SPEED (KT)									WIND DIRECTION (DEG)									VERIFYING OBSERVATION																																												
		VERIFYING OBSERVATION									VERIFYING OBSERVATION									0 - 1			2 - 9			10 - 19			20 - 29			30 - 99			00 - 44			45 - 89			90 - 134			135 - 180			181 - 224			225 - 269			270 - 314			315 - 359			360 - 404			405 - 449		
		0 - 1			2 - 9			10 - 19			20 - 29			30 - 99			00 - 44			45 - 89			90 - 134			135 - 180			181 - 224			225 - 269			270 - 314			315 - 359			360 - 404			405 - 449																				
GFM FORECAST	0 - 1	1013	2766	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																														
	2 - 9	2835	79553	3927	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																														
	10 - 19	0	3933	7577	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																														
	20 - 29	0	0	2	139	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																														
COLUMN TOTALS:		3848	86654	11644	166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																														
BIASES:		.98	1.00	1.00	1.01	1.01	99.99																																																									
PERCENT CORRECT:		86.57%																																																														
HEIDKE SKILL SCORE:		.4984																																																														
CHI-SQUARE:		1.25																																																														

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0009	.000 - .0009	ROW TOTALS
GEM	.002 - .100	0	1	18
FORECAST	.001 - .0019	0	7	135
	.000 - .0009	17	138	101997
COLUMN TOTALS:			146	102149
BIASES:		1.06	.97	1.00
PERCENT CORRECT:	99.70%			
HEIDKE SKILL SCORE:	.0451			
CHI-SQUARE:	.17			

PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GEM	YES	0	0
FORECAST	NO	0	102312
COLUMN TOTALS:		0	102312
BIASES:	99.99	1.00	

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: 1.0000
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

FROZEN PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GEM	YES	0	0
FORECAST	NO	0	102312
COLUMN TOTALS:		0	102312
BIASES:	99.99	1.00	

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: 1.0000
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

GEM VERSUS VERIFYING OBSERVATION AT 20 MINUTE INTERVALS

LOWEST CLOUD HIT ('00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GEM	0 - 1	203	99	21	4	3	100
FORECAST	2 - 4	90	870	393	53	28	102
	5 - 9	10	194	603	210	51	180
	10 - 29	27	130	394	3340	227	900
	30 - 60	34	102	91	461	2402	1239
	61 - UNL	1283	2488	1738	2810	2237	76181
COLUMN TOTALS:		1647	3883	3240	6878	4948	78702
BIASES:		.26	.40	.39	.73	.88	99298

PERCENT CORRECT: 84.19

HEIDKE SKILL SCORE: .4746

CHI-SQUARE: 4943.33

THREAT SCORE: .2024

SECOND CLOUD HIT ('00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GEM	0 - 1	58	44	1	0	0	105
FORECAST	2 - 4	81	710	248	51	14	102
	5 - 9	2	220	707	211	40	180
	10 - 29	1	60	274	3070	236	1062
	30 - 60	2	48	51	386	1918	1130
	61 - UNL	63	192	320	1235	1546	84930
COLUMN TOTALS:		207	1274	1601	4953	3754	87509
BIASES:		1.01	.95	.85	.95	.94	99298

PERCENT CORRECT: 92.04

HEIDKE SKILL SCORE: .6251

CHI-SQUARE: 72.21

THREAT SCORE: .4461

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	0 - 1	21	45	1	0	0	128
	2 - 4	35	608	268	43	11	123
	5 - 9	1	141	664	199	23	224
FORECAST	10 - 29	0	19	182	2779	230	1184
	30 - 60	1	35	35	264	1604	1078
	61 - UNL	27	128	234	1056	1175	86732
COLUMN TOTALS:		85	976	1384	4341	3043	89469
BIASES:		2.29	1.12	.91	1.01	.99	1.00

PERCENT CORRECT: 93.06
 HEIDIKE SKILL SCORE: .6271
 CHI-SQUARE: 168.82
 THREAT SCORE: .4336

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	0 - 1	2	21	0	0	0	66
	2 - 4	9	457	256	33	3	144
	5 - 9	0	123	588	143	18	307
FORECAST	10 - 29	0	18	195	2086	205	1147
	30 - 60	0	21	20	320	1089	1178
	61 - UNL	4	81	178	873	978	88735
COLUMN TOTALS:		15	721	1237	3455	2293	91577
BIASES:		5.93	1.25	.95	1.06	1.15	.99

PERCENT CORRECT: 93.61
 HEIDIKE SKILL SCORE: .5857
 CHI-SQUARE: 479.07
 THREAT SCORE: .3950

VISIBILITY (MILES)

VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
GFM	0 - 31/64	261	71	118	79	29	53
FORECAST	1/2 - 63/64	86	75	159	75	19	36
	1 - 2 63/64	86	168	2566	1121	207	156
	3 - 4 63/64	63	49	1022	3506	1168	646
	5 - 6 63/64	32	24	233	1205	2935	1922
	7 - 100	33	37	167	537	1994	78360
COLUMN TOTALS:		561	424	4265	6523	6352	81173
BIASES:		1.09	1.06	1.01	.99	1.00	1.00
							99298

PERCENT CORRECT: 88.32
 HEIDKE SKILL SCORE: .6377
 CHI-SQUARE: 7.16
 THREAT SCORE: .3175

STATION PRESSURE (INCHES OF HG)

VERIFYING OBSERVATION

	0 - 29.236	29.530	29.677	29.825	29.973	29.974	30.121	30.268	30.269	30.563	30.564 - 35.000	ROW TOTALS
GFM	0 - 29.235	0	0	0	0	0	0	0	0	0	0	0
FORECAST	29.236 - 29.530	0	1792	38	0	0	0	0	0	0	0	1830
	29.531 - 29.677	0	34	3316	165	0	0	0	0	0	0	3515
	29.678 - 29.825	0	0	175	17825	577	0	0	0	0	0	18577
	29.826 - 29.973	0	0	0	539	40810	434	0	0	0	0	41783
	29.974 - 30.120	0	0	0	0	427	29034	105	0	0	0	29566
	30.121 - 30.268	0	0	0	0	0	131	3660	21	0	0	3812
	30.269 - 30.563	0	0	0	0	0	0	21	194	0	0	215
	30.564 - 35.000	0	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:		0	1826	3529	18529	41814	29599	3786	215	0	99298	
BIASES:		99.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	99.99		

PERCENT CORRECT: 97.31
 HEIDKE SKILL SCORE: .9614
 CHI-SQUARE: .43

TEMPERATURE (DEGREES FAHRENHEIT)

		VERIFYING OBSERVATION																										
		-30	-4	5	14	15	24	25	34	35	40	45	49	50	54	55	59	60	64	65	74	75	84	85	94	95	110	ROW TOTALS
-30	-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	-24	0	0	0	0	0	0	0	0	41	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	
25	-34	0	0	0	0	0	0	0	0	0	31	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	
35	-39	0	0	0	0	0	0	0	0	0	12	576	194	0	0	0	0	0	0	0	0	0	0	0	0	0	782	
GEM	40	-44	0	0	0	0	0	0	0	0	217	2416	401	0	0	0	0	0	0	0	0	0	0	0	0	0	3034	
45	-49	0	0	0	0	0	0	0	0	0	363	3279	730	1	0	0	0	0	0	0	0	0	0	0	0	0	4373	
FORECAST	50	-54	0	0	0	0	0	0	0	0	0	4	677	6954	1000	0	0	0	0	0	0	0	0	0	0	0	0	8635
55	-59	0	0	0	0	0	0	0	0	0	0	0	20	897	13083	1802	0	0	0	0	0	0	0	0	0	0	0	15802
60	-64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	1675	29379	1710	0	0	0	0	0	0	0	32779
65	-74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1727	23253	850	0	0	0	0	0	0	25831
75	-84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	851	7044	18	1	1	1	19	7917
85	-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
95	-110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
COLUMN TOTALS:		0	0	0	0	0	0	41	61	829	2977	4377	8596	15760	32912	25814	7912	19	99298									
BIASES:		99.99	99.99	99.99	1.44	1.10	.94	1.02	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		

PERCENT CORRECT: 86.67
 HEIDKE SKILL SCORE: .8292
 CHI-SQUARE: 13.09

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

		VERIFYING OBSERVATION												
		0 - 1	2 - 7	8 - 15	16 - 25	26 - 99								
GEM	0 - 1	6905	2760	2	0	0	0	0	0	0	9667			
	2 - 7	2707	32168	2153	2	0	0	0	0	0	37030			
FORECAST	8 - 15	0	2199	22225	1814	2	0	0	0	0	26238			
	16 - 25	0	13	1805	17707	650	0	0	0	0	20175			
	26 - 99	0	0	1	660	5527	0	0	0	0	6188			
COLUMN TOTALS:		9612	37140	26186	20183	6177					99298			
BIASES:		1.01	1.00	1.00	1.00	1.00								

PERCENT CORRECT: 85.13%
 HEIDKE SKILL SCORE: .7980
 CHI-SQUARE: .77

WIND SPEED (KT)
VERIFYING OBSERVATION

	0 - 1	2 - 9	10 - 19	20 - 29	30 - 99	ROW TOTALS
GFM FORECAST	0 - 1 2 - 9 10 - 19 20 - 29 30 - 99	735 2853 1 0 0	2806 76933 4318 2 0	4 431 7033 138 0	0 2 136 26 0	0 0 0 0 0
COLUMN TOTALS: BIASES:		3589	84059	11486	164	99298
PERCENT CORRECT: .85.33% HEIDKE SKILL SCORE: .4532 CHI-SQUARE: .58		.99	1.00	1.00	1.01	99.99

WIND DIRECTION (DEC)
VERIFYING OBSERVATION

	00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359	ROW TOTALS	
GFM FORECAST	00 - 44 45 - 89 90 - 134 135 - 179 180 - 224 225 - 269 270 - 314 315 - 359	4693 1019 204 118 130 122 352 2225	1197 2855 822 96 114 125 224 374	305 851 1962 603 366 336 312 293	138 122 889 7211 3551 516 562 252	98 99 405 4044 15567 2017 779 185	137 116 222 461 2104 4386 2289 298	459 318 281 400 916 2257 11960 2664	1911 393 211 164 309 337 2912 7660	8938 5773 4996 13097 23057 10096 19390 13951
COLUMN TOTALS: BIASES:		8863	5807	5028	13241	23194	10013	19255	99298	
PERCENT CORRECT: .56.69% HEIDKE SKILL SCORE: .4883 CHI-SQUARE: 5.26		1.01	.99	.99	.99	1.01	1.01	1.00		

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

		.0002 - .100	.001 - .0019	.000 - .0009	ROW TOTALS
GFM FORECAST	.002 - .100	0	0	18	18
	.001 - .0019	0	.3	1.38	1.41
	.000 - .0009	17	140	989.2	991.39
COLUMN TOTALS:		17	143	991.38	992.98
BIASES:		1.06	.99	1.00	
PERCENT CORRECT:	99.68%				
HEIDKE SKILL SCORE:	.0174				
CHI-SQUARE:	.09				

PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

		YES	NO	ROW TOTALS
GFM FORECAST	YES	0	0	0
	NO	0	99298	99298
COLUMN TOTALS:		0	99298	99298
BIASES:		99.99	1.00	

PERCENT CORRECT: 100.00%

HEIDKE SKILL SCORE: *****

CHI-SQUARE: 0.00

THREAT SCORE: *****

FROZEN PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

		YES	NO	ROW TOTALS
GFM FORECAST	YES	0	0	0
	NO	0	99298	99298
COLUMN TOTALS:		0	99298	99298
BIASES:		99.99	1.00	

PERCENT CORRECT: 100.00%

HEIDKE SKILL SCORE: *****

CHI-SQUARE: 0.00

THREAT SCORE: *****

GFM VERSUS VERIFYING OBSERVATION AT 30 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	0 - 1	202	126	34	5	5	116
FORECAST	2 - 4	85	792	468	78	35	137
	5 - 9	6	135	472	222	60	199
	10 - 29	37	121	427	3072	253	998
	30 - 60	27	125	117	455	2167	1283
	61 - UNL	1252	2454	1666	281	2268	73722
COLUMN TOTALS:		1609	3753	3184	6703	4788	76455
BIASES:		.30	.43	.34	.73	.87	96492

PERCENT CORRECT: 83.35

HEIDKE SKILL SCORE: .4479

CHI-SQUARE: 4744.46

THREAT SCORE: .1931

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	0 - 1	64	26	6	0	1	106
FORECAST	2 - 4	81	623	258	72	13	203
	5 - 9	0	220	602	199	50	1179
	10 - 29	1	53	315	2757	244	1255
	30 - 60	1	52	73	462	1751	4438
	61 - UNL	57	246	323	1330	1581	3576
COLUMN TOTALS:		204	1220	1577	4820	3640	82304
BIASES:		1.00	.97	.80	.92	.98	96492

PERCENT CORRECT: 91.30

HEIDKE SKILL SCORE: .5898

CHI-SQUARE: 106.25

THREAT SCORE: .3946

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM FORECAST	0 - 1 2 - 4 5 - 9 10 - 29 30 - 60 61 - UNL	28 35 1 2 0 18	26 534 150 25 32 164	6 281 563 221 50 239	0 63 215 2542 265 1136	0 8 37 239 1388 1284	130 150 226 1262 1020 84152
COLUMN TOTALS:		84	931	1360	4221	2956	86940
BIASFS:		2.26	1.15	.88	1.02	.93	1.00

PERCENT CORRECT: 92.45

HEIDKE SKILL SCORE: .5910

CHI-SQUARE: 190.43

THREAT SCORE: .3769

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM FORECAST	0 - 1 2 - 4 5 - 9 10 - 29 30 - 60 61 - UNL	1 10 0 0 0 4	10 394 126 26 16 109	3 247 518 205 34 210	0 54 166 1884 276 980	0 2 20 204 990 1008	72 205 302 1221 1166 86029
COLUMN TOTALS:		15	681	1217	3360	2224	88995
BIASFS:		5.73	1.34	.93	1.05	1.12	.99

PERCENT CORRECT: 93.08

HEIDKE SKILL SCORE: .5494

CHI-SQUARE: 464.75

THREAT SCORE: .3245

VISIBILITY (MILES)

VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
GEM	0 - 31/64	205	50	126	75	28	72
	1/2 - 63/64	72	36	152	75	30	40
FORECAST	1 - 2 63/64	81	158	2267	1200	223	179
	3 - 4 63/64	30	38	1030	3121	1173	773
	5 - 6 63/64	41	30	229	1190	2577	2067
	7 - 100	61	54	208	608	2089	76104
COLUMN TOTALS:		490	366	4012	6269	6120	79235
BIASES:		1.14	1.11	1.02	.98	1.00	1.00

PERCENT CORRECT: 87.38

HEIDKE SKILL SCORE: .6013

CHI-SQUARE: 17.26

THRFAT SCORE: .2497

STATION PRESSURE (INCHES OF HG)

VERIFYING OBSERVATION

	0 - 29.236	29.530	29.677	29.678 - 29.825	29.826 - 29.973	29.974 - 30.120	30.121 - 30.268	30.269 - 30.563	30.564 - 35.000	ROW TOTALS
GEM	0 - 29.235	0	0	0	0	0	0	0	0	0
	29.236 - 29.530	0	1731	49	0	0	0	0	0	1780
FORECAST	29.531 - 29.677	0	44	3133	219	0	0	0	0	3396
	29.678 - 29.825	0	0	240	17151	724	0	0	0	18115
	29.826 - 29.973	0	0	0	662	39410	581	0	0	40653
	29.974 - 30.120	0	0	0	0	555	27918	155	0	28628
	30.121 - 30.268	0	0	0	0	0	185	3489	31	3705
	30.269 - 30.563	0	0	0	0	0	0	31	184	0
	30.564 - 35.000	0	0	0	0	0	0	0	0	215
COLUMN TOTALS:		0	1775	3422	18032	40689	28684	3675	215	0
BIASES:		99.99	1.00	.99	1.01	1.00	1.00	1.01	1.30	99.99

PERCENT CORRECT: 96.40

HEIDKE SKILL SCORE: .9482

CHI-SQUARE: .98

TEMPERATURE (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	-30 - 4	5 - 14	15 - 24	25 - 34	35 - 44	40 - 49	45 - 54	50 - 59	55 - 64	60 - 74	75 - 84	85 - 94	95 - 110	ROW TOTALS
	-30 - 4	0	0	0	0	0	0	0	0	0	0	0	0	0
	5 - 14	0	0	0	0	0	0	0	0	0	0	0	0	0
	15 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0
	25 - 34	0	0	0	0	0	0	0	0	0	0	0	0	0
	35 - 44	0	0	0	0	0	0	0	0	0	0	0	0	49
	45 - 54	0	0	0	0	0	0	0	0	0	0	0	0	57
	50 - 59	0	0	0	0	0	0	0	0	0	0	0	0	715
	60 - 64	0	0	0	0	0	0	0	0	0	0	0	0	2944
	65 - 74	0	0	0	0	0	0	0	0	0	0	0	0	4106
	75 - 84	0	0	0	0	0	0	0	0	0	0	0	0	8333
	85 - 94	0	0	0	0	0	0	0	0	0	0	0	0	15269
	95 - 110	0	0	0	0	0	0	0	0	0	0	0	0	31803
COLUMN TOTALS:	0	99.99	99.99	99.99	1.69	1.33	.91	1.04	1.00	1.01	1.00	.99	1.00	96492
BIASES:														

PERCENT CORRECT: 82.24

HEJDKE SKILL SCORE: .7722

CHI-SQUARE: 51.40

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DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	0 - 1	2 - 7	8 - 15	16 - 25	26 - 99	ROW TOTALS
	0 - 1	5656	2849	12	0	8517
	2 - 7	3499	30195	2708	2	36404
	8 - 15	2	2737	20588	2302	25629
	16 - 25	0	25	2298	16666	19812
	26 - 99	0	0	5	838	6130
COLUMN TOTALS:	9157	35806	25611	19808	6110	96492
BIASES:	.93	1.02	1.00	1.00	1.00	0

PERCENT CORRECT: 81.24%

HEJDKE SKILL SCORE: .7448

CHI-SQUARE: 54.80

		WIND SPEED (KT)						WIND DIRECTION (DEG)								
		VERIFYING OBSERVATION						VERIFYING OBSERVATION								
		0 - 1	2 - 9	10 - 19	20 - 29	30 - 99		00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359	ROW TOTALS
GFM	0 - 1	591	2727	5	0	0		4157	1218	388	168	125	189	508	1982	3323
FORECAST	2 - 9	2809	74445	4427	4	0		1053	2484	856	167	130	157	360	387	81685
	10 - 19	1	4421	6762	136	0		247	834	1580	865	489	234	317	243	11320
	20 - 29	0	2	140	22	0		113	145	578	6332	4219	556	490	218	164
	30 - 99	0	0	0	0	0		140	130	395	3803	14342	2155	1062	395	0
COLUMN TOTALS:		3401	81595	11334	162	0		224	140	136	324	612	2183	3597	2181	0
BIASFS:		.98	1.00	1.00	1.01	0.99		225	210	262	438	689	856	2460	11031	2931
PERCENT CORRECT:	84.79%							270	314	426	291	248	211	315	2770	7090
HEIDKE SKILL SCORE:	.4351							315	359	2275						13626
CHI-SQUARE:	1.93															96492

PERCENT CORRECT: 52.45%
 HEIDKE SKILL SCORE: .4380
 CHI-SQUARE: 15.23

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0009	.000 - .0009	ROW TOTALS
GEM FORECAST	.002 - .100 .001 - .0019 .000 - .0009	0 0 17	0 4 135	18 133 96185
COLUMN TOTALS:		17	139	96336
BIASES:	1.06		.99	1.00
PERCENT CORRECT:	99.69%			
HEIDKE SKILL SCORE:	.0244			
CHI-SQUARE:	.09			

PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GEM FORECAST	YES NO	0 0	0 96492
COLUMN TOTALS:		0	96492
BIASES:	99.99	1.00	

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

FROZEN PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GEM FORECAST	YES NO	0 0	0 96492
COLUMN TOTALS:		0	96492
BIASES:	99.99	1.00	

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

GFM VERSUS VERIFYING OBSERVATION AT 40 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL.	ROW TOTALS
GFM	0 - 1	241	297	85	17	14	183
	2 - 4	37	536	449	88	33	1283
FORECAST	5 - 9	10	138	446	234	54	1078
	10 - 29	28	143	423	2874	261	4773
	30 - 60	34	104	114	505	1981	4019
	61 - UNL.	1213	2419	1607	2841	2310	81897
COLUMN TOTALS:		1563	3637	3124	6559	4653	74351
BIASSES:		.54	.35	.35	.73	.86	1.10

PERCENT CORRECT: 82.64
 HEJDKE SKILL SCORE: .4260
 CHI-SQUARE: 4539.37
 THREAT SCORE: .1789

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL.	ROW TOTALS
GFM	0 - 1	52	37	10	0	2	100
	2 - 4	84	538	295	69	22	1167
FORECAST	5 - 9	0	213	559	231	48	1242
	10 - 29	4	76	314	2547	233	4341
	30 - 60	1	46	68	486	1584	1167
	61 - UNL.	54	249	310	1378	1652	79911
COLUMN TOTALS:		195	1159	1556	4711	3941	82725
BIASSES:		1.03	1.01	.80	.92	.96	1.01

PERCENT CORRECT: 90.74
 HEJDKE SKILL SCORE: .5627
 CHI-SQUARE: 108.11
 THREAT SCORE: .3536

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	0 - 1	17	29	7	0	1	130
	2 - 4	38	435	364	63	7	178
	5 - 9	2	171	489	218	37	225
FORECAST	10 - 29	2	39	246	2375	222	1333
	30 - 60	0	34	45	300	1202	969
	61 - UNL	21	169	244	1175	1406	81754
COLUMN TOTALS:		80	877	1335	4131	2875	84589
BIASES:		2.30	1.17	.86	1.02	.89	1.00

PERCENT CORRECT: 91.89

HEIDKE SKILL SCORE: .5579

CHI-SQUARE: 226.99

THREAT SCORE: .3151

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	0 - 1	1	10	3	0	0	67
	2 - 4	8	318	261	59	2	233
	5 - 9	0	132	464	186	29	310
FORECAST	10 - 29	0	34	215	1779	188	1274
	30 - 60	0	23	27	321	931	1202
	61 - UNL	4	127	209	938	1069	83523
COLUMN TOTALS:		13	644	1179	3283	2159	86609
BIASES:		6.23	1.37	.95	1.06	1.16	.99

PERCENT CORRECT: 92.68

HEIDKE SKILL SCORE: .5271

CHI-SQUARE: 521.32

THREAT SCORE: .2629

VISIBILITY (MILES)

VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2	63/64	3 - 4	63/64	5 - 6	63/64	7 - 100	ROW TOTALS
GFM	0 - 31/64	162	33	106	82	36	92	511		
	1/2 - 63/64	56	22	160	60	31	56	385		
	1 - 2 63/64	93	153	2008	1217	277	203	3951		
FORECAST	3 - 4 63/64	29	46	1056	2800	1121	895	5947		
	5 - 6 63/64	25	22	238	1226	2227	2141	5879		
	7 - 100	76	53	230	652	2218	73985	77214		
COLUMN TOTALS:		441	329	3798	6037	5910	77372	93887		
BIASES:		1.16	1.17	1.04	.99	1.00	1.00			

PERCENT CORRECT: 86.49
 HEIDKE SKILL SCORE: .5677
 CHI-SQUARE: 28.63
 THREAT SCORE: .1960

STATION PRESSURE (INCHES OF HG)

VERIFYING OBSERVATION

	0 -	29.236 -	29.531 -	29.678 -	29.826 -	29.973	29.974 -	30.121 -	30.269 -	30.564 -	ROW TOTALS
GFM	0 - 29.235	0	0	0	0	0	0	0	0	0	0
	29.236 - 29.530	0	1672	59	0	0	0	0	0	0	1731
	29.531 - 29.677	0	54	2966	265	0	0	0	0	0	3285
FORECAST	29.678 - 29.825	0	0	287	16515	858	0	0	0	0	17660
	29.826 - 29.973	0	0	0	758	38086	744	0	0	0	39588
	29.974 - 30.120	0	0	0	0	698	26902	203	0	0	27803
	30.121 - 30.268	0	0	0	0	0	236	3328	41	0	3605
	30.269 - 30.563	0	0	0	0	0	0	41	174	0	215
	30.564 - 35.000	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:		0	1726	3312	17538	39642	27882	3572	215	0	93887
BIASES:		99.99	1.00	.99	1.01	1.00	1.00	1.01	1.00	99.99	

PERCENT CORRECT: 95.48
 HEIDKE SKILL SCORE: .9350
 CHI-SQUARE: 1.69

TEMPERATURE (DEGREES FAHRENHEIT)

		VERIFYING OBSERVATION																		
		-30 -	5 -	15 -	25 -	35 -	40 -	45 -	49	54	55 -	60 -	65 -	75 -	85 -	94	110	95 -	ROW TOTALS	
-30 -	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5 -	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15 -	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25 -	34	0	0	0	0	19	7	13	0	0	0	0	0	0	0	0	0	39	39	
35 -	39	0	0	0	0	0	1	52	0	0	0	0	0	0	0	0	0	53	53	
GEM FORECAST	40 -	44	0	0	0	0	20	367	207	53	0	0	0	0	0	0	0	647	647	
45 -	49	0	0	0	0	0	0	310	1988	519	55	0	0	0	0	0	0	2872	2872	
50 -	54	0	0	0	0	0	5	495	2246	1030	87	0	0	0	0	0	0	3863	3863	
55 -	59	0	0	0	0	0	0	15	1010	5503	1507	53	0	0	0	0	0	8088	8088	
60 -	64	0	0	0	0	0	0	0	2	67	1350	10408	2935	0	0	0	0	0	14762	14762
65 -	74	0	0	0	0	0	0	0	0	0	55	2670	25297	2855	0	0	0	0	30877	30877
75 -	84	0	0	0	0	0	0	0	0	0	0	8	2950	20754	1309	0	0	0	25021	25021
85 -	94	0	0	0	0	0	0	0	0	0	0	0	0	12	1358	6276	19	0	7665	7665
95 -	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:		0	0	0	0	19	28	747	2707	3895	7993	14680	31247	24967	7585	19	93887			
BIASES:		99.99	99.99	99.99	2.05	1.89	.87	1.06	.99	1.01	1.01	.99	1.00	1.01	1.01	0.00				

PERCENT CORRECT: 77.60
 HEIDKE SKILL SCORE: .7123
 CHI-SQUARE: 93.01

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DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

		VERIFYING OBSERVATION											
		0 - 1	2 - 7	8 - 15	16 - 25	26 - 99							
GEM FORECAST	0 - 1	3867	2598	15	0	0	6480				36841		
	2 - 7	4877	28679	3281	4	0					25011		
	8 - 15	2	3229	19017	2762	1					19474		
	16 - 25	0	64	2748	15676	986					6081		
	26 - 99	0	0	20	999	5062							
COLUMN TOTALS:		8746	34570	25081	19441	6049					93887		
BIASES:		.74	1.07	1.00	1.00	1.01							

PERCENT CORRECT: 77.01%
 HEIDKE SKILL SCORE: .6854
 CHI-SQUARE: 736.71

WIND SPEED (KT)

VERIFYING OBSERVATION

	0 - 1	2 - 9	10 - 19	20 - 29	30 - 99	ROW TOTALS
GEM FORCAST	0 - 1	547	2608	0	0	3155
	2 - 9	2651	72262	4504	3	79420
	10 - 19	3	4482	6523	140	11148
	20 - 29	0	2	144	18	164
30 - 99	0	0	0	0	0	0
COLUMN TOTALS:	3201	79354	11171	161	99	93887
BIASES:	.99	1.00	1.00	1.02	99.99	

PERCENT CORRECT: 84.52%

HEIDKE SKILL SCORE: .4260

CHI-SQUARE: .82

WIND DIRECTION (DEG.)

VERIFYING OBSERVATION

	00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359	ROW TOTALS
GEM FORCAST	00 - 44	3817	1215	446	203	146	228	553	1931
	45 - 89	1021	2256	870	143	159	180	389	474
	90 - 134	268	862	1298	870	525	213	391	216
	135 - 179	156	133	558	5624	4206	658	579	295
180 - 224	163	181	406	3890	13552	2178	1095	435	21900
225 - 269	220	161	317	770	2159	2738	2132	363	8860
270 - 314	472	256	492	747	944	2774	10298	3005	18988
315 - 359	2294	450	315	268	240	349	2793	6547	13256
COLUMN TOTALS:	8411	5514	4702	12515	21931	9318	18230	13266	93887
BIASES:	1.02	1.00	.99	.98	1.00	.95	1.04	1.00	

PERCENT CORRECT: 49.13%

HEIDKE SKILL SCORE: .3984

CHI-SQUARE: 64.34

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0009	.000 - .0009	ROW TOTALS
GEM	.002 - .100	0	0	0
FORECAST	.001 - .0019	0	4	122
	.000 - .0009	17	130	93618
COLUMN TOTALS:		17	134	93736
BIASES:		0.00	,91	1.00
PERCENT CORRECT:	99.72%			
HEIDKE SKILL SCORE:	,0286			
CHI-SQUARE:	18.08			

PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GEM	0	0	0
FORECAST	0	93887	93887
COLUMN TOTALS:	0	93887	93887
BIASES:	99.99	1.00	

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

FROZEN PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GEM	0	0	0
FORECAST	0	93887	93887
COLUMN TOTALS:	0	93887	93887
BIASES:	99.99	1.00	

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

GEM VERSUS VERIFYING OBSERVATION AT 50 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GEM	0 - 1	226	290	126	24	33	254
	2 - 4	35	501	492	105	28	157
	5 - 9	12	109	328	255	48	184
FORECAST	10 - 29	45	154	449	2680	256	1084
	30 - 60	30	101	109	550	1823	1277
	61 - UNL	1182	2371	1573	2840	2319	69368
COLUMN TOTALS:		1530	3526	3077	6454	4507	91418
BIASES:		.62	.37	.30	.72	.86	1.10

PERCENT CORRECT: 81.96

HEIDKE SKILL SCORE: .4064

CHI-SQUARE: 4411.38

THREAT SCORE: .1676

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GEM	0 - 1	31	35	11	0	3	99
	2 - 4	90	454	315	82	26	185
	5 - 9	2	225	518	224	42	196
FORECAST	10 - 29	2	79	334	2411	232	180
	30 - 60	4	44	66	519	1437	1190
	61 - UNL	57	261	300	1412	1690	77662
COLUMN TOTALS:		186	1098	1544	4648	3430	80512
BIASES:		.96	1.05	.78	.91	.95	1.01

PERCENT CORRECT: 90.26

HEIDKE SKILL SCORE: .5403

CHI-SQUARE: 130.47

THREAT SCORE: .3042

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GEM FORECAST	0 - 1	5	15	6	0	2	52
	2 - 4	42	366	315	80	12	273
	5 - 9	2	184	459	205	35	227
	10 - 29	0	38	262	2254	230	1341
	30 - 60	2	30	58	335	1075	1006
	61 - UNL	23	187	221	1199	1433	79444
COLUMN TOTALS:	74	820	1321	4073	2787	82343	91418
BIASES:	1.08	1.33	.84	1.01	.90	1.00	

PERCENT CORRECT: 91.45

HEIDKE SKILL SCORE: .5352

CHI-SQUARE: 150.47

THREAT SCORE: .2619

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GEM FORECAST	0 - 1	1	1	1	0	1	12
	2 - 4	7	276	281	66	4	348
	5 - 9	0	132	424	181	23	298
	10 - 29	0	26	233	1651	202	1298
	30 - 60	1	19	32	370	833	1272
	61 - UNL	3	146	187	964	1040	81085
COLUMN TOTALS:	12	600	1158	3232	2103	84313	91418
BIASES:	1.33	1.64	.91	1.06	1.20	.99	

PERCENT CORRECT: 92.18

HEIDKE SKILL SCORE: .4994

CHI-SQUARE: 357.82

THREAT SCORE: .2151

VISIBILITY (MILES)
VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
GFM	0 - 31/64	114	32	101	88	25	134
	1/2 - 63/64	54	10	133	72	40	68
FORCAST	1 - 2 63/64	101	151	1834	1179	297	377
	3 - 4 63/64	35	44	1071	2496	1053	3826
	5 - 6 63/64	23	29	228	1224	1936	5730
	7 - 100	68	44	251	730	2366	5645
COLUMN TOTALS:		395	310	3618	5789	5717	75589
BIASES:		1.25	1.22	1.06	.99	.99	1.00
PERCENT CORRECT:	85.63						
HEIDKE SKILL SCORE:	.5348						
CHI-SQUARE:	53.54						
THRFAT SCORE:	.1537						

STATION PRESSURE (INCHES OF HG)

	0 - 29.236	29.530	29.677	29.678 -	29.826 -	29.974 -	30.121 -	30.269 -	30.563	30.564 -	ROW TOTALS
GFM	0 - 29.235	0	0	0	0	0	0	0	0	0	0
	29.236 - 29.530	0	1622	69	0	0	0	0	0	0	1691
FORCAST	29.531 - 29.677	0	64	2814	310	0	0	0	0	0	3188
	29.678 - 29.825	0	0	327	15925	961	0	0	0	0	17213
	29.826 - 29.973	0	0	0	817	36862	889	0	0	0	38568
	29.974 - 30.120	0	0	0	0	823	25972	243	0	0	27038
	30.121 - 30.268	0	0	0	0	0	286	3168	51	0	3505
	30.269 - 30.563	0	0	0	0	0	0	51	164	0	215
	30.564 - 35.000	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:		0	1686	3210	17052	38646	27147	3462	215	0	91418
BIASES:		99.99	1.00	.99	1.01	1.00	1.00	1.01	1.00	0	99.99
PERCENT CORRECT:	94.65										
HEIDKE SKILL SCORE:	.9231										
CHI-SQUARE:	2.81										

TEMPERATURE (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	-30 - 4	5 - 14	15 - 24	25 - 34	35 - 44	40 - 49	45 - 54	50 - 59	55 - 64	60 - 69	65 - 74	75 - 84	85 - 94	95 - 110	ROW TOTALS
GEM FORECAST	-30 - 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5 - 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25 - 34	0	0	0	0	0	0	0	0	0	0	0	0	0	29
	35 - 44	0	0	0	0	0	0	0	0	0	0	0	0	0	53
	45 - 54	0	0	0	0	0	0	0	0	0	0	0	0	0	586
	55 - 64	0	0	0	0	0	0	0	0	0	0	0	0	0	2798
	65 - 74	0	0	0	0	0	0	0	0	0	0	0	0	0	3643
	75 - 84	0	0	0	0	0	0	0	0	0	0	0	0	0	7866
	85 - 94	0	0	0	0	0	0	0	0	0	0	0	0	0	14300
	95 - 110	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:	0	99.99	99.99	99.99	3.22	2.79	.83	1.08	.98	1.02	1.01	.98	1.00	1.02	91418
BIASES:															

PERCENT CORRECT: 73.59
 HEIDKE SKILL SCORE: .6603
 CHI-SQUARE: 179.55

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	0 - 1	2 - 7	8 - 15	16 - 25	26 - 99	ROW TOTALS
GEM FORECAST	0 - 1	3244	2802	30	0	0
	2 - 7	5129	26865	3727	16	0
	8 - 15	18	3590	17600	3228	6
	16 - 25	0	132	3193	14678	1130
	26 - 99	0	0	40	1136	4854
COLUMN TOTALS:	8391	33389	24590	19058	5990	6030
BIASES:	.72	1.07	.99	1.00	1.01	91418

PERCENT CORRECT: 73.55%
 HEIDKE SKILL SCORE: .6383
 CHI-SQUARE: 805.26

		WIND SPEED (KT)										
		VERIFYING OBSERVATION									ROW TOTALS	
		0 - 1	2 - 9	10 - 19	20 - 29	30 - 99						
GEM	FORECAST	0 - 1	498	2521	5	0	0	0	0	0	3024	77285
2 - 9		2536	70103	4642	4	0	0	0	0	0	10947	162
10 - 19		5	4620	6184	138	0	0	0	0	0	0	0
20 - 29		0	1	142	19	0	0	0	0	0	0	0
30 - 99		0	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:		3039	77245	10973	161	0	99.99				91418	
BIASES:		1.00	1.00	1.00	1.00							
PERCENT CORRECT:		84.01%										
HEIDKE SKILL SCORE:		.4083										
CHI-SQUARE:		.16										
		WIND DIRECTION (DEG)										
		VERIFYING OBSERVATION									ROW TOTALS	
		00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359			
GEM	FORECAST	3608	1163	485	206	168	217	627	1930	8404	408	5395
45 - 89		986	2159	866	188	139	238	411	408	4377	251	
90 - 134		327	730	1136	777	543	219	394	581	11887	323	
135 - 179		172	217	495	5148	4249	702	2130	1111	21342	406	
180 - 224		200	200	448	3972	12875	2048	2415	2048	8380	379	
225 - 269		188	181	279	838	2052	2709	9810	2968	18746	6284	
270 - 314		622	271	495	792	1079	375	2719	2719	12887		
315 - 359		2150	484	335	273	267						
COLUMN TOTALS:		8253	5405	4539	12194	21372	9005	17701	12949	91418		
BIASES:		1.02	1.00	.96	.98	1.00	.93	1.06	1.00			
PERCENT CORRECT:		47.51%										
HEIDKE SKILL SCORE:		.3790										
CHI-SQUARE:		121.70										

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0009	.000 - .0009	ROW TOTALS
GEM	.002 - .100	0	0	0
FORECAST	.001 - .0019	0	82	91
	.000 - .0009	17	121	91327
COLUMN TOTALS:		17	130	91418
BIASES:		0.00	.70	1.00
PERCENT CORRECT:	99.76%			
HEIDKE SKILL SCORE:	.0745			
CHI-SQUARE:	28.73			

PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GFM	YES	0	1
FORECAST	NO	0	91417
			91418
COLUMN TOTALS:		99	91418
BIASES:	99.99	1.00	

PERCENT CORRECT: 100.00%

HEIDKE SKILL SCORE: 0.0000

CHI-SQUARE: 0.00

THREAT SCORE: 0.0000

FROZEN PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GFM	YES	0	0
FORECAST	NO	0	91418
			91418
COLUMN TOTALS:		99	91418
BIASES:	99.99	1.00	

PERCENT CORRECT: 100.00%

HEIDKE SKILL SCORE: *****

CHI-SQUARE: 0.00

THREAT SCORE: *****

GFM VERSUS VERIFYING OBSERVATION AT 60 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	202	251	135	25	46	275	934
FORECAST	38	490	528	129	31	150	1366
5 - 9	13	109	289	237	44	269	961
10 - 29	53	139	426	2536	251	1130	4535
30 - 60	35	106	131	574	1686	1257	3789
61 - UNL	1156	2329	1524	2820	2274	67356	77459
COLUMN TOTALS:	1497	3424	3033	6321	4332	70437	89044
BIASES:	.62	.40	.32	.72	.88	1.10	

PERCENT CORRECT: 81.49

HEIDKE SKILL SCORE: .3931

CHI-SQUARE: 4136.93

THREAT SCORE: .1572

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GFM	26	32	15	0	4	90	167
FORECAST	84	477	446	117	23	225	1372
5 - 9	1	132	374	215	50	181	953
10 - 29	2	77	323	2231	226	1264	4123
30 - 60	5	43	85	568	1326	1216	3243
61 - UNL	58	286	290	1435	1677	75440	79186
COLUMN TOTALS:	176	1047	1533	4566	3306	78416	89044
BIASES:	.95	1.31	.62	.90	.98	1.01	

PERCENT CORRECT: 89.70

HEIDKE SKILL SCORE: .5160

CHI-SQUARE: 372.52

THREAT SCORE: .2888

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GEM	0 - 1	1	13	8	0	3	52
FORECAST	2 - 4	42	294	340	104	17	299
	5 - 9	0	201	429	221	35	230
	10 - 29	0	34	262	2021	223	1309
	30 - 60	1	28	60	405	987	1090
	61 - UNL	28	208	207	1250	1431	7721
COLUMN TOTALS:		72	778	1306	4001	2696	80191
BIASES:		1.07	1.41	.86	.96	.95	89044

PERCENT CORRECT: 90.90

HEIDKE SKILL SCORE: .5066

CHI-SQUARE: 169.80

THREAT SCORE: .2092

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
GEM	0 - 1	1	2	3	0	0	31
FORECAST	2 - 4	6	222	303	82	6	351
	5 - 9	0	145	395	196	29	321
	10 - 29	0	24	228	1487	216	1349
	30 - 60	0	16	36	401	753	1296
	61 - UNL	5	159	173	1004	1049	78755
COLUMN TOTALS:		12	568	1138	3170	2053	82103
BIASES:		3.08	1.71	.95	1.04	1.22	.99

PERCENT CORRECT: 91.65

HEIDKE SKILL SCORE: .4703

CHI-SQUARE: 454.01

THREAT SCORE: .1704

VISIBILITY (MILES)
VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
GFM FORECAST	0 - 31/64 1/2 - 63/64 1 - 2 63/64 3 - 4 63/64 5 - 6 63/64 7 - 100	87 42 104 25 46 27 73	27 11 130 1705 1014 265 63	79 66 1142 2348 1205 279 754	74 340 983 1672 2401 69950	63 29 340 983 1672 2401 69950	149 88 296 1130 2223 73520
COLUMN TOTALS:	358	301	3472	5589	5488	73836	89044
BIASES:	1.34	1.22	1.07	.99	.99	1.00	

PERCENT CORRECT: 85.10
HEIDKE SKILL SCORE: .5130
CHI-SQUARE: 74.85
THREAT SCORE: .1249

STATION PRESSURE (INCHES OF HG)

	0 - 29.235	29.236 - 29.530	29.531 - 29.677	29.678 - 29.825	29.826 - 29.973	29.974 - 30.120	30.121 - 30.268	30.269 - 30.563	30.564 - 35.000	ROW TOTALS
GFM FORECAST	0 - 29.235 29.531 - 29.677 29.678 - 29.825 29.826 - 29.973 29.974 - 30.120 30.121 - 30.268 30.269 - 30.563 30.564 - 35.000	0 0 0 0 0 0 0 0	0 74 0 0 0 0 0 0	0 2653 377 0 0 0 0 0	0 361 1065 873 0 0 0 0	0 0 0 956 0 0 0 0	0 0 0 25060 334 0 0 0	0 0 0 1049 0 0 0 0	0 0 0 283 3030 61 154 0	0 0 0 0 0 0 0 0
COLUMN TOTALS:	0 99.99	1646 1.00	3109 .99	16595 1.01	37662 1.00	26443 1.00	3374 1.02	215 1.00	99.99	89044
BIASES:										

PERCENT CORRECT: 93.74
HEIDKE SKILL SCORE: .9100
CHI-SQUARE: 4.58

TEMPERATURE (DEGREES FAHRENHEIT)											
VERIFYING OBSERVATION											
	-30 -	5 -	15 -	25 -	35 -	40 -	45 -	50 -	55 -	60 -	65 -
	-4	14	24	34	39	44	49	54	59	64	74
GFM FORECAST	-30 - 4	0	0	0	0	0	0	0	0	0	0
	5 - 14	0	0	0	0	0	0	0	0	0	0
	15 - 24	0	0	0	0	0	0	0	0	0	0
	25 - 34	0	0	0	0	0	0	0	0	0	0
	35 - 44	0	0	0	0	0	0	0	0	0	0
	45 - 49	0	0	0	0	0	0	0	0	0	0
	50 - 54	0	0	0	0	0	0	0	0	0	0
	55 - 59	0	0	0	0	0	0	0	0	0	0
	60 - 64	0	0	0	0	0	0	0	0	0	0
	65 - 74	0	0	0	0	0	0	0	0	0	0
	75 - 84	0	0	0	0	0	0	0	0	0	0
	85 - 94	0	0	0	0	0	0	0	0	0	0
	95 - 110	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:	99.99	99.99	99.99	99.99	18	664	2463	3553	13654	29819	24099
BIASES:					2.94	.82	1.10	.98	1.02	1.02	.98
									1.00	1.00	1.02
									0.00	0.00	0.00
											89044

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)											
VERIFYING OBSERVATION											
	0 - 1	2 - 7	8 - 15	16 - 25	26 - 99						ROW TOTALS
	0 - 1	2917	3390	61	0	0	0	0	0	0	6368
GFM FORECAST	2 - 7	5072	24788	4120	40	0	0	0	0	0	34020
	8 - 15	29	3935	16295	3626	16	16	16	16	16	23901
	16 - 25	0	189	3555	13805	1228	1228	1228	1228	1228	18777
	26 - 99	0	0	70	1222	4686	4686	4686	4686	4686	5978
COLUMN TOTALS:		8018	32302	24101	18693	5930	5930	5930	5930	5930	89044
BIASES:		.79	1.05	.99	1.00	1.01	1.01	1.01	1.01	1.01	

PERCENT CORRECT: 70.23
 HEIDKE SKILL SCORE: .6166
 CHI-SQUARE: 160.19

PERCENT CORRECT: 70.18%
 HEIDKE SKILL SCORE: .5935
 CHI-SQUARE: 433.35

WIND SPEED (KT)

VERIFYING OBSERVATION

	0 - 1	2 - 9	10 - 19	20 - 29	30 - 99	ROW TOTALS
GEM FORECAST	0 - 1 2 - 9 10 - 19 20 - 29 30 - 99	424 2469 4 0 0	2466 67999 4731 0 0	1 4730 5911 150 0	0 6 141 12 0	0 0 0 0 0
COLUMN TOTALS: BIASES:		2897 1.00	75196 1.00	10792 1.00	159 1.02	99.00 89044

PERCENT CORRECT: 83.49%
 HEIDKE SKILL SCORE: .3910
 CHI-SQUARE: .07

WIND DIRECTION (DEG)

VERIFYING OBSERVATION

	00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359	ROW TOTALS	
GEM FORECAST	00 - 44 45 - 89 90 - 134 135 - 179 180 - 224 225 - 269 270 - 314 315 - 359	3278 1027 369 178 198 184 649 2137	1216 1999 668 303 206 178 282 493	495 843 959 461 510 330 460 304	230 216 761 4753 4013 802 828 275	177 127 534 4206 12315 1958 1235 275	246 216 245 760 2109 2153 2626 374	712 423 371 657 1052 1950 2689 2689	1883 431 247 353 431 353 3014 1.07	8237 5282 4154 11671 20834 7908 18456 .99
COLUMN TOTALS: BIASES:		8020 1.03	5345 .99	4362 1.03	11878 .98	20827 1.00	8729 .91	17216 1.07	12667 .99	

PERCENT CORRECT: 45.79%
 HEIDKE SKILL SCORE: .3584
 CHI-SQUARE: 188.82

PRECIPITATION AMOUNT (INCHPS)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0019	.000 - .0009	ROW TOTALS
GEM	.002 - .100	0	0	0
FORECAST	.001 - .0019	0	0	30
	.000 - .0009	17	129	88868
COLUMN TOTALS:				89014
BIASES:				
PERCENT CORRECT:	99.80%			
HEIDKE SKILL SCORE:	-.0033			
CHI-SQUARE:	93.13			

PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GEM	YES	0	3
FORECAST	NO	0	89041
COLUMN TOTALS:			89044
BIASES:			
PERCENT CORRECT:	100.00%		
HEIDKE SKILL SCORE:	0.0000		
CHI-SQUARE:	0.00		
THREAT SCORE:	0.0000		

FROZEN PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
GEM	YES	0	0
FORECAST	NO	0	89044
COLUMN TOTALS:			89044
BIASES:			
PERCENT CORRECT:	100.00%		
HEIDKE SKILL SCORE:	*****		
CHI-SQUARE:	0.00		
THREAT SCORE:	*****		

Persistence Results

PERSISTENCE VERSUS VERIFYING OBSERVATION AT 10 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	223	118	33	48	31	1234
	2 - 4	139	1121	338	158	97	2184
FORECAST	5 - 9	37	307	983	400	87	1485
	10 - 29	39	176	359	3969	339	3299
	30 - 60	42	103	70	359	2924	7121
	61 - UNL	1215	2199	1519	2139	1654	5158
COLUMN TOTALS:		1695	4024	3302	7073	5132	81086
BIASES:		1.00	1.00	1.00	1.01	1.01	1.00
							102312

PERCENT CORRECT: 79.66
 HEIDKE SKILL SCORE: .4386
 CHI-SQUARE: .61
 THREAT SCORE: .1627

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	75	47	0	0	0	90
	2 - 4	67	846	236	38	13	140
FORECAST	5 - 9	3	204	838	263	47	274
	10 - 29	0	47	234	3525	238	1093
	30 - 60	4	30	35	261	2408	1173
	61 - UNL	65	157	272	1018	1188	87383
COLUMN TOTALS:		214	1331	1615	5105	3894	90153
BIASES:		.99	1.01	1.01	1.01	1.00	1.00
							102312

PERCENT CORRECT: 92.93
 HEIDKE SKILL SCORE: .6782
 CHI-SQUARE: .53
 THREAT SCORE: .5019

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	11	30	0	0	0	49	90
2 - 4	42	673	195	26	8	93	1037
PERSISTENCE	5 - 9	1	182	782	211	21	209
FORECAST	10 - 29	0	29	186	3076	222	974
30 - 60	2	18	28	213	1877	1024	3162
61 - UNL	34	94	206	943	1017	89836	92130
COLUMN TOTALS:		90	1026	1397	4469	3145	92185
BIASES:		1.00	1.01	1.01	1.01	1.01	1.00

PERCENT CORRECT: 94.08

HEIDKE SKILL SCORE: .6808

CHI-SQUARE: .37

THREAT SCORE: .5084

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	0	4	0	0	0	12	16
2 - 4	10	468	160	16	3	105	762
PERSISTENCE	5 - 9	0	168	706	147	8	243
FORECAST	10 - 29	0	13	138	2303	193	938
30 - 60	0	10	18	163	1281	908	2380
61 - UNL	6	95	237	930	885	92144	94297
COLUMN TOTALS:		16	758	1259	3559	2370	94350
BIASES:		1.00	1.01	1.01	1.00	1.00	1.00

PERCENT CORRECT: 94.71

HEIDKE SKILL SCORE: .6430

CHI-SQUARE: .42

THREAT SCORE: .4505

VISIBILITY (MILES)

VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
0 - 31/64	345	89	109	65	35	40	683
1/2 - 63/64	94	127	167	75	21	39	523
PERSISTENCE	95	186	2963	1047	166	117	4574
FORECAST	63	67	981	4040	1147	449	6747
3 - 4 63/64	37	28	186	1142	3449	1738	6580
5 - 6 63/64	39	25	137	396	1788	80820	83205
7 - 100							
COLUMN TOTALS:	673	522	4543	6765	6606	83203	102312
BIASES:	1.02	1.00	1.01	1.00	1.00	1.00	

PERCENT CORRECT: 89.67
 HEIDKE SKILL SCORE: .6852
 CHI-SQUARE: .51
 THREAT SCORE: .3751

STATION PRESSURE (INCHES OF HG)

VERIFYING OBSERVATION

	0 - 29.236	29.531	29.678	29.826	29.974	30.121	30.268	30.563	30.564 - 35.000	ROW TOTALS
0 - 29.235	29.530	29.677	29.825	29.973	30.120	30.268	30.563	30.564 - 35.000		
29.236 - 29.530	0	0	0	0	0	0	0	0	0	0
29.531 - 29.677	0	1860	22	0	0	0	0	0	0	1882
PERSISTENCE	0	22	3499	114	0	0	0	0	0	3635
29.678 - 29.825	0	0	114	18558	412	0	0	0	0	19084
FORECAST	0	0	0	389	42318	280	0	0	0	42987
29.826 - 29.973	0	0	0	0	282	30240	57	0	0	30579
29.974 - 30.120	0	0	0	0	0	73	3846	11	0	3930
30.121 - 30.268	0	0	0	0	0	0	11	204	0	215
30.269 - 30.563	0	0	0	0	0	0	0	0	0	0
30.564 - 35.000	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:	0	1882	3635	19061	43012	30593	3914	215	0	102312
BIASES:	99.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	99.99	

PERCENT CORRECT: 98.25
 HEIDKE SKILL SCORE: .9749
 CHI-SQUARE: .11

TEMPERATURE (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	-30 - 4	5 - 14	15 - 24	25 - 34	35 - 44	40 - 49	45 - 54	50 - 59	55 - 64	60 - 74	65 - 74	75 - 84	85 - 94	95 - 110	ROW TOTALS
PERSISTENCE FORECAST	30 - 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5 - 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25 - 34	0	0	0	0	0	0	0	0	0	0	0	0	0	69
	35 - 39	0	0	0	0	2	60	24	0	0	0	0	0	0	86
	40 - 44	0	0	0	0	0	13	674	162	0	0	0	0	0	849
	45 - 49	0	0	0	0	0	0	170	2684	312	0	0	0	0	3166
	50 - 54	0	0	0	0	0	0	0	296	3799	574	0	0	0	4669
	55 - 59	0	0	0	0	0	0	0	554	7663	773	0	0	0	8990
	60 - 64	0	0	0	0	0	0	0	7	744	14230	1394	0	0	16375
	65 - 74	0	0	0	0	0	0	0	0	3	1340	31245	1176	0	0
	75 - 84	0	0	0	0	0	0	0	0	0	0	1181	24358	711	0
	85 - 94	0	0	0	0	0	0	0	0	0	0	2	706	7352	15
	95 - 110	0	0	0	0	0	0	0	0	0	0	0	0	15	4
COLUMN TOTALS:	99.99	99.99	99.99	99.99	1.13	1.04	.83	.868	3142	4672	8984	16343	33822	26240	8078
BIASES:									1.00	1.00	1.00	1.00	1.00	1.00	1.00

PERCENT CORRECT: 90.05
 HEIDKE SKILL SCORE: .8728
 CHI-SQUARE: 1.93

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	0 - 1	2 - 7	8 - 15	16 - 25	26 - 99	ROW TOTALS
PERSISTENCE FORECAST	0 - 1	7211	2813	0	0	10024
	2 - 7	2825	34155	1687	0	38667
	8 - 15	0	1728	23654	1416	26798
	16 - 25	0	1	1416	18641	512
	26 - 99	0	0	0	526	5727
COLUMN TOTALS:	10036	38697	26757	20583	6239	102312
BIASES:	1.00	1.00	1.00	1.00	1.00	

PERCENT CORRECT: 87.37%
 HEIDKE SKILL SCORE: .8281
 CHI-SQUARE: .14

WIND SPEED (KT)
VERIFYING OBSERVATION

		0 - 1	2 - 9	10 - 19	20 - 29	30 - 99		ROW TOTALS
PERSISTENCE FORECAST	0 - 1	1013	2766	1	0	0		3780
	2 - 9	2835	79953	3927	2	0		86717
	10 - 19	0	3933	7577	138	0		11648
	20 - 29	0	2	139	26	0		167
COLUMN TOTALS: BIASES:	30 - 99	0	0	0	0	0		0
		3848	86654	11644	166	0		102312
PERCENT CORRECT: 86.57%								
HEIDKE SKILL SCORE: .4984								
CHI-SQUARE: 1.25								

WIND DIRECTION (DEG)
VERIFYING OBSERVATION

		00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359		ROW TOTALS
PERSISTENCE FORECAST	00 - 44	5407	1115	202	85	53	68	324	1894		9148
	45 - 89	943	3426	847	123	50	81	190	309		5969
	90 - 134	187	816	2614	889	260	150	170	123		5209
	135 - 179	71	52	660	8458	3527	308	288	130		13494
COLUMN TOTALS: BIASES:	180 - 224	76	80	287	3176	17481	1876	616	200		23792
	225 - 269	88	74	229	377	1852	5465	2158	218		10461
	270 - 314	262	161	177	297	533	2172	13671	2673		19946
	315 - 359	2089	256	209	160	127	234	2512	8706		14293
PERCENT CORRECT: 63.75%											
HEIDKE SKILL SCORE: .5718											
CHI-SQUARE: 2.09											

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .009	.000 - .009	ROW TOTALS
PERSISTENCE	.002 - .100	0	1	18
FORECAST	.001 - .0019	0	7	142
	.000 - .009	17	138	101997
COLUMN TOTALS:		17	146	102149
BIASES:		1.06	.97	1.00
PERCENT CORRECT:	99.70%			
HEIDKE SKILL SCORE:	.0451			
CHI-SQUARE:	.17			

PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE	YES	0	0
FORECAST	NO	0	102312
			102312
COLUMN TOTALS:		0	102312
BIASES:		99.99	1.00

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: 1.0000
 CHI-SQUARE: 0.00
 THRFAT SCORE: *****

FROZEN PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE	YES	0	0
FORECAST	NO	0	102312
			102312
COLUMN TOTALS:		0	102312
BIASES:		99.99	1.00

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: 1.0000
 CHI-SQUARE: 0.00
 THRFAT SCORE: *****

PERSISTENCE VERSUS VERIFYING OBSERVATION AT 20 MINUTE INTERVALS

		LOWEST CLOUD HIT (00')				VERIFYING OBSERVATION					
		0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL				
PERSISTENCE	0 - 1	211	124	32	48	28	1196				1639
	2 - 4	149	1002	368	166	103	2142				3930
	5 - 9	44	287	895	412	92	1502				3232
FORECAST	10 - 29	51	166	394	3614	369	2359				6953
	30 - 60	44	111	75	379	2583	1799				4991
	61 - UNL	1148	2193	1476	2259	1773	69704				78553
COLUMN TOTALS:		1647	3883	3240	6878	4948	78702				99298
BIASES:		1.00	1.01	1.00	1.01	1.01	1.00				

PERCENT CORRECT: 78.56

HEIDKE SKILL SCORE: .4090

CHI-SQUARE: 2.10

THREAT SCORE: .1546

		SECOND CLOUD HIT (00')				VERIFYING OBSERVATION					
		0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL				
PERSISTENCE	0 - 1	58	44	1	0	0	105				208
	2 - 4	81	738	263	55	16	157				1310
	5 - 9	2	216	769	266	56	301				1610
FORECAST	10 - 29	1	45	233	3176	257	1314				5026
	30 - 60	2	43	44	285	2101	1324				3799
	61 - UNL	63	188	291	1171	1324	84308				87345
COLUMN TOTALS:		207	1274	1601	4953	3754	87509				99298
BIASES:		1.01	1.03	1.01	1.02	1.01	1.00				

PERCENT CORRECT: 91.79

HEIDKE SKILL SCORE: .6277

CHI-SQUARE: 3.00

THREAT SCORE: .4432

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	5	28	0	0	0	56	89
2 - 4	47	573	219	29	10	134	1012
PERSISTENCE	5 - 9	2	189	715	224	25	1394
FORECAST	10 - 29	0	19	181	2776	230	4394
30 - 60	2	35	34	243	1631	1129	3074
61 - UNL	29	132	235	1069	1147	86723	89335
COLUMN TOTALS:	85	976	1384	4341	3043	89469	99298
BIASES:	1.05	1.04	1.01	1.01	1.01	1.00	

PERCENT CORRECT: 93.08

HEIDKE SKILL SCORE: .6282

CHI-SQUARE: 2.75

THREAT SCORE: .4547

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	0	1	0	0	0	15	16
2 - 4	10	405	169	18	3	137	742
PERSISTENCE	5 - 9	0	171	651	153	12	1258
FORECAST	10 - 29	0	8	144	2064	202	3507
30 - 60	0	19	17	199	1082	992	2309
61 - UNL	5	117	256	1021	994	89073	91466
COLUMN TOTALS:	15	721	1237	3455	2293	91577	99298
BIASES:	1.07	1.03	1.02	1.02	1.01	1.00	

PERCENT CORRECT: 93.93

HEIDKE SKILL SCORE: .5916

CHI-SQUARE: 2.06

THREAT SCORE: .3859

VISIBILITY (MILES)

VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
0 - 31/64	261	71	118	79	29	53	611
1/2 - 63/64	86	75	159	75	19	36	450
PERSISTENCE	86	168	2566	1126	208	160	4314
FORECAST	63	49	1022	3501	1167	642	6444
5 - 6 63/64	32	24	233	1205	2935	1922	6351
7 - 100	33	37	167	537	1994	78360	81128
COLUMN TOTALS:	561	424	4265	6523	6352	81173	99298
BIASES:	1.09	1.06	1.01	.99	1.00	1.00	

PERCENT CORRECT: 88.32

HEIDKE SKILL SCORE: .6370

CHI-SQUARE: 7.60

THREAT SCORE: .3175

STATION PRESSURE (INCHES OF HG)

VERIFYING OBSERVATION

	0 - 29.236	29.530	29.531 - 29.677	29.678 - 29.825	29.826 - 29.973	29.974 - 30.120	30.121 - 30.268	30.269 - 30.563	30.564 - 35.000	ROW TOTALS
0 - 29.235	29.235	0	0	0	0	0	0	0	0	0
29.236 - 29.530	0	0	1792	38	0	0	0	0	0	1830
29.531 - 29.677	0	34	3316	165	0	0	0	0	0	3515
PERSISTENCE	0	0	175	17825	577	0	0	0	0	18577
FORECAST	0	0	0	539	40810	434	0	0	0	41783
29.826 - 29.973	0	0	0	0	427	29034	105	0	0	29566
29.974 - 30.120	0	0	0	0	0	131	3660	21	0	3812
30.121 - 30.268	0	0	0	0	0	0	21	194	0	215
30.269 - 30.563	0	0	0	0	0	0	0	0	0	0
30.564 - 35.000	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:	0	1826	3529	18529	41814	29599	3786	215	0	99298
BIASES:	99.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	99.99	

PERCENT CORRECT: 97.31

HEIDKE SKILL SCORE: .9614

CHI-SQUARE: .43

TEMPERATURE (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	-30 - 4	5 - 14	15 - 24	25 - 34	35 - 44	40 - 49	45 - 54	50 - 59	55 - 64	60 - 69	65 - 74	75 - 84	85 - 94	95 - 110	ROW TOTALS
PERSISTENCE FORECAST	-30 - 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5 - 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25 - 34	0	0	0	0	0	0	0	0	0	0	0	0	0	59
	35 - 39	0	0	0	0	0	31	36	0	0	0	0	0	0	67
	40 - 44	0	0	0	0	0	12	576	194	0	0	0	0	0	782
	45 - 49	0	0	0	0	0	0	217	2416	401	0	0	0	0	3034
	50 - 54	0	0	0	0	0	0	0	363	3279	730	1	0	0	4373
	55 - 59	0	0	0	0	0	0	0	4	677	6954	1000	0	0	8635
	60 - 64	0	0	0	0	0	0	0	20	897	13083	1802	0	0	15802
	65 - 74	0	0	0	0	0	0	0	0	15	1675	29379	1710	0	32779
	75 - 84	0	0	0	0	0	0	0	0	0	1	1727	23253	850	0
	85 - 94	0	0	0	0	0	0	0	0	0	0	4	851	7044	18
	95 - 110	0	0	0	0	0	0	0	0	0	0	0	0	1	19
COLUMN TOTALS:	99.99	99.99	99.99	99.99	41	61	829	2977	4377	8596	15760	32912	25814	7912	19
BIASES:					1.44	1.10	.94	1.02	1.00	1.01	1.00	1.00	1.00	1.00	99298

PERCENT CORRECT: 86.67

HEJDKE SKILL SCORE: .8292

CHI-SQUARE: 13.09

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	0 - 1	2 - 7	8 - 15	16 - 25	26 - 99	ROW TOTALS
PERSISTENCE FORECAST	0 - 1	6903	2756	2	0	9661
	2 - 7	2709	32172	2153	2	37036
	8 - 15	0	2199	22225	1814	26238
	16 - 25	0	13	1805	17707	20175
	26 - 99	0	0	1	660	6188
COLUMN TOTALS:	9612	37140	26186	20183	6177	99298
BIASES:	1.01	1.00	1.00	1.00	1.00	

PERCENT CORRECT: 85.13%

HEJDKE SKILL SCORE: .7980

CHI-SQUARE: .67

		WIND SPEED (KT)						WIND DIRECTION (DEG)									
		VERIFYING OBSERVATION						VERIFYING OBSERVATION									
		0 - 1	2 - 9	10 - 19	20 - 29	30 - 99		00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359	ROW TOTALS	
PERSISTENCE	0 - 1	735	2806	4	0	0		4693	1197	305	138	98	137	459	1911	8938	
	2 - 9	2853	76929	4311	2	0		1019	2855	851	122	99	116	318	393	5773	
FORECAST	10 - 19	1	4322	7033	136	0		90 - 134	203	822	1962	889	405	222	281	211	4995
	20 - 29	0	2	138	26	0		135 - 179	118	96	603	7211	4044	461	400	164	13097
	30 - 99	0	0	0	0	0		180 - 224	130	114	366	3550	15566	2104	916	309	23055
COLUMN TOTALS:		3589	84059	11486	164	0		225 - 269	122	336	517	2018	4412	2268	337	10135	
BIASES:		.99	1.00	1.00	1.01	99.99		270 - 314	352	224	312	562	779	2263	11949	2912	19353
								315 - 359	2226	374	293	252	185	298	2664	7660	13952
								COLUMN TOTALS:	8863	5807	5028	13241	23194	10013	19255	13897	99298
								BIASES:	1.01	.99	.99	.99	1.01	1.01	1.00		

PERCENT CORRECT: 56.71%
 HEIDKE SKILL SCORE: .4885
 CHI-SQUARE: 5.65

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0009	.000 - .0009	ROW TOTALS
PERSISTENCE	.002 - .100	0	0	18
FORECAST	.001 - .0019	0	3	138
	.000 - .0009	17	140	98982
COLUMN TOTALS:				99139
BIASES:				99298
PERCENT CORRECT:	99.68%			
HEIDKE SKILL SCORE:	.0174			
CHI-SQUARE:	.09			

PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE	YES	0	0
FORECAST	NO	0	99298
COLUMN TOTALS:			99298
BIASES:			99298

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

FROZEN PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE	YES	0	0
FORECAST	NO	0	99298
COLUMN TOTALS:			99298
BIASES:			99298

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

PERSISTENCE VERSUS VERIFYING OBSERVATION AT 30 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	204 145	107 905	44 381	48 189	33 105	1165 2107
FORECAST	2 - 4	32	306	787	428	105	1520
	5 - 9						1601 3832 3178
	10 - 29						
	30 - 60						
	61 - UNL						
COLUMN TOTALS:		1609	3753	3184	6703	4788	76455
BIASES:		1.00	1.02	1.00	1.02	1.01	1.00

PERCENT CORRECT: 77.62

HEJDKE SKILL SCORE: .3844

CHI-SQUARE: 4.16

THREAT SCORE: .1443

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	64 81	26 651	6 274	0 78	1 14	106 181
FORECAST	2 - 4	0	220	672	287	73	1279 1599
	5 - 9						
	10 - 29						
	30 - 60						
	61 - UNL						
COLUMN TOTALS:		204	1220	1577	4820	3640	85031
BIASES:		1.00	1.05	1.01	1.02	1.01	1.00

PERCENT CORRECT: 91.04

HEJDKE SKILL SCORE: .5944

CHI-SQUARE: 5.76

THREAT SCORE: .3944

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	5	13	4	0	66	88
	2 - 4	49	498	224	50	161	988
	5 - 9	0	196	632	248	46	1381
FORECAST	10 - 29	2	26	211	2546	234	4299
	30 - 60	0	30	46	238	1502	2970
	61 - UNL	28	168	243	1139	1168	86766
COLUMN TOTALS:		84	931	1360	4221	2956	86940
BIASES:		1.05	1.06	1.02	1.02	1.01	1.00

PERCENT CORRECT: .92.45

HEIDKE SKILL SCORE: .5952

CHI-SQUARE: 5.86

THREAT SCORE: .3702

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	0	1	0	0	0	15
	2 - 4	11	340	158	30	2	16
	5 - 9	0	164	585	179	17	724
FORECAST	10 - 29	0	15	165	1872	193	1244
	30 - 60	0	16	27	186	989	3426
	61 - UNL	4	145	282	1093	1023	2232
COLUMN TOTALS:		15	681	1217	3360	2224	8895
BIASES:		1.07	1.06	1.02	1.02	1.00	1.00

PERCENT CORRECT: .93.36

HEIDKE SKILL SCORE: .5539

CHI-SQUARE: 4.94

THREAT SCORE: .3247

VISIBILITY (MILES)

VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2	63/64	3 - 4	63/64	5 - 6	63/64	7 - 100	ROW TOTALS
PERSISTENCE	0 - 31/64	205	50	126	75	28	72	556		
	1/2 - 63/64	72	36	152	75	30	40	405		
FORECAST	1 - 2	81	158	2267	1209	224	183	4122		
	3 - 4	30	38	1030	3112	1172	769	6151		
	5 - 6	41	30	229	1190	2577	2067	6134		
	7 - 100	61	54	208	608	2089	76104	79124		
COLUMN TOTALS:		490	366	4012	6269	6120	79235	96492		
BIASES:		1.14	1.11	1.03	.98	1.00				

PERCENT CORRECT: 87.37
 HEIDKE SKILL SCORE: .6010
 CHI-SQUARE: 18.47
 THREAT SCORE: .2497

STATION PRESSURE (INCHES OF HG)

	0 - 29.235	29.236 - 29.530	29.531 - 29.677	29.678 - 29.825	29.826 - 29.973	29.974 - 30.120	30.121 - 30.268	30.269 - 30.563	30.564 - 35.000	ROW TOTALS
PERSISTENCE	0 - 29.235	0	0	0	0	0	0	0	0	0
	29.236 - 29.530	0	1731	49	0	0	0	0	0	1780
FORECAST	29.531 - 29.677	0	44	3133	219	0	0	0	0	3396
	29.678 - 29.825	0	0	240	17151	724	0	0	0	18115
	29.826 - 29.973	0	0	0	662	39410	581	0	0	40653
	29.974 - 30.120	0	0	0	0	555	27918	155	0	28628
	30.121 - 30.268	0	0	0	0	0	185	3489	31	3705
	30.269 - 30.563	0	0	0	0	0	0	31	184	215
	30.564 - 35.000	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:		0	1775	3422	18032	40689	28684	3675	215	0
BIASES:		99.99	1.00	.99	1.01	1.00	1.00	1.00	99.99	96492

PERCENT CORRECT: 96.40
 HEIDKE SKILL SCORE: .9482
 CHI-SQUARE: .98

TEMPERATURE (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	-30 -	5 -	15 -	25 -	35 -	40 -	45 -	50 -	55 -	60 -	65 -	75 -	84	85 -	94	95 -	110	ROW TOTALS
-30 - 4	4	14	24	34	39	44	49	54	59	64	65 -	74	84	85 -	94	95 -	110	0
-30 - 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 - 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 - 34	0	0	0	0	29	17	3	0	0	0	0	0	0	0	0	0	0	49
35 - 39	0	0	0	0	0	9	48	0	0	0	0	0	0	0	0	0	0	57
PERSISTENCE	40 - 44	0	0	0	0	17	475	204	19	0	0	0	0	0	0	0	0	715
FORCAST	45 - 49	0	0	0	0	0	259	2208	467	10	0	0	0	0	0	0	0	2944
50 - 54	0	0	0	0	0	0	4	420	2757	911	14	0	0	0	0	0	4106	
55 - 59	0	0	0	0	0	0	0	2	847	6194	1279	11	0	0	0	0	8333	
60 - 64	0	0	0	0	0	0	0	0	37	1114	11729	2389	0	0	0	0	15269	
65 - 74	0	0	0	0	0	0	0	0	0	37	2163	27298	2285	0	0	0	0	31803
75 - 84	0	0	0	0	0	0	0	0	0	0	2	2331	22006	1091	0	0	0	25430
85 - 94	0	0	0	0	0	0	0	0	0	0	0	0	5	1110	6633	19	0	7767
95 - 110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	19
COLUMN TOTALS:	0	0	0	0	29	43	789	2834	4127	8266	15207	32034	25401	7743	19	1.00	1.00	96492
BIASES:	99.99	99.99	99.99	1.69	1.33	.91	1.04	1.00	1.01	1.00	.99	1.00	.99	1.00	1.00	1.00	1.00	

PERCENT CORRECT: 82.22

HEIDKE SKILL SCORE: .7720

CHI-SQUARE: 32.24

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	0 - 1	2 - 7	8 - 15	16 - 25	26 - 99		ROW TOTALS
0 - 1	5910	3385	13	0	0		9308
2 - 7	3245	29659	2707	2	0		35613
8 - 15	2	2737	20588	2302	0		25629
16 - 25	0	25	2298	16666	823		19812
26 - 99	0	0	5	838	5287		6130
COLUMN TOTALS:	9157	35806	25611	19808	6110		96492
BIASES:	1.02	1.00	1.00	1.00	1.00		

PERCENT CORRECT: 80.95%

HEIDKE SKILL SCORE: .7416

CHI-SQUARE: 3.61

		WIND SPEED (KT)						WIND DIRECTION (DEG)								
		VERIFYING OBSERVATION						VERIFYING OBSERVATION								
		0 - 1	2 - 9	10 - 19	20 - 29	30 - 99		00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359	ROW TOTALS
PERSISTENCE	0 - 1	591	2728	5	0	0		4157	1218	386	168	125	189	508	1982	3324
	2 - 9	2809	7443	4427	4	0		2684	858	167	130	157	360	387	81683	81683
	10 - 19	1	4422	6762	136	0		834	1580	865	489	234	317	243	11321	11321
	20 - 29	0	0	2	140	22		141	575	6358	4231	557	490	218	164	164
FORECAST	30 - 99	0	0	0	0	0		130	395	3777	14328	2154	1062	395	0	0
	COLUMN TOTALS:	3401	81595	11334	162	0		210	136	325	612	2202	3710	2269	339	96492
	BIASES:	.98	1.00	1.00	1.01	0.99		210	439	689	839	2347	10943	2931	18856	18856
	PERCENT CORRECT:	84.79%						2275	430	292	248	211	315	2770	7090	13631
		HEIDKE SKILL SCORE:	.4350					2275	430	292	248	211	315	2770	7090	13631
		CHI-SQUARE:	1.88					8601	5635	4850	12884	22555	9663	18719	13585	96492
									.99	.98	.99	1.01	1.01	1.00		
		PERCENT CORRECT:	52.49%													
		HEIDKE SKILL SCORE:	.4386													
		CHI-SQUARE:	10.31													

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0009	.000 - .0009	ROW TOTALS
PERSISTENCE	.002 - .100	0	0	18
FORECAST	.001 - .0019	0	4	133
	.000 - .0009	17	135	96185
COLUMN TOTALS:		17	139	96336
BIASES:		.99	1.00	96492
PERCENT CORRECT:	99.69%			
HEIDKE SKILL SCORE:	.0244			
CHI-SQUARE:	.09			

PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE	YES	0	0
FORECAST	NO	0	96492
			96492
COLUMN TOTALS:		0	96492
BIASES:		99.99	1.00

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

FROZEN PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE	YES	0	0
FORECAST	NO	0	96492
			96492
COLUMN TOTALS:		0	96492
BIASES:		99.99	1.00

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

PERSISTENCE VERSUS VERIFYING OBSERVATION AT 40 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	176	104	46	52	36	1151
	2 - 4	156	782	424	191	120	2068
FORECAST	5 - 9	33	324	734	464	95	1480
	10 - 29	59	173	424	3085	378	2523
	30 - 60	35	112	94	412	2141	1854
	61 - UNL	1104	2142	1402	2355	1883	65275
COLUMN TOTALS:		1563	3637	3124	6559	4653	74351
BIASES:		1.00	1.03	1.00	1.01	1.00	1.00

PERCENT CORRECT: 76.89

HEIDIKE SKILL SCORE: .3654

CHI-SQUARE: 4.53

THREAT SCORE: .1311

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	52	34	9	0	2	100
	2 - 4	84	541	319	67	23	210
FORECAST	5 - 9	0	244	616	316	65	345
	10 - 29	4	60	278	2713	263	1472
	30 - 60	1	39	46	326	1752	1383
	61 - UNL	54	241	288	1289	1436	79215
COLUMN TOTALS:		195	1159	1556	4711	3541	82725
BIASES:		1.01	1.07	1.02	1.02	1.00	1.00

PERCENT CORRECT: 90.42

HEIDIKE SKILL SCORE: .5665

CHI-SQUARE: 8.66

THREAT SCORE: .3412

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	6	14	3	0	0	62	85
2 - 4	44	399	255	48	9	203	958
PERSISTENCE	5 - 9	0	215	567	282	41	1371
FORECAST	10 - 29	2	38	220	2368	219	4194
30 - 60	0	32	39	255	1379	1157	2862
61 - UNL	28	179	251	1178	1227	81554	84417
COLUMN TOTALS:		80	877	1335	4131	2875	84589
BIASES:		1.06	1.09	1.03	1.02	1.00	1.00

PERCENT CORRECT: 91.89

HEIDKE SKILL SCORE: .5656

CHI-SQUARE: 10.13

THREAT SCORE: .3012

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	0	1	0	0	0	15	16
2 - 4	8	267	181	33	2	214	705
PERSISTENCE	5 - 9	0	175	527	203	24	303
FORECAST	10 - 29	0	20	181	1758	171	1232
30 - 60	0	22	19	188	931	1205	3335
61 - UNL	5	159	271	1101	1031	83879	2153
COLUMN TOTALS:		13	644	1179	3283	2159	86609
BIASES:		1.23	1.10	1.05	1.02	1.00	1.00

PERCENT CORRECT: 93.05

HEIDKE SKILL SCORE: .5325

CHI-SQUARE: 10.00

THREAT SCORE: .2505

VISIBILITY (MILES)

VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
PERSISTENCE	0 - 31/64	162	33	106	82	36	92
	1/2 - 63/64	56	22	160	60	31	56
FORECAST	1 - 2 63/64	93	153	2009	1224	279	385
	3 - 4 63/64	29	46	1055	2793	1119	3965
	5 - 6 63/64	25	22	238	1226	2227	5933
	7 - 100	76	53	230	652	2218	5879
COLUMN TOTALS:		441	329	3798	6037	5910	77214
BIASES:		1.16	1.17	1.04	.98	1.00	93887

PERCENT CORRECT: 86.48

HEIDKE SKILL SCORE: .5675

CHI-SQUARE: 30.26

THREAT SCORE: .1960

STATION PRESSURE (INCHES OF HG)

VERIFYING OBSERVATION

	0 - 29.235	29.236 - 29.530	29.531 - 29.677	29.678 - 29.825	29.826 - 29.973	29.974 - 30.120	30.121 - 30.268	30.269 - 30.563	30.564 - 35.000	ROW TOTALS
PERSISTENCE	0 - 29.235	0	0	0	0	0	0	0	0	0
	29.236 - 29.530	1672	59	0	0	0	0	0	0	1731
FORECAST	29.531 - 29.677	0	54	2966	265	0	0	0	0	3285
	29.678 - 29.825	0	0	287	16515	858	0	0	0	17660
	29.826 - 29.973	0	0	0	758	38086	744	0	0	39588
	29.974 - 30.120	0	0	0	0	698	26902	203	0	27803
	30.121 - 30.268	0	0	0	0	0	236	3328	41	3605
	30.269 - 30.563	0	0	0	0	0	0	41	0	215
	30.564 - 35.000	0	0	0	0	0	0	-0	0	0
COLUMN TOTALS:		0	1726	3312	17538	39642	27882	3572	215	0
BIASES:		99.99	1.00	.99	1.01	1.00	1.00	1.01	1.00	99.99

PERCENT CORRECT: 95.48

HEIDKE SKILL SCORE: .9350

CHI-SQUARE: 1.69

TEMPERATURE (DEGREES FAHRENHEIT)

		VERIFYING OBSERVATION														
		-30 - 4	5 - 14	15 - 24	25 - 34	35 - 44	40 - 49	50 - 59	55 - 64	60 - 69	65 - 74	75 - 84	85 - 94	95 - 110	ROW TOTALS	
PERSISTENCE	-30 - 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
FORECAST	5 - 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	15 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	25 - 34	0	0	0	0	19	7	13	0	0	0	0	0	0	39	
	35 - 49	0	0	0	0	0	1	52	0	0	0	0	0	0	53	
	40 - 44	0	0	0	0	20	367	207	53	0	0	0	0	0	647	
	45 - 49	0	0	0	0	0	310	1988	519	55	0	0	0	0	2872	
	50 - 54	0	0	0	0	0	5	495	2246	1030	87	0	0	0	3863	
	55 - 59	0	0	0	0	0	0	15	1010	5503	1507	53	0	0	8088	
	60 - 64	0	0	0	0	0	0	2	67	1350	10408	2935	0	0	14762	
	65 - 74	0	0	0	0	0	0	0	0	55	2670	25297	2855	0	0	30877
	75 - 84	0	0	0	0	0	0	0	0	0	8	2950	20754	1309	0	25021
	85 - 94	0	0	0	0	0	0	0	0	0	12	1358	6258	18	7646	
	95 - 110	0	0	0	0	0	0	0	0	0	0	0	18	1	19	
COLUMN TOTALS:		0	0	0	19	28	747	2707	3895	7993	14680	31247	24967	7585	19	
BIASES:		99.99	99.99	99.99	2.05	1.89	.87	1.06	.99	1.01	1.01	.99	1.00	1.00	1.00	
															93887	

PERCENT CORRECT: 77.58

HEIDKE SKILL SCORE: .7121

CHI-SQUARE: 73.66

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

		VERIFYING OBSERVATION									
		0 - 1	2 - 7	8 - 15	16 - 25	26 - 99					
PERSISTENCE	0 - 1	4809	4137	40	0	0	0	0	8986		
FORECAST	2 - 7	3935	27140	3256	4	0	0	0	34335		
	8 - 15	2	3229	19017	2762	1	0	0	25011		
	16 - 25	0	64	2748	15676	986	1	0	19474		
	26 - 99	0	0	20	999	5062	0	0	6081		
COLUMN TOTALS:		8746	34570	25081	19441	6049			93887		
BIASES:		1.03	.99	1.00	1.00	1.01					

PERCENT CORRECT: 76.37%

HEIDKE SKILL SCORE: .6799

CHI-SQUARE: 8.60

		VERIFYING OBSERVATION																					
		0 - 1			2 - 9			10 - 19		20 - 29		30 - 99		ROW TOTALS									
PERSISTENCE FORECAST	0 - 1	547		2609		0		0		0		0		3156									
	2 - 9	2651	3	72257	4504	3		0		0		0		79415									
	10 - 19	0	2	4486	6523	140		0		0		0		11152									
	20 - 29	0	0	0	144	18		0		0		0		164									
	30 - 99	0	0	0	0	0		0		0		0		0									
	COLUMN TOTALS:	3201	.99	79354	11171	161		0		99.99				93887									
BIASES:				1.00	1.00	1.02																	
PERCENT CORRECT:		84.51%																					
HEJDKE SKILL SCORE:		.4259																					
CHI-SQUARE:		.77																					
		WIND DIRECTION (DEG)																					
		VERIFYING OBSERVATION																					
PERSISTENCE FORECAST	00 - 44	45	-	89	90	-	134	135	-	179	180	-	224	225	-	269	270	-	314	315	-	359	ROW TOTALS
	00 - 44	3817	1215	446	203		143		227		553		1931		8535								
	45 - 89	1021	2256	870	143		160		179		389		474		5492								
	90 - 134	268	865	1301	872		531		213		391		215		4656								
	135 - 179	128	130	555	5676	4274		656		577		245		1241									
	180 - 224	163	181	393	3825	13460		2167		1095		433		2117									
COLUMNS TOTALS:		225	225	163	331	790		2231		3088		2319		369		9516							
BIASES:		270	-	314	468	254	491	738	890	2437	10111	3001		18390									
		315	-	359	2321	450	315	268	242	351	2795	6598		13340									
PERCENT CORRECT:		49.32%																					
HEJDKE SKILL SCORE:		.4012																					
CHI-SQUARE:		16.48																					

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0009	.000 - .0009	ROW TOTALS
PERSISTENCE FORECAST	.002 - .0019	0	0	18
	.000 - .0009	0	4	125
COLUMN TOTALS:		17	130	93593
BIASES:				93740
PERCENT CORRECT:	99.69%			
HEIDKE SKILL SCORE:	.0255			
CHI-SQUARE:	.25			

PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE FORECAST	YFS	0	0
	NO	0	93887
COLUMN TOTALS:		0	93887
BIASES:	99.99	1.00	93887

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

FROZEN PRECIPITATION OCCURENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE FORECAST	YFS	0	0
	NO	0	93887
COLUMN TOTALS:		0	93887
BIASES:	99.99	1.00	93887

PERCENT CORRECT: 100.00%
 HEIDKE SKILL SCORE: *****
 CHI-SQUARE: 0.00
 THREAT SCORE: *****

PERSISTENCE VERSUS VERIFYING OBSERVATION AT 50 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	150	114	51	48	40	1120
	2 - 4	159	684	458	194	113	2041
FORECAST	5 - 9	44	325	675	490	94	1446
	10 - 29	55	186	429	2898	370	3074
	30 - 60	41	109	96	466	1969	2533
	61 - UNL	1081	2108	1368	2358	1921	1816
COLUMN TOTALS:		1530	3526	3077	6454	4507	63368
BIASES:		1.00	1.04	1.00	1.00	1.00	72204

PERCENT CORRECT: 76.29

HEIDKE SKILL SCORE: .3500

CHI-SQUARE: 4.59

THREAT SCORE: .1214

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
PERSISTENCE	0 - 1	31	35	10	0	3	106
	2 - 4	90	454	337	74	28	185
FORECAST	5 - 9	2	257	568	327	65	1218
	10 - 29	3	64	292	2553	257	1571
	30 - 60	3	35	57	365	1609	4666
	61 - UNL	57	253	280	1329	1468	3435
COLUMN TOTALS:		186	1098	1564	4648	3430	80512
BIASES:		1.00	1.11	1.02	1.00	1.00	80343

PERCENT CORRECT: 89.88

HEIDKE SKILL SCORE: .5434

CHI-SQUARE: 14.02

THREAT SCORE: .2937

THIRD CLOUD HIT ('00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	5	15	6	0	2	52	80
2 - 4	39	326	264	54	12	242	937
PERSISTENCE	5 - 9	1	220	536	277	43	1359
FORECAST	10 - 29	0	38	237	2245	227	4091
30 - 60	2	27	51	299	1261	1135	2775
61 - UNL	27	194	227	1198	1242	79288	82176
COLUMN TOTALS:	74	820	1321	4073	2787	82343	91418
BIASES:	1.08	1.14	1.03	1.00	1.00	1.00	

PERCENT CORRECT: 91.51

HEIDKE SKILL SCORE: .5465

CHI-SQUARE: 18.74

THREAT SCORE: .2523

FOURTH CLOUD HIT ('00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	1	1	1	0	1	12	16
2 - 4	7	200	189	33	2	256	687
PERSISTENCE	5 - 9	0	187	497	203	20	316
FORECAST	10 - 29	0	19	189	1636	192	1217
30 - 60	1	19	29	212	820	999	2080
61 - UNL	3	174	253	1148	1068	81513	84159
COLUMN TOTALS:	12	600	1158	3232	2103	84313	91418
BIASES:	1.33	1.15	1.06	1.01	.99	1.00	

PERCENT CORRECT: 92.62

HEIDKE SKILL SCORE: .5042

CHI-SQUARE: 18.27

THREAT SCORE: .1890

VISIBILITY (MILES)
VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
0 - 31/64	114	32	101	88	25	134	494
1/2 - 63/64	54	10	133	72	40	68	377
PERSISTENCE	1 - 2 63/64	101	151	1834	1187	298	3840
FORECAST	3 - 4 63/64	35	44	1071	2491	1053	5721
	5 - 6 63/64	23	29	228	1221	1935	2204
	7 - 100	68	44	251	730	2366	75346
COLUMN TOTALS:		395	310	3618	5789	5717	75589
BIASES:		1.25	1.22	1.06	.99	.99	1.00

PERCENT CORRECT: 85.62
HEIDKE SKILL SCORE: .5346
CHI-SQUARE: 55.53
THREAT SCORE: .1537

STATION PRESSURE (INCHES OF HG)

	0 - 29.236	29.530	29.531 -	29.678 -	29.826 -	29.974 -	30.121 -	30.268	30.563	30.564 -	ROW TOTALS
0 - 29.235	0	0	0	0	0	0	0	0	0	0	0
29.236 - 29.530	0	1622	69	0	0	0	0	0	0	0	1691
29.531 - 29.677	0	64	2814	310	0	0	0	0	0	0	3188
PERSISTENCE	29.678 - 29.825	0	327	15925	961	0	0	0	0	0	17213
FORECAST	29.826 - 29.973	0	0	817	36862	889	0	0	0	0	38568
	29.974 - 30.120	0	0	0	823	25972	243	0	0	0	27038
	30.121 - 30.268	0	0	0	0	286	3168	51	0	0	3505
	30.269 - 30.563	0	0	0	0	0	51	164	0	0	215
	30.564 - 35.000	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:		0	1686	3210	17052	38646	27147	3462	215	0	91418
BIASES:		99.99	1.00	.99	1.01	1.00	1.00	1.00	1.00	0	99.99

PERCENT CORRECT: 94.65
HEIDKE SKILL SCORE: .9231
CHI-SQUARE: 2.81

TEMPERATURE (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	-30 - 4	5 - 14	15 - 24	25 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	65 - 74	75 - 84	85 - 94	95 - 110	ROW TOTALS
PERSISTENCE	-30 - 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FORECAST	5 - 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25 - 34	0	0	0	0	0	0	0	0	0	0	0	0	0	29
	35 - 39	0	0	0	0	0	45	8	0	0	0	0	0	0	53
	40 - 44	0	0	0	0	19	288	194	85	0	0	0	0	0	586
	45 - 49	0	0	0	0	0	349	1769	548	131	1	0	0	0	2798
	50 - 54	0	0	0	0	0	5	573	1876	982	207	0	0	0	3643
	55 - 59	0	0	0	0	0	0	30	1117	5002	1567	150	0	0	7866
	60 - 64	0	0	0	0	0	0	6	92	1512	9302	3388	0	0	14300
	65 - 74	0	0	0	0	0	0	0	0	94	3064	23479	3355	0	29992
	75 - 84	0	0	0	0	0	0	0	0	0	15	3471	19604	1505	0
	85 - 94	0	0	0	0	0	0	0	0	0	0	19	1576	5923	19
	95 - 110	0	0	0	0	0	0	0	0	0	0	0	0	0	19
COLUMN TOTALS:	99.99	99.99	99.99	99.99	3.22	2.79	.83	1.08	.98	1.02	1.01	.98	1.00	1.01	91418
BIASES:															

PERCENT CORRECT: 73.57

HEIDKE SKILL SCORE: .6600

CHI-SQUARE: 160.04

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	0 - 1	2 - 7	8 - 15	16 - 25	26 - 99	ROW TOTALS
PERSISTENCE	0 - 1	3936	4661	94	0	0
FORECAST	2 - 7	4437	25006	3663	16	0
	8 - 15	18	3590	17600	3228	6
	16 - 25	0	132	3193	14678	1130
	26 - 99	0	0	40	1136	4854
COLUMN TOTALS:	8391	33389	24590	19058	5990	91418
BIASES:						

PERCENT CORRECT: 72.28%

HEIDKE SKILL SCORE: .6249

CHI-SQUARE: 14.31

		WIND SPEED (KT)				VERIFYING OBSERVATION				ROW TOTALS			
		0 - 1	2 - 9	10 - 19	20 - 29	30 - 99							
PERSISTENCE FORECAST	0 - 1	498	2521	5	0	0					3024		
	2 - 9	2536	7099	4642	4	0					77281		
	10 - 19	5	4624	6184	138	0					10951		
	20 - 29	0	1	142	19	0					162		
COLUMN TOTALS: BIASES:		3039	77245	10973	161	0					0		
		1.00	1.00	1.00	1.01	99.99					91418		
PERCENT CORRECT: 84.01%													
HEIDKE SKILL SCORE: .4083													
CHI-SQUARE: .14													

		WIND DIRECTION (DEC)				VERIFYING OBSERVATION				ROW TOTALS			
		00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359				
PERSISTENCE FORECAST	00 - 44	3605	1159	484	206	161	217	627	1928	8387			
	45 - 89	989	2164	867	188	141	238	411	409	5407			
	90 - 134	336	797	1152	794	570	219	394	253	4515			
	135 - 179	132	141	462	5243	4309	697	582	268	11834			
COLUMN TOTALS: BIASES:		200	206	445	3849	12732	2115	1108	404	21059			
		225 - 269	195	298	865	2210	2822	2309	380	9264			
		270 - 314	617	267	496	776	974	2322	9551	2970	17973		
		315 - 359	2179	486	335	273	275	375	2719	6337	12979		
PERCENT CORRECT: 47.70%													
HEIDKE SKILL SCORE: .3821													
CHI-SQUARE: 29.21													

PRECIPITATION AMOUNT (INCHES)

		VERIFYING OBSERVATION		ROW TOTALS	
		.002 - .100	.001 - .0009		
PERSISTENCE	.002 - .100	0	0	18	18
FORECAST	.001 - .0019	0	13	113	126
	.000 - .0009	17	117	91140	91274
COLUMN TOTALS:		17	130	91271	91418
BIASES:		1.06	.97	1.00	
PERCENT CORRECT:	99.71%				
HEIDKE SKILL SCORE:	.0861				
CHI-SQUARE:	.18				

PRECIPITATION OCCURENCE (Y OR N)

		VERIFYING OBSERVATION		ROW TOTALS	
		YES	NO		
PERSISTENCE	YES	0	0	0	0
FORECAST	NO	0	91418	91418	91418
COLUMN TOTALS:		0	91418	91418	91418
BIASES:		99.99	1.00		
PERCENT CORRECT:	100.00%				
HEIDKE SKILL SCORE:	*****				
CHI-SQUARE:	0.00				
THREAT SCORE:	*****				

FROZEN PRECIPITATION OCCURENCE (Y OR N)

		VERIFYING OBSERVATION		ROW TOTALS	
		YES	NO		
PERSISTENCE	YES	0	0	0	0
FORECAST	NO	0	91418	91418	91418
COLUMN TOTALS:		0	91418	91418	91418
BIASES:		99.99	1.00		
PERCENT CORRECT:	100.00%				
HEIDKE SKILL SCORE:	*****				
CHI-SQUARE:	0.00				
THREAT SCORE:	*****				

FIRST-SENCE VERSUS VERIFYING OBSERVATION AT 60 MINUTE INTERVALS

LOWEST CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	142	111	54	44	39	1096	1486
2 - 4	158	591	509	188	135	1995	3576
PERSISTENCE	5 - 9	39	355	597	482	97	1447
FORECAST	10 - 29	60	196	425	2762	363	3017
	30 - 60	42	129	109	491	1821	6314
	61 - UNL	1056	2042	1339	2354	1877	4359
COLUMN TOTALS:		1497	3424	3033	6321	4332	70292
BIASES:		.99	1.04	1.00	1.00	1.01	61624
							89044

PERCENT CORRECT: 75.85

HEIDKE SKILL SCORE: .3386

CHI-SQUARE: 7.39

THREAT SCORE: .1116

SECOND CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL	ROW TOTALS
0 - 1	26	33	15	0	5	100	179
2 - 4	82	374	370	91	23	256	1196
PERSISTENCE	5 - 9	3	265	513	346	68	1552
FORECAST	10 - 29	2	64	290	2372	263	4551
	30 - 60	4	40	69	403	1477	3337
	61 - UNL	59	271	276	1354	1470	78229
COLUMN TOTALS:		176	1047	1533	4566	3306	78416
BIASES:		1.02	1.14	1.01	1.00	1.01	89044

PERCENT CORRECT: 89.35

HEIDKE SKILL SCORE: .5199

CHI-SQUARE: 22.28

THREAT SCORE: .2472

THIRD CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL.	ROW TOTALS
0 - 1	1	13	8	0	3	.52	77
2 - 4	36	254	280	69	15	.262	916
PERSISTENCE	5 - 9	3	235	491	294	.42	1347
FORECAST	10 - 29	0	35	256	2056	.234	3998
30 - 60	1	26	56	332	1149	.1138	2702
61 - UNL.	31	215	215	1250	1253	.77040	80004
COLUMN TOTALS:		72	778	1306	4001	.2696	80191
BIASES:		1.07	1.18	1.03	1.00	1.00	1.00

PERCENT CORRECT: 90.96

HEIDKE SKILL SCORE: .5179

CHI-SQUARE: 26.56

THREAT SCORE: .1975

FOURTH CLOUD HIT (00')

VERIFYING OBSERVATION

	0 - 1	2 - 4	5 - 9	10 - 29	30 - 60	61 - UNL.	ROW TOTALS
0 - 1	1	1	1	0	0	.12	15
2 - 4	6	159	185	40	3	.277	670
PERSISTENCE	5 - 9	0	191	464	223	.23	316
FORECAST	10 - 29	0	22	215	1470	.207	1258
30 - 60	0	15	36	254	737	.973	3172
61 - UNL.	5	180	237	1183	1083	.79267	2015
COLUMN TOTALS:		12	568	1138	3170	.2053	82103
BIASES:		1.25	1.18	1.07	1.00	.98	1.00

PERCENT CORRECT: 92.20

HEIDKE SKILL SCORE: .4777

CHI-SQUARE: 25.52

THREAT SCORE: .1521

VISIBILITY (MILES)

VERIFYING OBSERVATION

	0 - 31/64	1/2 - 63/64	1 - 2 63/64	3 - 4 63/64	5 - 6 63/64	7 - 100	ROW TOTALS
PERSISTENCE	0 - 31/64	85	27	79	73	63	149
	1/2 - 63/64	44	11	130	67	29	88
	1 - 2 63/64	104	130	1705	1150	343	299
FORECAST	3 - 4 63/64	25	46	1014	2338	979	1120
	5 - 6 63/64	27	24	265	1207	1673	2230
	7 - 100	73	63	279	754	2401	69950
COLUMN TOTALS:		358	301	3472	5589	5488	73836
BIASES:		1.33	1.23	1.08	.99	.99	1.00

PERCENT CORRECT: 85.08

HEIDKE SKILL SCORE: .5126

CHI-SQUARE: 76.43

THREAT SCORE: .1249

STATION PRESSURE (INCHES OF HG)

VERIFYING OBSERVATION

	0 - 29.235	29.236 - 29.530	29.531 - 29.677	29.678 - 29.825	29.826 - 29.973	29.974 - 30.120	30.121 - 30.268	30.269 - 30.563	30.564 - 35.000	ROW TOTALS
PERSISTENCE	0 - 29.235	0	0	0	0	0	0	0	0	0
	29.236 - 29.530	0	1572	79	0	0	0	0	0	1651
	29.531 - 29.677	0	74	2653	361	0	0	0	0	3088
FORECAST	29.678 - 29.825	0	0	377	15361	1065	0	0	0	16803
	29.826 - 29.973	0	0	0	873	35641	1049	0	0	37563
	29.974 - 30.120	0	0	0	0	956	25060	283	0	26299
	30.121 - 30.268	0	0	0	0	0	334	3030	61	3425
	30.269 - 30.563	0	0	0	0	0	0	61	154	215
	30.564 - 35.000	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:		0	1646	3109	16595	37662	26443	3374	215	89044
BIASES:		99.99	1.00	.99	1.01	1.00	1.00	1.02	1.00	99.99

PERCENT CORRECT: 93.74

HEIDKE SKILL SCORE: .9100

CHI-SQUARE: 4.58

TEMPERATURE (DEGREES FAHRENHEIT)

VERIFYING OBSERVATION

	-30	5	15	25	34	39	44	49	54	59	64	69	74	84	85	94	95	110	ROW TOTALS
-30	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-5	-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	-34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
35	-39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53
PERSISTENCE	40	-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FORECAST	45	-49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	-54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	-64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	-74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	-84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	-94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	-110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COLUMN TOTALS:	99.99	99.99	99.99	99.99	0	0	18	664	2463	3553	7454	13654	29819	24099	7301	19	0	89044	
BIASES:							2.94	.82	1.10	.98	1.02	1.02	.98	1.00	1.00	1.02	1.00		

PERCENT CORRECT: 70.21

HEIDKE SKILL SCORE: .6164

CHI-SQUARE: 140.42

DEW POINT DEPRESSION (DEGREES FAHRENHEIT)
 VERIFYING OBSERVATION

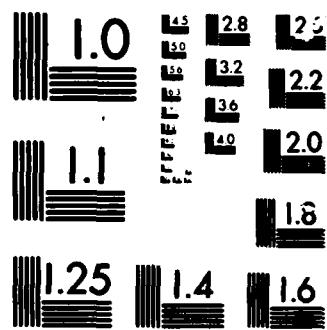
	0 - 1	2 - 7	8 - 15	16 - 25	26 - 99	ROW TOTALS
0 - 1	3282	4961	187	0	0	8430
2 - 7	4707	23217	3994	40	0	31958
PERSISTENCE	8 - 15	29	3935	16295	3626	23901
FORECAST	16 - 25	0	189	3555	13805	1228
	26 - 99	0	0	70	1222	4686
COLUMN TOTALS:	8018	32302	24101	18693	5930	89044
BIASFS:	1.05	.99	.99	1.00	1.01	

PERCENT CORRECT: 68.83%
 HEIDKE SKILL SCORE: .5787
 CHI-SQUARE: 27.26

		WIND SPEED (KT)									WIND DIRECTION (DEG)											
		VERIFYING OBSERVATION									VERIFYING OBSERVATION											
		0 - 1	2 - 9	10 - 19	20 - 29	30 - 99	ROW TOTALS				00 - 44	45 - 89	90 - 134	135 - 179	180 - 224	225 - 269	270 - 314	315 - 359	ROW TOTALS			
PERSISTENCE FORECAST	0 - 1	424	2463	1	0	0	0	0	0	0	2888											
	2 - 9	2469	67998	4730	6	0	0	0	0	0	75203											
	10 - 19	4	4735	5911	141	0	0	0	0	0	10791											
	20 - 29	0	0	150	12	0	0	0	0	0	162											
COLUMN TOTALS:		2897	75196	10792	159	0	0	0	0	0	89044											
BIASES:		1.00	1.00	1.00	1.02	0	0	0	0	0												
PERCENT CORRECT:		83.49%																				
HEIDKE SKILL SCORE:		.3910																				
CHI-SQUARE:		.09																				

RD-A167 849 VERY SHORT RANGE STATISTICAL FORECASTING OF AUTOMATED 2/2
WEATHER OBSERVATION. (U) FEDERAL AVIATION
ADMINISTRATION WASHINGTON DC PROGRAM ENGINEER.
UNCLASSIFIED R G MILLER MAR 86 DOT/FAA/PM-86/10 F/G 4/2 NL





MICROCOM[®]

CHART

PRECIPITATION AMOUNT (INCHES)

VERIFYING OBSERVATION

	.002 - .100	.001 - .0009	.000 - .0009	ROW TOTALS
PERSISTENCE	.002 - .100	0	.18	
FORECAST	.001 - .0019	0	.119	125
	.000 - .0009	17	123	88761
COLUMN TOTALS:		17	129	88898
BIASES:		1.06	.97	1.00
PERCENT CORRECT:	99.69%			
HEIDKE SKILL SCORE:	.0402			
CHI-SQUARE:	.18			

PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE	YES	0	0
FORECAST	NO	0	89044
			89044
COLUMN TOTALS:		0	89044
BIASES:		99.99	1.00

PERCENT CORRECT: 100.00%

HEIDKE SKILL SCORE: *****

CHI-SQUARE: 0.00

THREAT SCORE: *****

FROZEN PRECIPITATION OCCURRENCE (Y OR N)

VERIFYING OBSERVATION

	YES	NO	ROW TOTALS
PERSISTENCE	YES	0	0
FORECAST	NO	0	89044
			89044
COLUMN TOTALS:		0	89044
BIASES:		99.99	1.00

PERCENT CORRECT: 100.00%

HEIDKE SKILL SCORE: *****

CHI-SQUARE: 0.00

THREAT SCORE: *****

END
FILED

5-86

DTIC